Apr 5th, 3:45 PM - 4:00 PM

Ameliorating ocean acidification: towards a model relating pCO2, irradiance and leaf area index of Zostera marina (eelgrass) in Padilla Bay, WA

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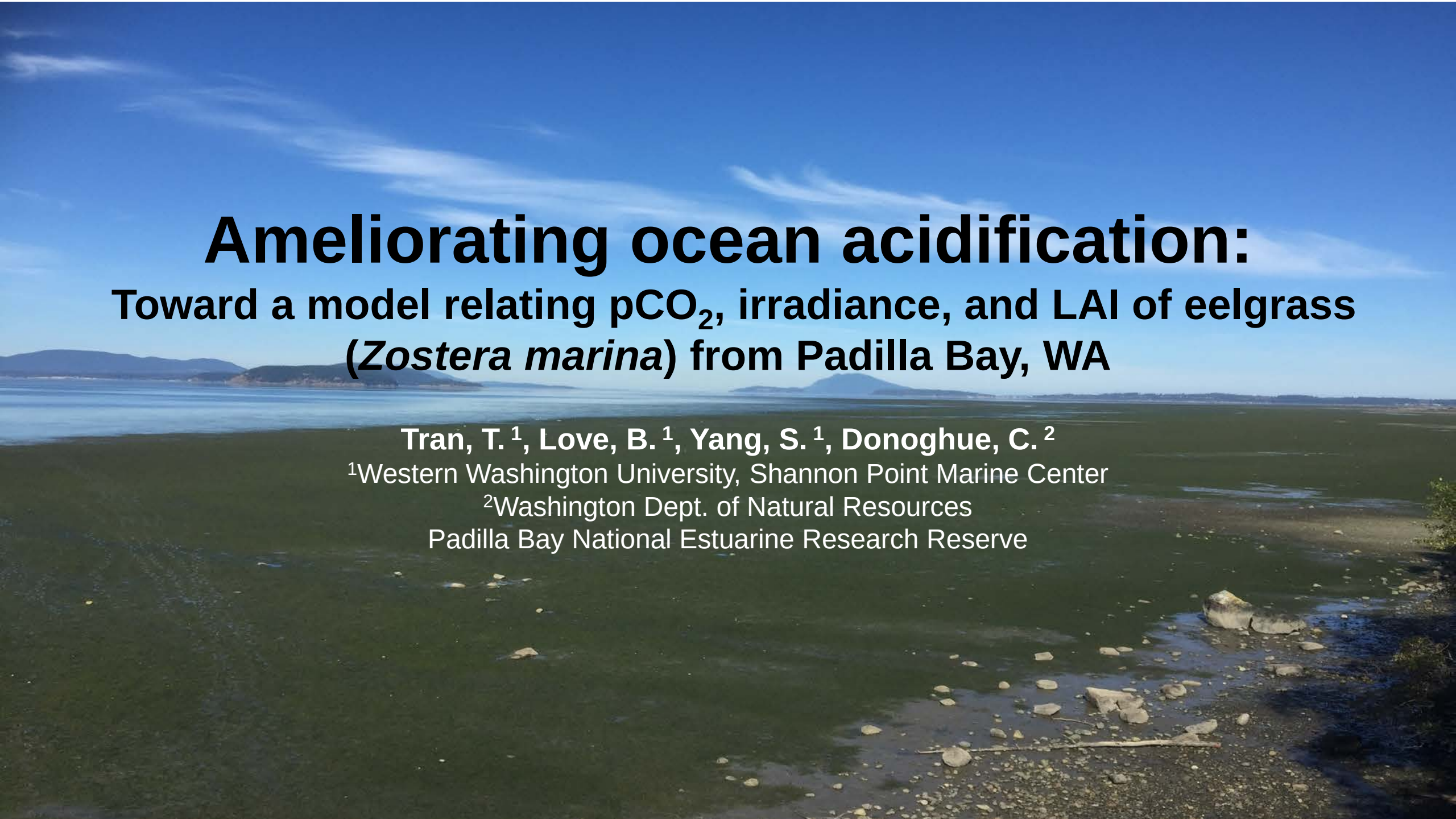


Ameliorating ocean acidification:

Toward a model relating pCO_2, irradiance, and LAI of eelgrass (*Zostera marina*) from Padilla Bay, WA

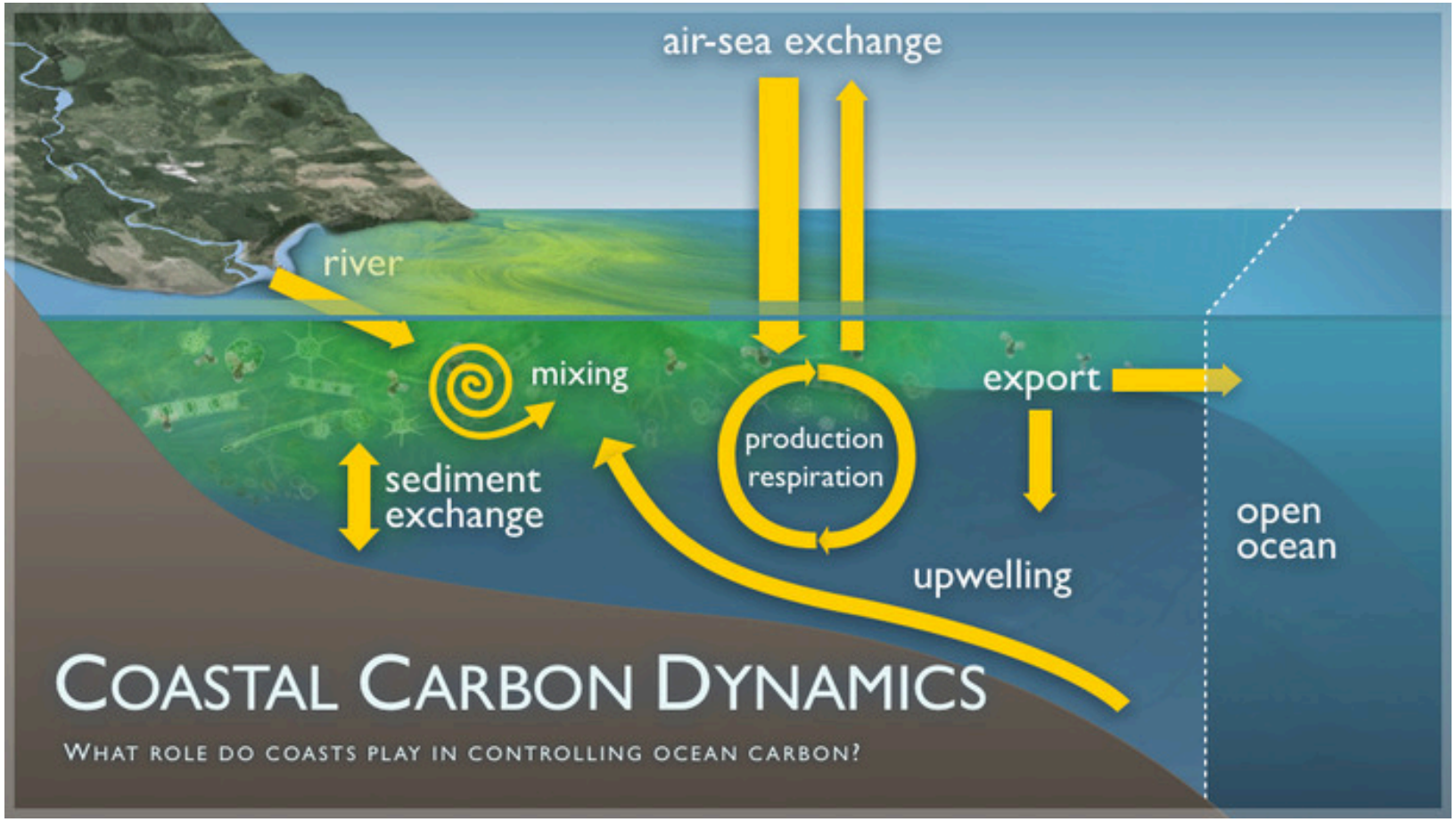
Tran, T.[1], Love, B.[1], Yang, S.[1], Donoghue, C.[2]

[1]Western Washington University, Shannon Point Marine Center

[2]Washington Dept. of Natural Resources

Padilla Bay National Estuarine Research Reserve

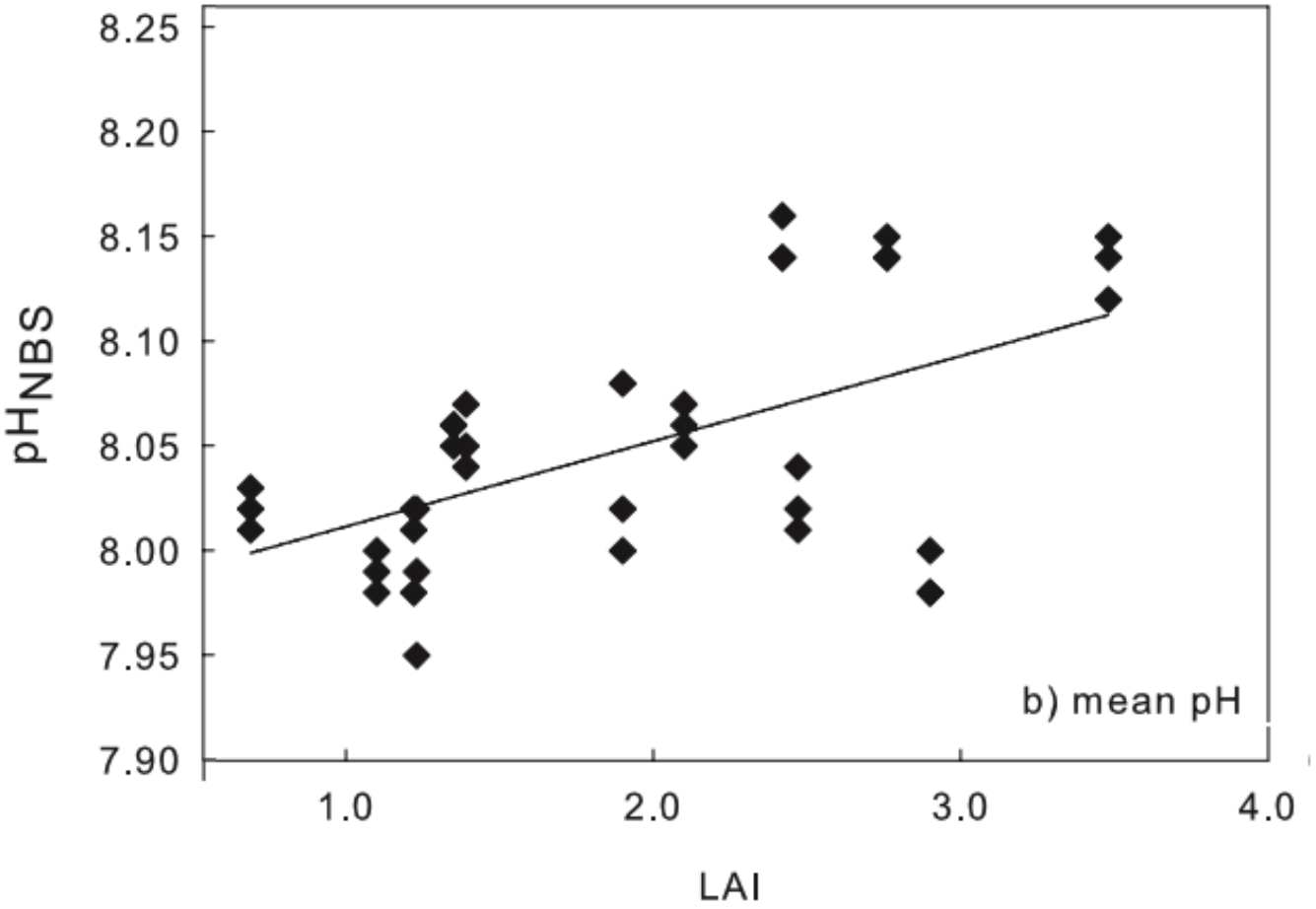
In the Salish Sea, anthropogenic CO_2 will exacerbate existing local ocean acidification due to upwelling



http://pmel.noaa.gov/co2/files/coastalcarbondynamics.jpg

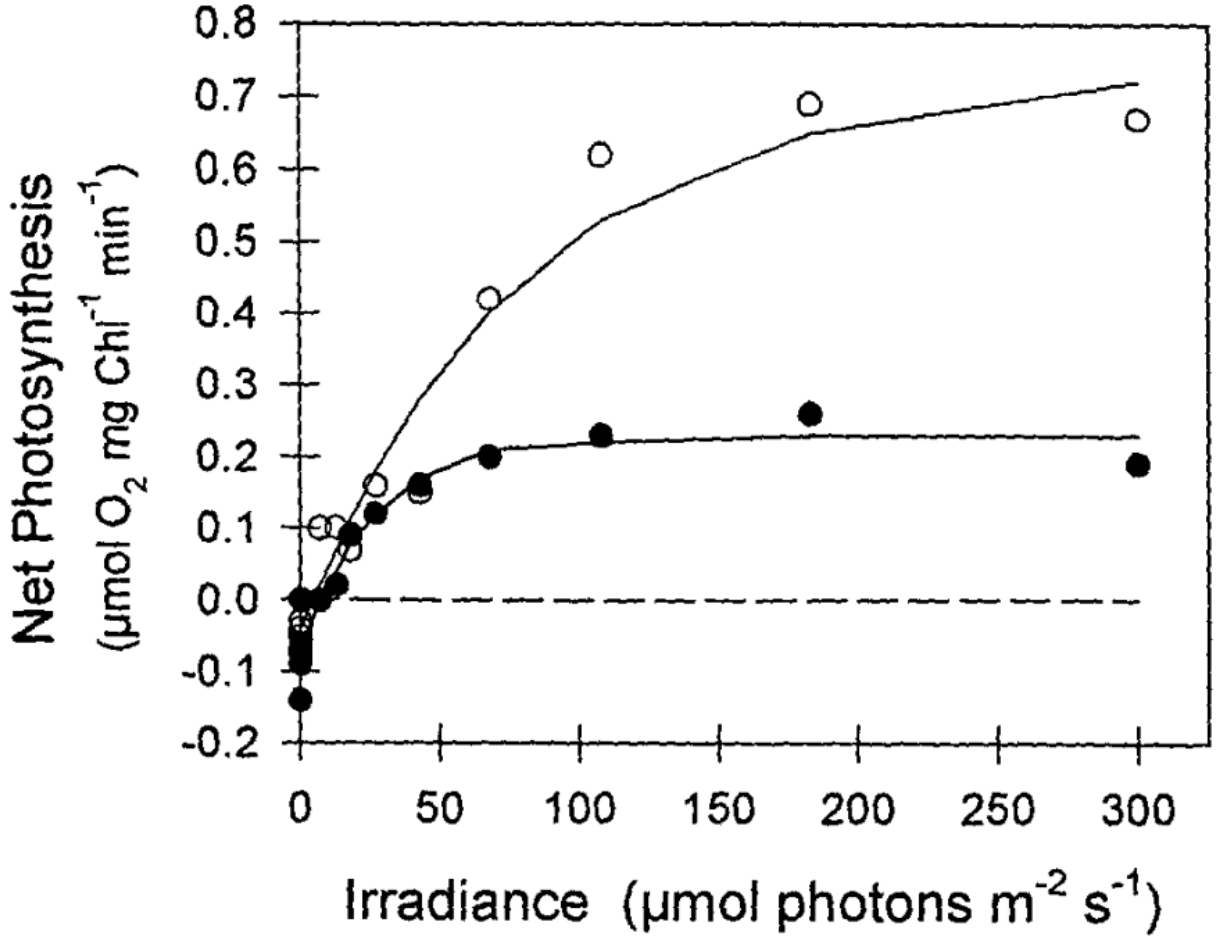
Seagrass meadows have been identified as potential short-term mitigators of ocean acidification

$$LAI = \frac{Total\ leaf\ area}{Total\ ground\ area}$$



Hendriks et al. 2014

Eelgrass is effective at taking up carbon since eelgrass are carbon-limited

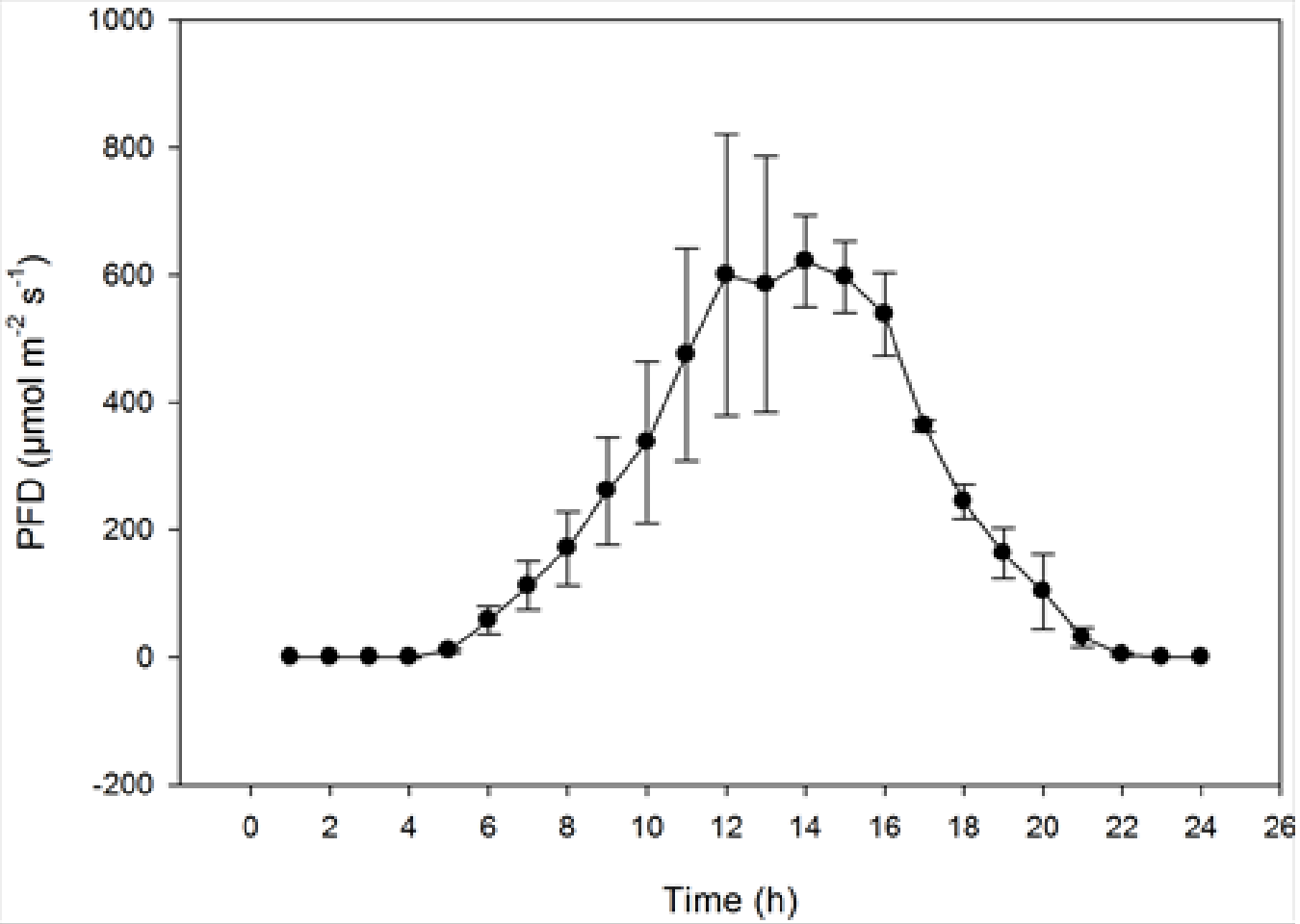


pH: 6.2

pH: 8.2

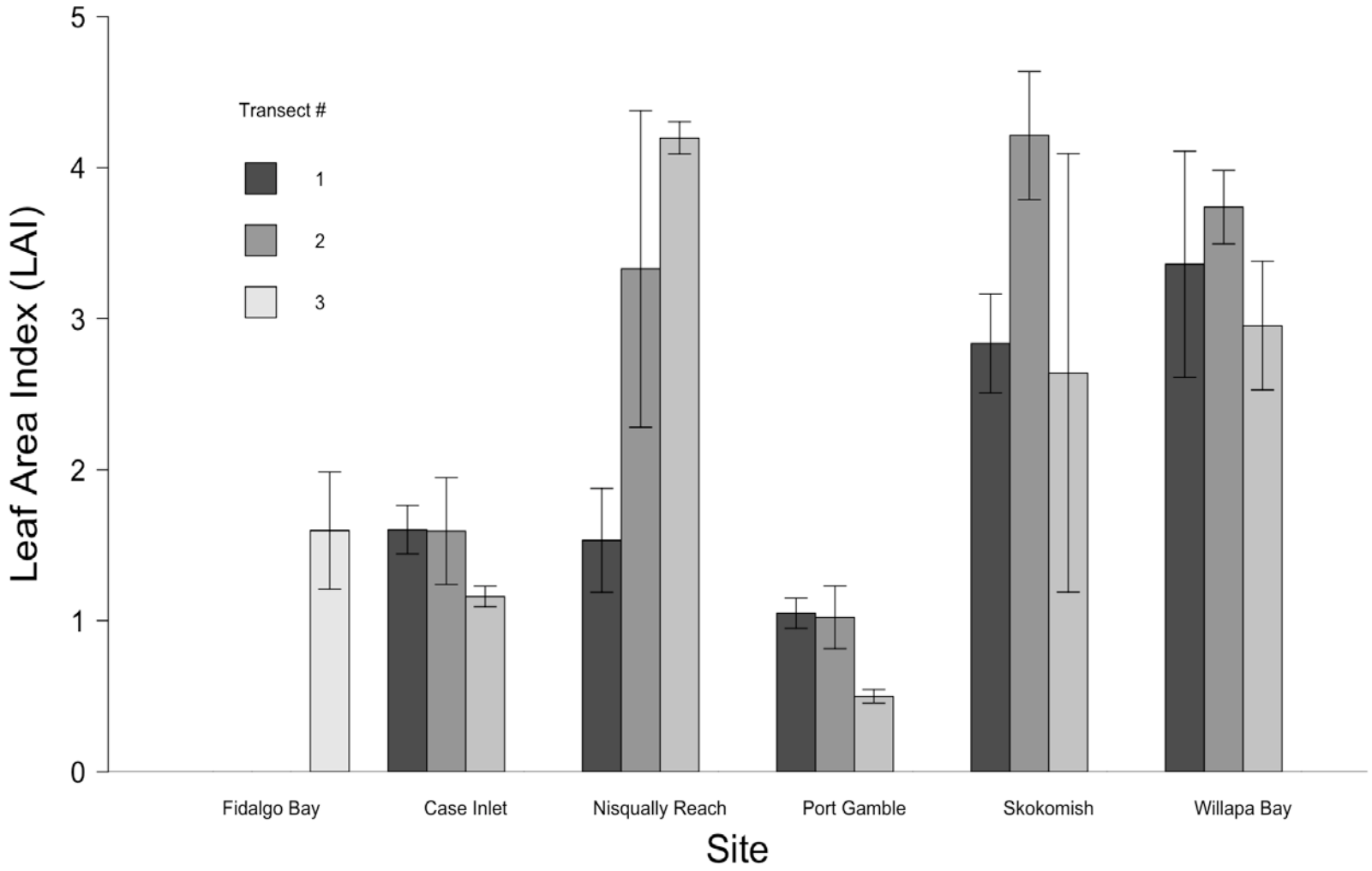
Zimmerman et al. 1997

Light varies throughout a day and could affect photosynthesis



Hückstädt et al. 2013

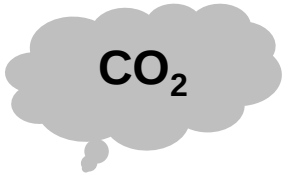
The amount of eelgrass varies in the Salish Sea



How do LAI, pCO_2, and irradiance interact to modify the carbonate chemistry?

We designed our pCO_2. light and leaf area index treatments to reflect ambient conditions

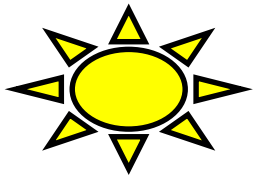
Initial pCO_2



Ambient pCO_2
(800 µatm)

Enriched pCO_2
(2500 µatm)

Light



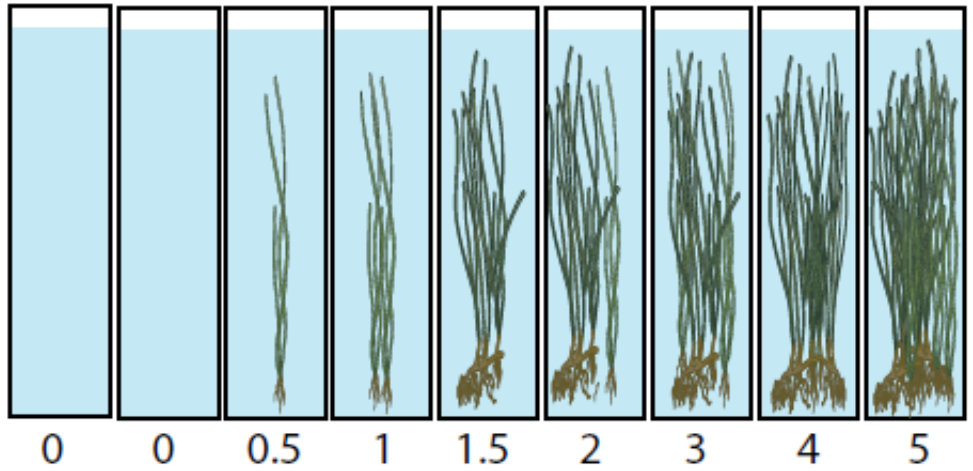
Saturating Light

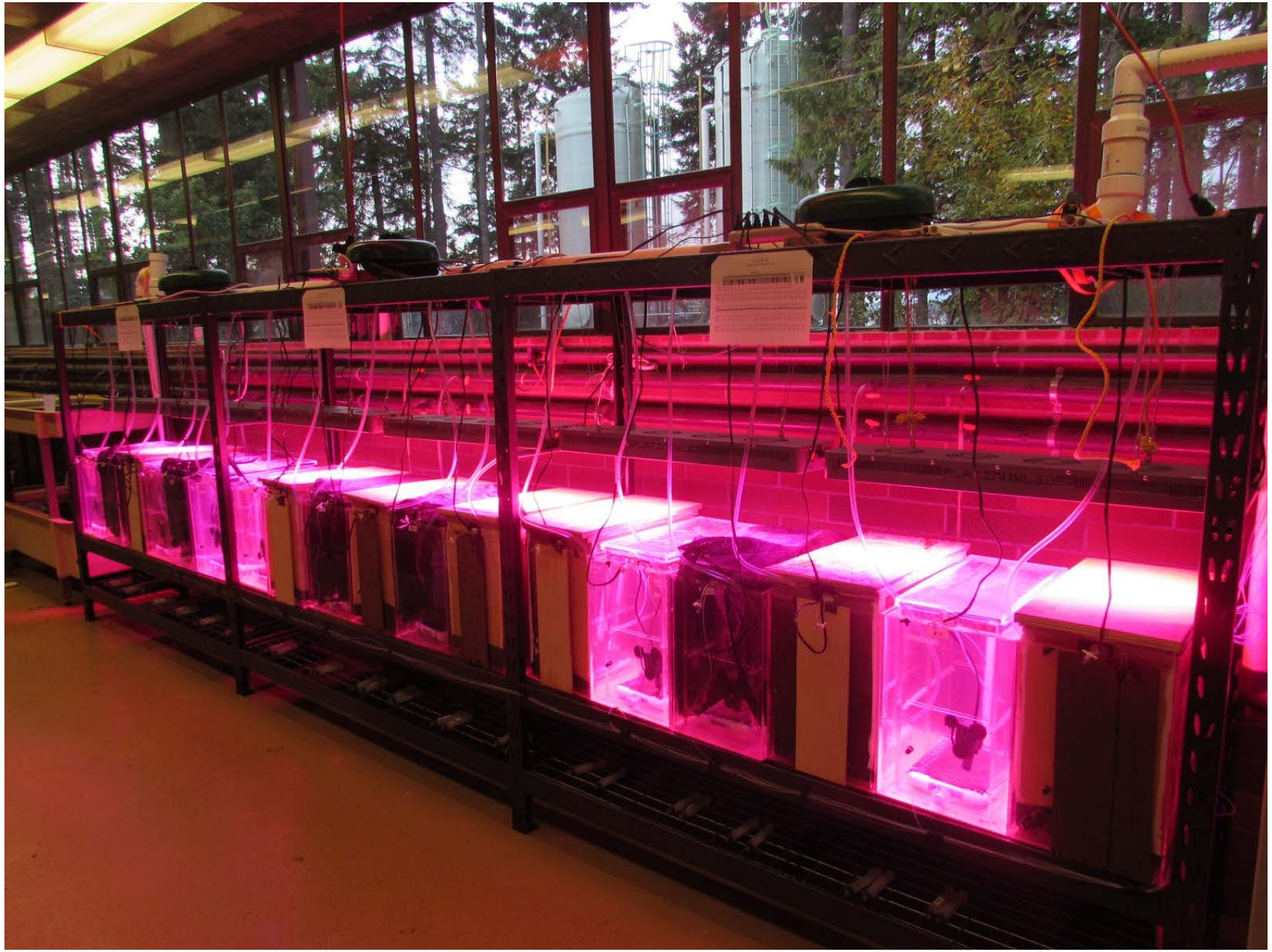
Sub-saturating Light

Dark

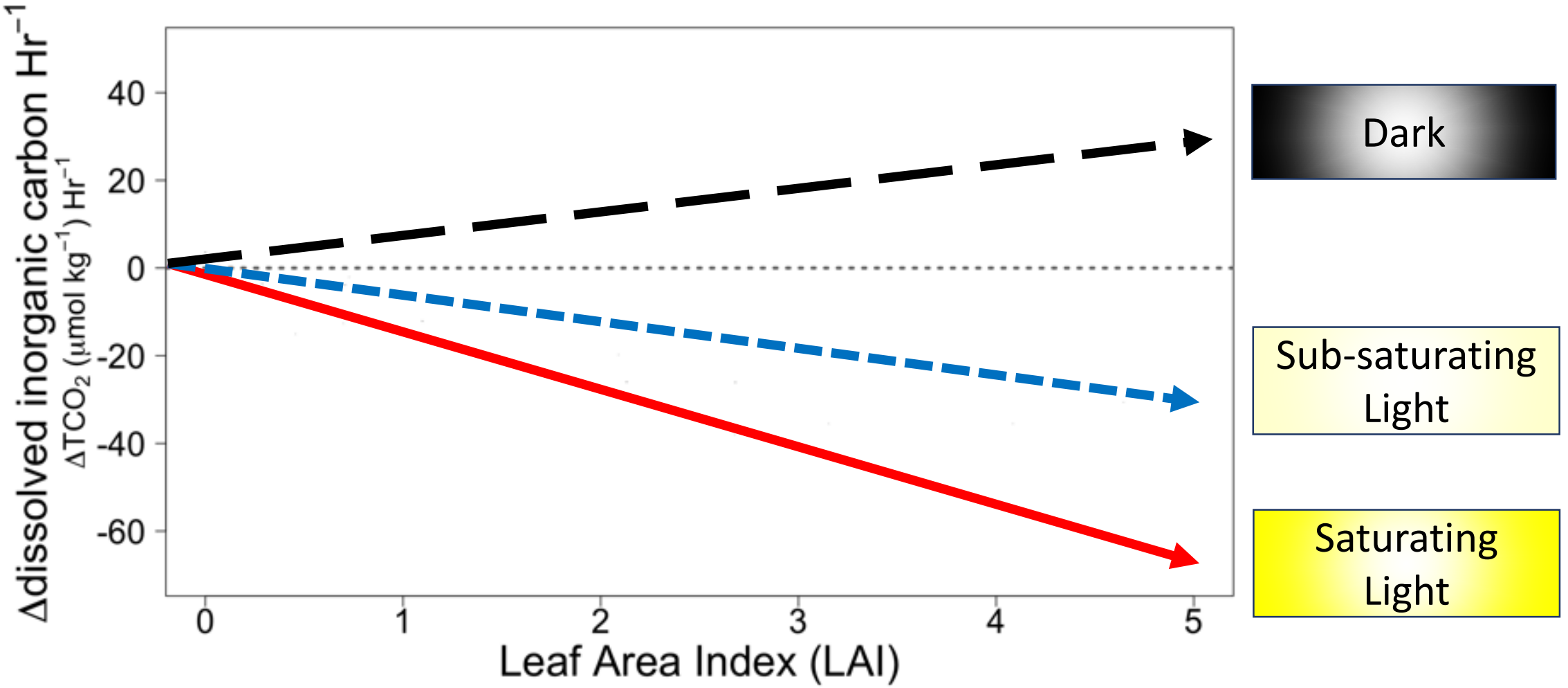
Eelgrass Leaf Area Index

$$LAI = \frac{Total\ leaf\ area}{Total\ ground\ area}$$

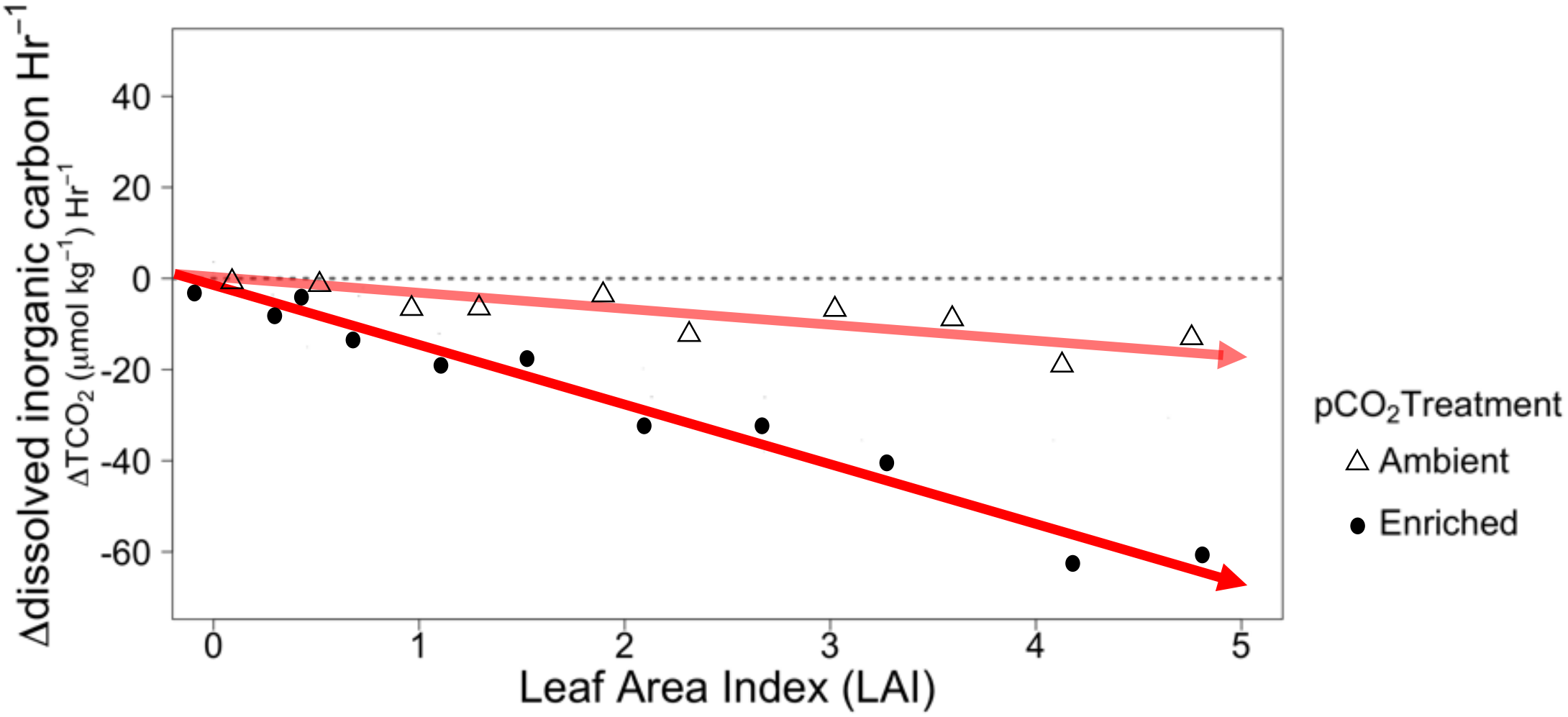




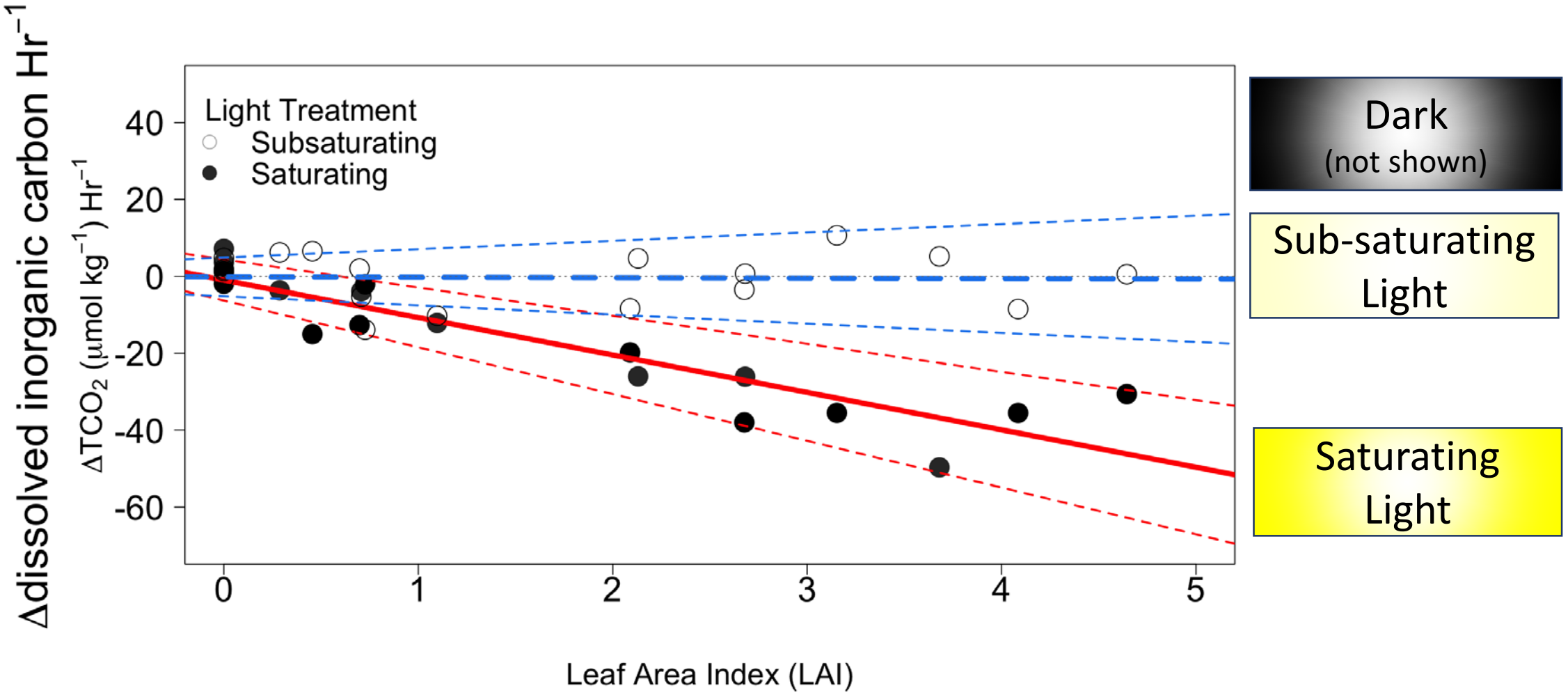
We predicted that eelgrass would take up carbon at a greater rate with more eelgrass and more light



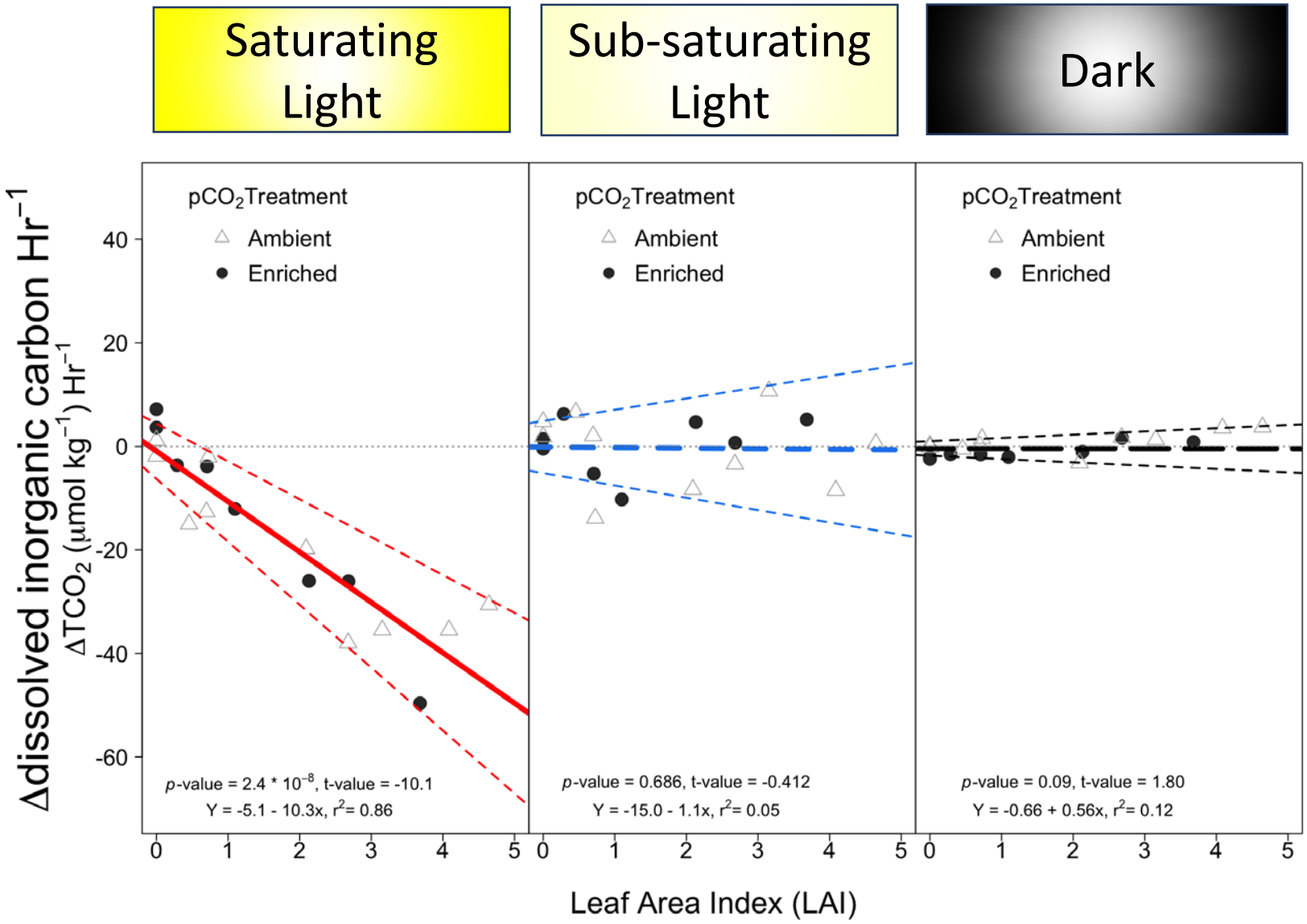
We also predicted that eelgrass would take up carbon at a greater rate with enriched pCO_2



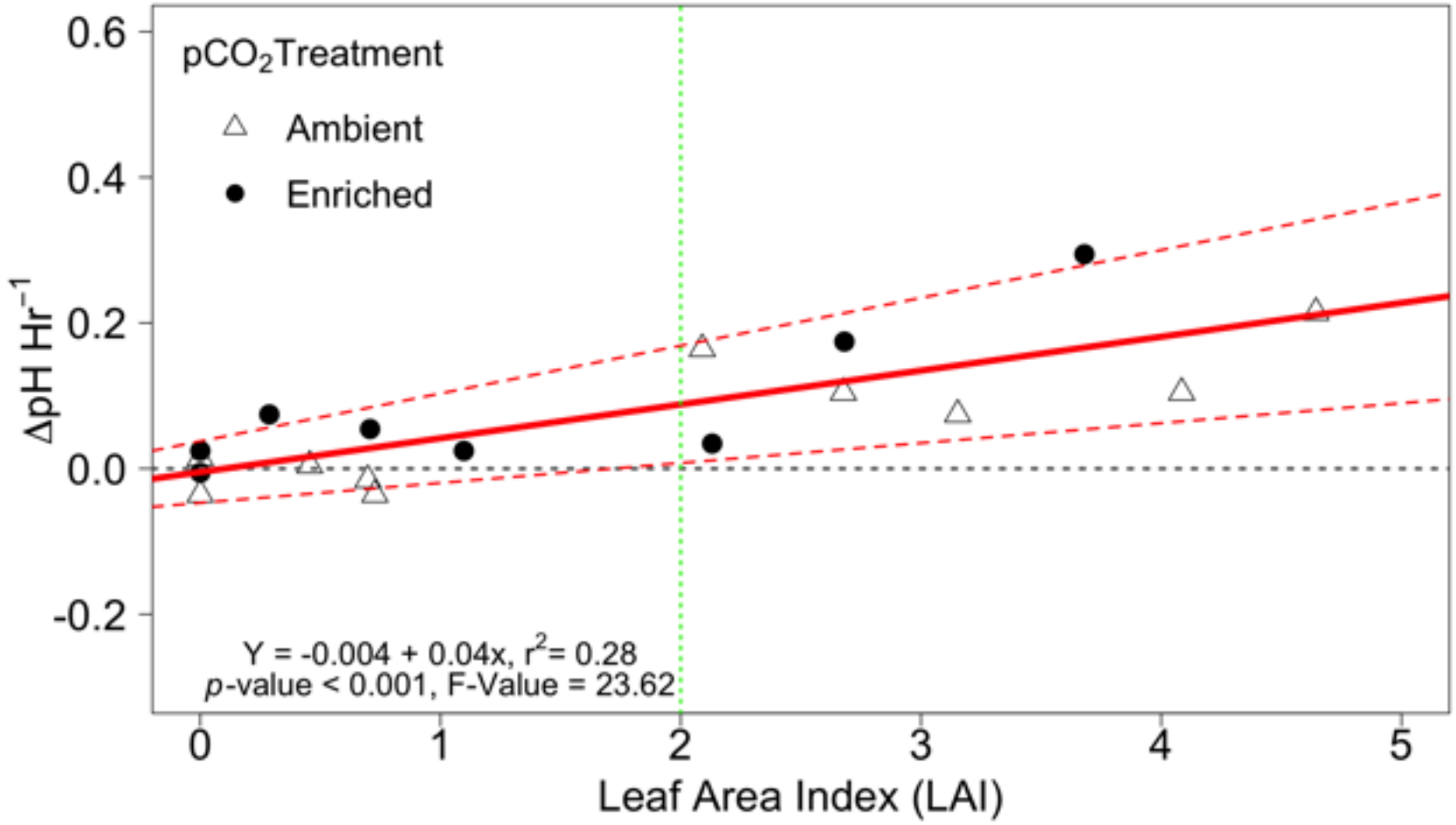
Carbon uptake increased at higher LAI but only when exposed to saturating light



No differences were detected between pCO_2 levels

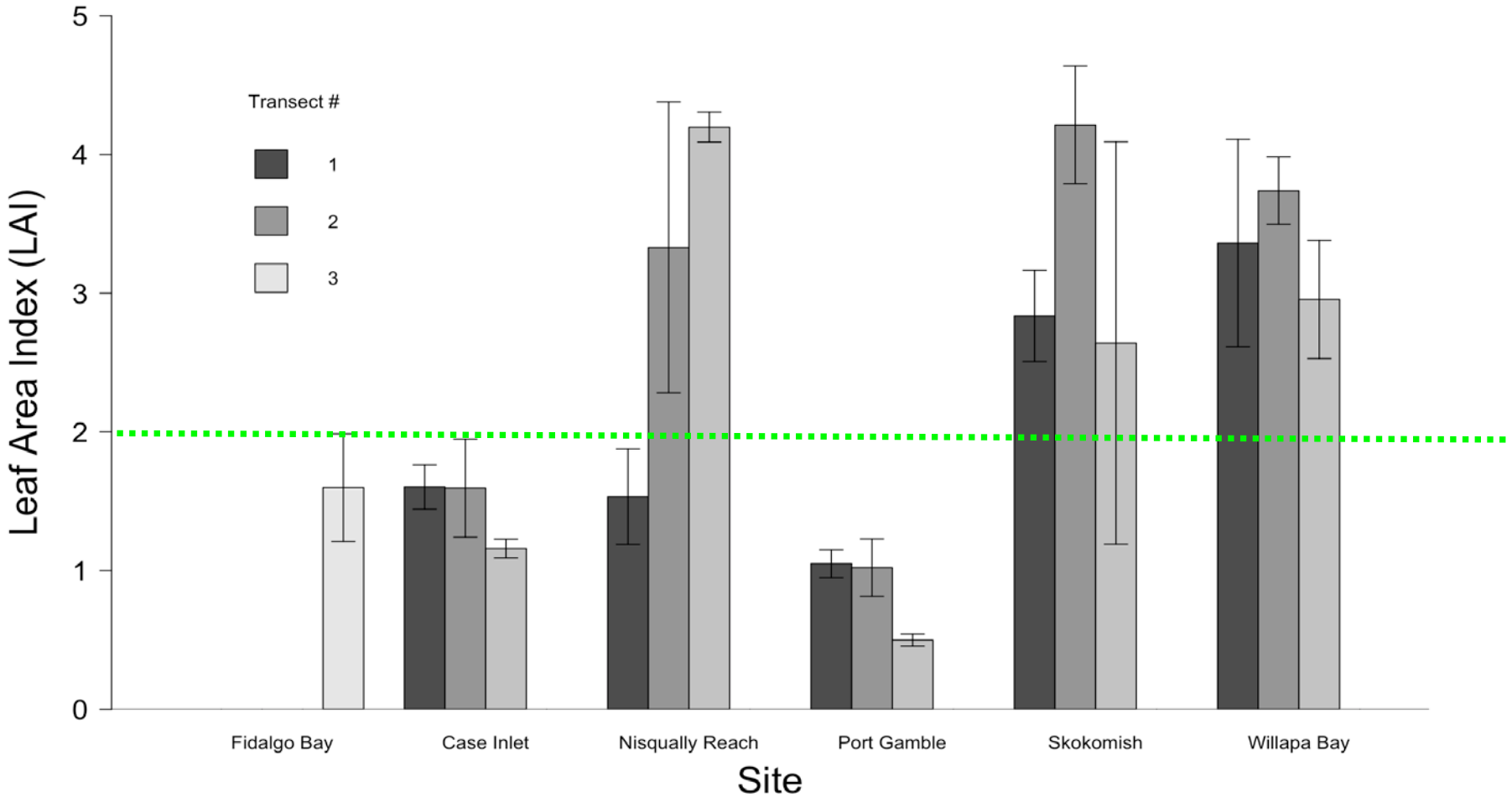


Carbon uptake in the saturating light treatment led to increased pH



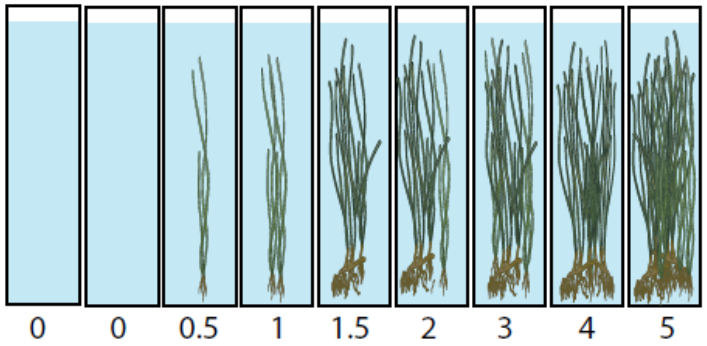
Saturating Light

Implication: not all eelgrass meadows have sufficient LAI to mitigate ocean acidification



In Summary

1. **Carbon uptake of eelgrass increased linearly with leaf area index only when light was saturating**
2. **The change in pH can range between 0 and 0.2 units per hour based on LAI, water depth, and residence time**
3. **We did not detect a change in the rate of carbon uptake between pCO_2 treatments**



Saturating Light

Thus, eelgrass can potentially mitigate ocean acidification, however:

- Saturating light is needed
- Anthropogenic factors could decrease light attenuation
- There must be 2x more eelgrass than substrate
- There are also localized eelgrass declines

But further study is needed:

- Water depth and residence time must be explored

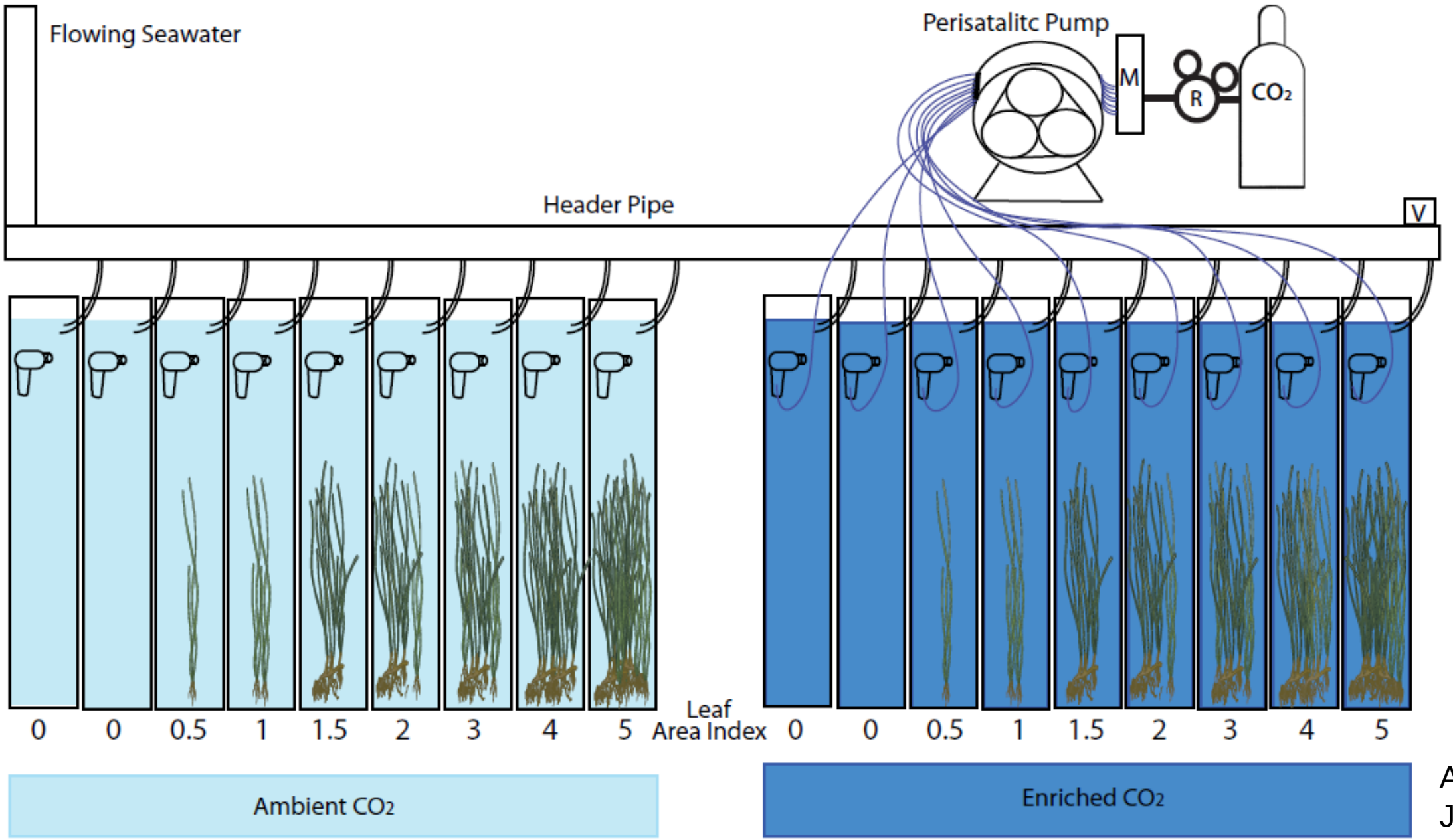
Shannon Point Marine Center
Western Washington University

Washington Department of Natural Resources
NATURAL RESOURCES

Padilla Bay
National Estuarine Research Reserve

NW CSC
Northwest Climate Science Center

Hillary Thalmann, Katey Williams, Lynne Nowak, Mike Adamczyk, Jayshen Blows, Abby Ernest-Beck, Eric Wilson, Darby Finnegan, Brooke McIntyre, Cristina Villalobos, Gene Mckeen, Nate Schwarck, Andy Wilken and Joyce Foster



After Jokiel et al. 2014