

## Aquaponics, Fish Diseases and Allostatic Load

Disease is a set of interactions among the host (fish), the pathogen, and the environment (water) (Fig 1).. The factors such as the species of fish, size or age, strain or stock, immune status, and general physiological condition of fish affect the host robustness to pathogen and resistance to diseases. For the pathogen, factors include the concentration of infectious particles present in water, their physiological properties and the virulence of the strain. The sensitive balance between the pathogen and the host is linked to disease and health, and that balance is mainly influenced by environmental factors, particularly by water quality. Fish in the aquaponic system may be exposed to adverse environmental conditions (e.g. poor water quality) and to management practices (e.g. crowding or handling) that can impose stressors and affect the immune defence reactions of the fish. Disease outbreaks typically occur when environmental quality or the defence systems of the fish have deteriorated.

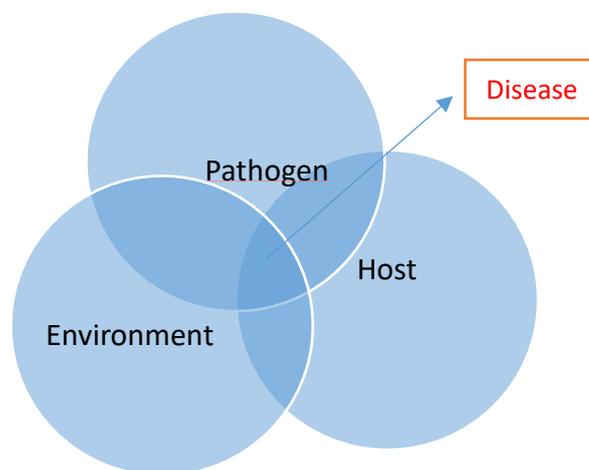
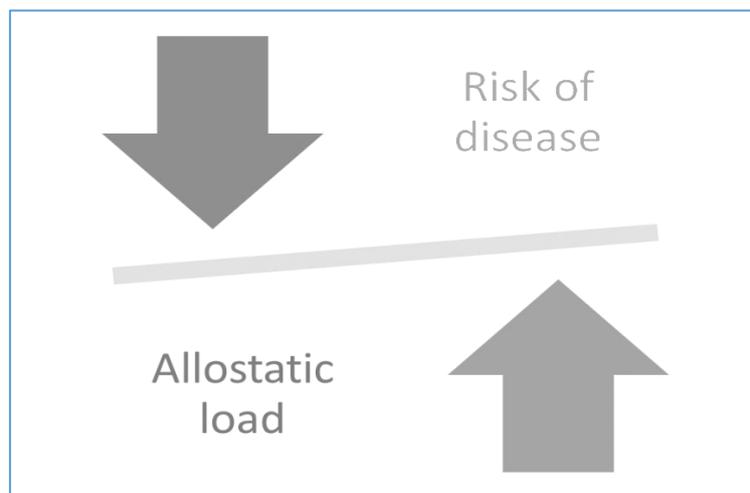


Fig 1. “Snieszko diagram” (1974) illustrating the complex interaction between the host (genetics, immune system), pathogen (virulence), and environment (stress, climate) on development of diseases.

Fish pathogens exist in aquaponics however, fish usually are able to resist them unless allostatic load gets to the level of overload. The stress response can also be defined as allostasis, which explains the struggle to maintain homeostasis through alterations in

physiological systems. Allostasis enables fish to configure the physiological status to resist against stress. Allostatic load also expresses the cumulative result of allostatic states. This can be regarded as the cost an animal has to pay to realise homeostasis via allostasis. Allostatic load can be included in the adaptive response to a threat and considered as competent however, when the allostatic load turns into allostatic overload, the stress comes to the phase of detrimental effects. Although being an adaptive response at first, prolonged and/or additional exposure to novel stressors leads to a situation named allostatic overload, in which pathologies and diseases occur. Ultimately, as allostatic load increases the risk of diseases increases.



The community of the microbial organisms in the aquaponics system is one of the major complementary part of the system. The bacteria species existing in the system are of great concern mainly due to nitrifying bacteria. However, pathogen bacteria and other disease agents should be carefully evaluated for its potential disease risk as the disease outbreak may be an important constraint to the expansion of economically efficient and healthy aquaponics production. The agents of primary infections of fish are parasitic, fungal, bacterial and viral. Diseases of fish are mostly species and system specific thus, the diseases specific to aquaponic conditions and fish species cultured in aquaponic are of potential to emerge. To sustain aquaponics, the prophylactic measures against the diseases should be taken into consideration and the necessary strategy specific to the aquaponics to prevent the diseases should be developed.