

Breaking Barriers:

Commercial Success of Recirculation in Mexico

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Site selection for Maricultura del Pacifico's original maturation and hatchery facilities was based on the assumption that the best seawater is found in the ocean, far away from sources of pollution such as cities, industry, and agriculture. Since its 1992 start-up, however, experience with recirculating systems has taught Mexico's prominent producer of *Penaeus vannamei* postlarvae otherwise.



Recirculation improves water quality and provides greater chemical stability.

After some adjustments and fine-tuning, the system achieved very stable water quality.

Recirculating System For Maturation

In February 2000, Maricultura del Pacifico invested in a recirculating system for its maturation facility just south of Mazatlan, Mexico. After making some adjustments and fine-tuning the system, it achieved very stable water quality, which led the company to capitalize on the benefits of the technology.

The 750-l/min recirculating system is comprised of a bead filter in series with a fluidized bed biofilter. An ultraviolet sterilizer is included for disinfection, and a packed column is placed at the exit of the fluidized bed biofilter for degasification and aeration.

After establishing *Nitrosomonas* and *Nitrobacter* bacterial colonies in the biofilter, the facility reduced water exchanges to about 20%/day. This water exchange was needed to prevent a build-up of nitrates and replenish water lost by evaporation, filter backwashing, leaks, and elimination of water containing medication.

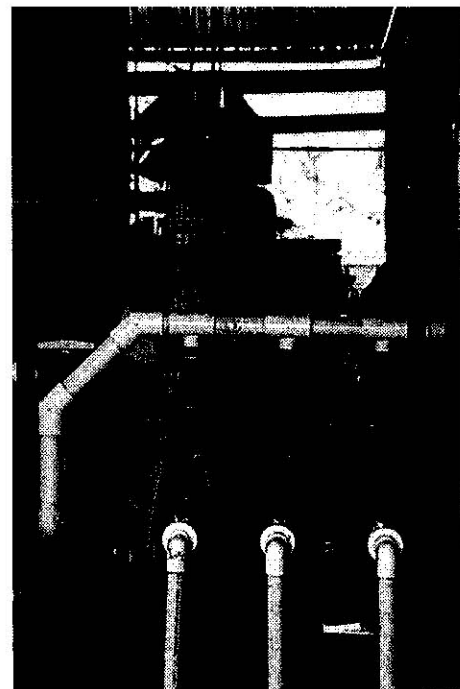
Operation

The system worked well from the start. However, small organic solids that were too small to be captured by the bead filter clogged the gills of broodstock. Maricultura del Pacifico solved the problem by filtering processed water returning to our tanks down to 5 μ , with sand filters and cartridge filters.

A water quality manager was also appointed to monitor filter maintenance and routinely test water quality in the maturation tanks. Very careful operation and maintenance of the recirculating system is essential to keeping it performing at its best.

Results

So far, the system has exceeded expectations. The most notable improvement came in the form of increased production. Due to the high-quality, stable water the recirculating system provides, more females mated per night, with more nauplii per female, and broodstock mortality de-



Pumps supply recirculated water into a fluidized bed biofilter at Maricultura del Pacifico.

creased, with an overall increase in the health and vitality of the broodstock.

Advantage

Despite the obvious economic advantages of increased nauplii production, the most dramatic advantage of recirculation technology came recently, when a red tide hit the Mazatlan area. Virtually all of the broodstock and postlarvae of the seven hatcheries in the area, including the three largest operations in the country, experienced mass mortalities.

During this time, the broodstock in Maricultura del Pacifico's one new maturation facility, which was undergoing the preliminary four-week, flow-through phase required to establish the bacteria in the biofilter, were wiped out. But the animals in the older, established recirculation facility remained alive and well throughout the crisis.

Conclusion

Recirculation technology has allowed Maricultura del Pacifico to be more profitable and sustainable. Because they answer two of the most important problems in shrimp hatcheries – control of discharge effluent and the need to provide consistent, stable water quality for breeding animals – recirculating systems will play an increasingly important role in the future.

Table 1. Quantitative analysis of IHNV by real-time PCR.

Source	Species	Origin	Tissue	Copy No. μg^{-1} DNA
Mexico	<i>P. stylirostris</i>	Wild-Caught	Gills Pleopods	1.1×10^9 4.2×10^8
Guam	<i>P. stylirostris</i>	Hatchery	Heads	1.2×10^9
Philippines	<i>P. monodon</i>	Farm	Whole Postlarvae	1.6×10^9
Mexico	<i>P. stylirostris</i>	Lab Infection Day 31, Post-Feeding	Pleopods	2.2×10^8
Panama	<i>P. stylirostris</i> (Super Shrimp®)	Lab Infection Day 32, Post-Feeding	Heads	Not Detected
Belize	<i>P. vannamei</i>	Farm	Pleopods	4.5×10^9

contained up to 10 billion copies of IHNV per μg of DNA.

Similar quantities of IHNV were detected in hatchery-raised, small juveniles of *P. stylirostris* collected from Guam in 1995, and in farm-raised postlarval *P. monodon* from the Philippines in 1996. Laboratory-infected *P. stylirostris* contained approximately one billion copies of IHNV 31 days after being fed IHNV-infected shrimp tissue.

Tests also confirmed that samples of Super Shrimp®, a line of *P. stylirostris* selected for IHNV resistance,

showed no signs of infection 32 days after ingesting IHNV-infected shrimp tissue. In *P. vannamei* with Runt-Deformity Syndrome (RDS) collected in Belize this year, 10 billion copies of IHNV were detected (Table 1).

Belize Aquaculture, Ltd. has used real-time PCR to evaluate IHNV in *P. vannamei* showing RDS. Ten shrimp each of three sizes (20, 8, and 4 g) were selected from a pond affected with RDS. Pooled pleopods of each group were submitted for real-time PCR analysis.

Results showed the number of copies of IHNV varied by shrimp size. The

smallest shrimp most affected by RDS had the heaviest viral load (1×10^9 copies of IHNV), the intermediate size had an intermediate load (6.3×10^8), and the largest shrimp had the lightest viral load (4.4×10^7).

Based on these results, real-time PCR analysis was used to help select shrimp from a broodstock pond stocked with large non-runted shrimp from an IHNV-infected production pond. The majority of shrimp from that pond had 107-109 copies of IHNV, but 10% of the broodstock tested had only 103-104 copies of IHNV. These broodstock are now being bred to determine if offspring will also have lower levels of IHNV, and therefore less tendency to develop runt deformity.

Conclusion

Real-time PCR is a practical technique that can rapidly quantify a large number of samples with high specificity and sensitivity. The use of this method to detect and quantify IHNV in penaeid shrimp has already revealed new information regarding levels of IHNV infection and the progress of viral infections.