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Hatchery systems

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HATCHERY SYSTEMS

The mortality rate during the larval phase is significantly higher compared to the other phases of culture operations. The survival rate of eggs and larvae is particularly important where fecundity of fish is low. For these reasons, the development of indoor hatchery systems - where female broodstocks spawn, the eggs fertilized and hatched, and the fry grow until strong enough for stocking - is highly desirable. In such systems, the early stages of the life cycle are carried out in a controlled environment where the quality and temperature of the water, the amount of light and other factors including disease and feeding are closely monitored to ensure optimal living conditions.

The rapid growth of the aquaculture industry, concurrent with new technological endeavors and scientific breakthroughs inbreeding, has led to an increasing but still insufficient and inconsistent fry supply. The development of good hatchery systems to cope with the rising demand for fry is, thus, indispensable.

Site selection. When establishing a hatchery, particularly a large-scale modem hatchery, the criteria for site selection must be rigidly followed considering the high financial input. Some of the more important criteria include:

• *Quality and source of water.* The water to be used in hatcheries should be clean, pollution-free and of good and stable quality throughout the year.

In the case of water supply for a tropical freshwater fish/shrimp hatchery, the following are considered ideal: an average temperature of 24 - 31°C; pH, 7 - 8.5; dissolved oxygen (DO), >5 ppm; hardness, >20 ppm; turbidity, <50 FTU; BOD, <1 ppm; ammonia, <0.1 ppm; nitrite, 0.02 ppm; and trace amounts of heavy metals and no pesticides. For marine fish and brackishwater shrimp, besides these prerequisites, a salinity range of 28 - 33 ppt is also recommended.

• *Climatic conditions.* Hatcheries should be established in areas where temperature/ humidity do not fluctuate excessively. In addition, the land elevation should be high enough to prevent flooding.

• *Facilities.* Electricity is essential to life-supporting systems and other hatchery equipment. Pumps and aerators can be driven by generators in areas without electricity although it is more economical to operate hatcheries in areas with a reliable source of electricity. The installation of an on-site standby generator is, nevertheless, absolutely necessary.

Easy accessibility should also be ensured all year-round to facilitate communication and transportation of equipment, supplies and fingerlings.

Finally, the presence of spawners at the vicinity of the proposed site to ensure a consistent supply especially for those species of which full artificial reproduction cycle has not been mastered is advantageous.

Design and Construction. For economic reasons, hatchery design should be simple, compact, and easy to operate with maximum efficiency. Principles of sanitation and hygiene should be followed in the design and construction since fish/shrimp larvae are usually very susceptible to disease.

There is no standard format for the layout of a hatchery. Similarly, there is no limitation on the size of a hatchery. For optimal health conditions and control reasons, the hatchery layout should be "compartmentalized". The different sections should have separate water supplies, and cleaning material; and care should be taken to disinfect all equipment before reuse.

It is desirable that all materials used in the construction of hatcheries be locally available, low-priced, and durable. Examples: wood, concrete, reinforced concrete, ferro-concrete, fiberglass, and wood with plastic lining.

Management and operation. The management and operation of hatcheries usually follow similar lines, although there are slight variations depending on species cultured and scale of operation.

•*Broodstock development and spawning.* Fish/shrimp selected for broodstock should be fast-growing, active, healthy and among the largest and strongest individuals of their age group.

Broodstock are usually kept in maturation tanks until spawning time. There are various ways in which spawners are induced to spawn, from semi-natural methods involving, for example, raising the water level in tanks, photoperiodic induction and eyestalk ablation as practiced for shrimp, to completely artificially induced breeding by injecting spawners with hormones. Egg collection can then take place by natural means or by stripping. In the latter technique, the female is held by the operator out of the water and the ripe eggs carefully stripped off. The eggs are then gently mixed with previously collected male sperms. The addition of a small amount of water will trigger the fertilization process.

• *Incubation*. After fertilization, the eggs of the different species are put in incubators. Eggs require a constant supply of consistently good quality water, if optimum hatch rates and survival of fry are to be attained. The ideal incubator design is a water flowthrough system - in one end and out the other. The outflow can either be recirculated through a biological filter or be discharged. Flow rates vary, depending on the buoyancy of the eggs and/or their susceptibility to mechanical stress.

• *Hatching*. Hatching normally takes place in the incubator. Depending on the species, it can take from a few hours to a few days until all the eggs of one batch have hatched. After hatching, the hatchlings have to be separated from the egg shells to prevent occurrence of disease. The hatchlings which are still attached to their egg yolk sac from birth are then placed in a small tank or container. When the egg yolk sac is almost empty, the swim bladder becomes operational and the larvae go to the surface for air. Fins and tail are moving, the mouth and anus have been formed and from now on the larvae have to be fed.

• *Larval rearing.* The tanks used for the primary phases of larval rearing could be built from concrete, reinforced polyester or fiberglass. Smooth flow of water in the tank must be ensured to facilitate ample oxygen availability for the larvae. The types of tanks used will depend on the species to be farmed. Two examples of differently designed larval rearing tanks are: a rectangular tank with a sloping bottom and a circular tank in which the water flows as a spiral from the outer edge to the center. The system is "self cleaning", the dirt being sucked into a drainage point in the center. This system is used, for example, for salmonids which prefer to swim against the current.

• *Water management and monitoring.* Clear water is generally used for rearing of larvae. Except in recirculation systems, about 20-60 percent of the rearing water is usually changed daily, with concomitant siphoning of bottom wastes. Maintenance of salinity is very important for marine species particularly shrimp. Care should also be taken to avoid temperature fluctuations, and regular monitoring of larvae health is imperative.

• *Feeds and feeding.* Availability of good quality feed and proper feeding technology are crucial for the success of a hatchery. Feeds may contribute up to 60 percent of the operational costs of a hatchery. Characteristics of feeds suitable for fish larvae are: acceptability to fish, proper size, high dietary value especially highly unsaturated fatty acids, and easy to mass produce. Live food is usually preferred to commercially available feed in the initial stages of larval development.

Mollusc larvae is the primary starter feed for fish larvae. In addition, selected phytoplankton such as *Chlorella, Tetraselmis* and *Isochrysis* as well as rotifers are also suitable.

For shrimp larvae, diatoms and *Tetraselmis* are particularly suitable for feeding of zoea followed by *Artemia* for mysis. In the later stages, *Artemia* and/or pellets are used.

• *Diseases and their control.* Disease outbreaks could be controlled through proper cleaning and adoption of good sanitation and hygiene practices throughout hatchery operations. Various drugs are available in the market for controlling disease outbreaks including malachite green or treflan, chloramphenicol, oxytetracycline (OTC), and formalin. Proper nutrition and water quality maintenance to prevent disease are, however, more important than control itself.

• *Harvesting.* Harvesting of fish/shrimp larvae should be carefully done using a scoop net or bag net.

• *Transportation.* The mode of transport varies slightly with species and distance involved. Various containers could be used, such as polyethylene bags and bamboo baskets. The use of clean water, and the incorporation of antimetabolites and other suitable chemicals are considerations for reducing mortality.

Source: Gerald L. Roessink, **INFOFISH International**, September-October 1989.

OPERATING A MILKFISH HATCHERY

Mass production of milkfish fry is now possible!

The technology for operating a milkfish hatchery has come of age after over a decade of research work on milkfish at SEAFDEC/AQD: from the development of broodstock technology; to induction of spawning and larval rearing since 1977; to regular spontaneous spawning of broodstock in captivity during the breeding season since 1980; to completion of the life cycle in 1983; to development of techniques for collection of spawned eggs in 1986.

The supply of wild milkfish fry is often unpredictable and the catch in recent years has apparently diminished. Moreover, the recent trend toward semi-intensive culture is expected to create a heavier demand for fry which may not be met by the supply from traditional sources. Hatchery production of fry can stabilize the supply of seeds and eventually promote increased production of milkfish, an important food fish in the Philippines.

Naturally spawned milkfish eggs may be secured from the SEAFDEC Aquaculture Department and from the National Bangus Breeding Program (NBBP) project sites of BFAR in Alaminos, Pangasinan; Calape, Bohol; and Sta. Cruz, Davao del Sur.

Item One: Tanks and Equipment

A milkfish hatchery needs larval rearing tanks, culture tanks for rotifer (*Brachionus*) and green algae (*Chlorella*), and hatching tanks for the brine shrimp (*Artemia*). A volume ratio of 1 ton larval rearing tank to 3 tons algal and rotifer tank is recommended. Tanks should be easily drained through a harvesting canal. A layout of a typical milkfish hatchery is shown in Figure 1.

Larval Rearing Tank. Circular canvas or concrete tanks with an airstone at the center may be used. Larger tanks may be used; however, tanks of smaller volumes are preferred tor easy management. Larval rearing tanks should be placed under a shade to protect the larvae from the glare and heat of direct sunlight and to deter growth of diatoms that contribute to poor water quality.

Algal/Rotifer Tank. Square, rectangular or circular canvas or concrete tanks may be used for mass production of *Chlorella* and *Brachionus.* To maximize tank usage, tanks for algae are also used to culture rotifer.