Cumulative impacts of oil pollution and climate change on Arctic copepods

Find the article

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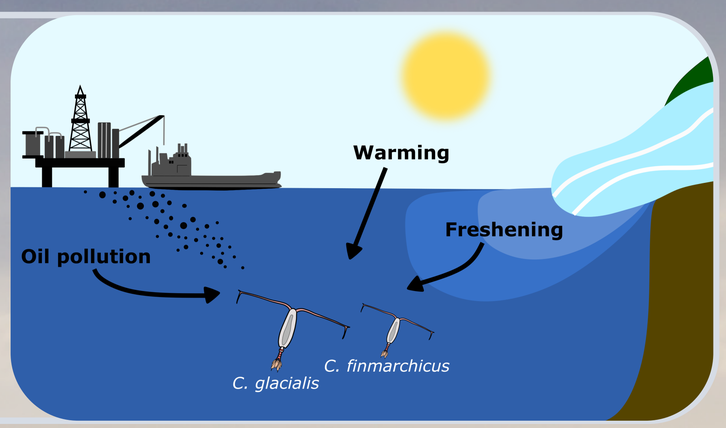
The Arctic is subject to rapid and dramatic changes, and biota are exposed to multiple stressors. Among these, pollution and climate change are both expected to increase in intensity. Still, little in known about their joint impacts.

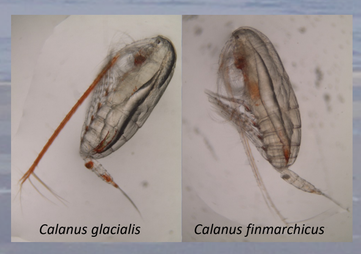
Aim: Experimentally assess how crude oil and climate change, specifically warming and freshening, in combination affect two key species of Arctic copepods (*Calanus glacialis* and *Calanus finmarchicus*) through a tri-stressor exposure.



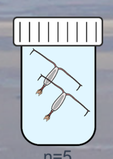
TREATMENTS

	Ambient	Scenario 1	Scenario 2
No oil	0 °C 33 psu	5 °C 27 psu	5 °C 27 psu
+ Oil	1 µl L^{-1}	1 µl L^{-1}	1 µl L^{-1}

EXPOSURE



Sampled and exposed in West Greenland

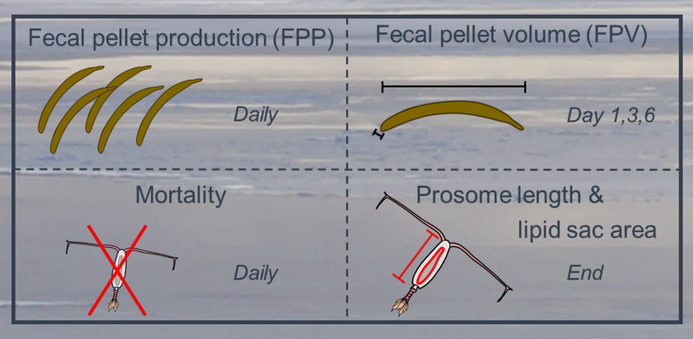


6 days exposure

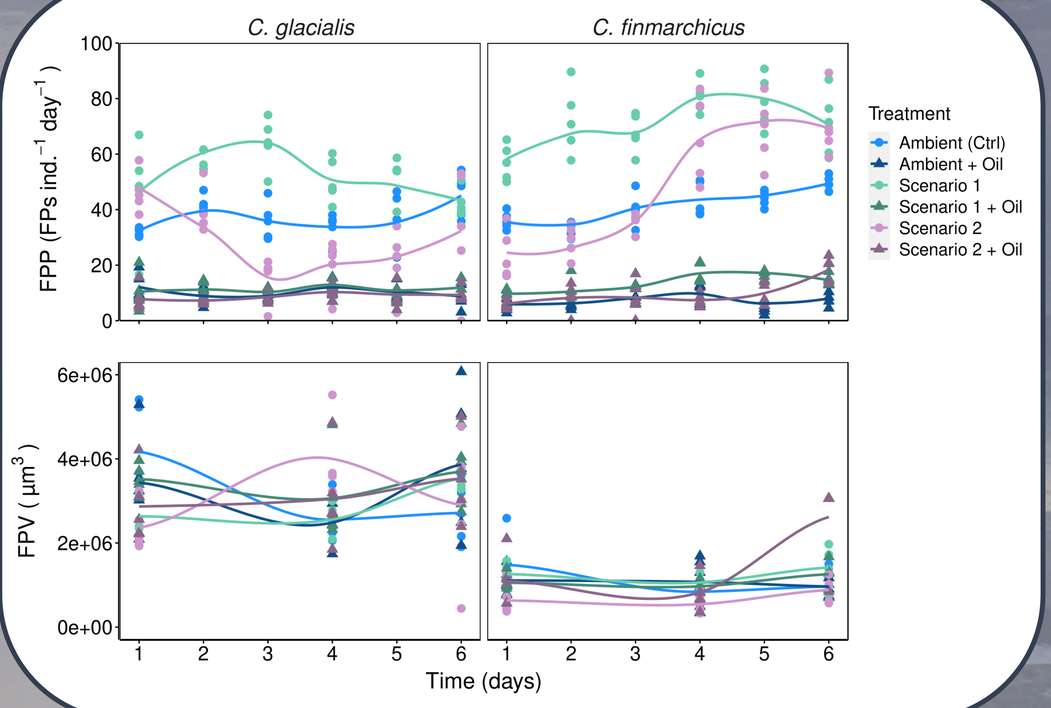
2 individuals per 300 mL

Daily renewal and feeding (*Thalassiosira weissflogii*)

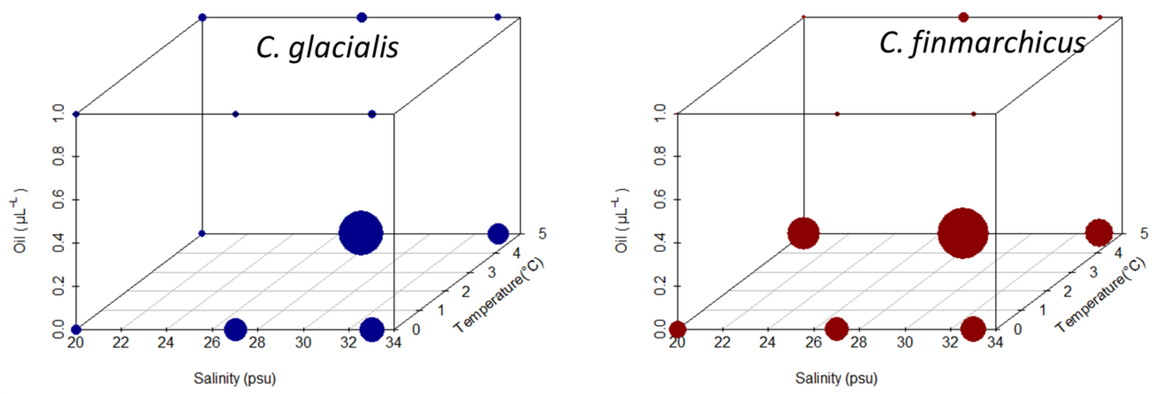
RESPONSES



EFFECTS ON FEEDING



CUMULATIVE IMPACTS



Oil drastically decreased feeding (up to 83%), irrespective of the climate scenario

Salinity affected feeding in a non-linear way

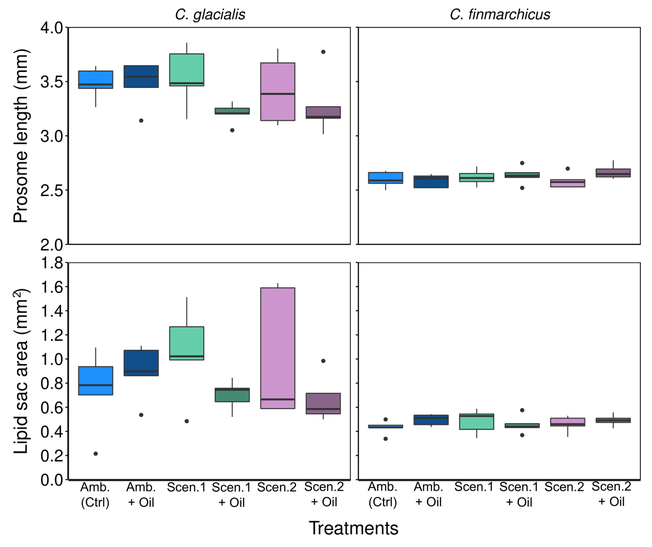
Warming increased feeding

Cumulative effects
(all three factors interacted)

No mortality

No difference in prosome length or lipid sac size

BODY CONDITION



CONCLUSIONS

- Strong effects of environmentally relevant levels of crude oil pollution and climate change on copepod feeding
- *C. glacialis* was more sensitive than *C. finmarchicus*
- Reduced feeding can have serious implications for:
  - Copepods' energy budget
  - Build-up of lipid reserves → overwintering, food for higher trophic levels
  - Carbon sequestration (sinking fecal pellets)

CHEMICAL ANALYSIS

32 polycyclic aromatic compounds at elevated concentration

- 10 priority PAHs: 790 ng L^{-1} (sum)
- 7 other PAHs: 230 ng L^{-1} (sum)
- 15 alkylated PAHs & dibenzothiophenes: 1236 ng L^{-1} (sum)

1 heavy metal: Lead 0.6 µg L^{-1}

Reference: Rist, S., Rask, S., Ntinou, I.V., Varpe, Ø., Lindegren, M., Ugwu, K., Larsson, M., Sjöberg, V., Nielsen, T.G., 2023. Cumulative impacts of climate change and oil pollution on the consumption of Arctic copepods. Environ. Sci. Technol., 58,7, 3163-3172. doi: 10.1021/acs.est.3c09582

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CLIMATE NARRATIVES

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