Chapter 1

Introductory Chapter: Importance of Plant and Invertebrates in Aquaculture

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Additional information is available at the end of the chapter

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1. Introduction

Aquaculture is an economic activity that presents a rhythm of global production with a sustained growth of 10–11% per year during the last years, with expectations of equating production by extractive fishing in 2025 [1]. It currently contributes about 50% of the world fish supply, and is considered to be one of the main economic activities of this century. In 2010, world aquaculture production was around 59.9 million tons; where freshwater fish dominated production (56.4%), followed by the cultivation of invertebrates such as mollusks (23.6%) and crustaceans (9.6%) [2].

It is an activity that encompasses very varied practices, and a wide range of species, systems and production techniques. Aquaculture can be defined as the production of aquatic organisms with techniques aimed at making their performance more efficient. It is worth mentioning that more than half of the total amount of food of aquatic origin consumed today by the world population, as well as products destined for non-food uses, comes from aquaculture farms where fish, crustaceans, micro algae, mollusks and other invertebrates are raised [1, 4, 5]. Particularly, invertebrates make up 95% of the animals that inhabit our planet. Due to its great biodiversity, it has not been possible to study in its entirety. There are species of mollusks, crustaceans and echinoderms that are consumed by man and therefore are the object of artisanal or massive fishing, which can lead to problems of population reductions, local extinctions or loss of genetic diversity [3], thus Aquaculture is a good alternative to solve this problem.

2. Sections of the book

The capture and cultivation of aquatic organisms in paddy fields has a long history and tradition, especially in Asia, where the availability of rice and fish has been linked to prosperity and food security. Rice-based ecosystems provide habitats for a wide variety of aquatic organisms used extensively by the local population. They also allow the improvement and breeding of aquatic organisms. A wide variety of aquatic species such as carp, tilapia, catfish and breams are being raised in the rice fields. Prices and market preferences can provide decisive opportunities for farmers to further diversify the use of species, especially eels, loaches and various crustaceans, to sell and market higher value biological products [7]. The problems associated with the breeding of aquatic organisms in paddies do not differ from those related to the development of aquaculture in general. These include the availability and access to seeds, feed and capital, as well as natural risks related to water control, diseases and predation [8].

Molluscs are currently the group of cultivable marine organisms that offers better prospects in terms of production and economic profitability, their production costs are not high and are a valuable source of food. To perform its cultivation requires detailed knowledge of the basic biology of the species, supply sources of seed, growth parameters and mortality in culture, and the effect of environmental conditions as well as their spatial and temporal variability. The cultivation of bivalve mollusks represents an economically viable alternative due to the possibility of large-scale operation, in addition, this activity can be environmentally sustainable by helping to reduce fishing effort in coastal areas [6].

The constant increase in world population necessarily implies a challenge in terms of food production in large volumes and with high nutritional quality. To achieve the economically profitable production of healthy animals with a limited environmental impact, it is necessary to improve growth rates and feeding and reproduction efficiency, decreasing the losses caused by diseases, by improving the immune response, diagnostic techniques and prophylactic measures [6, 9]. In an intensive aquatic production system, control of the disease plays a key role, where an intimate relationship between the host and bacteria is present [10, 11]. There is currently a widespread concern that antibacterial agents in aquaculture will lead to the emergence of antibiotics resistant bacteria [12]. Probiotics and the use of homeopathy, which act mainly on the innate response of cultured organisms, constitute a viable, promising and economic strategy to make aquaculture process more sustainable, since it reduces the indiscriminate use of antibiotics and chemotherapeutic product.

In case of treatment with probiotic, it has been carried out successfully in mollusks [13], fish [14, 15] and crustacean species [11, 16, 17]. Wherein the probiotics used in aquaculture studies include Gram-positive and Gram-negative bacteria, bacteriophages, yeasts and unicellular algae [18], and the beneficial effects include growth and feeding efficiencies in culture systems [19].

Homeopathy in the aquaculture of freshwater and marine species is a potential alternative for the world aquaculture industry, because their medicines are free of relevant adverse reactions and do not bio-accumulate toxic substances in the harvested product. The studies realized, although scarce, suggest that homeopathy can be applied with prophylactic and therapeutic criteria. Among its mechanisms of probable action stands out the stimulation of the innate and acquired immune system, and consequently the increase in the resistance of the treated organism, against the pathogens that normally proliferate proportionally to the level of intensification of the culture. Higher survival, growth and reduction of stress levels have been reported, as well as notable changes in other parameters observed, such as less inclusion of lipids in the liver, greater hypertrophy of the muscle fiber, production of mucin-producing cells that are related to the inhibition to the entrance of parasites, and changes in blood parameters. These are indicators of improvement in health and nutrition of the organism cultivated, and if all this can be achieved by applying "ultra-diluted" doses, production costs are reduced and harmful effects are mitigated to the environment making aquaculture homeopathy an eco-sustainable alternative [20].

Conflict of interest

We declare no conflict of interest.

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References

[1] Tacon AJ. Aquaculture production trends analysis. In: Review of the State of World Aquaculture. Roma, Italy: Food and Agriculture Organization of the United Nations (FAO Fisheries Circular No. 886); 2003. pp. 5-29

[2] FAO Fisheries Department. State of world fisheries and aquaculture 2012. In: FAO Fisheries Technical Paper. Rome: FAO; 2012

[3] Bigatti G, Penchaszadeh PE. Invertebrados del mar patagónico, Diagnóstico de la problemática actual y potencial de su conservación y manejo. In: Estado de Conservación del Mar Patagónico. Foro para la conservación del Mar Patagónico y Áreas de Influencias. Referencias; 2008. pp. 105-130

[4] Muller-Feuga A. Microalgae for aquaculture: The current global situation and future trends. In: Richmond A, editor. Handbook of Microalgal Culture. Oxford: Blackwell Science; 2004. pp. 352-364

[5] Freites L, Lodeiros C, Guevara M, Alió J, Graziani C. Experiencias en el cultivo de organismos marinos en el Golfo de Cariaco, Venezuela saber. Revista Multidisciplinaria del Consejo de Investigación de la Universidad de Oriente. 2012;**24**:5-24

[6] Pipitone C, Badalamenti F, Anna GD, Patti B. Fish biomass increase after a four-year trawl ban inthe Gulf of Castellammare (NW Sicily, Mediterranean Sea). Fisheries Research. 2000;**48**:23-30

[7] Miao WM. Recent developments in rice-fish culture in China: A holistic approach for livelihood improvement in rural areas. In: de Silva SS, Davy FB, editors. Success Stories in Asian Aquaculture. Springer; 2010. pp. 15-42

[8] Lu J, Li X. Review of rice–fish-farming systems in China—One of the globally important ingenious agricultural heritage systems (GIAHS). Aquaculture. 2006;**260**(1-4):106-113

[9] Akira S, Uematsu S, Takeuchi O. Pathogen recognition and innate immunity. Cell. 2006; **124**:783-801

[10] Carnevali O, Zampon MCI, Sulpizio R, Rollo A, Nardi M, Orpianesi C, et al. Administration of probiotic strain to improve sea bream wellness during development. Aquaculture International. 2004;**12**:377-386

[11] Rodríguez J, Espinosa Y, Echeverría F, Cárdenas G, Román R, Stern S. Exposure to probiotics and β-1,3/1,6-glucans in larviculture modifies the immune response of *Penaeus vannamei* juveniles and both the survival to white spot syndrome virus challenge and pond culture. Aquaculture. 2007;**273**:405-415

[12] Scholz U, García-Díaz G, Ricque D, Cruz-Suárez LE, Vargas-Albores F, Latchford J. Enhancement of vibriosis resistance in juvenile *Penaeus vannamei* by supplementation of d resistance in juvenile *Penaeus vannamei* by supplementation of diets with different yeast products. Aquaculture. 1999;**176**:271-283

[13] Macey BM, Coyne VE. Colonization of the gastrointestinal tract of the farmed South African abalone *Haliotis midae* by the probionts *Vibrio midae* SY9, *Cryptococcus* sp. SS1, and *Debaryomyces hansenii* AY1. Marine Biotechnology. 2006;**8**:246-259

[14] Robertson PAW, O'Dowd C, Burrels C, Williams P, Austin B. Use of *Carnobacterium* sp. as a probiotic for Atlantic salmon (*Salmo salar* L.) and rainbow trout (*Oncorhynchus mykiss,* Walbaum). Aquaculture. 2000;**185**:235-243

[15] Brunt J, Newaj-Fyzul A, Austin B. The development of probiotics for the control of multiple bacterial diseases of rainbow trout, *Oncorhynchus mykiss* (Walbaum). Journal of Fish Diseases. 2007;**30**:573-579

[16] Harzevili ARS, Van Duffel H, Dhert P, Swings J, Sorgeloos P. Use of a potential probiotic *Lactobacillus lactis* Ar21 strain for the enhancement of growth in the rotifer *Brachionus plicatilis* (Müller). Aquaculture Research. 1998;**29**:411-417

[17] Rengpipa TS, Rukpratanporn S, Piyatiratitivorakul S, Menasav P. Immunity enhancement in black tiger shrimp (*Penaeus monodon*) by a probiont bacterium (*Bacillus* S11). Aquaculture. 2000;**191**:271-288

[18] Irianto A, Austin B. Probiotics in aquaculture. Journal of Fish Diseases. 2002;**25**:633-642

[19] Venkat HK, Shau NP, Jain KJ. Effect on feeding Lactobacillus-based probiotics on the gut microflora, growth and survival of postlarvae of *Macrobrachium rosenbergii* (de Man). Aquaculture Research. 2004;**35**:501-507

[20] Ortiz-Cornejo NL, Tovar-Ramírez D, Abasolo-Pacheco F, Mazón-Suástegui JM. Homeopatía, una alternativa para la acuicultura. Revista Médica de Homeopatía. 2017;**10**(1):28-34