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Integrated health management combines hygiene, targeted treatments in shrimp hatcheries

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Focus on hygiene and environmental and animal conditions

In recent years, the cost of farm operations has increased significantly in shrimp-farming nations, mainly due to disease problems. Concurrently, world market prices for shrimp have declined, reducing the profit margins for farmer

Management problems can be complex and widespread, and no single technique or product can totally protect animals from infections. Maintaining healthy stock requires a multidisciplinary approach that focuses on hygiene and both environmental and animal conditions.



When added at low doses to hatching tanks just before incubation of artemia cysts, new biocides can suppress bacterial growth in the hatching water throughout the entire hatching procedure (left).

Hatchery problems

Major losses in penaeid shrimp hatcheries are often due to opportunistic *Vibrio* sp. bacteria. Normally present in the culture facilities as well as larval gut flora and live feed such as artemia nauplii, *Vibrios* usually cause disease in suboptimal physiological or environmental culture conditions.

Vibrio-related disease outbreaks can proceed rapidly and lead up to 100 percent mortality. Once such disease problems arise, it is normally too late for effective or cost-efficient treatment. Therefore disease prevention, not treatment, should be emphasized in hatchery operations.

Hygiene, disinfection minimize pathogens

Hypochlorite (bleach) is widely used in aquaculture because of its spectrum of activity and cost-effective pricing. From water treatment and equipment cleansing to biosecurity measures like sanitary foot baths, it is a versatile treatment. Bleach's drawbacks include its caustic nature in concentrated

liquid and gas forms, its decreasing effectiveness in sunlight, and other issues.

New generations of biocides now show a wider range of action than bleach, including effects against many viruses. The biocides remain active in the presence of organic matter, and may act at lower concentrations with significantly fewer safety, health, and environmental problems. Evaluations of the bactericidal activity of these disinfectants should not be restricted to bacterial suspensions, but also be performed with biofilms.

Most artemia cysts, regardless of their origin or quality, harbor numerous bacteria. Together with live feed, a significant number of undesirable bacteria (mainly *Vibrio* sp.) are often introduced in larval-rearing tanks (Fig. 1).

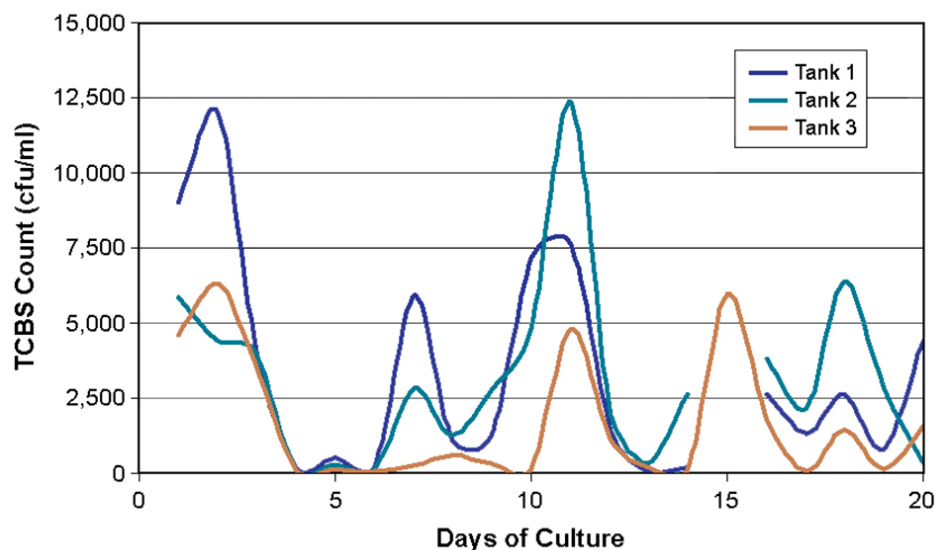


Fig. 1: Bacteria concentrations in the untreated water of shrimp larval-rearing tanks. Fluctuations in thiosulfate citrate bile sucrose (TCBS) count were observed from day 5, when Artemia feeding started. Water exchange started at day 7.

Traditional disinfection of cysts and hatched nauplii is not always effective for killing large numbers of bacteria. New products like INVE Aquaculture Nutrition's Sanocare HC, developed for continuous action during the whole hatching procedure, result in significantly reduced *Vibrio* loads in artemia hatching water. The biocide is part of an overall hatchery management system.

Probiotics development

The use of beneficial bacteria to inhibit the growth of pathogens or compete with them for nutrients can be an alternative to the formerly common prophylactic use of antibiotics. However, the development of suitable probiotics requires considerable empirical and fundamental research, full-scale trials, and appropriate monitoring tools.

The authors recently carried out a selection of potential probiotic strains by investigating in vitro the inhibitory activity of over 55 *Bacillus* strains against pathogenic *Vibrio* isolated from the haemolymph of shrimp in both Asia and Latin America. The ability of the antagonistic *Bacillus* strains to grow under

conditions prevailing in larval-rearing systems and degrade waste products was used to identify strains for further evaluation. The selected strains were then included in bioassays and challenge tests to confirm the lack of toxin production and pathogenicity to the target organisms.

Since lab-scale performance cannot completely predict in-vivo effects, formulations with the best-performing *Bacillus* strains were repeatedly assessed in hatchery tests in Asia. Nauplii of Black tiger shrimp, (*Penaeus monodon*), were reared to PL₁₀ and fed a combination of (*Chaetoceros*), artemia nauplii, and a commercial larval diet. Various applications of the probiotic formulations were then studied with animals stocked in 175-l tanks with three or more replicates per treatment, with negative controls and prophylactic antibiotic treatments.

The investigations indicated that daily applications of the formulation now marketed as Sanolife MIC led to a significant improvement in survival rates and biomass production compared to the control treatments. In some of the tests, survival and biomass harvest were higher in the probiotic treatment than the antibiotic treatment (Fig. 2). The better performance can be explained by the improved water quality and notably lower *Vibrio* load in the water (Table 1).

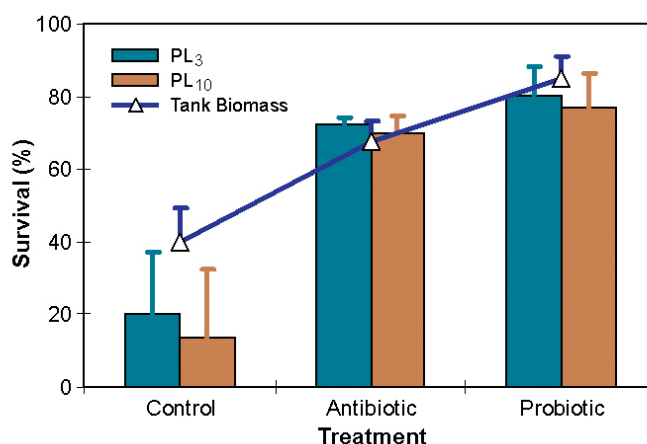


Fig. 2: Postlarvae survival and biomass at harvest (PL11) in tanks receiving varied treatments. Four replicates per treatment. Bars indicate standard deviation.

Braak, Treatment effects on *Vibrio* concentrations, Table 1

Treatment	TCBS Count Average	TCBS Count 95% Range	TCBS Count 95% Range
Control	2,518	1,850	3,186
Antibiotic (P < 0.05)	1,585	1,124	2,049
Probiotic (P < 0.005)	1,415	1,003	1,828

Table 1. Treatment effects on *Vibrio* concentrations in water (TCBS count).

Improve animal conditions

Next to good hygienic and environmental conditions, the health status of animals should be optimized. A combination of quality seed and feed should be used to produce strong, healthy larvae able to resist pathogens. Monitoring tools are essential to detect pathogens at an early stage in order to apply appropriate measures.

Better-performing hatchery operations not only increase their cost efficiency, but bring high-quality postlarvae into the market. Stronger post-larvae increase profit margins for both hatchery owners and grow-out farmers.

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