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Impacts of *Egrecia menziesii*, a foundational alga, on intertidal communities in the San Juan Islands

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Introduction

- Canopy forming seaweeds cover other organisms, such as smaller algae and invertebrates, by growing large enough to shelter them.
- Intertidal canopy-forming seaweeds can have positive effects by providing a physical barrier over benthic organisms protecting them from UV radiation, desiccation, and heat/temperature stress [1-4] and can have negative effects by limiting the settling of other sessile organisms [5, 7].
- *Egregia menziesii*, a foundation species [7], is one of the largest most common brown seaweeds on the west coast in the intertidal zone and can be found from Alaska to Baja California[6].

Question

How does the presence of *Egregia menziesii* impact biotic and abiotic factors for the understory community?

Methods

Experimental Design

- Field Site: Cattle Point, WA
- Block Design (Fig. 1) Total = 20 plots
 - 5 plots/block
 - 1 treatment/plot
- (2 started with *Egregia*, 2 started without *Egregia*)

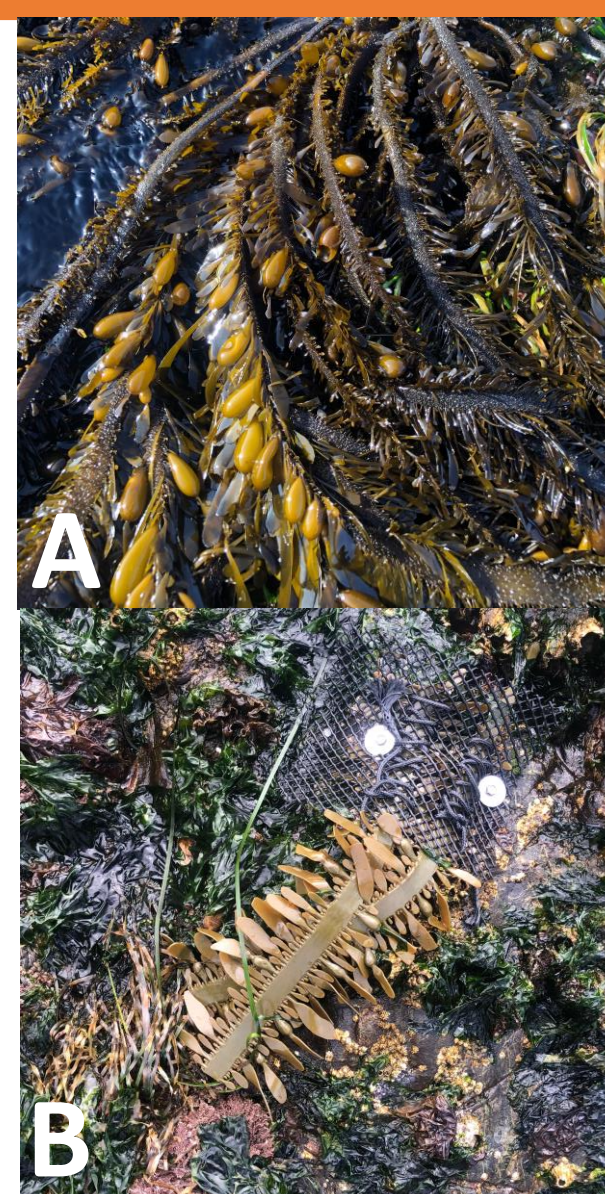


Figure 2. A: *Egregia menziesii*. B: *Egregia mimic*.

Data Collection

- Assess community structure at start (before establishing treatments) and twice/year (fall and winter): point-contact % cover estimates (sessile species and counts (mobile species)).
- Quantify abiotic conditions

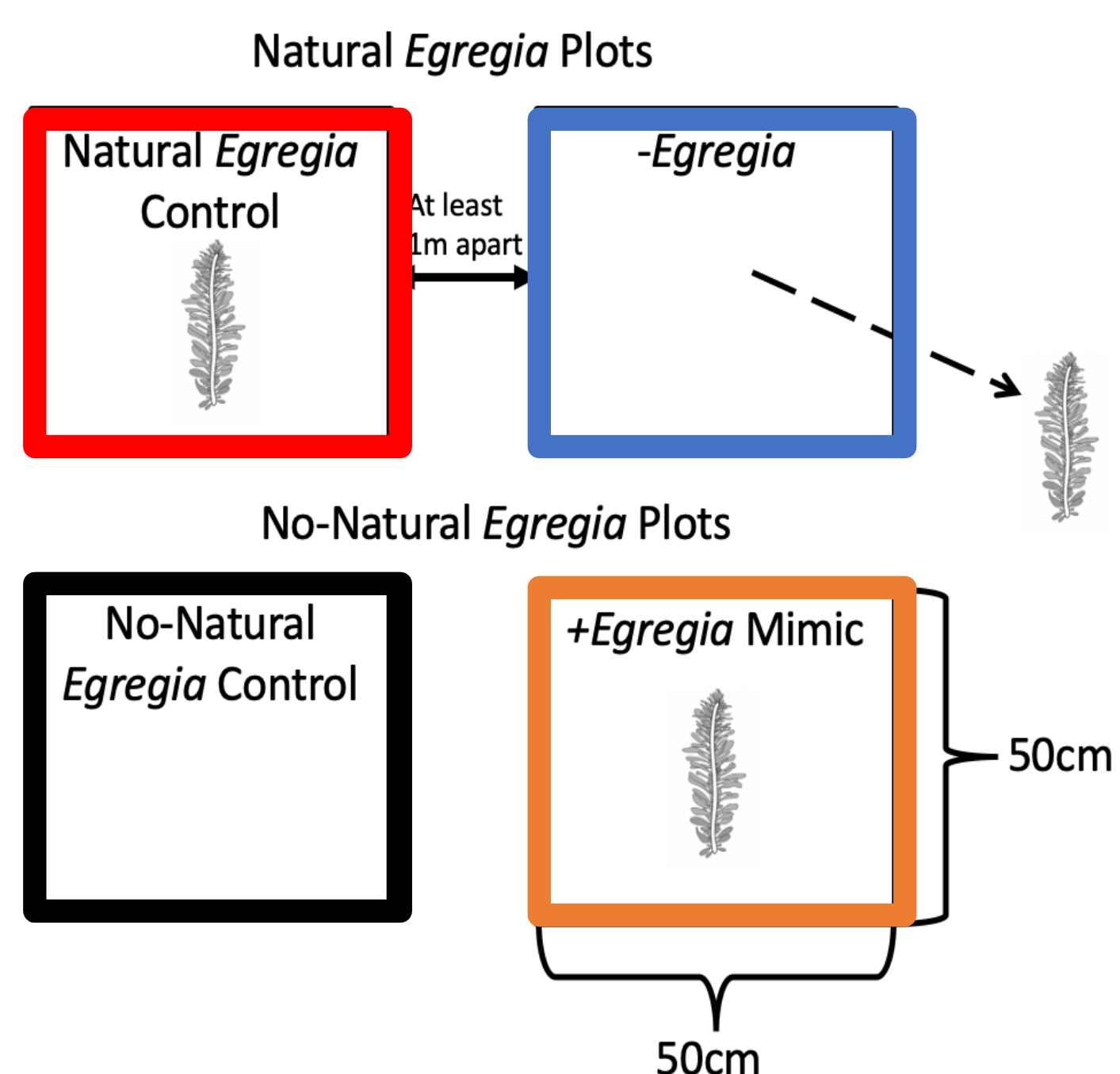


Figure 1. Block Design – 4 Treatments; Natural *Egregia* (no manipulation), *-Egregia* (*Egregia* removed), No-Natural *Egregia* (no manipulation), or +mimic *Egregia* (plastic *Egregia* mimic).

Results

Single Day Temperature

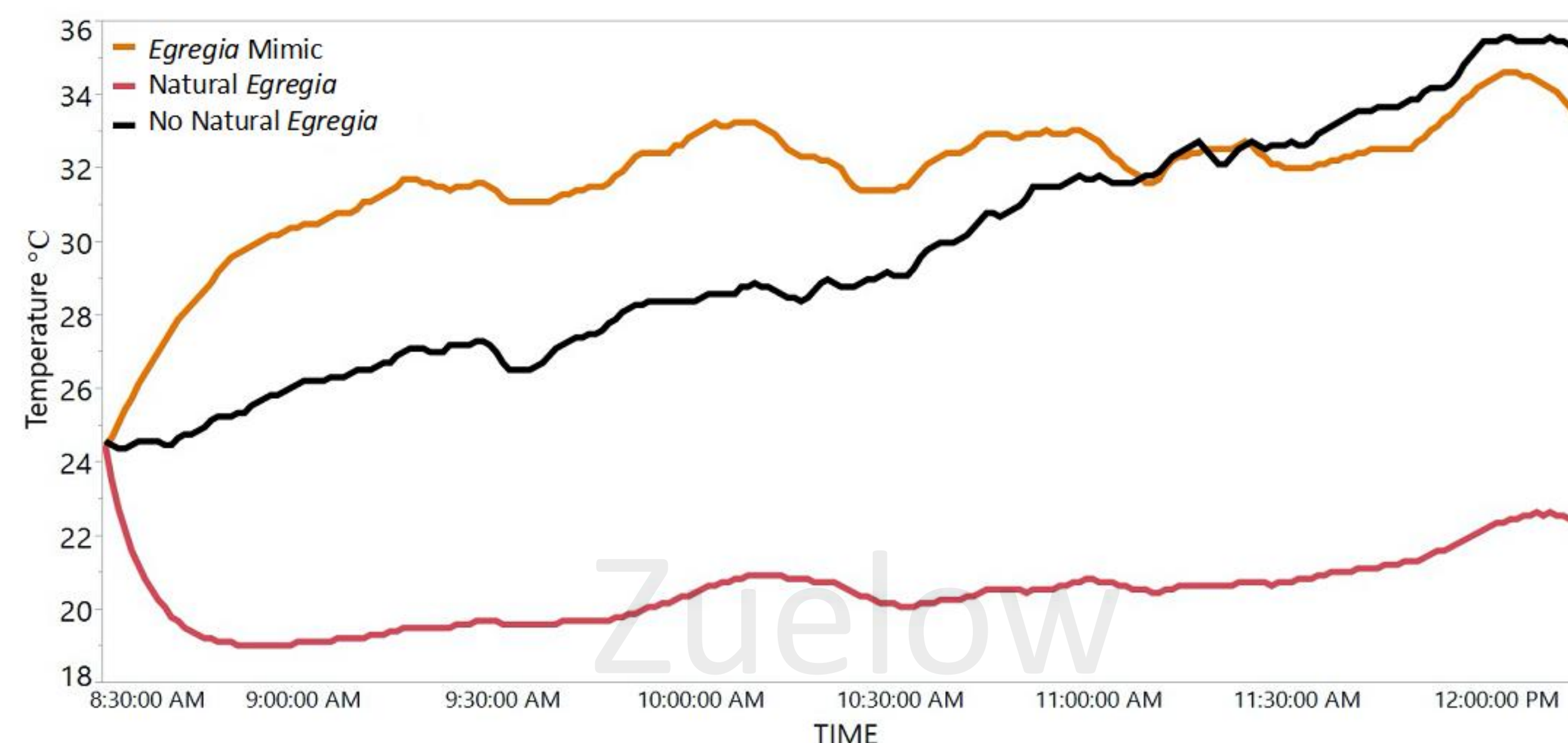


Figure 3. Continuous temperature data from July 20, 2020, during low tide exposure. Loggers recorded temperature at 1-minute intervals (N=1 logger/treatment).

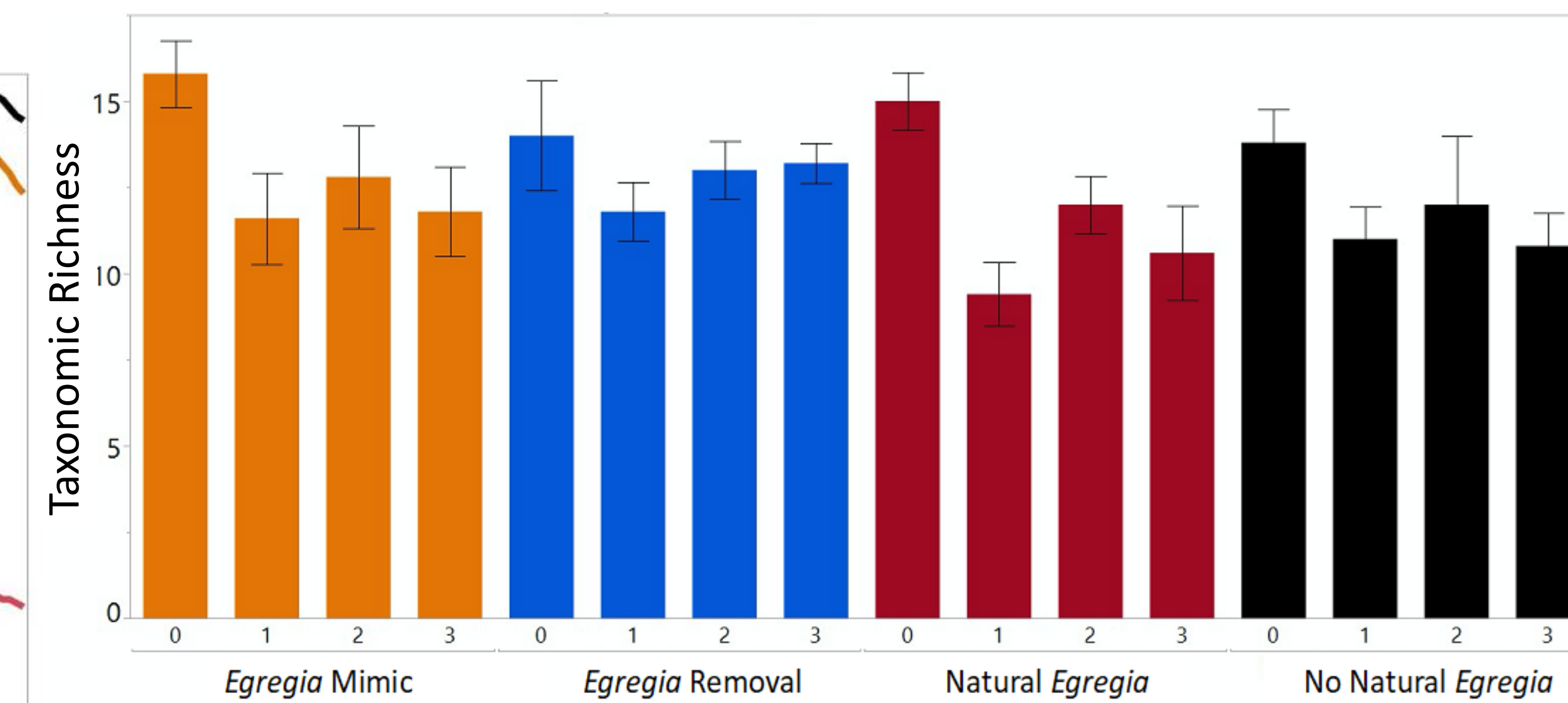


Figure 4. Taxonomic richness from Summer 2019-Winter 2021 (0: Summer 2019, 1: Winter 2020, 2: Summer 2020, 3: Winter 2021). Data are mean \pm SE, N = 5 plots/treatment/season.

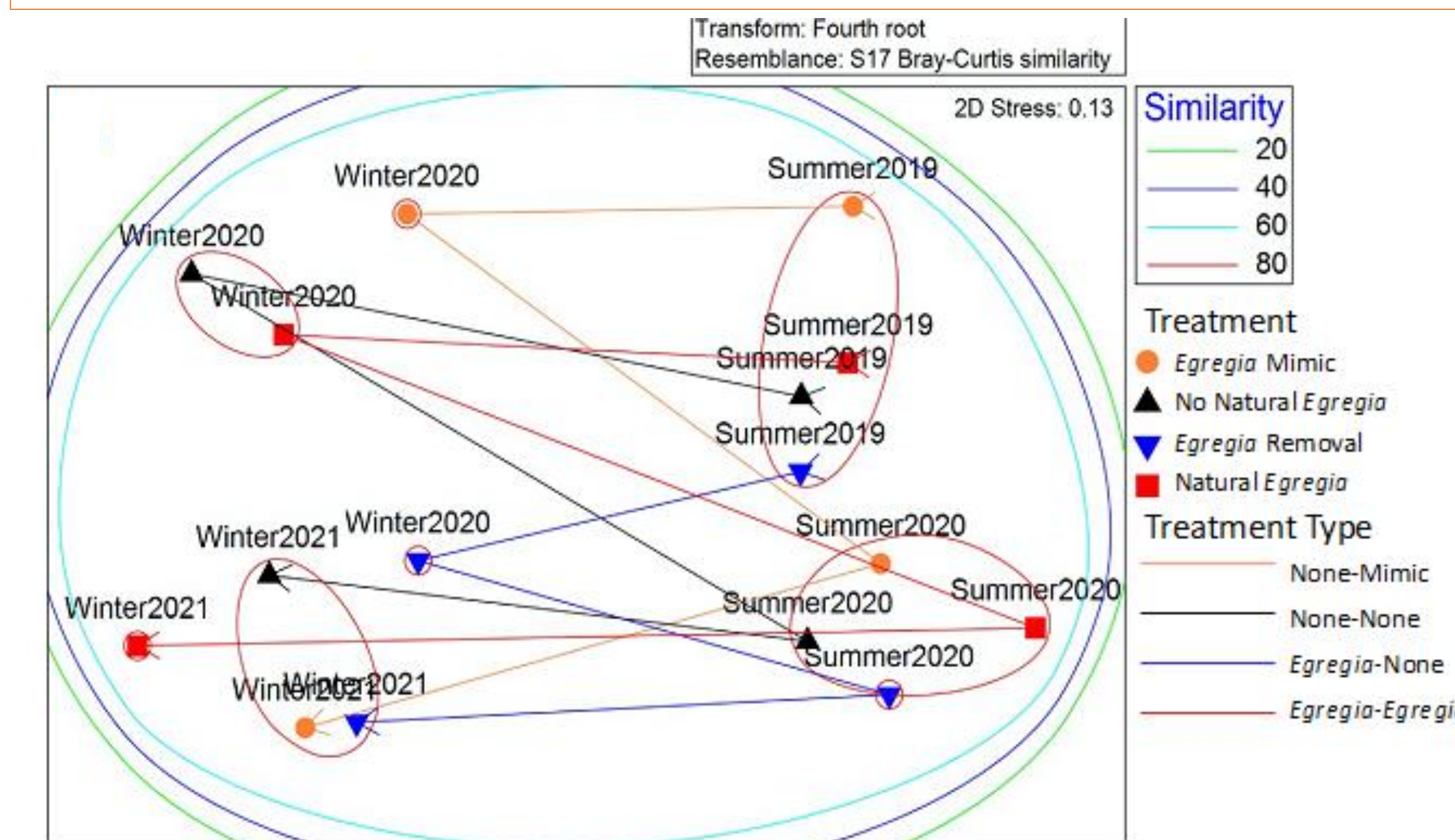


Figure 5. Non-metric MDS (nMDS) representation of community structure (Percent Cover of Algae and Invertebrates) from Summer 2019-Winter 2021. Bray-Curtis similarity on 4th root transformed data. Similarity measure indicated by line color.

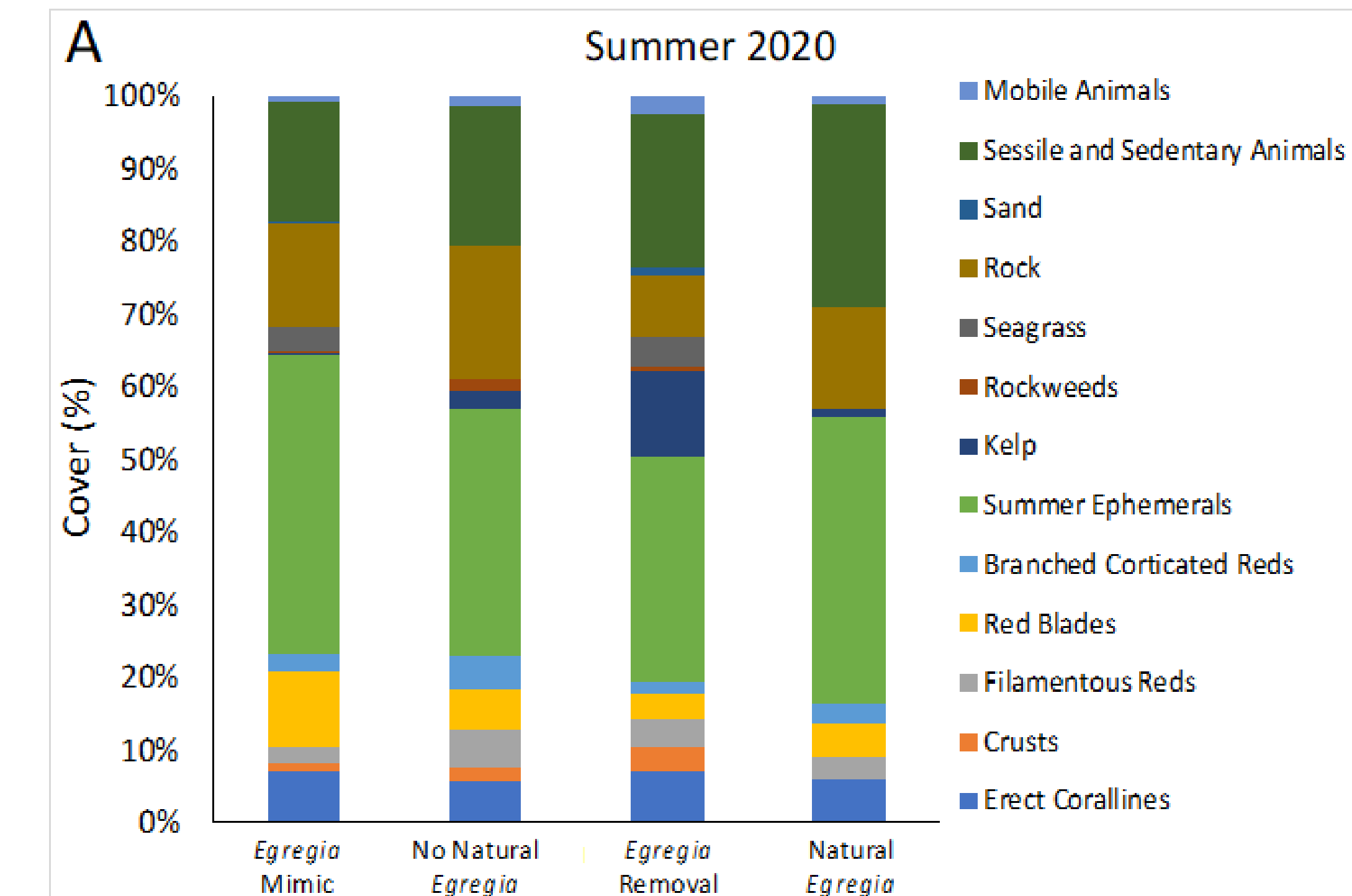


Figure 6. Cover of functional groups for the entire community (including algae, sessile and sedentary invertebrates, and non-living layers) for Summer 2020: 12 months after treatments placed.

- Temperature is **reduced** underneath *Egregia* canopy during Summer afternoon low tides. Sometimes up to a 10°C difference! (Fig. 3)
- Significant differences in **taxonomic richness between seasons** (p-value <0.001, MANOVA), but not between treatments. (Fig. 4)
- Multivariate analysis revealed significant **treatment and season effect** on community structure across the duration of experiment. (Fig. 5)
- In Summer 2020, proportion of ephemeral cover was highest in the *Egregia* Mimic plots and lowest in *Egregia* Removal plots. The proportions of mobile animals, corticated reds, filamentous reds and erect corallines were similar across all treatments. The proportion of bare rock was highest in the No Natural *Egregia* plots and lowest in the *Egregia* removal plots. (Fig. 6)

Discussion/Conclusions

Abiotic: Temperature is reduced underneath *Egregia* canopy during low tides compared to plots without any coverage. Mimics copy the morphology of *Egregia*, but they heat up more than *Egregia* which may have consequences for organisms who already experience natural desiccation or heat stress during low tides.

Biotic: Taxonomic richness was impacted by season, but not treatment. However, multivariate analysis revealed significant differences in community structure between treatments AND season. Multivariate analysis includes identity and abundance, which is absent from taxonomic richness metrics, so multivariate analysis can catch more difference in community structure.

References and Acknowledgements

[1] Bertness, M.D., Leonard, G.H., Levine, J.M., Schmidt, P.R., Ingraham, A.O. (1999). *Ecol.* 80 (8), 2711-2726. [2] Burnaford, J.L. (2004). *Ecol.* 85 (10), 2837-2849. [3] Jenewein, B.T., Gosselin, L.A. (2013). *J. Exp. Mar. Biol. Ecol.* 449, 28-35. [4] Scrosati, R.A., Ellrich, J.A. (2018). *Mar. Biol.* 165: 115. [5] Dayton, P.K. (1972). In *Proceedings of the Colloquium on Conservation Problems in Antarctica* (Parker, B.C., ed.), pp. 81-96, Allen Press. [6] Abbott, I.A., Hollenberg, G.J. (1976). *Marine Algae of California*. Stanford University Press, Stanford, CA, 827 [7] Hughes, B.B. (2010). *J. Exp. Mar. Biol. Ecol.* 393, 90-99. Acknowledgements: We would like to thank our funding sources: CSUF Violet Horn Graduate Research Fellowship in Ecology, Evolution and Conservation Biology, CSU Council on Ocean Affairs, Science and Technology Graduate Student Research Award, CSU Sally Casanova Pre-Doctoral Fellowship and the University of Washington's Friday Harbor Labs Pamela Roe Graduate Student Endowed Fund and the Anne Hof Blinks Fellowship. I would also like to thank my other committee members and the entire Burnaford lab for the constant support and Karen Lau for working tirelessly to secure approval for the lab to conduct fieldwork during a pandemic.