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Biofilms improve nursery culture of pink shrimp in Brazil

Responsible Seafood Advocate logo
1 October 2004 Eduardo L. Cupertino Ballester, M.Sc. Wilson Wasielesky Jr., Ph.D. Ronaldo O. Cavalli, Ph.D. Paulo César Abreu, Ph.D. Marcos H. S. Santos, Ph.D.

Complex communities of microbes and small invertebrates an important food source

Since 1993 at the University of Rio Grande in Brazil, the authors have collaborated with local artisanal fisher communities to develop technology for the culture of *Farfantepenaeus paulensis*, an indigenous pink shrimp. Although excellent results in low-cost cages and pen enclosures have been achieved so far – with production of 500 kilograms per cycle in 3,100-square-meter pen enclosures – there is still much room for improvement.

One of the possible areas of improvement is the use of nursery systems. The nursery phase, characterized by higher stocking densities and the use of high-quality artificial diets, usually produces larger and more disease-resistant shrimp that ultimately reach commercial size faster.

In southern Brazil, the culture period is restricted to five or six months per year because of low temperatures. Under these conditions, the stocking of grow-out pens with larger and sturdier juveniles is very important. Another advantage in using nursed shrimp is control of shrimp predators. According to previous studies, larger shrimp in pen enclosures can avoid predation more efficiently than small animals.

Role of microorganisms

Another aspect studied by the group is the role of microorganisms in shrimp feeding. In Brazil, there is a perception that the nutritional requirements of shrimp depend entirely on exogenous feeding. However, recent studies demonstrated that shrimp performance is enhanced by nutritional factors produced by micro organisms native to the culture systems.

Study results demonstrated that biofilms – the complex communities of microalgae, protozoa, bacteria and other small invertebrates that attach to submersed surfaces – are an important food source of high nutritional quality to shrimp. Furthermore, biofilms also play a role in increasing water quality of culture environments.

Biofilm effects

Biofilms are an important food source of high nutritional quality to shrimp… and also play a role in increasing water quality.

In a series of trials that examined the attachment of biofilm to different substrates, the authors measured their influences on the survival and growth of pink shrimp postlarvae reared in nursery cages in a shallow estuarine inlet of Patos Lagoon in southern Brazil.

The first trial tested the capacity of six types of net material (white and green polyethylene nets, sack cloth from commercial shrimp diets, polyamide net, and PVC-coated polyester nets) to fix biofilm over 28 days of immersion. Weekly samples were taken to estimate chlorophyll *a* content. The final chlorophyll a values ranged 3.68 to 9.34 grams per square centimeter. All materials showed a high capacity to fix biofilm, but the polyethylene nets showed higher chlorophyll *a* concentrations. The final choice among these materials must also consider the type of culture system in which it is used.

A second trial evaluated the survival and growth of shrimp juveniles reared in cages for 30 days. In three cages, the attachment of biofilm was limited through the exchange of cages every 10 days. The other three cages were placed in the estuary 15 days before stocking the shrimp, and the biofilm was not cleaned throughout the experimental period. After 30 days, the growth of shrimp reared in cages where biofilm was not removed was 16 percent higher than in the other treatment.

A third experiment assessed the effects of increasing the surface available for biofilm fixation on the survival and growth of shrimp. Six cages were placed in the water 15 days prior to shrimp stocking. In three cages, the area for

biofilm attachment was increased 100 percent with the addition of extra polyethylene net substrate. Again, both growth and survival of juveniles were higher in the cages with additional substrates. The increase in growth was 11 percent.

During these experiments, composition analysis of the biofilm found that its main organisms were benthonic diatoms, ciliates, cyanobacteria and nematodes.

Conclusion

Experimental results have demonstrated the positive influences of biofilm and the use of added substrates to increase the growth and survival of juvenile *F. paulensis* reared in cages in an estuarine area. Future research by the authors will measure the actual contribution of the microorganisms present in the biofilm to increased cultured shrimp biomass.

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