What Do Warming Ocean Temperatures Mean For Eelgrass

Phil Colarusso US EPA

Global average temperature change



Impact of Marine Heatwaves on Seagrass Ecosystems

Oscar Serrano, Ariane Arias-Ortiz, Carlos M. Duarte, Gary A. Kendrick, and Paul S. Lavery

The vulnerability and resilience of seagrass ecosystems to marine heatwaves in New Zealand: a remote sensing analysis of seascape metrics using PlanetScope imagery

Ken Joseph E. Clemente^{1,2} ^(D), Mads S. Thomsen^{1,3} ^(D) & Richard C. Zimmerman⁴ ^(D)

¹Marine Ecology Research Group, School of Biological Sciences, University of Canterbury, Christchurch 8041, New Zealand
²University of Santo Tomas, Manila 1015, Philippines
³Department of Bioscience, Aarhus University, 4000, Roskilde, Denmark
⁴Department of Ocean and Earth Sciences, Old Dominion University, Norfolk, Virginia 23529, USA

A marine heatwave drives massive losses from the world's largest seagrass carbon stocks

A. Arias-Ortiz^{1*}, O. Serrano^{2,3}, P. Masqué^{1,2,3}, P. S. Lavery^{2,4}, U. Mueller², G. A. Kendrick^{3,5}, M. Rozaimi^{2,6}, A. Esteban², J. W. Fourqurean^{5,7}, N. Marbà⁸, M. A. Mateo^{2,4}, K. Murray⁹, M. J. Rule^{3,9} and C. M. Duarte^{8,10}

13

35-year trend, summer water temperature around Long Island













NSC Concentrations in Eelgrass Rhizomes



Is It All About the Carbon?

- Carbon accumulation is a function of both light and temperature
 - In cloudy water, the carbon break even point < 25° C
- Plaisted et al. (2022) the mean temperature of the preceding summer was a predictor of eelgrass presence
 - Suggests a carbon limitation issue
- Does carbon depletion result in reduced reproductive fitness?

Genetics/Phenotypic Plasticity

- Meadow life history differences (annual vs perennial)
- Individual differences
 - Dubois et al, 2019 found a thermally resilient meadow in mid range
- Common garden
 - Locally adapted populations did best

Sugar phosphate backbone

Other Potential Effects of Warming Waters

Timing of flowering

- 10 C to initiate the process
- 15 C to produce flowers and seeds
- Duration of flowering/seed production
 - Southern latitudes short windows
 - Northern latitudes elongated window
 - Overlap/offset with seed predator activity
- Germination occurs < 10 C

Questions?