

Iran – Pioneer Shrimp Farmers in the Middle East

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It is a very strange experience arriving at a shrimp farm in the middle of the desert. Yet shrimp production in Iran, has been growing year on year.

Traditional shrimp farming has been practiced for centuries in Asia. After 1970s the industry was transformed by more intensive commercial production and brought a number of opportunities to these countries, in terms of employment, wealth creation, trade as well as providing local and sustainable animal protein. Other countries are also recognizing the potential of aquaculture, specifically shrimp farming; Iran is one of these countries.

Iranian shrimp farming is much younger than its Asian counterpart; the first farm was opened in 1994. Today shrimp farming is a common activity along the Persian Gulf and, according to FAO data, the production of Pacific white shrimp, *Litopenaeus vannamei*, in Iran was 22,500 tons in 2014 (Figure 1).

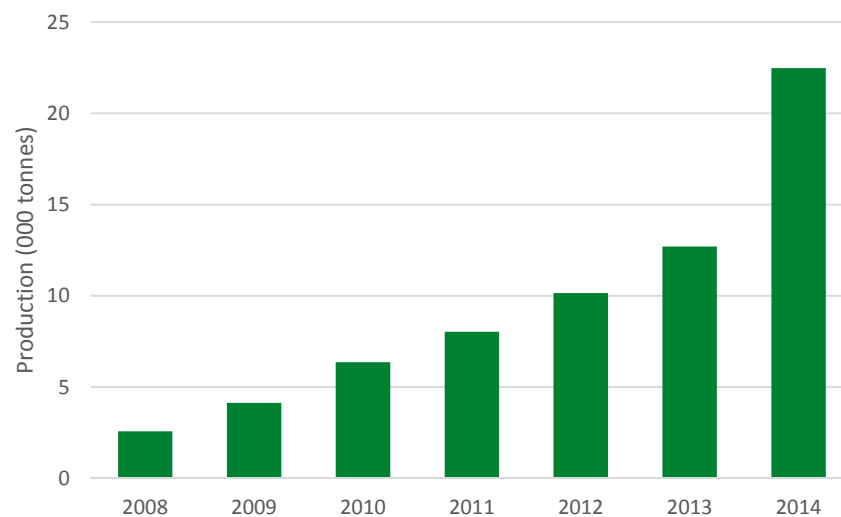


Figure 1: Production of *L. vannamei* between 2008 and 2014. SOURCE: FAO FISHSTAT

It can certainly be argued that Iranian shrimp farmers face some unique challenges. During our recent visit speaking with producers, two issues were repeatedly raised that are surprisingly common to the industry at large: first, maintaining good water quality and second, disease control. Actually, these issues are interlinked. For example, *Vibrio* spp. are part of the 'normal' microbiota associated with seawater. Despite this, under normal culture conditions healthy shrimp will grow well. However, if the shrimp are stressed due to poor water quality, they may become immunocompromised which presents an opportunity for these opportunistic pathogens. Therefore, by maintaining optimum water quality, one can reduce

the likelihood or severity of disease. White spot syndrome (WSSV) is another major concern for Iranian producers. Luckily, early mortality syndrome (EMS) is not a problem (yet). The one thing that both these disease threats have in common (whether bacterial or viral), is that they can be mitigated, or controlled, through biosecurity and management; prevention really is better than cure. To achieve this, probiotics are a valuable management tool.

BIOMIN is there



In collaboration with ETOUK FARDA, BIOMIN works with shrimp farmers across Iran to improve aquaculture pond management with innovative probiotic solutions. AquaStar® offers producers a 'one-stop-shop' for probiotic products. The formulation contains multiple beneficial bacterial species which have complimentary and synergistic benefits.

For shrimp producers, it offers greater nutrient release, improved water quality and better survivability.

Greater nutrient release

The majority of commercial probiotic products are based around *Bacillus* spp., primarily because of its ability to produce large quantities of enzymes. While AquaStar® products do contain *Bacillus* sp., enzymatic digestion of organic matter is further intensified by an enzyme cocktail. This facilitates the release of highly digestible nutrients, which can be utilized by the shrimp. In addition, the enzymes break down organic matter, preventing the accumulation, and directly reducing 'black sludge' in the pond sediment. This benefit was demonstrated through a field trial in China. Shrimp were stocked at 50 PL/m² and split into two treatments; control and AquaStar®. After 57 days of culture, ponds supplemented with AquaStar® showed higher productivity, improved growth performance and higher profitability (Table 1). Furthermore, visual differences could be seen in the quality of the pond sediment (Figure 2).



Table 1: Improved revenues by AquaStar® in commercial field trial

Treatment	Production (kg)	Commercial shrimp price (USD*/kg)	Sales revenue (USD*)
Control	2,306	2.92	6,736
AquaStar®	2,687	3.54	9,503

* Based on exchange rate at time of print

↻ Δ+41%

Water quality

To improve water quality, AquaStar® contains unique bioremediation strains which promote the conversion of toxic ammonia to nitrate, via nitrite (nitrification; Figure 3). While nitrate is not as toxic as ammonia or nitrite, its accumulation can be harmful to shrimp and acts as a fertilizer leading to dangerous phytoplankton blooms, making its removal equally as important. AquaStar® is the only commercial probiotic to use *Thiobacillus* sp., to convert nitrate to harmless nitrogen gas (denitrification). While most bacteria need a carbon source to grow, *Thiobacillus* can take its energy from an inorganic source. Thus, this species has a dual function: the removal of nitrate and hydrogen sulfide (Figure 4).



Figure 2: Samples of pond sediment with (a and b) and without (c and d) AquaStar®. Layers of black anoxic sediments can be seen in the pond bottom when AquaStar® is not used.

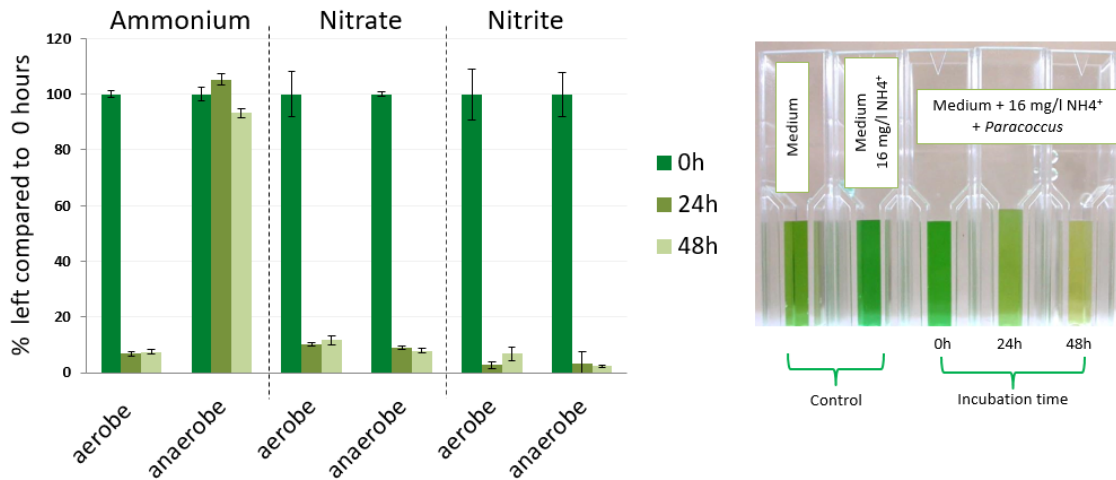


Figure 3: The effect of *Paracoccus* on the removal of nitrogen waste under aerobic (with oxygen) and anaerobic (without oxygen) conditions after 24 and 48 hours. INLAY: Dark green indicates high ammonia after 0 hours. After 48 hours the lighter green indicates this ammonia has been removed by the probiotic.

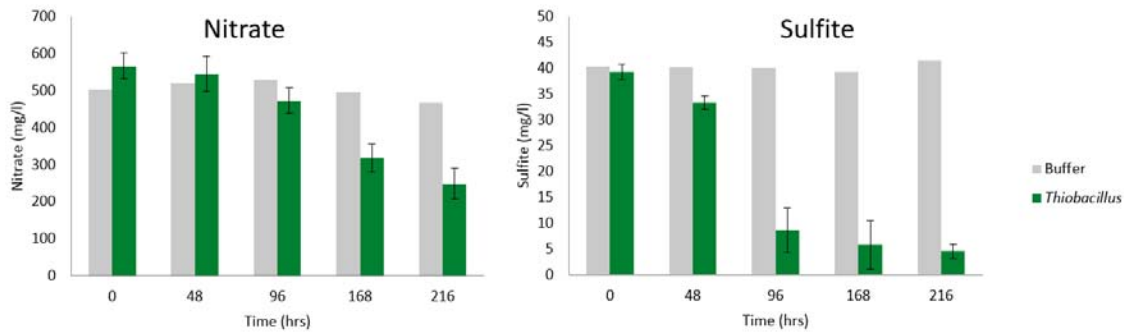


Figure 4: *Thiobacillus* can remove nitrate and hydrogen sulfide

Improved survivability

While other probiotic species are capable of reducing pathogens, lactic acid bacteria (LAB) are by far the best candidates for this role. The LAB in AquaStar® directly reduce a wide range of pathogens by producing numerous potent antibacterial substances, termed bacteriocins. Furthermore, when LAB are ingested, they can colonize the intestinal epithelia where they drive immunity and enable the shrimp to fight pathogens using its own immune response. This was clear in a recent field trial in Brazil. When shrimp were challenged by *Vibrio parahaemolyticus*, survival was significantly higher in those ponds that had received AquaStar® probiotics (Figure 5).

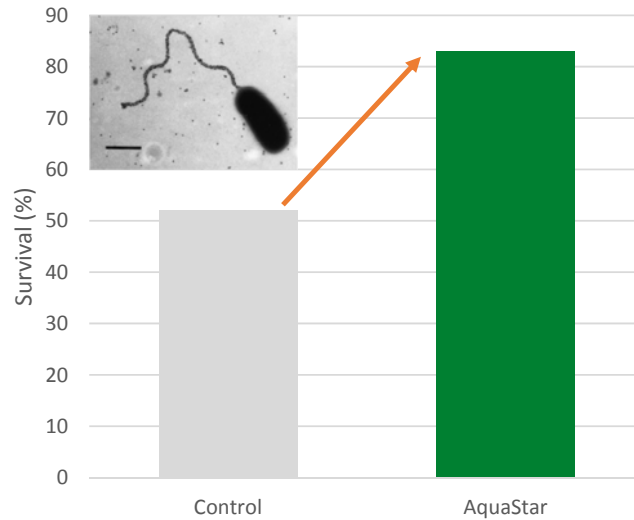


Figure 5: Survival of shrimp in control treatments and AquaStar® treatments when challenged with *V. parahaemolyticus* under field trial conditions. Inlay shows a single *V. parahaemolyticus* cell.

To conclude, AquaStar® is a valuable tool for shrimp producers. The multi-species formula is designed to bring multiple benefits to the producer; better water quality, reduced organic matter, reduced sludge, pathogen control and increased pond productivity. For more information please contact [ETOUK FARDA](#) who will advise you.