predation pressure could be a decisive factor for the avoidance-(re)colonisation response. In addition, the results of (re)colonisation studies with daphnids and shrimps exposed to cadmium, caffeine and the herbicide irgarol indicate a lack of relation between avoidance and (re)colonisation, probably due to the mechanisms of action of contaminants producing stimulative and lethargic effects. Considering that the consequences of the avoidance-(re)colonisation response could be ecologically analogous to mortality (as organisms disappear), these trials provide an environmentally protective approach and an ethical advantage to lethal tests, reducing the suffering of organisms.

9.10 Experimental Evidence of Contamination on the Dynamics of Shrimp Populations: Susceptibility to Spatial Isolation

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Landscape-scale ecology comprises complex structures where a flow of energy, materials and organisms among ecosystems conditions the dynamics of populations. Several natural and anthropogenic stressors are likely to affect the landscape composition, generally leading to the rupture of ecological connectivity among populations. Although contamination is considered one of the most threatening factors for biodiversity, its impact on spatial dynamics of populations (e.g., distribution, persistence and abundance) from an *eco*-toxicological perspective is still unknown. In the current study, the potential effect that contamination can exert on the loss of connectivity among populations (chemically fragmented habitats) leading to population isolation was assessed. The estuarine shrimp *Palaemon varians* was used as model organisms and a novel version of the HeMHAS (Heterogeneous Multi-Habitat Assay System) was used to simulate spatially heterogeneous landscapes. In order to provide more ecological relevance to the study, besides copper as stressor [at low (0.5 µg/L) and high (25 µg/L) levels], other two factors were simultaneously tested: fish kairomones (as a predation signal) and food availability. Different scenarios were simulated in the HeMHAS to create heterogeneous landscapes that vary depending on the presence or absence of these stressors. The behavior observed by the population of *P. varians* clearly showed that the shrimp detected copper and avoided the regions with the highest levels of contamination. However, when fish kairomones were added to previously preferred regions, the behavior of shrimp populations did a radical turn: they escape the predator signals, moving towards contaminated regions, but with a clear preference for less contaminated areas. When faced whether to stay in a clean area with no food or moving through disturbed regions to colonize a clean region with food, shrimps' populations crossed the regions, but with a more dynamic transit in the region with kairomones and no copper. These results indicate that contamination might interfere in the spatial dynamics of shrimps' populations by: (i) triggering avoidance, (ii) preventing colonization, (iii) isolating populations and (iv) making them more susceptible to local extinction.

9.11 Integrating Avoidance Behavior and Stress to Understand How Contamination Affects the Health and Spatial Distribution of Fish in Heterogeneously Contaminated Landscapes

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Environmental contamination might make ecosystems unsuitable to accommodate life due to their aversive effects on organisms. As many aquatic ecosystems are spatially connected, some organisms might avoid the consequences of a continuous exposure to contaminants by moving to less contaminated habitats. In this sense, the habitat selected by organisms might be conditioned by a balance among the advantages of moving to another area to escape from contamination, the level of stress produced in a contaminated area and the availability of uncontaminated areas. Considering the connectivity that exists among ecosystems and that contamination is not homogeneously distributed, the aim of the current study was to assess how the avoidance behavior can help reducing the stress (cortisol levels) of zebrafish (*Danio rerio*) in a chemically heterogeneous landscape. Zebrafish were exposed to heterogeneous copper contamination scenarios in a free-choice multi-compartmented system. Under those scenarios, fish escaped from the most contaminated areas, with an avoidance by 50% of population (AC_{50}) at concentrations of 41 (copper gradient scenario), 25 (poorly contaminated scenario) and 69 (highly contaminated scenario) µg/L. Higher stress levels was observed in the populations exposed to homogeneously contaminated and highly contaminated (by copper) scenarios, in which there are no clean areas to flee to. In summary, the uncontaminated areas might be crucial for the well-being and spatial dynamics of fish populations in a chemically heterogeneous landscape due to their role as escape zones to alleviate stress.