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Research Article

# Present Status and Prospect Trends of Probiotics in Shrimp Aquaculture

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## Introduction

The marine fisheries stocks have turn down worldwide and provided an impulsion for fast development in aquaculture. As a result between 1987 and 1997, global production of farm as fishes and shellfishes was just two fold only. Currently, seafood production is undergoing a dramatic transition with introduction of more cultivable species and new farming techniques. Aquaculture production accounts for over one quarter of all fish consumed by humans. In the history of man, fish and shellfish have contributed prominently as protienaceous food source. A part of human population obtains certain amino acids from the flesh of domesticated animals and also from fish. On an overall global scale, fish and fishery products make up about 16% of animal protein intake. The incidence mentioned in the Bible, reveal that the ancient sculptures of Egypt exhibit the art of fish culture and fish trade. Such an age old practice of this production has gained its momentum in India only very recently. Because of the urgent need for sea food for consumption and export, especially the species of shrimps have been cultured under various farming systems (Karthik *et al.,* 2016 a & b).

## Current Status of Aquaculture

Aquaculture has been the fastest growing food production sector in the world among other sectors over the past 30 years. However, in some cases the rapid growth of the aquaculture sector has outstripped planning and regulation. Environmental Impact and marketing have become unavoidably overriding issues in aquaculture development. Resource use conflicts have intensified because of the growing scarcity of resources. At the same time, demand for product quality and safety increased significantly. There are good prospects for continued development of aquaculture in the light of the available living and non-living resources and technical advancements. However, the sector may require new approaches if it is to realize its developmental potentials in the coming decades.

It is stressed that the basic changes required for increased production on a sustainable basis must be with minimal environmental perturbation. In this century the world fish catch grew from a very rough estimate of 4 million metric tons (mmt), in 1900 to nearly 100 million (FAO, 1995), by 1995, while the world's population increased from about 1.6 to nearly 6 billion. The total world fisheries production (including aquatic plants) was 126.8 million tons in 1998, of which 69% was contributed by captured fisheries and 31% by aquaculture. The contribution of marine environment is more in capture fisheries, providing 92% of the total catch; while an aquaculture in 1998, the share of marine, fresh and brackish water production was 52%, 46% and 2% respectively. There is little scope for increasing marine fish catch, due to competition between nations, over farming activities etc., while for enhancing aquaculture production, the scope is enormous. However, based on unit value, shrimps alone are more recognized for marine and coastal aquaculture and in the farming of shrimps and several problems are to be monitored and managed.

## Management of Aquaculture Systems

The world commission on environment and development (WCED) has advocated aquaculture as one of the measures that would help to attain sustainable development. Sustainability in fish and shrimp productivity is an important criterion. The FAO (1997) has stated sustainable growth as "the management and protection of the natural resource base, and the orientation of the scientific and institutional change in such a way as to make sure that the achievement and sustained contentment of human needs

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for present and future generation. Concentrating more animals in a small space creates high oxygen demands and accumulation of waste products (mainly nitrates and phosphates), and increases the chances of disease prevalence and transmission. The aquaculture industry has made considerable achievements in areas in which environmental impacts have even negatively affected production in quantity as well as quality.

## Evaluation of R & D in the Proposed Area

Fast development of shrimp culture has been accompanied by the occurrence of diseases induced both by natural and made-up environmental changes. The important pre-disposing factors leading to disease outbreaks in shrimp culture are adverse environment, high stocking density, nutritional deficiency, inadequate aeration, insufficient water exchange, heavy algal blooms, physical injury and presence of high numbers of dangerous pathogens (Alavandi *et al.,* 1995; Guan *et al.,* 2003 and Sanchez *et al.,* 2008). The majority of current shrimp diseases can be categorized into two major groups: viral and bacterial. Viral diseases are the most devastating because they are often difficult to be detected and impossible to be treated in ponds (Brock *et al.,* 1997).

Improving health of culture organisms and elimination of pathogens by improving aquatic environment is the best method to prevent and control disease, particularly in aquaculture. Thus, how to improve the ecological environment of aquaculture has become the focus of attention of international aquaculture. Previous studies have elucidated the importance of culture environment viz., the grown out ponds, elimination of disease causing pathogens and the introduction of healthy seeds in shrimp culture. Since all the three above mentioned components are inter connected, in the manifestation of diseases and loss of productivity the concept/hypothesis that delinking of the above three links in aquaculture viz., environment vs. pathogens vs. culture organisms would be present approach to enhance productivity and prevention of loss in economy. In this context the introduction of probiotic species of bacterial species as a growth component of bioremediators in aquaculture seems to be a pertinent approach. Researchers also have demonstrated about the use of probiotic bacteria in aquaculture to improve the water quality and immune system by balancing bacterial flora in water and reducing pathogenic bacterial load (Watson *et al.,,* 2008).

The accumulation of antibiotics both in the environment and in shrimp tissues can be potentially risky to consumers and the environment. One of the potential alternatives is bacterial based approach especially probiotics. Nitrite is also toxic to crustaceans, although the mechanism is poorly understood. Physical, chemical and biological processes have been used to invalidate or eliminate the pollutant/toxicants from the aquatic environment. The physical process has limits to application but larger amount of water can be processed through it. Nitrification is a natural process, which occurs in pond ecosystem but during several occasions, this may not be reaching a higher order of magnitude. Application of nitrifying bacterial consortium to growth artificially and reduce toxicity of ammonia in aquatic system is used in this experiment as a tool for bioremediation. Nitrifying bacteria not only convert ammonia to nitrate but also reduce carbon dioxide to organic matter (carbohydrate), obviously these chemoautotrophic bacteria use energy released by the oxidation of ammonia to nitrate and reduce carbon dioxide to organic carbon. However the amount of organic matter synthesized by chemoautotrophic bacteria is very small in comparison to the quantum produced by photosynthesis (Karthik *et al.,* 2014). These bacteria are added to aquaculture production systems in order to modify or manipulate the microbial communities in the water and sediment to reduce or eliminate selected pathogenic species of microorganisms, and generally, to improve growth and survival of the targeted cultured aquatic species. Additionally, according to the demonstrations of manufacturers and distributors of probiotics, the products improve water quality and lower the level of the organic sludge in the aquaculture facility.

Hence, there is an urgent need of solution through research on the culture, growth performance and disease management of shrimp culture. The term, probiotic, simply means "for life", originating from the Greek words "pro" and "bios". Metchnikoff's (1907) work at the beginning of the century is regarded as the first research conducted on probiotics (Fuller, 1992). He described them as microbes ingested with the aim of promoting good health". The most widely quoted definition was made by Fuller (1989). The use of these beneficial bacteria, to control pathogens through a variety of mechanisms, is mainly considered as an alternative to antibiotic treatment (Karthik *et al.,* 2015 a, b & c). The use of probiotics in human and animal nutrition is well documented (Fuller, 1992) and recently, they are being applied in aquaculture (Gatesoupe, 1999; Gomez Gil *et al.,* 2000; Verschuere *et al.,* 2000a). Several studies on probiotics have been published during the last decade. In aquaculture, the use of probiotics confers many advantages, such as improved growth, feed efficiency, enhanced immune system response, as well as improved water quality. Although numerous reports have demonstrated the efficiency of probiotics, most of these studies were conducted and evaluated under laboratory conditions. Therefore, the application of mixture and /or consortium of beneficial microbes as probiotics under laboratory as well as field (pond) scale culture conditions has necessary to evaluate its use accurately.

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