

**Training Manual
on
Cage Culture
of
Marine Finfishes**

Editors

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Training Manual



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Different aspects of cage culture management for sustainable fish production

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Introduction

A technological intervention has been the major impetus for the rapid development of cage farming of marine fishes across the world. In spite of the various technologies available for the fulfilment of high production and proper installation of the cages, it is necessary to optimise the many factors periodically to avoid the adverse impact of environmental and ecological factors for long maintenance of cages and also to maintain the healthy animals in the cage. In this context, monitoring plays vital role in any type of mariculture activity. Therefore, a well conceived and designed monitoring programme is needed to promote good growth of fishes and to obtain optimal production in a sustainable manner from cages. Cage monitoring is an integral part of the cage culture and it should be continued starting from the installation of the cage to till harvesting the fishes. The following are the major aspects where the cage monitoring is essential and it includes maintenance of cage and its accessories, stocking of the fish, feeding, fish husbandry, health management, water quality and harvesting.

Maintenance of cage and its accessories

The materials are used in constructions of cages have a definite life span and will eventually wear out. Therefore, cage with net and mooring system should be checked periodically during the culture period. Generally algae grow on the cage frame, which makes the frame slippery. It should be scrapped once in a

month to keep cage frame clean, so the worker can easily work by standing on the cage. The chain and floats attached to the mooring system should be regularly (once in a month) inspected for any damage such as loosening of shackle and damage of chain. If any damage is noticed, it should be repaired immediately. The mooring system should be compulsorily checked after any extreme weather conditions such as cyclones, storms, depressions, etc. The net attached to the cage frame is always in the water, and it is susceptible to settlement of fouling organisms such as barnacle, algae, etc. Therefore, the nets should be frequently checked for assessing the extent of fouling and if it is observed that the more than 50 % of the net meshes are clogged and then the net must be changed. The inner net of the cage should be changed once in every 3 months or depends on the rate of fouling, and the mesh size used in the inner net should be selected according to the growth of stocked fish. The net must be checked frequently for any damage.

Stocking of the fish

The candidate species for which the seed is readily available is the ideal for cage culture. Seed may be obtained from wild source or can be procured from commercial hatcheries. However, they should be of uniform size for stocking. The seed collected from wild or hatchery should be acclimatized to the water condition in the cage so that mortality will be reduced during stocking. It is better to stock the cage during early morning or evening hours to avoid wide temperature fluctuations. The ideal size of the fish to be stocked in cage is around 10-15 cm. If the size of fish is smaller than recommended size, then it has to be reared in nursery system either in tank or pond or cage itself. When smaller sized fishes are reared in the cage, it is better to stock in hapa of appropriate mesh size. In this case, fishes have to be graded every week to avoid cannibalism depending on the species. A fine knotless mesh hand-net should be used for handling the fish

to minimize damage. Feeding of fish on transfer to the cage should commence 3-4 hours after transfer. The stocking density in the cage will vary according to size of the fish. Generally, the recommended stocking density for Asian sea bass (*Lates calcarifer*) of 10-15 cm is 24-30 no/m³.

Feeding

Feed and feeding regimes need proper management for maintaining better health and growth of the cultured fish. Feeding should be done throughout the culture period at varying levels depending on the growth rate and natural feed availability in the system. Generally, fishes should be fed @ 10 % of body weight during the starting period and slowly it should be brought down to 3-5%. Hand feeding is done in most cases and it is recommended for small-scale farmers. However, mechanical feeders such as demand feeders and automatic feeders are used in large scale farms. Feed rings can be used if floating pellets are used. Feed trays set inside the cages at different positions can also be used for distribution feed evenly. During hand feeding, the feeding of fish can be monitored and can be fed till satiation. While doing so, the stock health status can also be monitored. It is better to give mixed feed for e.g. alternates of pellet feed and trash fish. The mixed feeding scheduled is good for proper growth of fish. When frozen trash fish is given as feed, should be thawed first, chopped and then broadcasted over the surface. The trash fish should be washed properly with fresh water to avoid any external parasite entering into the cage with feed. Overfeeding of the stocked fish should be avoided otherwise it could lead to deterioration of water quality. The fish should be fed at least twice per day once in the morning and then evening. However, at the earlier stage, feeding frequency of more than two times is suggested for better growth.

Fish husbandry

Regular observation of fish stock is essential for any culture system. Therefore, farmers should observe the fish stock without unduly disturbing them which helps to understand the general behaviour of the fish under normal cycle of environmental condition prevalent at the site, i.e., dawn/mid day/dusk/high tide/low tide, feeding/non feeding, etc. If something wrong is observed then fish should be sampled and examined further for changes in physical appearance in different body parts: spine - deformed spine; skin - abnormal colour, presence of lesion, rashes, spots or lumps, excessive mucus; eyes - bulging eyes, cloudy lens; fin and tail - erosion. These clinical signs indicate that the fish stocks are in abnormal condition, which might be due to effects of adverse environmental factors or infected with disease. These problems need to be properly addressed to adopt the further precautionary measures or to give proper treatments to the fishes.

In cage, fish sampling should be done at regular interval of at least once in a month to understand the growth rate of the fish. Periodic information on the growth rate of the fish is required for the calculating the feed requirement of the fish stock. This information will give a fair idea about the stock performance and the feed requirement for further coming days of the culture and then also help to avoid over feeding. Record keeping of the farming practices such as daily mortality, feed consumption, and growth rate should be maintained. It is crucial in understanding the epidemiology of diseases and this allows farmer to identify the critical management point in the production cycle. Observation, collection and storing the data during a culture practices help to take early preventive action in case of disease outbreaks/abnormal situation in the subsequent culture practices.

Health management

Implementation of the good sanitation practices is essential in any fish culture system. However, it is difficult to implement the practices in cage farming system since there are no barriers between the cage environment and its surroundings (where the pathogen can be found). Even though, it is necessary to reduce the risk of contamination by adopting simple management practices to reduce the pathogen pressure in the environment. The important practices to be followed to reduce the pathogenic loads include, avoid the overfeeding to the stock; wash the trash feed with fresh water; remove the moribund or dead animal immediately, maintain the optimal stocking density in cage, exchange of net at appropriate time. The uneaten food is a potential source of pathogens, so stock must be not overfed. The dead animal is another source of pathogens in the cage, if a moribund or dead fish is noticed it should be removed immediately. Washing trash fish with fresh water will kill almost all the external pathogens from sea origin; hence washing the feed with fresh water is must. The fish stocking density should not be more than the recommended stocking density otherwise it will lead to many complications and finally stock will collapse due to health problem. The net of the cage should be removed at appropriate time, otherwise the water flow in the cage will reduce which may leads to water quality related problems and finally stock will collapse.

Water quality

Maintenance of good water quality parameters in cage farming system is difficult, since the cage culture practiced in open water bodies and no boundary existing between the cage environment and its surroundings. However, the important water quality parameters are to be monitored frequently to avoid losses caused by lethal changes in water quality. It is essential to have long term data on

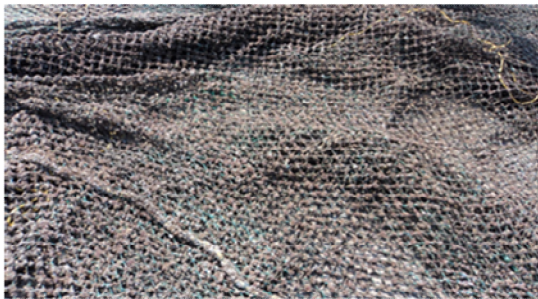
the changes in the water quality parameters at the site; so that changes in the water quality parameters from the site could be observed and predicted and accordingly preventive decision could be taken in advance. Frequent recording of important water quality parameters like ammonia, nitrite and nitrate, pH, turbidity and temperature will give a clear idea about cage environment and also will help to understand the health status of the animals in the system.



Cage anchored in Sea



Sea bass seed ready for stocking



Fouling on net



Net exchange

Harvesting

Harvesting of fish is done continually or in batches depending on how the production cycle is managed. Before harvesting, the fish may be starved for a day to have empty gut which will help to get long shelf life of the produce. Fish could be harvested in situ or the cages are towed to convenient places where the netting

operation may be carried out more smoothly. The process of harvesting is simple where the net is lifted up and fishes are concentrated to a small volume and scooped out.

Cage farming of the fishes in existing open water is a gift to the most of the fish farming communities and this removes one of the biggest constraints of fish farming on land. Cage farms are positioned to utilise natural currents, which provide the fish with oxygen and other appropriate natural conditions while also removing waste. Open sea cage aquaculture is one of the more contentious methods of aquaculture. Environmental groups worldwide condemn the culture practices, but the industry promotes itself as sustainable method of fish culture for the future. In this controversy situation, the culture practise need to be proved as one of the best method for the sustainable production of fish by giving profit to the farmer/entrepreneur through increased production and less investment. This could be achieved through proper management and continuous monitoring the different aspect related to cage culture.

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