

Temperature effects on growth and photosynthesis reactivation after the Polar Night in two Arctic kelp species

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ABSTRACT

Warmer winters in Arctic fjords have led to an ice-free spring, in which sunlight penetrates the water column about two months earlier than it used to. To elucidate the effects of a warmer Polar Night; growth, photosynthetic performance, Rubisco quantity and activation state, respiration and biochemical composition were studied in the Arctic kelps *Alaria esculenta* and *Saccharina latissima*. Laboratory-grown sporophytes were transferred to complete darkness at 1 °C and 5 °C for 8 weeks, followed by 2 weeks of increasing light exposure. During darkness, photosynthetic pigments and Rubisco quantity only decreased in *A. esculenta*, with no temperature effect. However, Rubisco activation state remained unchanged in both species during this period and photosynthetic reactivation occurred within the first hour of light exposure. Higher temperature accelerated biomass loss in complete darkness in *S. latissima*, and reduced growth rates during the 2 weeks of increasing light exposure in both species, mainly due to higher respiration rates. This study highlights that a warming Arctic would affect carbon budgets, having a negative impact on growth recovery after the Polar Night, potentially compromising the survival of marine kelp forests.

Keywords: Polar Night, Arctic kelp, warming, photosynthesis.