Vibrio Control In Shrimp Farming

Part I. Hatcheries

Artemia culture systems can be great sources of bacterial contamination. Mitigants range from bacterial amendments to disinfection to kill surface-attached *Vibrios*.

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Summary:
Various *Vibrio* bacteria have been associated with high mortality in shrimp larval culture. Control of *Vibrios* should focus on minimizing overall bacterial loads and the potential for horizontal transmission. Females should be rinsed with a surface disinfectant before placement in spawning tanks, then quickly removed after spawning. Eggs should be washed with clean water between surface disinfection protocols. Healthy nauplii should be washed in a similar manner. To avoid contamination from *Artemia* and algae feeds, use amendments and/or surface disinfection.

Perhaps the single greatest problem affecting shrimp hatcheries is high mortality in the early stages of larval culture. The term "zoeae syndrome" was coined to describe the affected stage. Typically, the animals do not molt from Z1 to Z2, and very high levels of mortality ensue. Various strains of *Vibrio* bacteria have been implicated in this process.

The challenge for hatchery managers is to identify gaps in biosecurity and how to plug them without creating a production environment that has been manipulated to the point where other problems can readily present themselves. The idea is to control the bacteria without creating niches for other potential pathogens.

Ubiquitous Bacteria

It is important to appreciate that bacteria are everywhere. Life depends on them. They are critical for ecological stability and recycling of nutrients, and play a myriad of other roles that we are just beginning to appreciate.

Most bacteria are benign, while some can negatively impact animals that have been made susceptible to them for various reasons, of which the presence of stressors is usually a critical element. A very few are obligate pathogens that kill animals merely by being present. Most of the problems in hatcheries arise from bacterial species that are not obligate pathogens.

It is also important to realize there has been an inordinate focus on *Vibrios* when many other species of bacteria could (and do) cause problems. Control efforts should not be focused on total elimination of all bacteria, but instead should target those production areas where it is possible to minimize the overall bacterial loads.

Production Stages Connected

As with any agricultural process, aquaculture production stages are linked and overlap others. Broodstock sold in huge numbers commercially become the sources of eggs and nauplii that, in turn, are sold to become the source of postlarval shrimp stocked in production systems for growout to commercial sizes.

Broodstock come from a variety of sources. Most – especially for Pacific white shrimp, *Litopenaeus vannamei* – are from commercial operations that sell genetically selected animals that are usually also specific-pathogen-free (SPF), typically for pathogens the World Organization for Animal Health dictates should not be present.

Black tiger shrimp, *Penaeus monodon*, are available from similar sources, although there is still significant use of wild broodstock at black tiger farms.

Routine Procedures For Maturation Facilities

The use of SPF animals has had a dramatic impact on shrimp farming globally, although it has not always proven to be the salvation that many envisioned it could be. There are many reasons for this. Suffice it to say that regardless of the source of the animals, maturation facilities should all be doing certain things routinely.

Aside from efforts to minimize the levels of bacteria entering maturation systems, the focus should be on controlling the potential for horizontal transmission throughout the production process. While mass spawning is the norm, for example, individual spawning offers greater control.

When females spawn, bacteria present on them and in their ovarian fluids and feces can readily attach to the surfaces of eggs. Females should be rinsed with a

surface disinfectant such as formalin for a short period before being placed in spawning tanks to lessen the external loads of bacteria.

Females should be removed from spawning tanks as soon as possible after spawning – easier when animals are spawned individually. The eggs should be collected and washed with copious amounts of clean water between surface disinfection protocols using formalin, iodophors or other compounds that have been shown effective in reducing the levels of attached bacteria.

After the eggs hatch into nauplii, healthy nauplii are collected by their attraction to light and seeded into hatchery tanks. Prior to their addition to the tanks, they should be washed in a manner similar to that used to surface disinfect the eggs.

These procedures are aimed at significantly reducing the levels of bacteria on external surfaces. Bacteria present in eggs cannot be eliminated in this manner. If tests determine this is a problem, the broodstock need to be treated with appropriate antibiotics in a clean production system and given feeds that are not carrying potential pathogens.

Contamination

Assuming the water in production systems is properly treated and that an effective tool for managing microbial loads in production tanks is used, perhaps the greatest sources of contamination from bacteria in the early life stages are *Artemia* and algal culture systems.

There are many ways to mitigate these contaminants, ranging from the use of bacterial amendments to the use of chemicals such as formalin or chloramine-T to kill any surface-attached *Vibrios* and airborne contaminants that occur as a result of where and how the *Artemia* are produced. Alternatively, *Artemia* nauplii can be collected and surface disinfected as with shrimp. The use of copious amounts of clean water is essential to dislodge weakened and weakly attached bacteria.

Algae are often heavily contaminated with bacteria, as well. This can be mitigated by the use of closed production systems. Where this is not feasible, microbial amendments can lower overall non-benign bacterial loads.

Perspectives

It is critical to examine all inputs into maturation and the early stages of larval culture to ensure levels of potential pathogens are controlled. As the animals molt and various feeds are added to the production tanks, bacteria will grow. Again, the use of a bacterial bioremediation amendment can help control the levels of *Vibrios* throughout this process.

The last link in this process is the stocking of postlarvae into ponds. Some of the same tools used in disinfection of eggs and nauplii can be employed to lessen the levels of attached bacteria.