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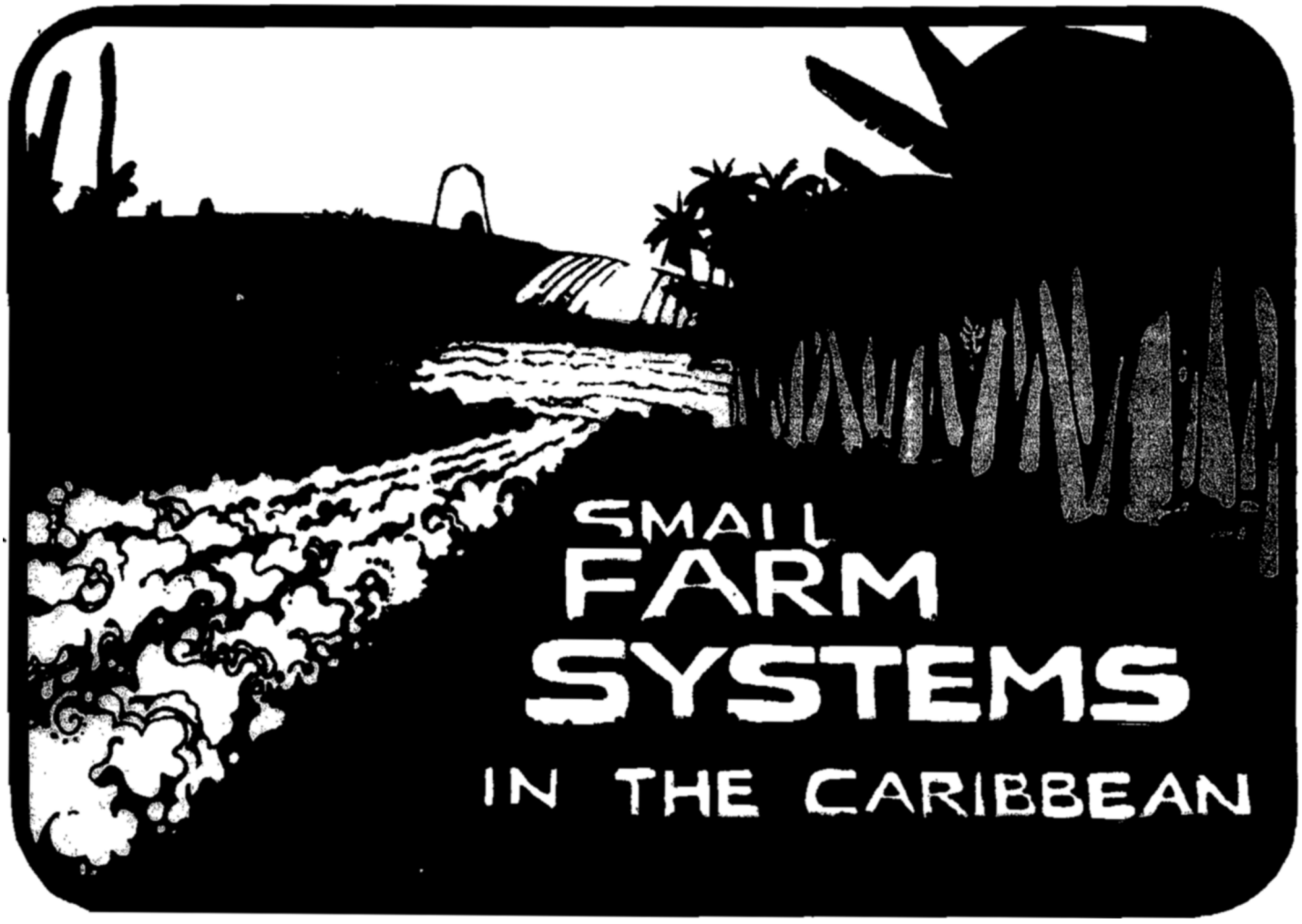

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Use of Open Versus Closed Systems in Caribbean Prawn Hatcheries

Dallas E. Alston
Department of Marine Sciences
University of Puerto Rico – Mayaguez Campus
Mayaguez, PR 00708 USA

Fernando Ibañez
Aquaculture Enterprises, Inc.
Call Box 5000 Caja 449
San German, PR 00753 USA

The culture of *Macrobrachium rosenbergii*, the giant Malaysian prawn, has led to Caribbean culturists starting hatcheries to produce postlarvae as stock. Two systems are primarily employed: open, which utilize continuous or batch exchange of water, and closed, which recirculate the water. Open systems are generally safer since water exchanges can be made as needed. A disadvantage of open systems is that the hatchery must be located sufficiently near a source of saline water. Closed system hatcheries can be situated far from the coast, since the addition of both fresh and saline water is minimal. Disadvantages of closed systems are the higher initial costs and difficulty in eliminating contaminated waters.

El cultivo de *Macrobrachium rosenbergii*, el camarón gigante de Malasia, ha obligado a los cultivadores del Caribe a empezar sus propios criaderos para la producción de postlarvas para la cria. Los sistemas abiertos y cerrados son los dos ptincipales métodos usados. Los sistemas abiertos utilizan flujo continuo del agua o cambios frecuentes de ésta. La ventaja de este sistema está en el poder eliminar aguas contaminadas en un momento determinado. Los sistemas cerrados recirculan el agua. Los criaderos de sistema cerrado pueden set instalados lejos de la costa, ya que el uso de agua dulce y salada es minimo. Las desventajas de este sistema se deben al incremento del costo inicial y al problema de deshacerse del agua de cultivo cuando surgen problemas. Los sistemas abiertos utilizan cambios continuous de agua o en poca cantidad.

Macrobrachium rosenbergii, the giant Malaysian prawn, has become an increasingly important culture organism in the Caribbean region. Currently, there are prawn farms in Cosra Rica, the Dominican Republic, Honduras, Jamaica, Martinique, Panama, and Puerto Rico. Most of the culturists prefer to establish a local hatchery to produce their own stock of postlarvae since importation on a large scale is prohibitive.

Macrobrachium hatcheries require brackish water with salinities ranging from 12 to 19 ppt. Two systems are primarily employed: open, which utilize continuous or batch exchange of water, and closed, which recirculate the water. There are many designs and methods for culture. The choice of a suitable system should be determined by the availability of a good water source, the distance from the hatchery to the growout ponds, and the initial investment.

Open Systems

Open systems are often a logical choice for the majority of prawn hatcheries since the initial investment is ofren lower than fot closed systems. A good supply of uncontaminated fresh and saline water is needed. The site of the open system thus necessitates that the hatchery be located near a saline water source, since considerable amounts of water are used in continuous or batch exchanges of water.

The intensive labor involved in the culture of the larvae results in considerable capital input during the culture period. However, if problems arise during the culture, an open system provides for complete exchange of the culture water, a practice which may often save the larvae.

The hatchery should have a total water storage of at least double the larval tank volume. This capacity allows for adequate watet storage for the mixing of the brackish water and provides space for storing postlarvae before distribution to ponds (New and Singholka, 1982).

Surface watet should be filtered before use in the hatchery. The filtration process should include a sand filter and then a smaller mesh filter near the mixing tank (New and Singholka, 1982). Tap water can often be used without filtration, since most of the water has been treated for human use. Care must be taken, however, to remove the residual chlorine from the water.

Ideal sites would be where the wells could be drilled to various depths to either saltwater or freshwater strata (New and Singholka, 1982). This could be done along the coast where saltwarer intrusion occurs and forms a wedge beneath the freshwater strata. Care must be taken if surface water supplies for fresh or saltwater are to be used. These waters are subject to contamination and salinity variations. If the hatchery location requires use of surface water, the water should be carefully checked for pesticides (New and Singholka, 1982).

Other water quality parametets should also be monitored. Prawn larvae require water of extremely high quality because they are particularly susceptible to toxic ammonia, and to bacterial and fungal infections (Aquatic Farms, 1979). Postlarvae are especially susceptible to nitrite and nitrate, both in terms of acute and chronic toxicity (New and Singholka, 1982). Sublethal effects of nitrite at levels as low as 1.8 ppm with prawn larvae have been reported. Reports are that hardness of less than 100 ppm $CaCO^3$ are suitable for freshwater (New and Singholka, 1982).

Two techniques of open systems are generally employed in prawn hatcheries. These two methods have been described by Aquatic Farms (1979) as follows:

Green Water Method

Phytoplankton is cultured in separate tanks to precondition the water prior to introduction into the larval rearing tanks. Every other day, the phytoplankton-rich water is used to replace 50 to 75% of the volume in the larval tanks. With this method, the phytoplankton continuously "condition" the water (presumably by taking up the metabolic wastes of the larvae and other food organisms), and shade the larvae from strong sunlight.

Partial Change (or Clear Water) Method

This practice involves utilizing continuous or batch exchanges of clear water in the larval tanks. With this technique, 75% or more of the waste is exchanged daily, either by continuous flushing or by a daily rapid purge, and the accumulation of toxic metabolites in the larval tanks is prevented without the necessity of culturing phytoplankton. However, the water usually requires pretreatment or conditioning and the larval tanks must be shaded from direct sunlight.

A major disadvantage of the open system is the necessity of an adequate supply of both fresh and saline water. Thus, care must be taken to insure that the water sources will remain uncontaminated. If water is not of suitable quality, considerable expense to treat the water for hatchery use may incur. Pumping costs may also be high. Another disadvantage of an open system is that the hatchery might be located far from the growout facility.

Closed Systems

Closed system hatcheries can be situated far from the coast, since the addition of both fresh and saline water is minimal. Closed systems are useful in areas with freshwater and energy shortages (New and Singholka, 1982). Such systems usually involve filters and other water quality imptovement apparatus to improve the quality, so construction expense may be higher.

Seawater is usually transported to the hatchery site. This operation is costly, so water conservation is essential in the system. Artifical seawater has been used but this practice is usually expensive (New and Singholka, 1982). Most closed systems, however, still need a 25% exchange of their water each week. This is because of the buildup of nitrate, which is the least toxic end product of nitrification, but which can still affect larvae when in high concentrations.

An innovative use of brine water from salt ponds has been reported by Tunsutapanish (1980a; as reported by New and Singholka).The use of brine reduces the amount of water that has to be transported to the hatchery. The brine can be diluted at the hatchery. The water from salt ponds contains few or no pathogenic organisms. However, more research is needed before this source is utilized extensively. *Dunaliella salina*, a green algae, is frequently present in these salt ponds. The effect of this algae on prawn larvae is unknown.

SUMMARY

Open and closed systems have both advantages and disadvantages. Open systems are safer, since the contaminants can be washed out. Closed systems are also designed to remove contaminants, but the use of filters and other water quality apparatus becomes necessary. The location of either system should take into consideration the effects from hurricanes or other tropical storms prevalent in the Caribbean.

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