# Influence of temperature on acute and chronic toxicity of marine algal toxins — a case study with copepod *Nitokra spinipes*

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Harmful algal blooms (HABs) – proliferated algae densities with often a toxin producing ability – have been found increasingly in both northern and southern oceans. Recent studies have established that increasing temperatures contribute to HABs occurrence. But the broader influence of climate change on these outbreaks is less well quantified. Of particular concern is the limited research on HABs toxin effects under varying temperatures, especially concerning zooplankton, a crucial component of aquatic ecosystems. They do not only consume algae but also serve as prey for organisms at higher trophic levels, hence, are pivotal in energy transfer and nutrient cycles in aquatic food webs.

Therefore, we examined the impact of marine toxins on marine zooplankton in the context of climate change. We designed a series of laboratory experiments using filtered seawater to assess the toxicity of four commonly occurring algal toxins, purified and sourced from CIFGA Laboratory, on a model organism for ecotoxicological studies, *Nitokra spinipes*, exposed to three different temperatures. We evaluated acute toxicity of domoic acid and yessotoxin, respectively. Adult females were exposed to these toxins at 15, 20, and 25°C for 48 hours. EC50 values of domoic acid arranged from 11.08±3.81 to 88.51±164.89 µg/L, respectively. Also, juveniles, aged 48 to 72 hours, were exposed at 18, 20, and 22°C for the same duration. The EC50 of domoic acid in this case arranged from 65.36±10.66 to 102.76±9.52 µg/L. Mortality rates across temperatures showed no significant difference. In chronic toxicity test, larval development ratio (LDR), brood size and inter-brood time of domoic acid, yessotoxin, saxitoxin, and microcystin-LR were examined at 18, 20, and 22°C. We observed that with increasing temperatures, LDR for domoic acid increased, whereas brood size significantly decreased as toxin concentration rose. While these results are preliminary, they indicate a temperature dependent sensitivity of copepods towards toxins produced by HABs.

**Keywords**
Climate Change; Harmful Algae; Marine Toxins; Zooplankton