

Histopathological indicators: a useful fish health monitoring tool in common carp (*Cyprinus carpio* Linnaeus, 1758) culture

Research Article

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Abstract: In order to evaluate the relationship between water quality in ponds and indices of histopathological changes occurring in the vital organs of the common carp (*Cyprinus carpio* L., 1758), two six-month field experiments were carried out using two different water supplies: from the nearby stream and a tube well. The fish were fed supplemental feed: raw cereals, pelleted and extruded compound feed. Histopathological analysis, alteration frequencies, and semi-quantitative scoring of the changes were used to assess the health status of the fish. Ponds supplied by stream water were characterized by higher water hardness, dissolved oxygen and pH values, while those supplied by the tube well had higher electroconductivity, total ammonium and orthophosphates content. Fish survival rate and habitat suitability index were lower in ponds supplied by stream water, while the weight gain did not differ between the two water supplies. The use of stream water resulted in a higher level of histopathological changes in gills and liver. Among the water quality parameters, pH level had the strongest influence on fish. Differences in water supply produced greater influence on the level of histopathological changes than the type of feed applied. Gills were the most sensitive organ, while the kidney was the least responsive.

Keywords: Histopathology • Semi-quantitative scoring • Water quality • Pond • Common carp

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1. Introduction

The use of histopathological (HP) indicators is a frequent practice in fish health research, as they are able to provide information on chronic and sub-lethal effects of xenobiotics on organs [1,2] and for the assessment of fish stress [3,4]. They are usually applied in research of polluted aquatic ecosystems, since they are good indicators of altered or polluted environments [5-9]. Gills, liver, kidney, and skin are the most frequently used HP indicators in assessing health status of fish [10].

A variety of stressors are present in the fish pond. Stress can be initiated by inadequate water quality, stocking density, diet or feeding technique, infestation by parasites or a disease [11]. The level of stress in farmed fish is usually assessed using physiological

parameters [12], while HP parameters are rarely used, especially in common carp (*Cyprinus carpio*) reared in earthen ponds [13-16]. Contrary to natural freshwater ecosystems, the water quality in fish ponds is monitored and maintained within certain limits. However, the interaction between different factors can affect the environment, making it less suitable and consequently induce stress in fish [12]. Environmental stress in fish triggers the hypothalamic-pituitary-inter-renal axis, which helps fish to adapt to environmental change [17]. This mechanism causes an increase in ACTH and cortisol, which alter fish metabolism and physiology, and if the stressor is chronic, changes in organ morphology occur [18]. Such changes can be detected by means of histopathology. In addition, by using a scoring system, it is possible to quantify HP changes and correlate them

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