

TOXICITY OF KARENIA SPECIES ON GREENSHELL MUSSEL REPRODUCTION: INSIGHTS INTO THE POTENTIAL BLOOM IMPACT ON AQUACULTURE IN NEW ZEALAND

Karenia is a genus of dinoflagellates that includes species capable of inducing harmful algal blooms (HABs). Blooms of *Karenia* species occur globally (Lassus et al., 2016), particularly *Karenia mikimotoi* (Sakamoto et al., 2021), which can reach concentrations up to 10^8 cells·L⁻¹ (D'silva et al., 2012). These blooms can cause mass mortalities of marine fauna (Orlova et al., 2022), including in aquaculture, resulting in significant economic losses (Yanagi et al., 1995). Exposure to *K. mikimotoi* has been shown to induce hemolytic effects, fish gill damage, and harmful impacts on bivalves. In New Zealand, *Karenia* spp. can bloom during summer, overlapping with the reproductive period of the Greenshell™ mussel (*Perna canaliculus*). In 1998, a *K. brevisculcata* bloom caused mass mortality of benthic organisms in Wellington Harbour. Species such as *K. mikimotoi*, *K. brevisculcata*, *K. papilionacea*, *K. selliformis*, and *K. longicanalis* are now monitored by the Cawthron Institute due to their bloom-forming potential. However, their effects on early life stages of Greenshell™ mussels, a species of major economic importance in New Zealand, remain poorly characterized. This study aimed to assess how New Zealand *Karenia* species affect *P. canaliculus* reproduction. Embryo-larval development tests, sperm viability assays, and ROS (reactive oxygen species) measurements were conducted to evaluate the toxicity of the five species at bloom-level concentrations. Additionally, three strains of *K. mikimotoi* were tested to assess intraspecific variability. Results showed that toxicity is species- and strain-dependent. After two hours of exposure, sperm viability was unaffected, but variations in ROS production indicated sublethal effects. One *K. mikimotoi* strain significantly impaired embryo-larval development, possibly due to gymnodimine-C. *K. selliformis* and *K. papilionacea* also had significant effects, though the toxins involved remain unidentified. These findings suggest that, at environmental bloom levels (10^6 – 10^7 cells·L⁻¹), *K. mikimotoi*, *K. selliformis*, and *K. papilionacea* may impair early development of Greenshell™ mussels, posing a risk to aquaculture.

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