

**FISH HEALTH CHALLENGE AFTER STRESS. INDICATORS OF  
IMMUNOSUPPRESSIVE STATUS**

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**EXTENDED ABSTRACT ONLY - DO NOT CITE**

The immune system of fishes is characterised by a number of features related to the evolutive status of fish and the water environment they inhabit. Thus, the occurrence of microorganisms and the nature of an aqueous habitat results in a high level of contact with foreign molecules. As a result, a significant feature of the piscine immune response is the range of non-specific immune response, its wide repertoire and also the notably high immune activity found on external surfaces, especially in freshwater fish. The potency of the non-specific responses in fish is opposite from that found in higher vertebrates, wherein memory and specific immunoglobulin responses are more effective.

Stressors activate the alarm responses in all physiological compartments and neuro-endocrine mediators are mobilised as a first response. These molecules may be used as markers for immune activation. The stressed status and the occurrence of hormones generate physiological and metabolic changes and when the effects become chronic one of the consequences of maladaptation is the depression or suppression of immune mechanisms due to the concentration of resources to overcome energetic needs. Therefore, two types of indicators may be considered regarding the time course of immune responses, early-immediate or short-term markers, that will indicate the initiation of immune mechanisms which may be adaptative, and the long term markers that will often indicate a diseased status and/or a drop in immunocompetence.

Amongst the first grouping, the cytokines are key players. Thus detection of pleiotropic interleukins such as TNF $\alpha$  or interleukin-1 $\beta$  allows for detection of primary immune be applied including those based upon specific cellular responses such as marker gene expression, cell proliferation/apoptosis, cell functions (phagocytosis) and cell migration/localisation. In addition, lysozyme

activity, complement activity, lectins and immunoglobulin production may be also be utilized.

In terms of applied work only a select number of indicators can be transferred and used to test immunocompetence/immunosuppression on site where the scientific/analytic equipment is often scarce. Of clear importance for quality analysis is sampling technique, especially in blood and tissue sampling, and subsequent sampling thereof. In the near future the development of simple kit-based formats for key markers such as cytokines for the assessment of immunological status will be highly desirable.