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TITLE: Effects of low crude oil chronic exposure on the northern krill (*Meganyctiphanes norvegica*)

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ABSTRACT:

Chronic oil pollution related to gas and oil drilling activities is increasing in the sea due to the rising offshore petroleum industry activity. Among marine organisms, zooplankton play a crucial role in the marine ecosystem and therefore understanding the effects of crude oil chronic exposure on zooplankton is needed to determine the impact of oil in marine environments. The present study reports on the effect of crude oil on adult northern krill, *Meganyctiphanes norvegica*, collected during three seasons. Their sensitivity to oil was examined with oil concentration of 0.01 versus 0.1 mg oil L<sup>-1</sup> and photo-modified oil in flowing seawater maintained in the dark for 2 weeks at in situ temperature. Oil (polycyclic aromatic hydrocarbons, PAHs) entered the krill (on average, 350 and 4400 µg·kg<sup>-1</sup> wet weight in low and medium oil treatments respectively) and a larger fraction of the krill exhibited digestive gland pathologies (enhanced apoptosis and pathology of digestive tubules) in oil treatments (27–80%) compared to a significantly lower fraction (7–13%) in treatments that received no oil. However, 2-week oil exposure at these concentrations did not significantly decrease survivorship or impair basic functioning such as feeding and respiration rates. Similarly, there were only limited changes in the transcription of 7 selected genes from head tissue. Additionally, although there was significant seasonal variation in krill total lipid content and fatty acid composition, there was no treatment effect on both these parameters, which suggests limited oxidative stress under experimental conditions. Furthermore, there was no significant treatment effect on two direct measures of oxidative stress (MDA: malondialdehyde and AOPP: advanced oxidation protein products) in any of the seasons. Nevertheless, histology clearly revealed enhanced digestive gland pathologies in krill even at low concentrations. Although krill with such pathologies continue to survive, their accumulation of PAHs may be transferred up the food chain, impacting their predators and the wider ecosystem.

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