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Influence of anthropogenic nutrient sources on kelp canopies during a marine heat wave

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ABSTRACT

Giant kelp (*Macrocystis pyrifera*), a keystone species in many temperate coastal oceans, is increasingly threatened by global change and local stressors including increased temperature, reduced nutrients, and decreased water clarity. In the Southern California Bight (SCB), a coastal region with enriched nitrogen input from of 23 million, understanding the factors that contribute to the stability of kelp habitat demands comprehensive research to protect this species and its critical ecosystem roles. During the 2014–2016 marine heat wave (MHW), giant kelp exhibited variability in its response across the SCB despite region-wide temperature increases, leading to questions about what might be conferring resilience to thermal stress. To better understand this variation, we spatially analyze kelp forest canopy area before and during the 2014–2016 MHW. We use spatial statistics to determine the correlation between these observations and estimates of anthropogenic dissolved inorganic nitrogen (DIN) derived from a regional physical-biogeochemical model. We find there are regions within the SCB where anthropogenic sources could elevate dissolved inorganic nitrogen to concentrations adequate for kelp growth during periods in which natural supplies would fall below growth thresholds. We also find kelp forests with greater days of anthropogenic influence during the MHW sustained a greater percentage of pre-MHW normalized canopy area. These results suggest possible contribution of anthropogenic nitrogen to kelp nutrient requirements during climate-driven nutrient stress. More work remains to tease apart anthropogenic nutrients from other eutrophication impacts, such as changes to water clarity from increased productivity, as well as other potential environmental and biological factors during MHW and non-MHW periods.

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