

Boon or Doom?

While cage culture in inland open waters can help increase fish production in India, there is a need to be wary of hasty and arbitrary policymaking

Cage aquaculture, though relatively new to the inland aquaculture scenario of India, brings in new opportunities for optimizing fish production from reservoirs and lakes, and also developing new skills among fishers and entrepreneurs to enhance their earnings. Generally perceived as a boon for increasing production, this mode of production can as well turn out to be a harbinger of doom, if allowed to grow unchecked. This article stresses the importance of (a) following the existing guidelines on cage culture, (b) the need for developing norms for better environmental impact assessments, and (c) the importance of exercising

receives in the form of unused feed and metabolic wastes of caged fishes. Equally important is the physical obstruction to the fishing activities of traditional fishers and the resultant conflicts. Exotic species, after escapement from cages, can play havoc with the ecosystem and its biodiversity. High input of feeds can lead to eutrophication and related damage to the ecosystem. Eutrophication upsets the nutrient cycles and the community metabolism of reservoirs, making them barren. It must be borne in mind that our reservoirs support fisheries on which the livelihoods of thousands depend.

After the recent introduction of pangas (*Pangasianodon hypophthalmus*), which is an air-breathing fish allowing high stocking density, 3-5 tonnes of fish are being produced from a small cage of 6m x 4m x 4m. Considering that at least 6 - 10 tonnes of feed go into the system per cage per production cycle, the staggering scale of artificial nutrient loading it can cause is mind boggling. A mad rush for cage culture in reservoirs has already started in the country and if continued unabated, the situation might go out of control, leading to a disaster, much greater in scale than the shrimp culture debacle of the 1990s.

Ecological disaster

Laguna de Bay is a living example of how uncontrolled growth of pen culture triggered off an ecological disaster in the Philippines. Cage culture is a relatively new area of fish production in India and its environmental impacts are not fully understood. There is a wealth of literature abroad on assessing the nutrient loading, which is directly

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caution while aggressively pursuing cage culture in inland open waters of India.

Considering the ever-increasing and often conflicting cross-sectoral demands for water and land, there are limitations for growth in pond-based aquaculture. In this context, culture of fish in enclosures such as cages and pens installed in open water bodies offer scope for increasing production, obviating the need for more land-based fish farms. However, mindless proliferation of this activity for increased production can lead to some very serious environmental and social problems. The first and foremost is the high nutrient input that the water body

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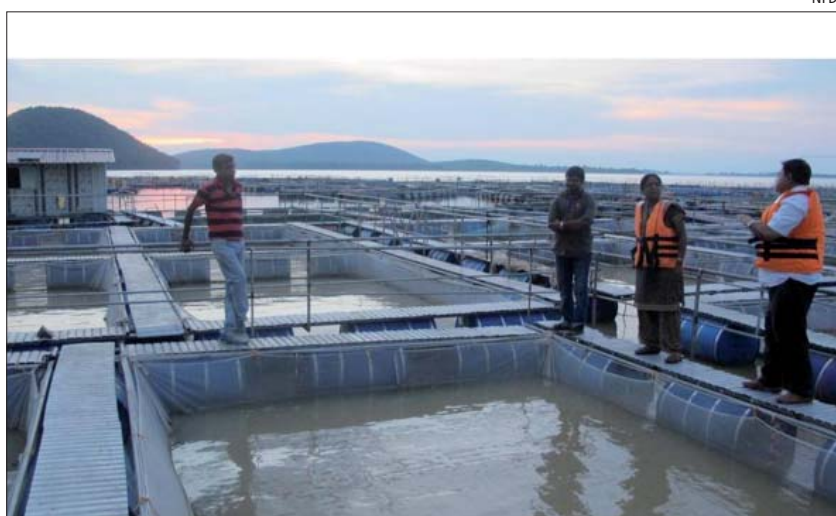
related to the feed input and feed conversion rate (FCR). But these models are not directly applicable in India due to the different environmental regimes under which these have been developed, especially the variations in temperature and trophic status. Efforts are on to develop such models in India, but the results will not be available for a while.

Research institutes in India that develop cage-culture technologies often neglect studies on its environmental impact, although such studies are essential and complementary. Our research institutes should pay attention to assessing the carrying capacity of reservoirs and inform the government and policy-makers how to proceed with developing cage culture in the country. Hasty and arbitrary policymaking at the state level to allow cages in large numbers in reservoirs without assessing the environmental impacts is a matter of deep concern, especially in the backdrop of our bad experience with coastal aquaculture in the 1980s and 1990s when unregulated growth without addressing environmental concerns resulted in disastrous consequences to ecosystems. Following the guidelines of the Code of Conduct for Responsible Fisheries of the Food and Agriculture Organization of the United Nations (FAO-CCRF) for dealing with data-deficient systems, our policy towards environmental impact assessment (EIA) of cage culture should be based on a precautionary approach.

Recognizing the importance of cage culture in inland open waters, a National Level Committee was set up on 25 April 2016 to develop guidelines with a mandate to (a) assess the potential of this culture system to contribute to increased production, employment, income generation and other benefits, (b) assess the possible environmental and socioeconomic impact, (c) suggest precautions to be taken, and (d) suggest the modes of propagating and scaling up this technology to optimize benefits in a sustainable manner. The committee

developed a set of guidelines that provide several recommendations covering many aspects on cage culture such as (1) the relevance and scope for cage culture in inland open waters, (2) definition of cage and cage culture, (3) cage size, shape and materials, (4) site selection, (5) cage maintenance, (6) species selection, (7) stocking density, (8) feed and feeding and FCR, (9) fish health monitoring, (10) safety measures, (11) market, post-harvest facilities and infrastructure, (12) environmental precautions and impact assessment, (13) carrying capacity, (14) ownership, (15) beneficiaries, (16) governance, (17) and (18) social relevance.

These guidelines are addressed to all stakeholders, including farmers, self-help groups (SHGs), co-operative societies, other community organizations, business process development facilitators (BDFs), farmer producer organizations (FPOs), Fisheries Departments of the Indian states, the Department of Animal Husbandry Dairying and Fisheries, Government of India, and its institutes, research organizations and environmentalists. But it is pertinent to note that at present, India does not have an umbrella agency that oversees/regulates freshwater aquaculture activities or implements guidelines/best management practices (BMPs). Equally glaring is the lack of a uniform policy across the country that governs freshwater



Cage culture in Chandi Reservoir, India. Generally perceived as a boon for increasing production, this mode of production can as well turn out to be a harbinger of doom

aquaculture. Thus, there is no scope for these guidelines to be readily implemented at this stage. Nevertheless, these can still (a) guide the departments/agencies of the state and central governments in formulating development plans based on cage culture, (b) inform policies to be framed in future, and (c) guide farmers and entrepreneurs for practising responsible cage culture in the country.

The following are the major highlights of the guidelines:

- Due to ecological reasons, cage culture in rivers needs to be discouraged.
- Subject to other conditions, it can be practised in estuaries, lagoons, lakes and large/medium reservoirs.
- Cage culture shall be allowed in water bodies having a surface area 1,000 ha or more at FRL. (Exception to this can be made only in case of 'very deep abandoned mines', which are less than 1,000 ha in area, but too deep for practising culture-based fisheries, subject to all other conditions prescribed).
- Cage culture shall be allowed in reservoirs with an average depth of 10 m (average depth is calculated as: area in hectares divided by water holding capacity in m³).
- The cage site at the reservoir should have at least 10 m depth round the year.
- Cage culture should not be attempted in any water body having total phosphorus and total nitrogen levels in the water exceeding 0.02 mg/l and 1.2 mg/l, respectively.
- Environmental impact assessment is necessary before clearing cage-culture projects. This will be done/facilitated by recognized organizations, following the standard procedure.
- The state governments should demarcate, list and notify water bodies that are suitable for cage culture on the basis of its trophic characteristics and other criteria of site selection, and upload the list of water bodies and their suitability on geographic information system (GIS) platform with the help concerned institutions.
- It will be mandatory for the cage-culture operators to record the water quality parameters like dissolved oxygen, pH, CO₂ and total alkalinity, inside and outside the cages, from day one of the operation, keeping in view the need for long-term environmental impact. Any increase in nutrients level away from the cage area should be taken as a warning.
- It will be mandatory for the cage-culture operators to collect data on the trophic status in and around the cages as well as the areas away from the cages periodically and report to the authorities to assess the impacts in terms of nutrient loading. Studies on other chemical and physical quality parameters of water and sediments also shall be collected as per the risk perception.
- NFDB and central organizations will build capacity at state governments to interpret such data and arrive at conclusion.
- *Pangasianodon hypophthalmus* and *Genetically Improved Farmed Tilapia* (GIFT tilapia) are allowed to be cultured, but all other exotic species (including illegally introduced fishes) are strictly prohibited for cage culture.
- As far as possible, use of antibiotics and chemicals should be avoided. However, in the event of it becoming necessary under exceptional circumstances, the use should be judicious and it must be clearly understood that only approved drugs/chemicals, permitted by government regulatory authorities at standard doses shall be used.

The carrying capacity of a water body to hold cages is the most vital input for decisionmaking in cage culture. But, unfortunately, we are not in a position to arrive at carrying capacity at decent precision levels due to paucity of data. Therefore, guidelines on carrying capacity have been based on a precautionary approach. Provisions of the FAO-CCRF clearly stipulate the need to follow

the 'precautionary approach' while dealing with data-deficient systems. Accordingly, taking into account the general trend of nutrients in Indian reservoirs and the possibility of nutrient loading from cage culture, the guidelines prescribe the following carrying capacity on a precautionary-approach basis (Table 1):

Table 1. Limits set for cage culture in reservoirs under the guidelines

Reservoir area (ha)	Maximum number of cages allowed (1 unit is 6m x 4m x 4m)
< 1000	Not allowed
1001 to 2000	500
2001 to 3000	1000
3001 to 4000	1500
4001 to 5000	1900
5001 to 10000	3000
> 10000	5000

As standalone or in in batteries (of 6, 12, or 24 units) as required

Large-scale production through cage culture can adversely impact prices, leading to a glut in the market, which can act as a major disincentive to present and potential entrepreneurs. A few cases of glut have been reported, especially with regard to problems in marketing of *pangas*. With many newer species such as tilapia, seabass, cobia, etc, lined up for cage culture, a careful strategy involving marketing plans, value addition and market infrastructure should be evolved.

Unlike land-based aquaculture undertaken on private land, cage culture is practised in common-property resources. Therefore, the question "who owns the cages installed in reservoirs" needs an important consideration. While answering the question, the following facts need to be considered:

- a. Almost all large and medium reservoirs in the country are owned by the government or government-controlled agencies, which are used by fishers as 'common-property resources' with 'free' or 'almost free' access.
- b. Fish produced from the reservoirs is essentially a natural resource in the form of 'ecosystem goods and

services', on which the traditional and local fish communities have the 'natural primary rights'.

- c. The livelihoods of many poor people depend on catching fish from reservoirs.
- d. Reservoir fishing is used sometimes as a means to rehabilitate people ousted from the dam projects.

Considering the above facts, it is essential to ensure that expansion of cage culture does not impair the livelihoods and income of fishers. Cage culture can adversely impact the interests of local fishers by denying them access to fishing grounds, obstructing their pathways, and by way of a decline in fish catch. Fish catch can be adversely affected in many ways such as by lowering the natural productivity, eutrophication, algal blooms or through the impact of exotic species. At the same time, it is equally important to utilize the additional fish production potential through cage culture. Considering the need to avoid conflicts, the best way to achieve the goal is to empower fishers to take up this activity collectively. Pursuing a purely revenue approach (as being followed by some of the state governments) by allowing individual investors and corporate houses to undertake cage culture will be against the spirit of inclusive growth and can create social tensions. Thus, the community (or a group of members of the community) should own the cages as a common property and they should be the beneficiaries of this technology.

Co-management principles

A strong governance platform based on co-management principles is essential for responsible cage-culture operations to be undertaken by the community. But the existing fishermen's co-operative societies have a poor track record of functioning responsibly to work as a group. This throws up a big challenge to the government on how to organize and empower the fisher communities and develop capacity among them to enable

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Preparation of a bamboo cage. Drafting hasty policies without delving deep into the areas such as ecosystem processes can cause irreversible damage to the sector and the ecosystem

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them to take up cage culture. SHGs, co-operative societies or other such groups should be given licenses to undertake cage culture. Under any special circumstances, should a private entrepreneur or investor be brought to the scene, governments, through strong policies, should protect the interest of the local fishers and fisher communities, who have the primary rights to the natural resource. A Conflict Management Cell should be established to address complaints.

Cage culture in inland open waters is a fast-growing activity that could have many environmental and social impacts, which may not be predictable. But adequate precautions need to be taken. The ultimate goal should be increased fish production through environmentally sustainable and socially inclusive means.

The additional income generated from the reservoirs through the growth of cage culture should be shared by the fisher community rather than an investor walking away with all the benefits, while the fishers get only wages. Apart from an increase in fish production, a meaningful social impact should be in the form of generating additional income and improved standard of living for the fisher—the main stakeholder—who belongs to one of the weakest sections of society.

Considering India's rich and varied open-water resources like reservoirs, lakes and floodplain wetlands, enormous scope exists to increase production through enclosure aquaculture. Utilizing a modest fraction of their surface area, large and medium reservoirs can contribute a substantial quantity of fish to the total inland fish production. Although cage culture has not yet reached the desired commercial proportions capable of making any impact on the production figures, it is growing at a very fast pace, giving hopes and also causing some concern. The reservoir ecosystem is complex and so are its problems. Concerted efforts by scientists, government agencies and policy-makers and, above all, the community organizations and NGOs, will be required to optimize the benefits from reservoirs and to keep off undesirable paths by learning lessons from our past ecological mistakes, including those of other countries. Evolving simplistic solutions to problems and drafting hasty policies without delving deep into the areas such as ecosystem processes, socioeconomic milieus and governance regimes, will not only be useless, but can also cause irreversible damage to the sector and the ecosystem. 3

For more

nfdb.gov.in/PDF/GUIDELINES/Guidelines%20for%20Cage%20Culture%20in%20Inland%20Open%20Water%20Bodies%20of%20India.pdf
Guidelines for cage culture in inland open water bodies of India