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Potential of stunted fingerlings for reservoir fisheries enhancement and livelihood security of traditional fishers

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ABSTRACT

Reservoir fisheries represent an important component of inland fisheries in India and provide food, employment and livelihood opportunities to traditional fishing communities. Despite the considerable area and biological productivity of Indian reservoirs, fish production from many reservoirs remains below their potential because of inadequate stocking, poor availability of quality fish seed, predation, inappropriate fishing practices, weak post-stocking management and limited participation of fisher communities in fisheries development programmes. Stock enhancement through scientific stocking and culture-based fisheries has emerged as an important strategy for increasing fish production from reservoirs. In this context, the use of stunted fingerlings may provide an additional option for reservoir fisheries enhancement because fish subjected to controlled growth restriction may subsequently exhibit compensatory growth when favorable environmental and nutritional conditions are restored. The concept is particularly relevant where hatchery seed is seasonally available, nursery facilities are limited, or stocking needs to be synchronized with reservoir hydrology and food availability. Research on stunted *Labeo rohita* in Dimbhe Reservoir, Maharashtra, has demonstrated substantial subsequent growth when stunted fish were reared under suitable feeding and stocking-density conditions. However, direct evidence for large-scale release of stunted fingerlings into open reservoirs remains relatively limited compared with evidence supporting advanced fingerlings. Therefore, stunted fingerlings should be considered as a potential component of an integrated stock-enhancement strategy rather than a universal replacement for advanced fingerlings. Scientific seed selection, appropriate conditioning, acclimatization, reservoir-specific stocking density, predator management, closed-season protection, regulated fishing, community participation and systematic monitoring are essential for successful implementation. Community-based nursery and pen-culture systems can further connect seed production with traditional fisher livelihoods. Evidence from Indian reservoirs indicates that culture-based fisheries, pen culture and scientific stocking can increase fish production and improve economic opportunities for fishing communities. A participatory approach involving fisheries departments, research institutions, hatcheries and traditional fisher cooperatives could therefore contribute to sustainable reservoir fisheries development and livelihood security.

Keywords: Reservoir fisheries, Stunted fingerlings, Stock enhancement, Culture-based fisheries, Traditional fishers, *Labeo rohita*, Compensatory growth, Pen culture, Livelihood security, India

1. Introduction

Reservoirs constitute one of the most important inland fisheries resources of India and provide opportunities for capture fisheries, culture-based fisheries, cage culture, pen culture and other forms of fisheries enhancement. India possesses an estimated reservoir area of approximately 3.5 million ha, comprising small, medium and large reservoirs distributed across different geographical and climatic regions. Despite this substantial resource base, fish production from many reservoirs remains below their potential because the natural fish recruitment and productivity of reservoirs are not always sufficient to support optimum fish yields. Sarkar *et al.* (2020) [1] emphasized that scientific stocking and culture-based fisheries have become important strategies for enhancing reservoir fish production in India. Their assessment reported that successful adoption of culture-based fisheries in 83 small reservoirs of Odisha increased fish yield to approximately 204–323 kg ha⁻¹ yr⁻¹, while scientific fingerling stocking in 34 reservoirs of Chhattisgarh was associated with an increase in fish yield from approximately 48 to 160 kg ha⁻¹ yr⁻¹. In a large reservoir of Madhya Pradesh, fish yield increased from 1.1 kg ha⁻¹ yr⁻¹ in 2004–05 to 43.46 kg ha⁻¹ yr⁻¹ in 2017–18 following stock-enhancement interventions (Sarkar *et al.*, 2020) [1]. These examples demonstrate that scientifically planned stocking can contribute substantially to fisheries enhancement when it is combined with appropriate management.

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Reservoir fisheries differ fundamentally from conventional pond aquaculture because reservoirs are open ecosystems characterized by considerable spatial and temporal variation in water level, natural food availability, species composition, predator abundance, fishing pressure and environmental conditions. Consequently, stocking fish into a reservoir does not necessarily produce the same results as stocking fish into a managed aquaculture pond. The survival of stocked fish, their access to natural food, predation pressure and subsequent fishing mortality determine the actual contribution of stocking to fish production. Sarkar *et al.* (2020) [1] emphasized that scientific assessment of stocking impact is necessary for determining optimum stocking density and improving management strategies. Therefore, the success of a stocking programme depends not only on the number of fish released but also on the quality and size of seed, timing of stocking, reservoir productivity, species selection and post-stocking management.

The size of stocked fish is particularly important. Small fry and fingerlings are generally more vulnerable to predators and environmental stress immediately after release. Consequently, many reservoir-enhancement programmes emphasize the production and stocking of larger advanced fingerlings. Sarkar *et al.* (2020) [1] reported that Indian reservoir stocking recommendations have historically considered fingerlings within approximately 40–150 mm, with later recommendations varying according to reservoir size and management conditions. The development of nursery and pen-rearing technologies has provided an opportunity to produce larger stocking material closer to the reservoir itself.

Within this broader context, stunted fingerlings represent an interesting but comparatively less explored approach. Stunting refers to a condition in which fish experience controlled restriction of growth for a period but remain physiologically capable of resuming growth when environmental and nutritional conditions improve. When fish subsequently experience adequate food and favorable environmental conditions, they may demonstrate compensatory growth, which can partially or substantially reduce the difference between previously restricted and continuously fed fish. Ali *et al.* (2003) [2] described compensatory growth as a biological response to a period of growth depression, although its magnitude varies with species, developmental stage, duration and severity of restriction and subsequent feeding conditions.

The concept has relevance to reservoir fisheries because fish seed production is seasonal, while reservoir stocking must be synchronized with appropriate environmental and hydrological conditions. If fish can be maintained safely in nursery systems until a suitable stocking period, it may provide greater flexibility to fisheries managers. However, stunting should not be confused with poor-quality seed resulting from disease, chronic malnutrition or poor hatchery management. For fisheries enhancement, only healthy, active and properly conditioned fish should be considered.

2. Concept and biological basis of stunted fingerlings

Stunted fingerlings are fish that have undergone a controlled period of reduced growth but remain viable and capable of responding to improved conditions. The biological significance of stunting is closely associated with compensatory growth. During a period of restricted feeding or high-density rearing, fish may show reduced weight gain and slower development. When adequate food and favorable environmental conditions are restored, fish may exhibit accelerated growth compared with continuously restricted individuals. Ali *et al.* (2003) [2] reported that compensatory growth is a widespread response in fishes, although the extent of compensation depends upon the characteristics of the restriction and subsequent refeeding period.

The physiological response to growth restriction and subsequent refeeding is complex. Fish may modify feed intake, feed utilization, metabolism and allocation of nutrients during the compensatory phase. Increased appetite and improved utilization of available nutrients can contribute to accelerated growth following refeeding. Nevertheless, complete compensation is not universal. The degree of

recovery depends on species, age, initial size, temperature, nutritional quality of feed, stocking density and duration of the restriction period. Therefore, the concept of stunted fingerlings should be applied scientifically rather than simply holding fish under overcrowded or nutritionally deficient conditions.

In aquaculture, controlled stunting has been investigated as a strategy for extending seed availability and improving the flexibility of fingerling production. Pathan *et al.* (2022) [3] discussed the potential of stunted fingerling production as a means of extending the availability of stocking material and improving the management of seed resources. Such approaches can be particularly useful where hatchery production is seasonal and where fish need to be maintained until suitable stocking conditions occur.

An important consideration is that desirable stunting must be controlled and reversible. Fish should not be subjected to severe or prolonged starvation because this can compromise immunity, body condition and subsequent performance. Similarly, high-density rearing without adequate water quality may result in disease outbreaks and poor physiological condition. A scientifically produced stunted fingerling should therefore be healthy, active, structurally normal and free from visible disease symptoms before it is considered for stocking.

3. Relevance of stunted fingerlings to reservoir fisheries

The application of stunted fingerlings to reservoir fisheries is based primarily on the possibility of producing stocking material over a longer period and subsequently obtaining growth recovery when fish enter favorable reservoir conditions. Reservoirs often experience seasonal changes in water level and productivity, and stocking at an inappropriate time can reduce survival. A hatchery may produce seed during a particular period, whereas the most suitable stocking opportunity may occur later. Maintaining fish under controlled nursery conditions can potentially bridge this temporal gap.

Another potential advantage is the reduction of pressure on nursery systems. If fingerlings cannot immediately be stocked into reservoirs, they can potentially be maintained under controlled conditions until the appropriate stocking period. This may help fisheries agencies and cooperatives coordinate stocking with water availability, plankton production and fishing restrictions.

However, the biological and economic performance of stunted fingerlings after direct release into open reservoirs requires further investigation. Much of the available evidence concerns controlled rearing environments, including cages and ponds. Therefore, results from cage-based experiments should not automatically be interpreted as evidence of equivalent survival in open reservoirs. Open reservoirs expose fish to predators, fluctuating water quality, competition, fishing pressure and dispersal, all of which can strongly influence post-stocking survival.

For this reason, stunted fingerlings should currently be viewed as a potential complementary stocking strategy, particularly where nursery or pen-rearing systems can be used to restore growth before release. Advanced fingerlings remain an important reference point because larger fish generally have greater capacity to withstand predation and handling stress.

4. Evidence from Dimbhe Reservoir, Maharashtra

An important Indian example relevant to the present concept is available from Dimbhe Reservoir in Maharashtra. Research on the rearing of stunted *Labeo rohita* in cages demonstrated that fish subjected to an earlier period of restricted growth could subsequently attain substantial growth under suitable feeding and stocking-density conditions. In the study reported by Mane *et al.* (2018) [4] and related work on stunted rohu, reservoir-based cage culture was investigated as a means of producing larger fish from previously stunted stocking material.

Research on stunted *Labeo rohita* in Dimbhe Reservoir evaluated different stocking densities and feeding regimes. The study reported that

stunted rohu averaging approximately 14.65 cm in length and 38.23 g in weight could attain substantially higher body weight during subsequent cage rearing. The highest reported final body weight was approximately 732.64 g under the tested management conditions, with lower stocking density producing better individual growth (Mane *et al.*, 2018) [4]. These findings provide evidence that stunted rohu can recover considerable growth when appropriate feeding and environmental conditions are provided.

The importance of this study extends beyond the biological performance of fish because Dimbhe Reservoir provides an example of how reservoir-based cage technology can connect fisheries enhancement with local livelihoods. The use of cages provides a controlled environment in which fish can be protected, fed and monitored before harvesting or release. Such systems can therefore act as an intermediate step between hatchery production and open-reservoir fisheries.

Nevertheless, it is important to distinguish cage rearing from direct reservoir stocking. In a cage, fish are protected from many predators and have access to supplied feed. After release into an open reservoir, fish must depend largely on natural food resources and face predation and fishing pressure. Therefore, further experiments comparing the survival and growth of stunted and advanced fingerlings following direct reservoir release are required before large-scale adoption can be recommended.

5. Stock enhancement and culture-based fisheries in Indian reservoirs

Culture-based fisheries involve the enhancement of fish production in water bodies through stocking of desirable fish species, followed by controlled or regulated harvesting. The approach is particularly relevant to reservoirs where natural recruitment of commercially important fish may be inadequate. Sarkar *et al.* (2020) [1] documented several Indian examples in which scientific stocking was associated with substantial increases in reservoir fish production.

In Odisha, culture-based fisheries interventions in 83 small reservoirs resulted in reported fish yields of approximately 204–323 kg ha⁻¹ yr⁻¹. Similarly, in Chhattisgarh, scientific stocking in 34 reservoirs was associated with an increase in fish yield from 48 to 160 kg ha⁻¹ yr⁻¹. In a large reservoir in Madhya Pradesh, production increased substantially over the study period following adoption of fish stock enhancement strategies (Sarkar *et al.*, 2020) [1]. These observations illustrate the potential contribution of stocking to reservoir fisheries when stocking is supported by appropriate management.

The success of culture-based fisheries depends on several interacting factors. Reservoir productivity determines the amount of natural food available to stocked fish, while water-level fluctuations influence habitat availability. Predator abundance determines the mortality of stocked fish, and fishing pressure determines how much of the enhanced biomass is eventually harvested. Consequently, the stocking programme should be considered as one component of a larger fisheries-management system.

For traditional fishers, the objective should not simply be to increase the number of fish released. The objective should be to increase harvestable fish biomass while maintaining ecological sustainability and improving the economic return to fishing households. This requires scientific stocking combined with fishing regulations, community participation and monitoring.

6. Importance of fingerling size and survival

One of the central problems in reservoir stocking is mortality immediately following release. Small fingerlings are particularly susceptible to predation by piscivorous fishes and other predators. They may also experience stress during transportation and acclimatization. Consequently, the production of larger and healthier stocking material is an important component of reservoir fisheries enhancement.

The use of advanced fingerlings is therefore widely promoted in reservoir fisheries programmes. Sarkar *et al.* (2020) [1] discussed the importance of stocking suitable-sized fingerlings and noted that his-

torical stocking recommendations have generally emphasized fingerlings rather than very small fry. The development of pen culture provides an opportunity to rear fish within the reservoir until they reach larger stocking sizes.

The distinction between advanced fingerlings and stunted fingerlings is therefore important. Advanced fingerlings are deliberately reared to a larger size through adequate nutrition and management. Stunted fingerlings, in contrast, have experienced a period of growth restriction and may subsequently be subjected to a recovery phase. In practical reservoir management, a stunted fish may be most useful if it is first rehabilitated or conditioned to improve its physiological condition before release.

A useful approach may therefore involve a sequence of nursery rearing, controlled conditioning, growth recovery and final stocking rather than releasing severely stunted fish directly into an open reservoir. This approach could combine the advantages of seed availability with the survival benefits associated with larger and healthier stocking material.

7. Pen culture as a bridge between hatchery seed and reservoir stocking

Pen culture represents an important technology for reservoir fisheries enhancement because it permits fish to be reared directly within the reservoir before they are released into the open water. The technology can reduce transportation requirements, provide protection from predators and allow fish to acclimatize to local environmental conditions.

An important example is provided by Mapithel Reservoir in Manipur, where ICAR-CIFRI implemented a community-oriented pen culture programme for reservoir fisheries enhancement. ICAR-CIFRI supplied two 100 m² pens and 50,000 fish seed and trained local tribal fishers in reservoir fisheries management and pen culture. Indian major carps including *Catla*, Rohu and Mrigal were stocked and reared for approximately five months. Survival ranged from 80 to 88%, and the fish subsequently harvested from the pens were released into the reservoir for fisheries enhancement (ICAR-CIFRI, 2023) [5]. The programme involved local fishers and demonstrated how in-reservoir seed rearing can be integrated with stock enhancement and livelihood development.

The Mapithel example is particularly relevant to the concept of stunted fingerlings because it demonstrates a possible pathway through which smaller or conditioned seed can be reared under controlled conditions before release. Rather than releasing vulnerable fish immediately, fishers can participate in an intermediate nursery phase that increases their size and potentially improves their survival after release.

ICAR-CIFRI has also reported successful community participation in culture-based fisheries and pen culture at Bamuni Beel in Assam. The programme stocked 48,000 advanced fingerlings and subsequently used pen culture as an additional production activity. Fish production increased from approximately 6.29 tonnes to 13.52 tonnes, while reported annual net income increased from approximately ₹17,692 to ₹44,763 per household (ICAR-CIFRI, 2022) [6]. Although Bamuni Beel is a wetland rather than a reservoir, the example illustrates the livelihood potential of combining scientific stocking, pen culture and community participation.

8. Role of traditional fishers in reservoir stock enhancement

Traditional fishers are central stakeholders in reservoir fisheries because their livelihoods are directly connected to the availability and accessibility of fish resources. Stocking programmes designed without fisher participation may face challenges related to protection, fishing regulation and equitable distribution of benefits. A community-based approach can instead make fishers active partners in resource enhancement.

Traditional fishers possess valuable knowledge concerning fishing grounds, seasonal fish abundance, water-level fluctuations, local species composition and changes in fish availability. Scientific information from fisheries researchers can be combined with this local knowledge to develop reservoir-specific management plans.

Fishers can participate in several stages of the stocking programme, including seed transportation, nursery rearing, pen management, stocking, reservoir surveillance, data collection, fishing regulation and marketing. Such participation can create additional employment before the fish reach harvestable size.

The Mapithel Reservoir example demonstrates the potential of this approach. ICAR-CIFRI trained tribal fishers and provided infrastructure and seed for pen-based fish production. The harvested fish were subsequently released into the reservoir, and the intervention was specifically designed to support the livelihood of the reservoir-dependent population (ICAR-CIFRI, 2023) [5]. The programme therefore illustrates the potential of integrating scientific technology with community-based fisheries management.

Recent ICAR-CIFRI programmes continue to emphasize community participation in reservoir fisheries. In 2026, ICAR-CIFRI reported initiatives in Meghalaya involving tribal fishers, women-led enterprises, cage and pen culture, stocking and reservoir fisheries management, demonstrating the continued policy relevance of community-oriented reservoir fisheries enhancement (ICAR-CIFRI, 2026) [7].

9. Potential livelihood benefits

The primary socioeconomic objective of reservoir stock enhancement should be to improve the availability of harvestable fish and thereby strengthen the income and food security of fishing households. Increased fish biomass can potentially increase catch per fishing trip, reduce fishing effort required to obtain a given quantity of fish and improve the economic efficiency of fishing.

Stock enhancement may also generate secondary employment. Seed production, transportation, pen culture, cage culture, fish marketing, processing and value addition can create employment opportunities within fishing communities. Women and youth can participate particularly in fish handling, processing, marketing and record keeping.

The socioeconomic potential of such interventions is illustrated by ICAR-CIFRI's Mapithel Reservoir programme. The institute reported that the technology demonstration involved approximately 370 fishers through the cooperative society and generated substantial fish production from the pen-based intervention, with an estimated additional average income of approximately ₹24,000 per fisher under the reported programme conditions (ICAR-CIFRI, 2023) [5]. Such figures are programme-specific and should not be generalized to every reservoir, but they demonstrate how fisheries enhancement can be linked directly to livelihood outcomes.

Similarly, the Bamuni Beel intervention demonstrated an increase in both fish production and fisher household income after the introduction of culture-based fisheries and pen culture (ICAR-CIFRI, 2022) [6]. These examples indicate that stocking can have meaningful livelihood effects when combined with appropriate management and community participation.

10. Proposed model for stunted fingerling-based reservoir enhancement

A practical model for utilizing stunted fingerlings in reservoir fisheries could involve five major stages. In the first stage, hatcheries or nursery facilities would produce healthy fish seed. In the second stage, selected fish would be maintained under controlled nursery conditions where growth could be regulated without compromising health. In the third stage, fish would undergo a recovery or conditioning phase with adequate nutrition and water quality so that they attain an appropriate physiological and physical condition. In the fourth stage, the fish would be stocked into the reservoir or transferred into reservoir-based pens until they reach an appropriate release size. In

the fifth stage, the stocked population would be protected through appropriate fishing regulations before controlled harvesting begins.

Such a system could be particularly useful in reservoirs where seasonal seed availability does not coincide with the most suitable stocking period. It could also reduce the need to transport very small fish over long distances.

However, the proposed system should be validated through field experiments. A scientifically designed comparison between conventional fingerlings, stunted fingerlings and advanced fingerlings would provide important evidence for determining which stocking material provides the best combination of survival, growth and economic return.

11. Reservoir-specific stocking management

There should be no universal stocking density applicable to all reservoirs because reservoir productivity varies considerably. Sarkar *et al.* (2020) [1] noted that stocking recommendations have historically varied according to reservoir size, and emphasized the need for scientific assessment of stocking impact to determine optimum stocking density.

Before stocking, managers should evaluate reservoir area, water-spread dynamics, depth, dissolved oxygen, pH, transparency, plankton productivity, existing fish community, predator abundance and fishing pressure. The carrying capacity of the reservoir should then be considered before determining the quantity of seed to be released.

Species selection is equally important. Indian major carps such as *Catla* (*Labeo catla*), *Rohu* (*Labeo rohita*) and *Mrigal* (*Cirrhinus mrigala*) are widely used in Indian culture-based fisheries because they utilize different ecological niches. However, stocking should complement the existing fish community rather than simply introducing large quantities of the same species already present in sufficient abundance. The timing of stocking should coincide with suitable environmental conditions and sufficient availability of natural food. Immediately after stocking, fishing pressure should ideally be controlled so that fish have sufficient time to grow and contribute to reservoir biomass.

12. Post-stocking protection and fishing regulation

Stocking without post-stocking protection can reduce the effectiveness of fisheries enhancement. If stocked fish are harvested soon after release, the intended increase in fish biomass may not occur. A temporary closed period after stocking can therefore provide fish with sufficient time to acclimatize, disperse and grow.

Fishing regulations should include appropriate mesh sizes, protection of breeding grounds, seasonal restrictions and control of destructive fishing practices. Fisher cooperatives can play a major role in implementing such regulations because community ownership and participation may improve compliance.

The economic success of stocking should be evaluated through catch-per-unit-effort, total catch, average fish size, species composition and fisher income. Merely recording the number of fingerlings released is insufficient for evaluating the success of a reservoir fisheries programme.

13. Monitoring and evaluation

A scientifically managed programme should monitor both biological and socioeconomic indicators. Survival and growth of stocked fish should be assessed where possible through sampling and marking studies. Catch data should be collected regularly to determine whether the abundance of target species increases following stocking.

Catch per unit effort is particularly useful because it can indicate changes in fish availability while accounting for variations in fishing effort. Changes in fisher income should also be documented before and after implementation. Market price, fishing costs, fuel expenditure and fishing time should be included in economic analysis.

Environmental parameters including dissolved oxygen, temperature, pH, transparency and plankton abundance should also be monitored.

This information can help explain differences in fish growth and survival among reservoirs.

Long-term monitoring is especially important because reservoir fish production can vary naturally from year to year. A single high catch after stocking does not necessarily prove that stocking alone caused the increase. Therefore, multi-year datasets are preferable for evaluating stocking programmes.

14. Constraints and risks

Although stunted fingerlings offer potential advantages, several limitations must be recognized. The first is the relatively limited amount of direct evidence concerning their performance following release into open reservoirs. Much of the available research concerns controlled environments such as cages, ponds or nursery systems. Therefore, results obtained under protected conditions cannot automatically be extrapolated to open reservoirs.

The second major limitation is predation. Fish that are too small at the time of release may experience high mortality. This is one reason why advanced fingerlings are commonly preferred for reservoir enhancement. The third limitation is the possibility that severe stunting may reduce physiological condition. Controlled stunting should therefore never involve prolonged starvation or severe environmental stress.

Another concern is reservoir carrying capacity. Excessive stocking may increase competition for food and reduce individual growth. High stocking density can also increase disease transmission in nursery or pen systems.

Genetic considerations are also important. Hatchery-reared fish should be sourced responsibly, and stocking programmes should avoid unnecessary genetic risks to native fish populations. Where conservation-sensitive or indigenous species are involved, genetic and ecological assessments should precede stocking.

15. Future research requirements

Further research is required before stunted fingerlings can be widely recommended for open-reservoir stock enhancement. Comparative experiments should evaluate the performance of conventional fingerlings, stunted fingerlings and advanced fingerlings under similar reservoir conditions. Important parameters should include post-stocking survival, growth rate, recapture rate, biomass production and economic return.

Research should also determine whether the degree and duration of stunting influence subsequent performance. Species-specific responses need to be investigated because compensatory growth is not identical among fish species. The influence of water temperature, natural food availability, stocking density and predator abundance should also be evaluated.

A particularly valuable research programme for Maharashtra would involve reservoirs where cage and pen infrastructure is already available. Stunted *Labeo rohita* could be reared under controlled conditions, followed by release into selected reservoirs and comparison with conventionally produced advanced fingerlings. Such research would provide locally relevant evidence for fisheries policy and management.

16. Conclusion

Reservoir fisheries have considerable potential to contribute to fish production, food security and livelihood development in India. Scientific stock enhancement has already demonstrated positive production outcomes in several reservoirs, particularly when stocking is combined with appropriate management and community participation. Sarkar *et al.* (2020) [1] documented substantial increases in fish yield in reservoirs where culture-based fisheries and scientific fingerling stocking were implemented.

Stunted fingerlings represent a potentially useful addition to the reservoir fisheries-management toolbox because controlled growth restriction followed by favorable rearing conditions can result in compen-

satory growth. Evidence from Dimbhe Reservoir, Maharashtra, indicates that stunted *Labeo rohita* can subsequently achieve substantial growth under appropriate feeding and stocking-density conditions. However, this evidence should not be interpreted as proof that stunted fingerlings are universally superior to advanced fingerlings for direct release into open reservoirs.

A more scientifically defensible approach is to consider stunted fingerlings as an intermediate stocking resource that can be subjected to conditioning, recovery and nursery or pen rearing before final release. This approach could improve seed availability, reduce seasonal constraints and create opportunities for direct involvement of traditional fishers in seed production and reservoir enhancement.

The integration of quality seed production, controlled fingerling rearing, pen-based nursery technology, scientific reservoir stocking, predator management, post-stocking protection, regulated fishing, community participation and socioeconomic monitoring can provide a more comprehensive framework for reservoir fisheries development. The experiences of ICAR-CIFRI at Mapithel Reservoir, Bamuni Beel and other inland water bodies demonstrate that when scientific technology is combined with community participation, fisheries enhancement can contribute to both fish production and livelihood development (ICAR-CIFRI, 2022; ICAR-CIFRI, 2023) [6, 5].

Thus, the future of reservoir fisheries enhancement should move beyond the simple release of fish seed and toward a community-centred, scientifically monitored and reservoir-specific production system. For traditional fishers, such an approach has the potential to strengthen fish availability, employment and income while promoting responsible utilization of reservoir resources.

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