# Quantifying Sulfur and Bioaerosol Emissions from Sargassum Strandings in South Florida

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## Introduction

*Sargassum* is a genus of macroalgae (seaweed). Since 2011, *Sargassum* has been washing up in large amounts on the shores of nations in the Caribbean and Atlantic. This is known as *Sargassum* stranding. The region affected by stranding is sometimes called the Great Atlantic *Sargassum* Belt. South Florida is on the GASB and also gets affected by stranding.

Ecologists have documented that *Sargassum* stranding harms nearshore water quality and benthic ecosystems.[1] Additionally, public health studies have shown that *Sargassum* emits volatile sulfur compounds (VSCs), most notably $H_2S$.[2] VSCs can affect human health (e.g., respiratory illness due to $H_2S$ exposure) or the climate (e.g., cloud formation from $SO_2$).[3]

In addition to its effects on water and air quality, *Sargassum* may also affect benthic microbial communities, as it can provide warmth & nutrition for bacteria. In fact, the VSCs released by the algae are a product of bacterial anaerobic respiration of sulfate.

## Aims

1.Conduct field campaigns to monitor air pollutants during *Sargassum* stranding events.

2.Quantifying the emissions factors of sulfur -containing gases during *Sargassum* decomposition through laboratory experiments.

3.Document the changes in microbial communities in air and water for areas impacted by Sargassum inundations.

## Field Sampling

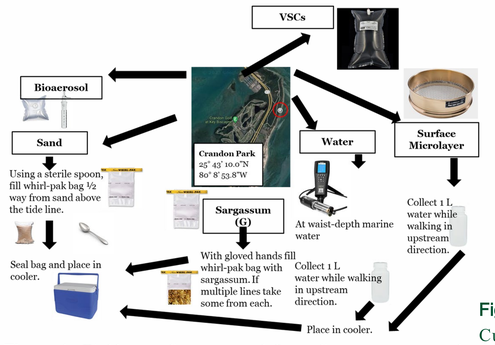



Figure 1. Field sampling protocol. Sampling encompassed air, water, environmental, and biological components.

Figure 2. Field sampling set up and in Bear Cut, Key Biscayne, with stranded wrack in the foreground.

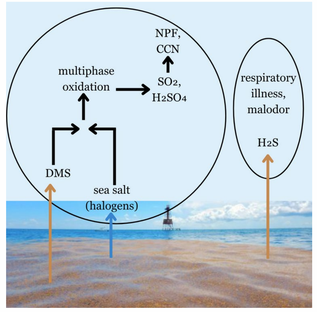
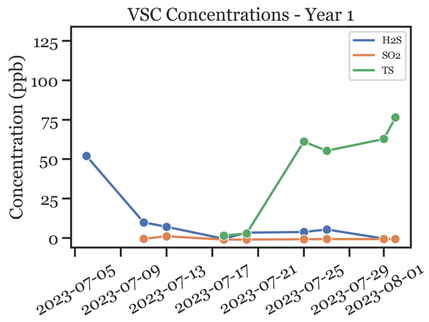



Figure 3. Microbes living in stranded *Sargassum* offset $H_2S$, a toxic gas. The microbes also emit DMS, a contributor to secondary marine aerosol formation. This is the first study quantifying the DMS emanating from *Sargassum*.



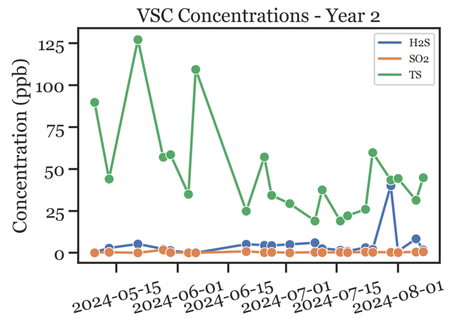




Figure 4. VSC concentrations from field sampling in 2023 and 2024. Averages: $H_2S$ = 5.95 ppb, $SO_2$ = 0.11 ppb, TS = 47.22 ppb.

## Chamber Study - Methods

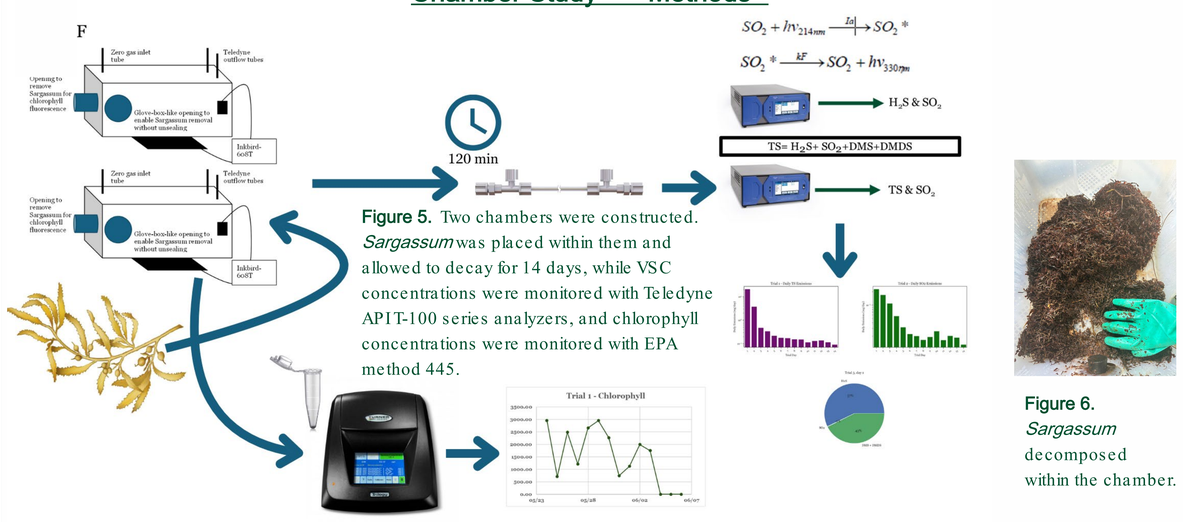



Figure 5. Two chambers were constructed. *Sargassum* was placed within them and allowed to decay for 14 days, while VSC concentrations were monitored with Teledyne API T-100 series analyzers, and chlorophyll concentrations were monitored with EPA method 445.



Figure 6. *Sargassum* decomposed within the chamber.

## Chamber Study - Results

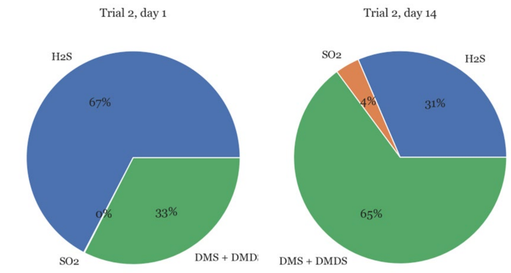



Figure 7. A representation of how the VSC makeup evolved in a sample trial. On the left is the initial makeup, and on the right is the final makeup, on day 14.

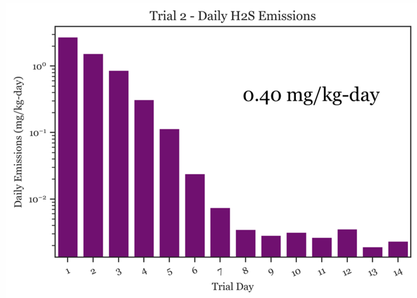



Figure 8. The evolution of daily $H_2S$ emissions corresponding to the trial in figure 5. The value on the graph corresponds to the mean emission factor of the trial.

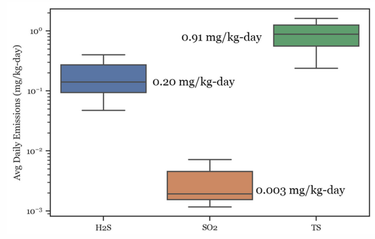



Figure 9. The average emission factors for $H_2S$, $SO_2$, and TS across each trial. The values displayed in the figure represent the average across all 3 trials.

## References

1. Chávez, V. et al. Water 12, 2908 (2020)
2. Resiere, D. et al. Clinical Toxicology (15563650) 59, 215–223 (2021)
3. Mayer, K. J. et al. ACS Cent. Sci. 6, 2259–2266 (2020)

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