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# Interaction of high seawater temperature and light intensity on photosynthetic electron transport of eelgrass (*Zostera marina* L.)

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**Abstract** The interaction of widely recognized causes of eelgrass decline (high seawater temperature and limited light intensity) on photosynthetic electron transport was investigated via chlorophyll fluorescence technique. High seawater temperature combined light intensity significantly increasing the relative maximum electron transport rate ($rETR_{max}$); at critical temperature of 30 ºC, the $rETR_{max}$ increased with the enhancement of light intensity, indicating the elevation of overall photosynthetic performance. Based on the magnitude of effect size ($\eta^2$), light intensity was the predominant factor affecting the performance index ($PI_{ABS}$), indicating that photosystem II (PSII) was sensitive to light intensity. Moreover, the donor side was severely damaged as evidenced by the higher decrease amplitude of fast component and its subsequent incomplete recovery. The reaction center exhibited limited flexibility due to the slight decrease amplitude in maximum photochemical quantum yield. In contrast with PSII, photosystem I (PSI) was more sensitive to high seawater temperature, based on the magnitude of $\eta^2$ derived from the maximal decrease in slope. High seawater temperature significantly increased PSI activity, plastoquinol reoxidation capacity, and probability for electron transfer to final PSI electron acceptors. Moreover, it combined elevated light intensity significantly stimulated the activity of cyclic electron flow (CEF) around PSI. Higher activity of both PSI and CEF contributed to balancing the linear electron transport via alleviating the over-reduction of the plastoquinone pool, exhibiting flexible regulation of photosynthetic electron transport at critical temperature. Therefore, limited light intensity decreased the tolerance of eelgrass to critical temperature, which might be a factor contributing factor in the observed decline.

**Keywords:** Chlorophyll a fluorescence; Eelgrass; High seawater temperature; Light intensity; Photosynthetic electron transport