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Abstract

Assessing Biological Effects of Contaminants in the Gulf of Finland, Northeastern Baltic Sea, Using Sediment Biotests with Amphipods (*Monoporeia affinis*) and Biomarker Responses in Clams (*Macoma balthica*) †

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The Gulf of Finland, in the northeastern Baltic Sea, is experiencing ongoing adverse effects due to human activities, leading to a decline in the quality of the marine environment [1]. The current emphasis in environmental monitoring and assessment lies in chemical and ecological measurements, with little attention given to the connection between these measurements and their biological effects. The neglect of examining biological effects hampers our understanding of the overall influence that various contaminants have on marine organisms, which results from complex combinations of multiple effects. We have collected sediments from moderately to highly contaminated offshore and coastal areas with subsequent analyses of selected chemicals (Figure 1). Where available, clams (*M. balthica*) were collected for biological effects measurements. From seven sites, whole-sediment bioassays with amphipods (*M. affinis*) were conducted to determine the effect of contaminants with the registration of the mortality rate and activity of three biochemical biomarkers. In the sediment biotest, the mortality rate was mostly uniformly low (around 8%). The comparison of the amphipod and clam biomarker data revealed that the amphipod, which was exposed to sediments from Narva Bay, did not exhibit significant changes in biomarker activities, except for catalase (CAT), which indicates oxidative stress (Figure 2). In clams, peaks and falls in enzymatic activities primarily reflect in situ exposure to harmful compounds and conditions. The lowest glutathione S-transferase (GST) activity in clams might be related to the impact of contaminants, as high levels of mercury registered simultaneously in the sediments near the Narva river mouth, while near Kunda harbour, the normalised content of PAH anthracene exceeded more than five times the HELCOM threshold. The highest GST in Narva bay clams might be related to the mixed impact of toxic biocide TBT, which exceeded the GES threshold by almost ten times, and moderate contamination by PAHs and non-dioxin-like PCBs was found in the sediments there. According to the calculated integrated biomarker response index, the highest value at the Sillamäe harbour reflects the most stressful conditions within the studied area. In addition, the elevated level of oxidative stress hints at the unfavourable hydrophysical and chemical conditions in this location.

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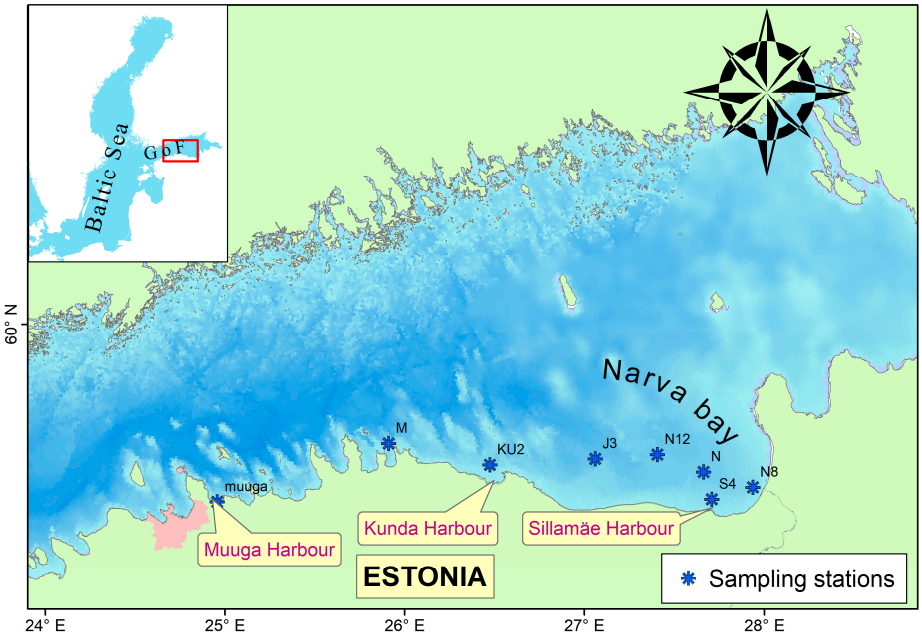

Figure 1. Sampling stations in the study area.

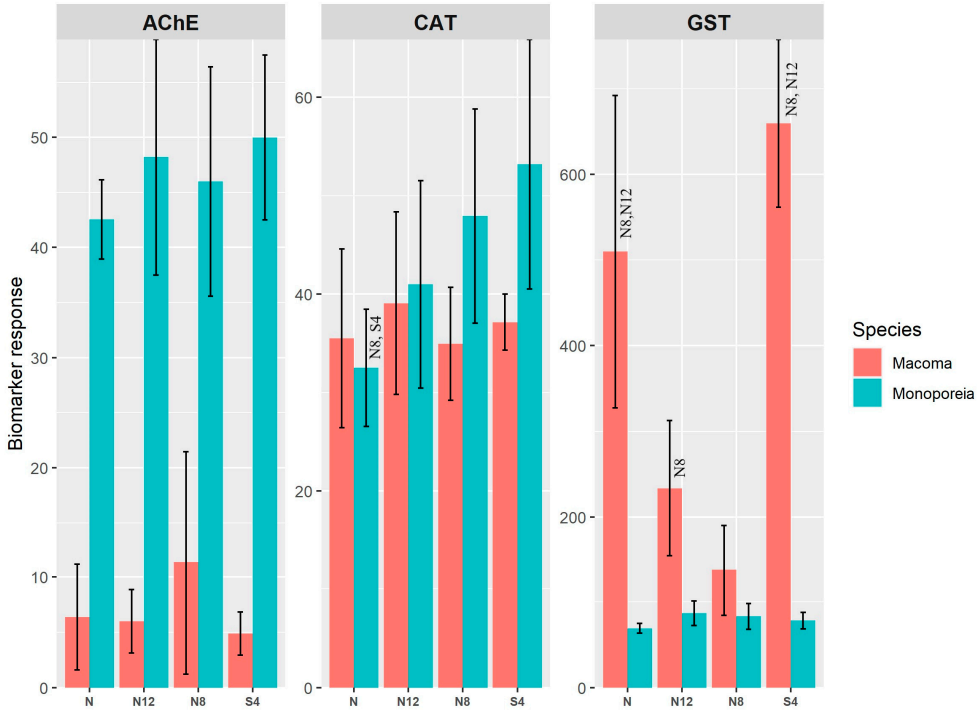

Figure 2. Biomarker response in both species (mean ± sd). Station names above the bars indicate significant differences between stations ($p < 0.05$).

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