Arctic sea-ice decline impacts on primary production

Letizia Tedesco1, Eva Leu2, Marc Macias-Fauria3, Christopher J. Mundy4, Dirk Notz5, Janne Søreide6, Malin Daase7, Jakob Doerr5, and Eric Stephen Post8

1Finnish Environment Institute, Marine Research Centre, Finland (letizia.tedesco@environment.fi)
2Akvaplan Niva, Norway
3University of Oxford, UK
4University of Manitoba, Canada
5University of Hamburg, Germany
6University of Svalbard, Norway
7UiT The Arctic University of Norway, Norway
8University of California Davis, USA

Arctic food webs are short and relatively species poor, rendering them vulnerable to changes or perturbations at any individual trophic level. High-latitude warming represents one major source of potential perturbation to Arctic marine and terrestrial food webs, which may experience cascading effects derived from changes in primary production through so-called “bottom-up” effects. We synthesize current knowledge on i) the changing Arctic marine icescape, ii) the drivers of biological changes for Arctic marine primary production, iii) the different pulses of Arctic marine primary production, iv) patterns of marine trophic and phenological changes, and iv) some mechanisms through which sea-ice dynamics ostensibly influence terrestrial primary productivity. We deliver a set of predictions for key productivity indicators, propose a semi-quantitative model of the expected future changes in primary production in the ice-covered Arctic Ocean, and close with an overview of the challenges ahead for reaching a holistic and comprehensive understanding of the ecosystem dynamical consequences and associated impacts on human life of warming-related sea-ice decline.