

Draft – Effect of Atmospheric Heatwaves on Reflectance and Pigment Composition of Intertidal *Nanozostera noltei* – Draft

Simon Oiry^{a,*}, Bede Ffinian Rowe Davies^a, Philippe Rosa^a, Pierre Gernez^a,
Laurent Barillé^a

^a*Institut des Substances et Organismes de la Mer, ISOMer, Nantes Université, UR 2160,
F-44000 Nantes, France,*

Abstract

To be written

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1. Introduction

Intertidal seagrasses play a crucial role in the ecosystem by providing habitats and feeding grounds for various marine species, supporting rich marine biodiversity, and contributing significantly to primary production and carbon sequestration [1, 2]. These seagrasses are essential in maintaining the health of coastal ecosystems by stabilizing sediments, filtering water, and serving as indicators of environmental changes due to their sensitivity to water quality variations [3]. The interactions between seagrass meadows and their associated herbivores further enhance the delivery of ecosystem services, including coastal protection and fisheries support [4, 5, 6]. Understanding and preserving these ecosystems are vital for maintaining the biodiversity and productivity of coastal regions [7, 8].

Despite their crucial role in marine ecosystems, intertidal seagrasses face numerous threats that compromise their health and functionality. Coastal development and human activities are primary threats. These activities not only reduce the available habitat for seagrasses but also increase water turbidity, which limits light penetration and hampers photosynthesis [9]. Seagrasses are also threatened by nutrient enrichment from agricultural and urban runoff, which can lead to eutrophication. This condition promotes the overgrowth of algal blooms that

*Corresponding author
Email address: oirysimon@gmail.com (Simon Oiry)

compete with seagrasses for light and nutrients, further stressing these important plants [10] (Oiry et al. 2024). Pollution from industrial and municipal sources introduces harmful chemicals and heavy metals into coastal waters, posing toxic risks to seagrass health. These pollutants can affect the physiological processes of seagrasses, reducing their growth and survival rates [11]. Additionally, invasive species can outcompete native seagrasses for resources, altering community structure and function [12].

Heatwaves, exacerbated by climate change, represent a significant and growing threat to seagrasses. The term heatwave can refer to both marine and atmospheric heatwaves. [13] defines Marine Heatwaves (MHW) as a prolonged discrete anomalously warm water event that can be described by its duration, intensity, rate of evolution, and spatial extent. Specifically, an anomalously warm event is considered a MHW if it lasts for five or more days, with temperatures warmer than the 90th percentile based on a 30-year historical baseline period. On the other hand, Atmospheric Heatwaves (AHW) has been defined by [14] as a period of at least three consecutive days with temperatures exceeding the 90th percentile for that time of year. These extreme temperature events can cause severe physiological stress, affecting growth, reproduction, and survival. Heatwaves can intensify the cumulative effects of other stressors such as overgrazing and seed burial, leading to compromised sexual recruitment [15].

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