

Crayfish in crisis: exploring pathogens and diseases in a challenging world.

In the era of the sixth extinction, the freshwater crayfish not only faces the major causes of destruction affecting freshwater systems (flow modification, water pollution, habitat destruction, overexploitation, climate change, invasive alien species), but also has to deal with diseases. It is therefore essential to understand crayfish pathogens and their impact on biodiversity in general.

Over the years, numerous studies have documented the causes and agents responsible for crayfish diseases through the use of traditional taxonomy, microscopy and molecular techniques. However, the global translocation of organisms for aquaculture purposes and for the aquarium trade has led to disease outbreaks in new geographic and host records, revealing previously unobserved conditions. This has contributed to the spread of certain diseases, leading to the decline and mortality of affected crayfish populations.

Historically, epidemiologists, population biologists and ecologists have used a variety of approaches to identify crayfish pathogens and understand the role of disease in shaping crayfish populations. With new molecular approaches, including environmental DNA (eDNA), genomics and transcriptomics (both host and pathogen), researchers can now focus on other aspects. Early detection of pathogenic organisms and understanding crayfish immune response to the presence of these pathogens are crucial to a comprehensive understanding of the problem.

To further understand the complex disease dynamics in freshwater crayfish ecosystems, we will examine several cases of pathogens that significantly affect a variety of freshwater crayfish species, with a particular focus on *Aphanomyces astaci*. Through this analysis, we will examine the interactions between these pathogens and crayfish populations, and how integrated approaches from a variety of disciplines can contribute to more effective management and conservation strategies for crayfish.