

Background

- Storm activity, deforestation, and global warming have increased Sargassum strandings since around 2010.
- Sargassum macroalgae contains molecules (like sugars) which provide nutrients for marine organisms.
- Sargassum leachate releases heavy metals ammonia and sulfide that can have detrimental effects on aquatic organisms and the environment.
- Meiofauna (organisms < 500 μm) is abundant in sandy marine sediment and provides ecosystem services including sediment mixing and organic matter mineralization.
- Meiofauna provides food for sedimentary organisms and demersal fish, contributing to the recycling of sedimentary carbon and nutrients back into the pelagic food web.

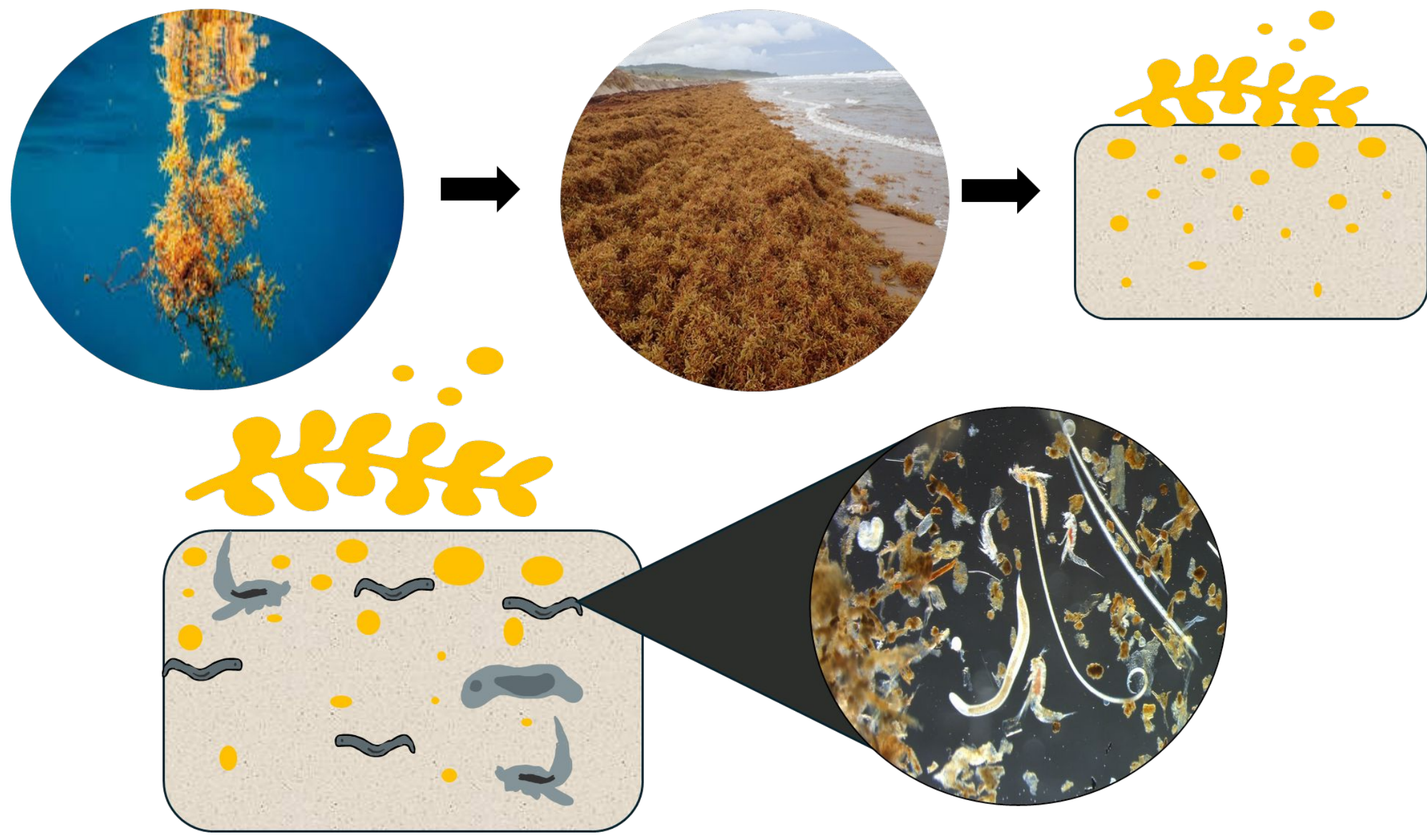


Figure 1: Sargassum grows in the ocean, then gets deposited on the beach where it produces leachate. This leachate is absorbed into the sediment where meiofauna lives.

Methods

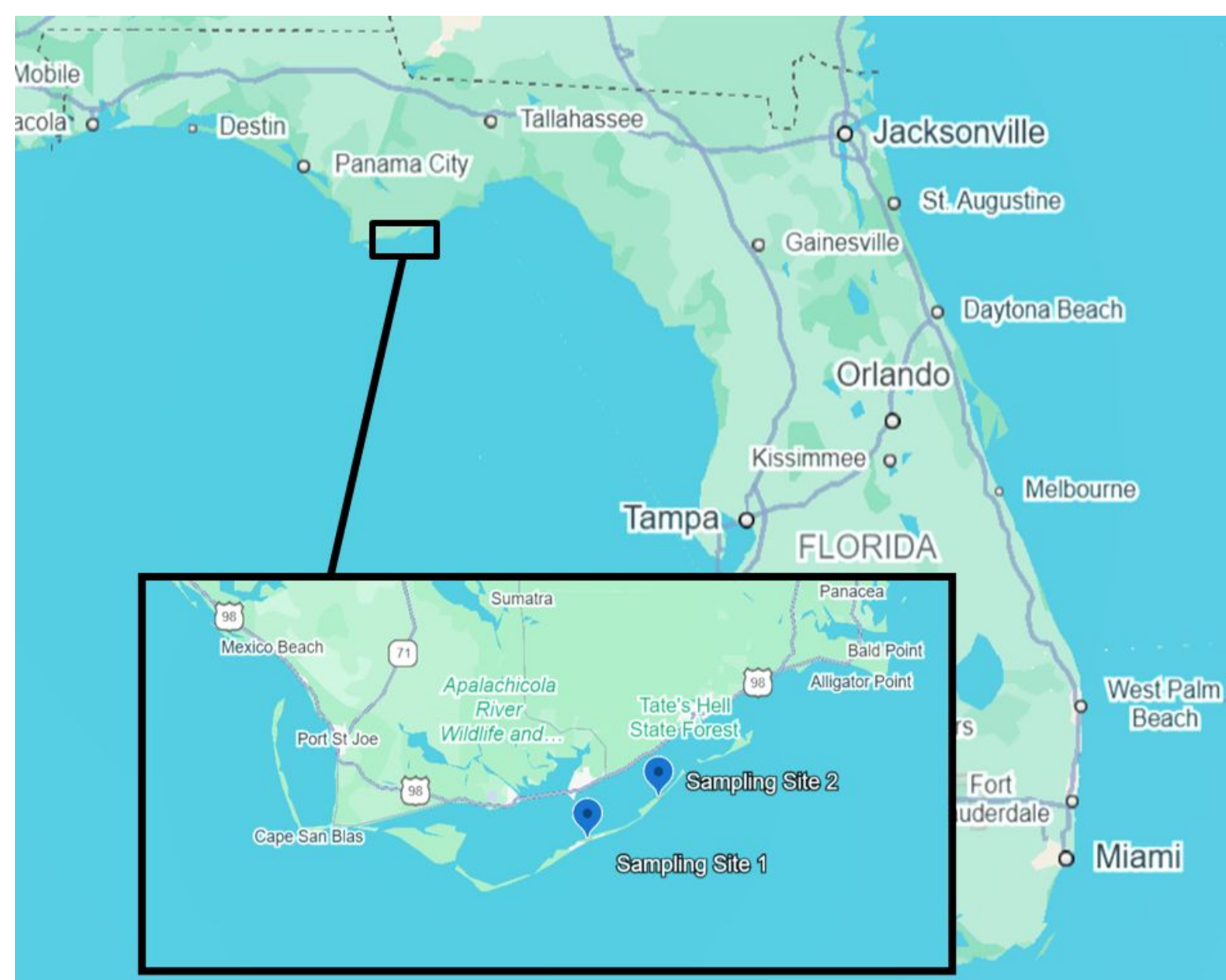


Figure 2: Study site. Small box in Florida map indicates location of St. George Island. The large insert depicts the island with sampling sites 1 and 2.

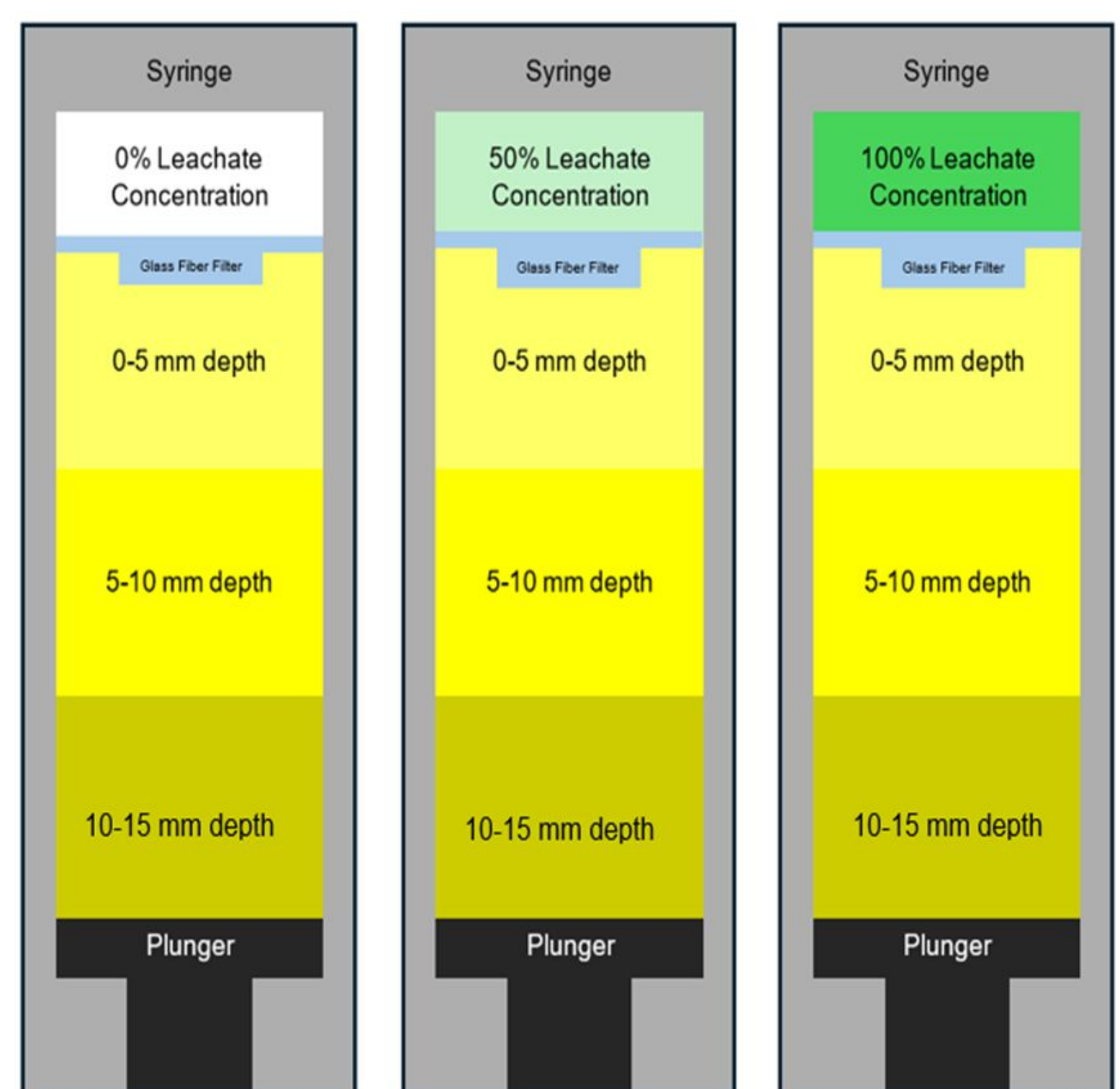


Figure 3: Experimental setup. Three 60 ml syringes containing 15 ml of surface sediment. Leachate concentrations (0%, 50%, and 100%) of stock solution were added to the tops of each core.

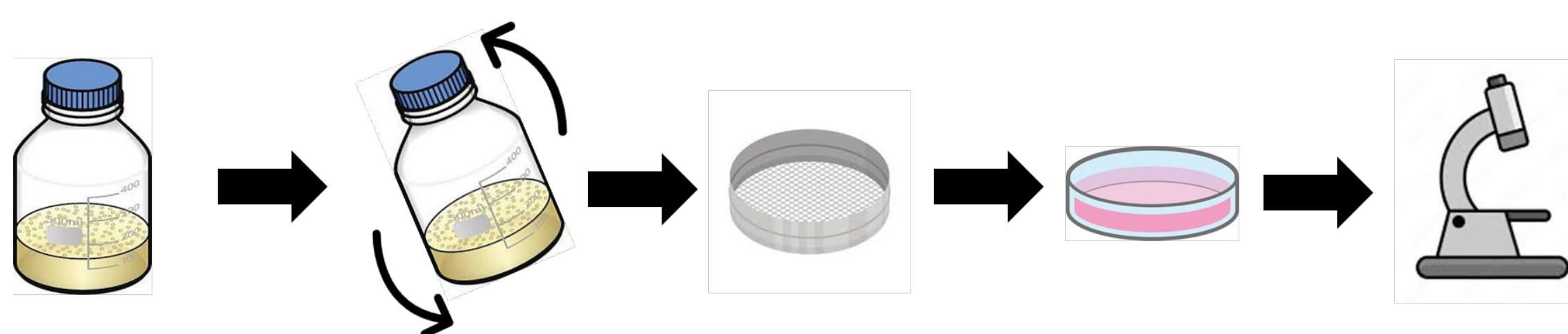


Figure 4: Meiofauna extraction and counting process using stepwise flushing onto a 50 μm sieve, and decanted into a petri dish.

Unsolved Problem

- Leachate released from decomposing Sargassum contains a variety of substances that may have positive and negative effects in coastal ecosystems.
- Intertidal sandy beach environments are sensitive ecosystems that are currently affected by Sargassum in the shores of the southern Atlantic and Caribbean.
- Only a few studies relate meiofauna and Sargassum.
- It is presently unknown how meiofauna diversity and community structure respond to Sargassum and if leachates cause a concentration or dispersal of meiofauna.

Goals

- Assess the response of meiofauna organisms to Sargassum leachates.
- Compare meiofauna community structure with and without Sargassum leachate exposure.
- Assess effects of moderate and high Sargassum leachate concentrations on meiofauna responses.

Hypotheses

- Null Hypothesis: Sargassum leachate has no effect on meiofauna distribution.
- Working hypothesis: meiofauna accumulates in specific sediment depth layers with a vertical Sargassum leachate concentration gradient.



Figure 5: Image of nematodes stained with bengal rose dye.

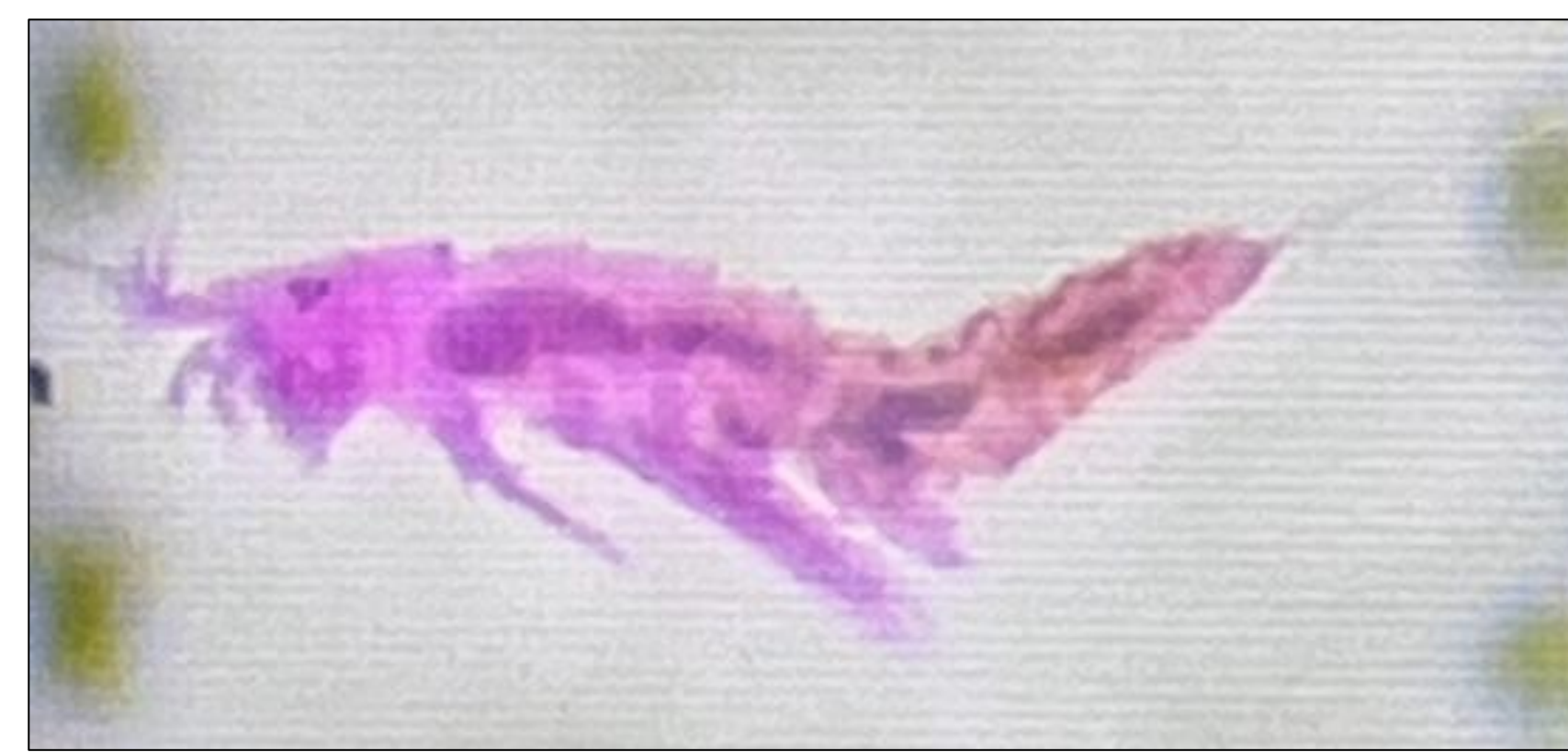


Figure 6: Image of a copepod stained with bengal rose dye.



Figure 7: Image of a tardigrade stained with bengal rose dye.

Acknowledgements

- Advisor: Dr. Markus Huettel
- Committee members: Dr. Lisa Herbert and Dr. Andrew Rassweiler
- Huettel Lab Members: Eva Mustian and Kailey Wendol

Results

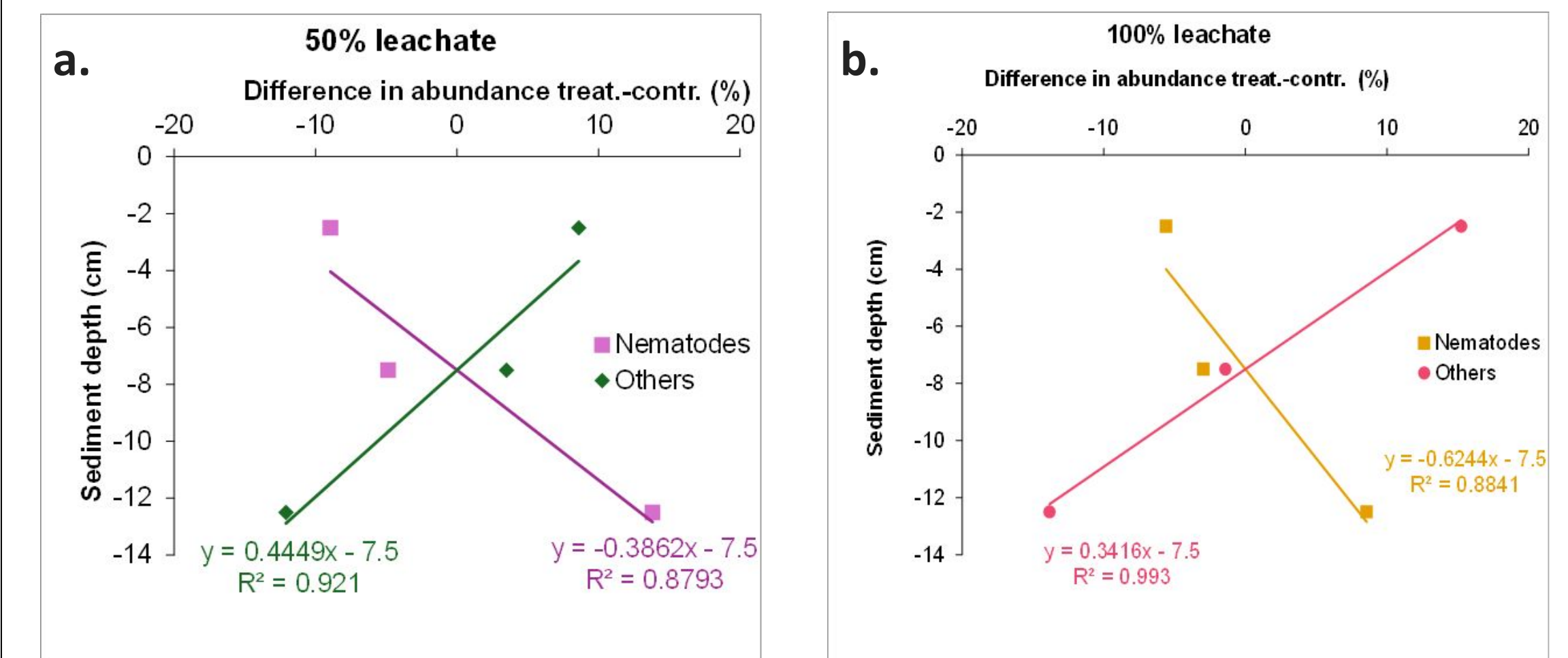


Figure 8: Linear regression models of the difference in treatment and control abundances for 50% (8a) and 100% (8b) leachates and nematodes and others.

Leachate Concentration	Average Nematodes	Average Others	Average Total	Depth
0%	19.0 ± 6.1	12.1 ± 3.8	31.1 ± 9.5	0-5 mm
	13.3 ± 4.8	6.8 ± 2.3	20.0 ± 6.7	5-10 mm
	18.1 ± 5.0	11.1 ± 3.0	29.3 ± 7.2	10-15 mm
50%	20.1 ± 10.8	24.8 ± 15.0	44.9 ± 25.6	0-5 mm
	15.0 ± 7.0	13.1 ± 5.1	28.1 ± 11.0	5-10 mm
	34.9 ± 14.7	12.6 ± 4.8	47.5 ± 17.6	10-15 mm
100%	15.1 ± 3.9	19.1 ± 8.8	34.3 ± 11.3	0-5 mm
	11.0 ± 4.0	7.3 ± 3.4	18.3 ± 7.2	5-10 mm
	21.0 ± 6.7	8.0 ± 2.1	29.0 ± 8.5	10-15 mm

Table 1: Table of base meiofauna count data.

Wavelength	0%	50%	100%	Depth
	Average Absorption			
355	0.029	0.165	0.242	0-5 mm
	0.006	0.089	0.15	5-10 mm
	0.006	0.062	0.157	10-15 mm
Standard Error (355)	± 0.008	± 0.038	± 0.056	0-5 mm
	± 0.001	± 0.023	± 0.034	5-10 mm
	± 0.001	± 0.018	± 0.029	10-15 mm
395	0.028	0.126	0.178	0-5 mm
	0.006	0.064	0.1	5-10 mm
	0.005	0.042	0.099	10-15 mm
Standard Error (395)	± 0.007	± 0.034	± 0.044	0-5 mm
	± 0.001	± 0.016	± 0.024	5-10 mm
	± 0.000	± 0.012	± 0.018	10-15 mm
630	0.029	0.082	0.101	0-5 mm
	0.011	0.036	0.046	5-10 mm
	0.009	0.023	0.04	10-15 mm
Standard Error (630)	± 0.007	± 0.023	± 0.024	0-5 mm
	± 0.001	± 0.007	± 0.010	5-10 mm
	± 0.000	± 0.004	± 0.007	10-15 mm

Table 2: Table of sargassum leachate absorption at different depths.

Conclusions

- Sargassum leachate penetrating into permeable intertidal sands influenced the behavior of interstitial meiofauna as reflected by their movement into a different depth layer when exposed to leachate.
- Nematodes responded negatively to the Sargassum leachate, i.e., they moved deeper into the sediment.
- Other meiofauna responded positively to the Sargassum leachate, i.e., they moved up within the sediment.
- The opposing responses led to a redistribution of meiofauna in the sediment, while total meiofauna abundance within each sand layer remained roughly the same.
- Anthropogenic disturbances of ocean nutrient distribution and temperature can affect benthic community structure though macroalgal blooms leading to baseline shifts that may be irreversible if algal strandings continue.

Conclusions

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