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MESOCOSM: AN OVERVIEW

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Species heterogeneity is the foremost approach for the sustainable development of aquaculture. For successful domestication of any species, larval rearing is the major constraint; therefore, the adaption of proper protocols is fundamental. Larval rearing is classified into two types based on their rearing densities, i.e., intensive rearing and extensive rearing. In intensive rearing, larvae are reared at higher densities under disciplined conditions with well sound knowledge of their biological requirements. In extensive rearing, larvae are reared at lower stocking densities in large tanks under natural conditions with an internal bloom of wild zooplankton. Subsequently, the probability of success is more than intensive rearing. Extensive rearing is already employed for more than 20 fish species. But the major constraint for large scale adaption extensive rearing is low productivity. To solve the larval rearing problem of several species, mesocosm is one of the major solutions.

Mesocosm

In 2002 mesocosm hatchery was installed at Centro de Maricultura Calheta (CMC), Madeira island depending on the environmental stability of the large rearing tanks with the use of **Green water** technique in low stocking densities to produce healthy fish larvae at low cost. Mesocosm is a semi-intensive (combination of both intensive and extensive) technology that promotes larval rearing of multiple species solving their biological, technical, and economic consequences. Mesocosm is a culture system of larval rearing enriching the pelagic ecosystem in hefty tanks size ranging from 1 to 10000 m3. This aquatic ecosystem comprises multiple species, the innate food chain of phytoplankton, zooplankton, and culturing fish larval species. In these pelagic system fish larvae acts as a predator which feeds on its prey, i.e., phytoplankton (Diatoms, Dinoflagellates. Etc,)and zooplankton (Copepod, Brachionus. Etc,)

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Difference between intensive, extensive, and mesocosm

Parameters	Techniques		
	Extensive	**Mesocosm**	**Intensive**
Rearing Enclosures	Ponds or bags	Tanks or bags	Tanks
Localisation	Outdoor	Indoor	Indoor
Rearing volume (m3)	>100	30-100	<20
Rearing density (Ind/l)	0.1-1	2-8	30-200
Food chain	Endogenous	Mixed	Exogenous
Infrastructures	Light	Medium	Sophisticated
Environment	Natural	Mixed	Controlled
Autonomy and autarky	High	Medium	Low to nil
Dependence on man and technique	Light	Medium	High to very high
Need for specific biological knowledge	Light	Medium	High to very high
Validity for new species	Very high	High	Medium to low

Mesocosm Protocol

Drying of tanks/ponds for 4 days

↓

Disinfection with the chemical to kill predators and pathogens

↓

Filling of tanks/ponds with adjacent seawater rich in plankton

(Note: While filling seawater inlet is fitted with a 350-500µm filterto prevent the entry of pathogens)

↓

Fertilizing filled water with N:P ratio 5-10(Seawater)

(Note: For freshwater poultry manure with additional fertilization for every 3days with chemical fertilizer)

↓

Stocking of fish larvae after adequate development of plankton

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In mesocosm, various types of plankton will develop one by one and this process is succession. The time of addition of fish larvae into to mesocosm system is after adequate development of plankton and when larvae start feeding.

Types of mesocosm

There are two methods to develop a mesocosm system for larval rearing.

Advective method

It is entirely dependent on the external processes of the system. In the first system, water is frequently exchanged. In this system, intaking water is filtered to prevent the entry of pathogens allowing Phyto and zooplankton. Similarly, outgoing water is filtered to avoid the exit of fish larvae.

Semi-intensive method

It is entirely dependent on the internal processes of the system. This system is convenient for aquaculture, as this system does not require technical knowledge. This system is further divided into four types based on the enclosures used for water retainment. They are

Pold system

Pold system is an isolated enclosure of fjords or lagoons and dams in isolated bays. Enclosures are treated with chemicals (Rotenone) before every cycle to make the culture system predator-free. An alternate method for the removal of predators is emptying and drying. After treatment and fertilization of the enclosure, microalgae are added as inoculum for the promotion of phytoplankton bloom. Copepod eggs resist rotenone treatment and help in the promotion of zooplankton bloom. Pold system is ready for stocking with fish larvae after an ample amount of copepod nauplii is developed. In the case of zooplankton depletion, zooplankton collected from nature can be introduced into the system.

Bag system

This system is a simplified version of the pold system. In this system, enclosures are polythene or PVC bags tied to the floating wharf. After filling the bag with filtered water, microalgae are added as inoculum to the system. Screened zooplankton is added to the bag after the successful development of phytoplankton bloom. When an ample amount of zooplankton is reached, fish larvae are introduced into the system. Water exchange can be carried at the rate of 1-2% for the first two weeks and then 10-100% of the bag volume per

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day. These bags have a conical bottom with an outward hose from the bottom to the surface for water renewal. These bags are used in Norway for the rearing of turbot, halibut, and cod fingerlings.

Pond system

This system is straightforward and cheap in construction, maintenance, and operation in this system enclosures are human-made ponds. This system is used in rearing freshwater cyprinid fish larvae in Denmark, Norway, and China.

Tank system

In this system, tanks are used for rearing fish larvae and copepod separately. The main idea of this system was to maintain abiotic (nutrient level, pH, temperature, light intensity,) and biotic (phytoplankton and copepod production, number of predators, bacterial turn-over, regeneration of nutrients from copepods and fish larvae)components separately and synchronize them in such way that one trophic level matches the predation by the higher level.

Benefits of mesocosm

1. The larval survival rate is high.
2. Fish larvae reared using mesocosm have more incredible growth performance and lower deformities.
3. Constant availability of lived feed to the fish larvae
4. Less vulnerable to technical failures.
5. Lower cost and simplicity in installation.

Challenges of mesocosm

1. Regular sorting of larvae to prevent size variation.
2. Synchronization of mesocosm setup and fish egg production.
3. Due to excessive plankton bloom production surface lipid film is formed.
4. Little control over the rearing environment.

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Conclusion

The Mesocosm system is a semi-intensive technology that has the advantages of more productivity and survival rate. The effectiveness of mesocosm for new species is similar to extensive rearing. This technology is an excellent adaption to achieve species heterogeneity and future weapon for larval rearing the most difficult species.

References

Andrade, C. A., Soares, F., Ribeiro, L., Roo, F. J., Socorro, J. A., &Dinis, M. T. (2015). Morphological, Histological, Histochemical, and Behavioral Aspects during Early Development of Red Porgy Pagruspagrus L. Reared in Mesocosm. *Turkish Journal of Fisheries and Aquatic Sciences*, *15*(1), 137-148.

Andrade, C., Nogueira, N., Silva, P., Dinis, M. T., & Narciso, L. (2012). Mesocosm hatcheries using semi-intensive methodologies and species diversification in aquaculture. *Journal of Agricultural Science and Technology. B*, *2*(4B), 428.

Divanach, P., &Kentouri, M. (2000). Hatchery techniques for specific diversification in Mediterranean finfish larviculture. *Cahiers options méditerranéennes*, *47*, 75-87.

http://www.fao.org/3/W3732E/w3732e0u.htm