

01/17/24



#FSGsymp24

@FloridaSeaGrant

FLORIDA SEA GRANT'S 2024 SYMPOSIUM: SPOTLIGHTING UF'S ROLE

Session I Healthy Coastal Ecosystems

Ana Zangroniz

FSG Extension Agent

UF/IFAS Miami-Dade County Extension at UM/RSMAS



US EPA-registered chemical algaecides to control *Karenia brevis* and brevetoxins

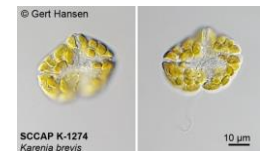
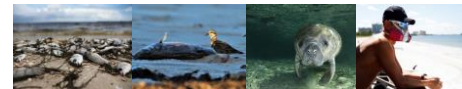
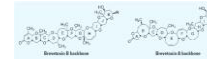
Dail Laughinghouse

Associate Professor

University of Florida, Fort Lauderdale Research & Education Center

Karenia brevis: 'Florida red tide'

- Mixotrophic dinoflagellate
- Common HAB-former in the Gulf of Mexico
- Produces brevetoxins (PbTx)
- Mortality of fish, turtles, seabirds, marine mammals
- Causes respiratory irritation in humans
- Tourism-related economic losses



Research Plan: *K. brevis* & PbTx Control

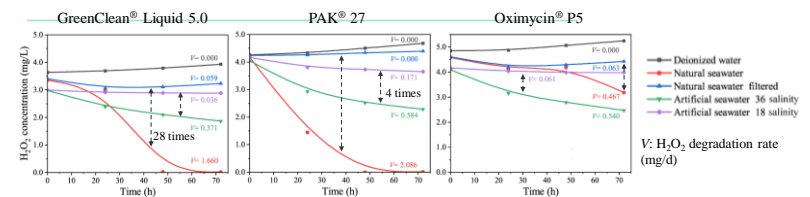
USEPA registered algaecides (within legal application concs.)

- Copper-based: Cu citrate, Cu gluconate, Cu ethanolamine complex
- Peroxide-based: H₂O₂ & peroxyacetic acid, Na percarbonate
- **Part I:** Stability of peroxide-based algaecides in salt water
- **Part II:** Effect of algaecides on *K. brevis*
- **Part III:** Effect of algaecides on brevetoxins

Table 1
Algaecide formulations and exposure concentrations examined in this work (mean ± SE).

Algaecide name	Measured concentrations (mg/L)			Active ingredient
	Low	Middle	High	
Algimycin® PWF	0.33 ± 0.01	0.65 ± 0.03	1.00 ± 0.02	Copper
Captain® XTR	0.34 ± 0.01	0.69 ± 0.01	1.13 ± 0.02	Copper
SeClear®	0.31 ± 0.01	0.59 ± 0.01	0.99 ± 0.01	Copper
GreenClean® Liquid 5.0	1.05 ± 0.06	2.86 ± 0.36	4.89 ± 0.06	Hydrogen peroxide
PAK® 27	1.54 ± 0.05	4.33 ± 0.07	6.48 ± 0.58	Hydrogen peroxide
Oximycin® P5	1.53 ± 0.04	4.38 ± 0.08	7.08 ± 0.20	Hydrogen peroxide

MAJOR TAKEAWAYS: PART I



- **Salinity/conductivity** influence stability of H₂O₂ in seawater.

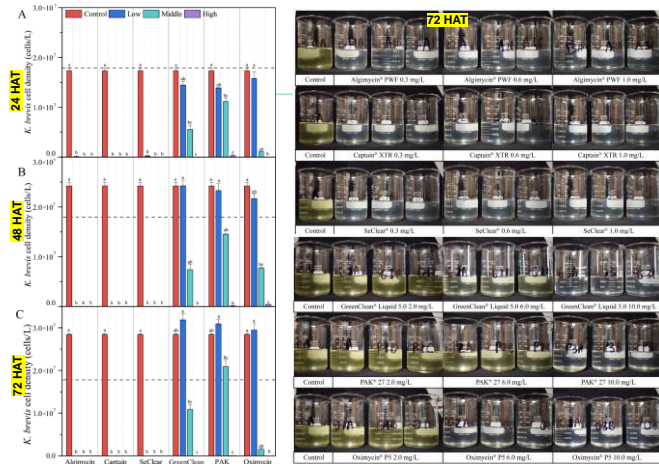
- **Microorganisms** and **organic matter** (> 0.2 µm) affect residence time of H₂O₂-based algaecides in seawater.

- **Oximycin®P5** = most stable product tested – degradation rate of 0.5 mg H₂O₂/L in natural seawater.

Peroxide-based algaecide degradation first-order kinetics model and half-life (day)⁻¹.

		Natural seawater
GreenClean® Liquid 5.0	k	0.662
	t _{1/2}	1.05
PAK® 27	k	0.749
	t _{1/2}	0.931
Oximycin® P5	k	0.954
	t _{1/2}	0.731

^a The algaecide degradation rate did not fit the first-order kinetics model in filtered

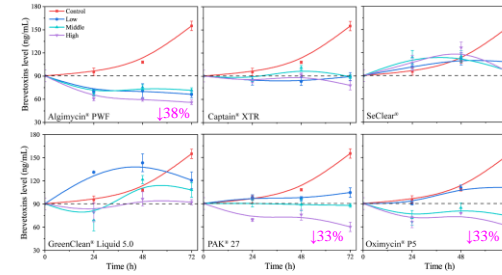


Takeaways: Part II

K. brevis Control (death):

- 0.3 mg/L (low dose) Cu-based algaecides = control
- 10.0 mg/L (high dose) H₂O₂-based algaecides = cell control.

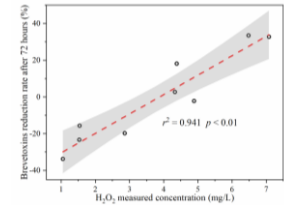
MAJOR TAKEAWAYS: PART III



PbTx Control/decay:

- 1.0 mg/L Alginate PWF (Cu), 10 mg/L Pak[®]27 (H₂O₂) and Oximycin[®]P5 (H₂O₂) = largest impact on PbTx reduction.

Strong dose-dependent relationship between H₂O₂-based algaecide exposure concentrations and PbTx reduction rate



ADDITIONAL RELEVANT INFO

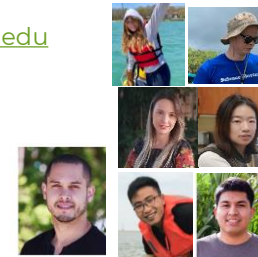
FSG funding for Algal Culture Collection (BLCC)

- >1000 strains
- >15 manuscripts
- Funding/collaborations



ACKNOWLEDGEMENTS

- hlaughinghouse@ufl.edu
- Lab members
- Funding agencies
- Collaborators



01/17/24

FLORIDA SEA GRANT'S 2024 SYMPOSIUM: SPOTLIGHTING UF'S ROLE

Filter-Feeding Bivalves & Organic Matter Cycling

Christine Angelini
Associate Professor | Engineering School for Sustainable Infrastructure and Environment
Director | UF Center for Coastal Solutions
Gainesville, FL

Contact Me: c.angelini@ufl.edu

Sea Grant FLORIDA
UNIVERSITY of FLORIDA
NOAA
#FSGsymp24
@FloridaSeaGrant

FL Sea Grant Seed Grant: Project Overview

In the headwaters...

- Cu-algicide application in stormwater ponds



76,000 urban stormwater ponds in FL

In the Estuary...



- Cu inhibits bivalve filter-feeding
- Bivalves are ~130 times more sensitive to Cu than humans

Is upstream pond management suppressing bivalve filtration functions?

1

FL Sea Grant Seed Grant: Research Plan

Guana River Watershed + Estuary in NE FL – GTM NERR water sampling detected elevated TCuI over time in the estuary



Bivalve Tissue + Sediment Field Sampling

- Are there headwater-ocean gradients in Cu concentrations?
 - 3 sampling sites

Cu-Dosing Experiments

- Does Cu exposure depress mussel and/or oyster filtration efficiency?
 - Acute & chronic Cu exposures



Hallie Fischman



Kristie Perez



Nikki Dix



AJ Reisinger



Ashley Smyth



Shirley Baker

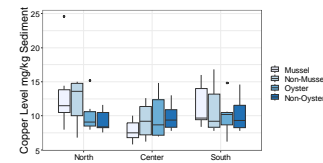


H. Dai Laughinghouse

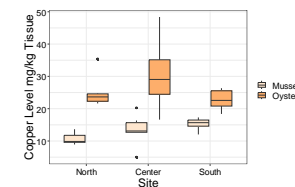
2

Key Findings

1. No variation in sediment [Cu] from headwater-ocean or with/without mussels or oysters



2. Tissue [Cu]: oysters > mussels; but all below human health limit



Preliminary results

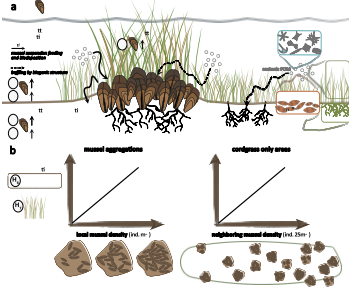
3. Oyster clearance rates are suppressed by ~70% by 15-day high dose [Cu] exposures but not acute exposures

4. Mussel clearance rates are suppressed about ~50% by acute exposure, but too many individuals died to evaluate response to chronic exposure

3

Some Spin-off Research

Are filter-feeding mussels counteracting estuarine eutrophication?



Key Findings:

- Mussels amplify salt marsh's ability to remove phytoplankton-based organic matter (OM) from coastal waters
- By increase C+ N storage capacity in plant tissues, mussels are increasing salt marsh blue carbon benefits

Student-led Publication:

Williams S.L., Rogers J.L., Fischman H.S., Morrison E.S., Angelini C. 2023. Journal of Geophysical Research: Biogeosciences 128 (11):e2023JG007535.

3

- Sydney Williams: FL Sea Grant Aquaculture Comms Fellow!
- 2nd Publication with A. Smyth –submitting soon!

01/17/24

Acknowledgements

Students:

- Hallie Fischman (lead, Engineering) + Kristie Perez (Fisheries)

Lab Support:

- Dail Laughinghouse + Ft Lauderdale Research & Education Center

Funding

- FL Sea Grant Seed Funds
- NSF via Georgia Coastal Ecosystems LTER
- NOAA Margaret Davidson Fellowship to S. Williams
- NOAA NERR Science Collaborative Grant (PI: A. Smyth)
- FL Sea Grant Aquaculture Communications Fellowship to S. Williams

Support

- Guana Tolomato Matanzas National Estuarine Research Reserve
- Sapelo Island National Estuarine Research Reserve

4

Development of a red tide communication plan for Florida

Lisa Krimsky
Water Resources Regional Specialized Agent
UF/IFAS Extension/Florida Sea Grant/IRREC

Findings & Impacts: Communication plan

Broad-scale overarching recommendations
Target Audiences • Key Themes • Actions • Evaluation

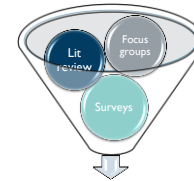
Framework

Sources and flow of information

Content

Format

PROJECT OVERVIEW & RESEARCH PLAN



Objective 4:
Communication strategy

Objective 1– Compile annotated bibliography of red tide communication articles

Scientific community

Objective 2– Evaluate the public's perception of value and usability of existing red tide communication resources.

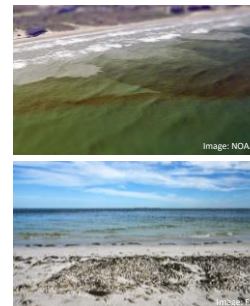
Florida residents

Objective 3– Evaluate red tide information needs and wants, assess how demographics influence how red tide information is received and why certain deliver modes are preferred

Natural resource managers, public health officials, tourism, hospitality, small businesses, media, residents and visitors

Objective 4– Develop a Florida red tide communication strategy comprising short-term event responses and guidance towards a long-term educational campaign, with both approaches using multilingual and multimodal outreach materials

Findings & Impacts: Communication plan



will need to:

- **Balance accuracy with empathy** – communicate science-based facts with compassion.
- **Balance information with empowerment** – provide the resources and tools to allow individuals and communities to make informed decisions, take protective measures for themselves and the environment, and be part of the solution.
- **Be comprehensive and place-specific** – acknowledge the statewide response while providing individuals the information to address what they can do, where, and when.

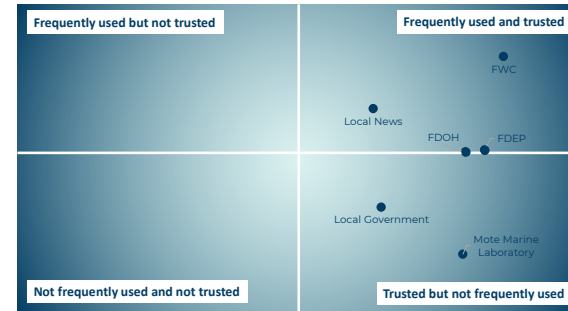
Framework

The primary concern is to protect public health without amplifying secondary (i.e., economic and social) risks.



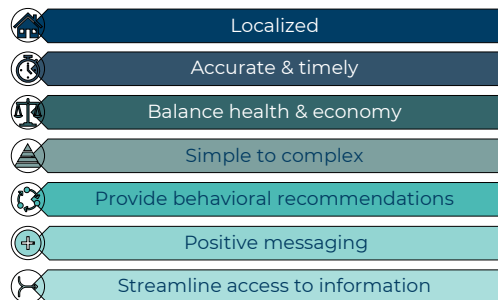
Figure 1. Red tide communication cycle adapted from the NOAA Social Science Committee and Crisis & Emergency Risk Communication models.

Sources of information



Frequency of use of trusted sources for red tide information

Information content



Format

STATEWIDE	Asthmatic (or similar respiratory issue) (n = 86)	Beachgoer (n = 320)	Boater (motorized) (n = 98)	Boater (non-motorized) (n = 79)	Commercial fisher (n = 20)	Recreational fisher (n = 136)	Seafood consumer (n = 432)	Waterfront business owner/employee (n = 19)
Facebook	47.7	46.6	46.9	48.1	60.0	59.6	42.4	68.4
Instagram	22.1	26.3	24.5	38.0	55.0	28.7	23.8	57.9
Mobile phone app	26.7	28.7	34.7	45.6	50.0	32.4	24.5	47.4
QR code on posted sign	17.4	15.9	16.3	26.6	35.0	17.6	13.0	31.6
SMS Message	41.9	38.8	34.7	49.4	45.0	34.6	35.6	52.6
Telephone hotline	10.5	9.4	11.2	16.5	25.0	8.1	8.6	26.3
Twitter	23.3	21.3	24.5	26.6	40.0	21.3	17.8	36.8
YouTube	29.1	25.0	24.5	20.3	40.0	27.9	23.1	31.6

REGIONAL	Asthmatic (or similar respiratory issue) (n = 56)	Beachgoer (n = 213)	Boater (motorized) (n = 63)	Boater (non-motorized) (n = 56)	Commercial fisher (n = 6)	Recreational fisher (n = 99)	Seafood consumer (n = 236)	Waterfront business owner/employee (n = 19)
Facebook	42.9	39.9	46.0	42.9	83.3	42.4	40.7	45.5
Instagram	10.7	12.2	9.5	23.2	33.3	14.1	14.0	9.1
Mobile phone app	39.3	40.8	47.6	51.8	50.0	46.5	36.9	54.5
QR code on posted sign	10.7	16.9	12.7	19.6	33.3	14.1	14.0	9.1
SMS Message	50.0	48.4	44.4	51.8	33.3	44.4	43.6	63.6
Telephone hotline	14.3	12.7	12.7	10.7	16.7	11.1	11.1	18.2
Twitter	8.9	9.9	4.8	12.5	16.7	14.1	10.6	18.2
YouTube	17.9	16.4	20.6	21.4	16.7	18.2	17.8	9.1

ADDITIONAL RELEVANT INFO

Recommendations are currently being implemented by Florida HAB

Communication Working Group:

- Develop up-to-date contacts for reliable, accessible, and effective experts, with a process to facilitate rapid communications and response to inquiries during an event
- Develop materials and training module for key information needs.
- Develop/improve platform(s) for sharing information within group and outside the group.
- Work to get everyone on the same page to promote consistent, timely, factual information being shared on websites and social media
- Use consistent, accurate, and minimally controversial terminology
- Educational material designed to raise the level of debate over the long term. Discuss with experts and end-users once a broader group is identified. Ensure climate change influences are addressed.
- Update beach signage to encourage self-efficacy actions and utilize icons that are understandable by non-English speaking individuals

Final reports

- SGR-148: Communication Plan (Obj 4)
- SGR-140: Annotated bibliography (Obj 1)
- SGR-141-143: Usability surveys (Obj 2)
- SGR-144-146: Focus group reports (Obj 3)
- SGR-147: Public survey report (Obj 3)
- Appendixes

flseagrant.org/redtideplan/



ACKNOWLEDGEMENTS

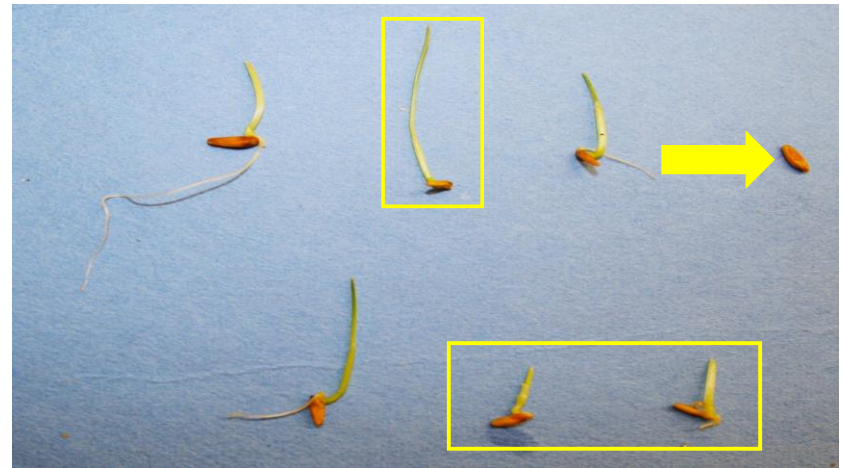
Thank you!

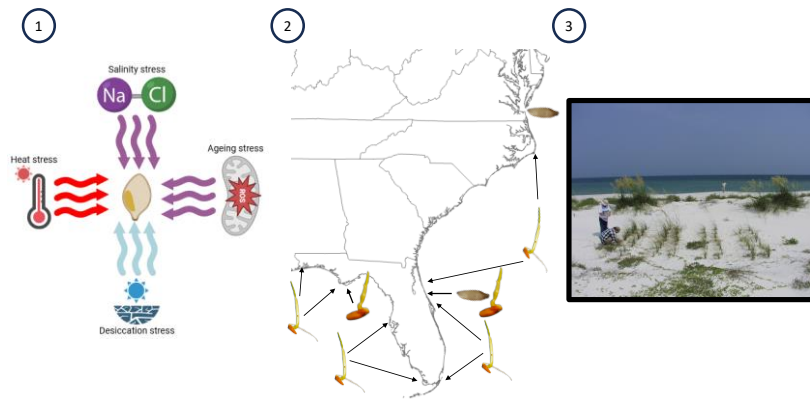
Lisa Krinsky
lkrinsky@ufl.edu

Betty Staugler • Chris Simoniello • Nancy Montes •
Paul Monaghan • Forest Hecker

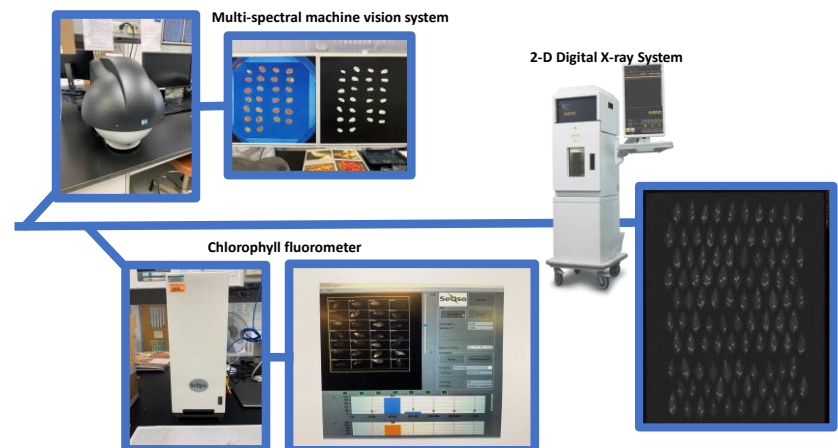
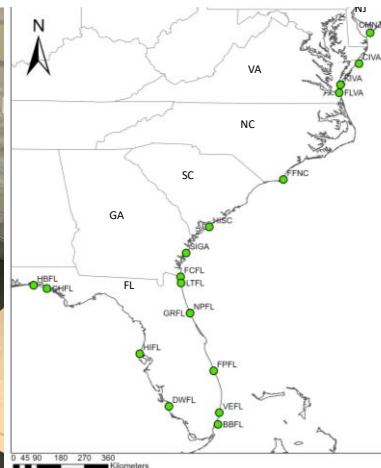
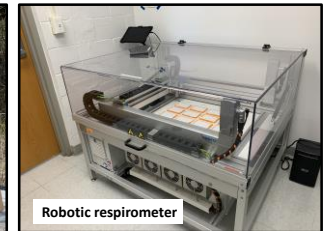
Funding for this project was provided by the Florida Fish and Wildlife Conservation Commission Fish and Wildlife Research Institute through the 2020 HAB Grant Program







Created in BioRender.com



MASS MORTALITY OF A KEYSTONE SEA URCHIN IN THE CARIBBEAN SEA

Joshua Patterson, Ph.D.
Associate Professor
UF/IFAS SFFGS

ACKNOWLEDGEMENTS

- Drs. Don Behringer, Liz Duermit-Moreau, Ruth Francis-Floyd, and Roy Yanong
- Drs. Ian Hewson (Cornell University) and Mya Breitbart (USF)
- AGRRA and region-wide collaborator network

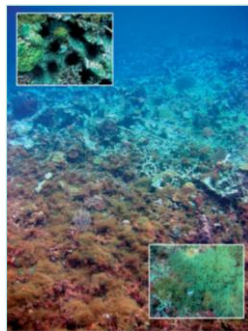


PROJECT OVERVIEW

Long-spined sea urchin – *Diadema antillarum*

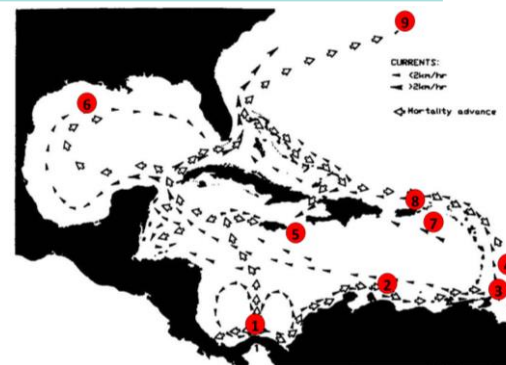


iStock



from Idjadi et al. 2010

PROJECT OVERVIEW



from Lessios 1988



video: Jerry Cowan, Admiralty Dive Center, St. Thomas USVI – 16 February 2022

RESEARCH PLAN

- Monitor die off progression
- Evaluate ecological effects
- Identify and understand the pathogen

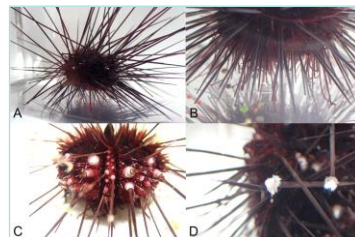
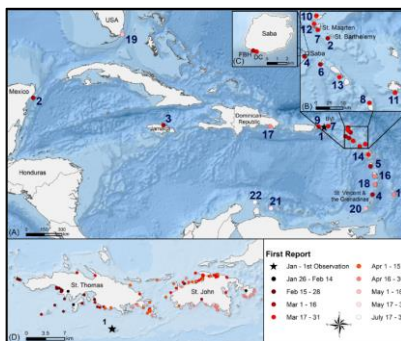


AGRA



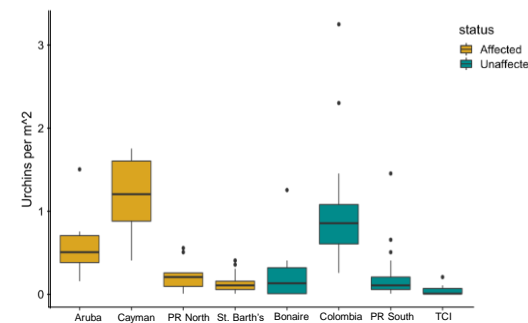
D. Behringer

FINDINGS & IMPACTS

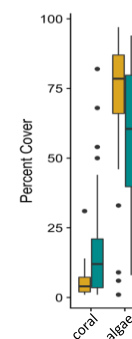


from Hylkema et al. 2023

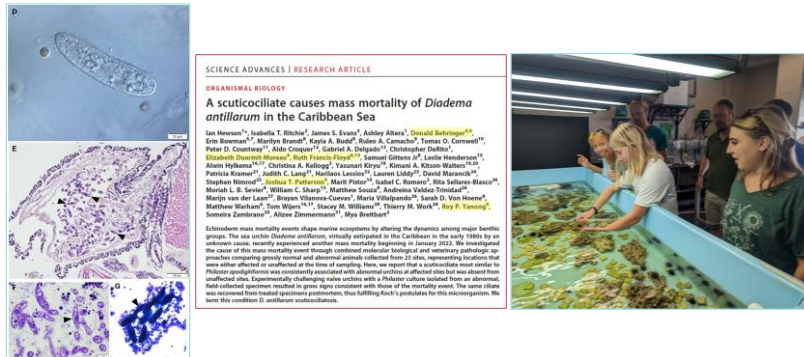
FINDINGS & IMPACTS



figures from L. Duermit-Moreau



FINDINGS & IMPACTS



IN CONCLUSION

- Collaboration on so many levels
- Responsiveness of NSF RAPID and Sea Grant “emergency” funding
- More work to do!

Sargassum Composting for Soil Amendment Applications in Landscaping

Ashley Smyth

Assistant Professor

University of Florida, Tropical Research & Education Center

PROJECT OVERVIEW



Photos: Top: AARP, Bottom: S. Krueger

- Influxes of *Sargassum* have been inundating Florida beaches
- Municipalities are spending millions of dollars on management
- Communities looking for alternatives; Success with composting in Ft. Lauderdale
- Concerns about arsenic and heavy metals have limited its use

PARTNERSHIPS

Michelle Leonard
MS Student, Monroe
County Extension



Vincent Encomio
Sea Grant, St. Lucie &
Martin County



Shelly Krueger
Sea Grant,
Monroe County



- Our goal was to assess the chemical properties of *Sargassum* compost
- 5 Extension agents and 1 specialist in 4 counties, west coast, east coast, and FL Keys
- Support from counties and solid waste departments



Randy Penn
Sarasota County Extension



Armando Ubada
Sea Grant, Sarasota County

RESEARCH PLAN

COLLECT SARGASSUM FROM
BEACHES OR CANALS



Photos from S. Krueger

TRANSFERRED TO GEOBIN
COMPOSTERS



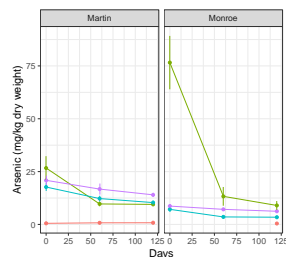
TREATMENTS

- 100% SARGASSUM
- 50% SARGASSUM
- 25% SARGASSUM
- 100% YARD WASTE



- *Sargassum* collected & composted in Martin & Monroe Counties
- Compost quality and arsenic concentration were collected from each composter after turning on days 0, 60, and 120.

FINDINGS & IMPACTS



- After 60 days, the arsenic levels were **below** the EPA standard for biosolid application (41 mg/kg)
- After 120 days, the arsenic levels were **above** FDEP residential soil standards (2.1 mg/kg)
- **Do not** recommend composting in residential landscapes

- Manuscript in prep, One EDIS document, lots of new collaborations

FINDINGS & IMPACTS

- Environment may play a role in the amount of arsenic contained within the *Sargassum*

Species	Location	Collection Date	As (mg/kg)
<i>S. Fluitans</i> III	Grayton Beach State Park, Walton County	2020-09-06	15.07
<i>S. Fluitans</i> III	299 E Coacoa Beach Causeway, Alan Shepard Park	2020-09-29	46.85
<i>S. Fluitans</i> III	Bill Baggs State Park, Miami	2020-09-11	113.85
<i>S. Fluitans</i> III	Smather's Beach, Key West	2020-11-26	51.49
<i>S. Fluitans</i> III	1500 N Altalntic Ave, Lori Wilson Park, Cocoa Beach	2021-06-01	53.39
<i>S. Natans</i> VIII	Navarre Beach, Pensacola Beach	2021-06-10	51.54
<i>S. Fluitans</i> III/ <i>S. Natans</i> VIII	Grayton Beach State Park, Walton County	2021-06-14	45.19
<i>S. Fluitans</i> III	Grayton Beach State Park, Walton County	2021-07-29	55.73

FINDINGS & IMPACTS

By the numbers:

- 1 Student trained
- 30 Master Gardeners and volunteers spent > 135 hours assisting with the project
- Contributions to *Sargassum* management master plans in 3 Florida counties



Photos from S. Krueger

NEXT STEPS

Future Studies

- What is the ultimate fate of *Sargassum* associated arsenic?
- Does arsenic transfer to plants grown in compost made from *Sargassum*?

Possibly
(Abdool-Chany et al., 2023)



Additional Funding

- *Sargassum* for biochar (funding to V. Encomio from Florida Sea Grant & EPA)

Seaweed

A new industry for Florida



Funded by UF/IFAS SEED-IT Program

ACKNOWLEDGEMENTS



- Florida Sea Grant Program Development Grant
- Dr. Dail Laughinghouse (Agronomy, FLREC)
- Dr. Jon Judy (SWES)
- Key West Botanical Garden, City of Key West, Key West Solid Waste, Martin & St. Lucie County Extension Office; Florida Power & Light