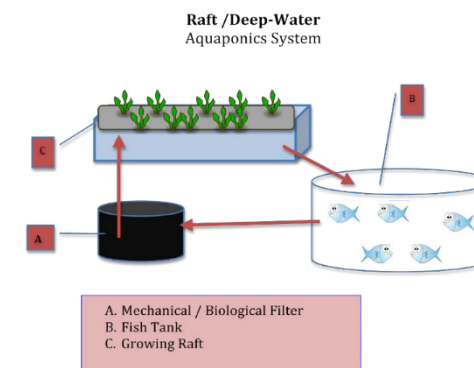


drain back into the fish reservoir. As it drains, oxygen is pulled through the roots. Using a bell siphon, is an alternative means of providing water. A syphon is a mechanism to draw water from a higher container to a lower container. In an aquaponics setup, siphons can be adapted to control the flooding and drainage of growth beds. They are called auto-siphons in this application, which can start and stop in response to changing water levels. Specifically, two useful and widely used methods for this application are bell siphons and loop siphons. In biological water filters, Bell siphons can also be used to create a wet / dry atmosphere useful for aerobic nitrifying bacteria.

Deep water culture

In Deep Water Culture or Raft system the plants are grown on rafts having holes on it and the most common material for the raft tray is a Styrofoam or polystyrene board that should be environment friendly and not harmful for the fishes. In the holes are kept the perforated pots which can be used for the plants to grow and as the plants grow the roots remain submerged and constantly float in water. Technically grow beds are used to house the bacteria but in this system a biofilter is used which requires less space and also houses the necessary bacteria to convert ammonia and ammonium to nitrites and then nitrates. This is a highly productive method, which requires good aeration and intensive filtration to keep the water clean and clear of solids waste.



Resources

- backyardaquaponics.com
- diyaquaponics.com
- aquaponicsnation.com
- You tube channels (Rob Bob's Aquaponics & Backyard Farm)

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CHAPTER-4 DEFENCE MECHANISM IN FISHES

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Introduction

Fish immunology is the most promising area of study for applications in global aquaculture industries. Till now majority of the fish consumed world-wide are produced by aquaculture rather than capture fisheries. Hence understanding fish immunity is essential if we want to effectively combat outbreaks of fish diseases. It is needless to say that the massive increase in aquaculture in modern decades has put greater importance on studies of the fish immune system to protect against diseases associated with intensive and semi-intensive fish rearing.

Immunology can be defined as the study of the immune system and its responses to invading pathogens. The word immunology comes from the latin word 'immunis' means 'exempt from'. The immune system generally includes the molecules, cells, tissues, and organs which are directly or combinedly associated with immunity in the host defence mechanisms. Every component of the fish and shellfish immune system has its own inherent protective value, and combination of these components is capable of developing a satisfactory immune response in fish and shellfish body

(Ángeles Esteban, 2012). Some of the main components of the innate immune system of fish are described in this chapter which are considered as the vanguard of fish immune defence and also plays a crucial factor in disease resistance.

The response of fish following an encounter with a pathogen:

Primary barriers

A layer of mucus covers the epithelial and mucosal barrier of fish such as skin, scales, gills and gut. The mucus of fish generally contains lectins, pentraxins, lysozymes, complement proteins, antibacterial peptides and immunoglobulin M (IgM), which have an essential role in inhibiting the entry of pathogens into the fish body. At the same time, defending cells like lymphocytes, macrophages and eosinophils are also present.

Fish defence system

Like other vertebrates, fish defence mechanisms can be categories as innate or non-specific and adaptive specific systems.

A. Innate or non-specific immunity/ defence

Innate immunity, otherwise known as natural or native immunity, takes part in the initial protection of the fish body against pathogens. The mechanisms of innate immunity provide the initial defence against any microbial infections. Majority of the microbes such as bacteria, virus are blocked by a physical barrier (skin, scale). Suppose the pathogens succeed in entering the fish body, in that case, those pathogens are eliminated by innate humoral components (antimicrobial polypeptides, complement, cytokines,