

**ANALYSIS OF ENVIRONMENTAL
FACTORS THAT CAUSE DISEASES IN FISH
RAISED IN INTENSIVE SYSTEMS,
DIAGNOSTIC AND CONTROL METHODS**

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ABSTRACT

The PhD thesis entitled “Analysis of Environmental Factors That Determine Diseases in Fish Raised in Intensive Systems, Diagnostic and Control Methods” addresses a current topic in the field of modern aquaculture and veterinary medicine, aiming to enhance sanitary and economic performance in fish farms.

The work is structured, under current regulations, into two main parts: a first part, entitled "Current State of Knowledge", which comprises 20 pages, and a second part, "Own Research", detailing the results obtained during the study period, containing 80 pages. The thesis includes: table of contents, introduction, abstract, list of references, list of abbreviations, list of figures, and list of tables. The paper contains 75 figures and 18 tables, with 237 bibliographic sources consulted.

Part I – Current State of Knowledge provides a comprehensive analysis of the specialized literature regarding the importance of aquaculture, environmental factors involved in fish health, the classification of fish diseases, and classical and modern diagnostic methods. This part is structured into three chapters:

Chapter 1, entitled “**The Importance of Aquaculture in the Global and National Context**”, provides general data on the status of aquaculture at both national and international levels.

Chapter 2, “**Environmental Factors in Aquaculture**”, details the main physico-chemical parameters that can influence fish health, sources of pollution and their impact on fish ecosystems, as well as the relationship between environmental factors and the occurrence of diseases.

Chapter 3, “**General Concepts on Fish Diseases**”, describes the main pathologies affecting fish, and the methods of diagnosis, prevention, and control.

Part II – Own Research, structured into five chapters, is dedicated to experimental studies carried out in several fish farms across Romania, where both traditional and recirculating

aquaculture systems (RAS) were analyzed. The main objectives include: assessment of water quality used in fish farming, identification of chemical and biological risk factors, disease diagnosis using complex methods, and the proposal of modern control solutions.

The research included the monitoring of physico-chemical water parameters (pH, dissolved oxygen, ammonia, nitrites, iron, sulfites, etc.), identification of pathogens using histopathological, microbiological, and

molecular methods (Real-Time PCR), as well as evaluation of the impact of pollution on fish health. The fish farms were selected based on the type of production system and geographical location.

Chapter 4, “Diseases Identified in Experimental Studies and Diagnostic Methods Applied to Cyprinids”, aims to identify the main diseases affecting cyprinids and to apply clinical, histopathological, bacteriological, and parasitological diagnostic methods.

Chapter 5, “Diseases Identified in Experimental Studies and Diagnostic Methods Applied to Salmonids”, includes the collection of biological samples for histopathological, parasitological, bacteriological, and molecular examinations (including Real-Time PCR for detection of *Aeromonas* spp.).

A significant contribution of the thesis is the use of FT-IR spectroscopy to monitor the presence of pollutants and their impact on fish health, demonstrating the potential of this method as a complementary diagnostic tool in aquaculture.

Chapter 6, “Effect of Administration of Feeds with Phytogetic Extracts, Evaluation of Oxidative Stress and Fish Health Status”, aimed to assess the effects of phytogetic extract-enriched feeds on the general health status of fish reared in intensive systems, to determine the influence of phytogetic extracts on oxidative stress levels in fish by monitoring specific biochemical biomarkers (e.g., MDA, SOD, CAT, GPx), and to compare the physiological and biochemical parameters of fish fed standard diets versus those fed diets with added phytogetic extracts.

Structured into nine subchapters, it details the evaluation of oxidative stress and other welfare indicators in relation to environmental factors, the role of gut microbiota in fish health, and the influence of wheatgrass juice administration, proposing modern

prophylactic methods.

An innovative element of the research is the testing of wheatgrass juice (*Triticum aestivum*) as a phytogenic feed additive in fish diets.

For this experimental stage, common carp (*Cyprinus carpio*) specimens, with an initial average weight of 8.8 g/individual, were reared in an indoor recirculating aquaculture system (RAS). This size was chosen due to the vulnerability of juveniles to environmental stress, and because this stage corresponds to a high growth rate. The optimization of rearing technology through the use of functional feeds contributes directly to the productivity and sustainability of the system.

Each experimental variant was carried out in triplicate, with 30 fish per tank. The experiment was conducted between July 5, 2024 – August 28, 2024. The RAS system included fiberglass tanks (0.75 m³), a drum mechanical filter, UV filter, biological filter, pumping system, and sensors for continuous water parameter monitoring. Natural lighting was supplemented with fluorescent light, for 10 hours/day, and salinity was maintained at 0.1 mg/L.

Water quality parameters were carefully monitored. Temperature and dissolved oxygen (DO) were measured with a portable oximeter Hach HQ30d, and pH and conductivity with a multiparameter Hach HQ11d. Ammonia, nitrites, nitrates, and phosphates were analyzed with the Hanna Iris HI801 spectrophotometer and specific reagents (Hanna Instruments, Sălaj, Romania).

Wheatgrass juice was administered in different concentrations, demonstrating beneficial effects on: the general health status of the fish, hematological parameters (increased hematocrit and hemoglobin), intestinal microbiota (stimulation of beneficial bacteria), meat quality (by reducing bacterial load and improving the nutritional profile) and resistance to bacterial and fungal infections.

Chapter 8, “General Conclusions and Proposals”, highlights the direct relationship between environmental quality and disease incidence in intensive aquaculture. It emphasizes that the use of modern diagnostic methods, along with natural solutions, contributes significantly to more effective pathology control. The administration of wheatgrass juice proved to be a promising alternative to antibiotics and synthetic additives.