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Title	Warming modifies the seasonal photophysiology and productivity of Arctic macroalgae

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Warming is affecting Kongsfjorden ecosystem with special intensity due to the influence of oceanic currents altered by Global Change. The effects of this stressor on the ecophysiology of Arctic seaweeds have been widely investigated, but mostly restricted to summer. However, Arctic coastal ecosystems experience strong seasonal changes in environmental light conditions from 24-hours of darkness in winter to 24-hours of light in summer, which likely alter the photosynthetic performance of macroalgae. In order to understand how increasing temperature will affect Kongsfjorden ecosystem dynamics it is crucial to analyze the effect of seasonal photoperiod on the responses of Arctic seaweeds to warming. Thus, we carried out experiments in September (fall equinox), March (spring equinox) and August (24h of light) to compare the photophysiological responses of common seaweed species of Kongsfjorden after acclimation to continuous light and 12:12 light:darkness at 4ºC, as well as the responses to increased temperature (8ºC) at the corresponding seasonal photoperiod.

Due to 24-hours light stress in summer, macroalgae generally showed reduced photosynthetic capacity when compared to the equinoxes. Additionally, higher photoinhibition along with higher respiration rates were induced when seaweeds were exposed to continuous light in the equinoxes, whereas macroalgae exposed to 12:12 light/dark cycles in summer showed no changes in the photosynthetic capacities and respiratory rates, indicating that seaweeds cyclically acclimate to the seasonal light conditions in the Arctic. These differences were observed when photosynthetic light reactions were assessed, but were reduced or even disappeared when 14CO2 fixation was measured. The increase in temperature frequently enhanced 14CO2 fixation and respiration rates, while growth rates were mostly unaltered, but season-specific and species-specific effects were observed. These results are highly valuable for constructing primary productivity models of the macrophytobenthos for the whole fjord, which can serve to make accurate predictions of productivity and ecosystem functioning in near-future scenarios.