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

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>
<thead>
<tr>
<th>Algaecide Formulation</th>
<th>Measured concentration (mg/L)</th>
<th>Active Algaecide</th>
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<tr>
<td>GreenClean Liquid 5.0</td>
<td>10.0 ± 0.05</td>
<td>Copper</td>
</tr>
<tr>
<td>PAK 27</td>
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<td>Copper</td>
</tr>
<tr>
<td>Oximycin P5</td>
<td>10.0 ± 0.05</td>
<td>Peroxide</td>
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</table>

**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.

**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

![Image of Karenia brevis](https://example.com/karenia-brevis-image.jpg)
Healthy Coastal Ecosystems
By Laughinghouse

**Takeaways: Part II**

*K. brevis* Control (death):
- 0.3 mg/L (low dose) Cu-based algaecides = control
- 10.0 mg/L (high dose) H$_2$O$_2$-based algaecides = cell control.

**PbTx Control/decay:**
- 1.0 mg/L Algimycin®PWF (Cu), 10 mg/L Pak®27 (H$_2$O$_2$) and Oximycin®PS (H$_2$O$_2$) = largest impact on PbTx reduction.

**MAJOR TAKEAWAYS: PART III**

Strong dose-dependent relationship between H$_2$O$_2$-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
**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

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**FL Sea Grant Seed Grant: Project Overview**

**In the headwaters...**

- Cu-algicide application in stormwater ponds

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**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?

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**FL Sea Grant Seed Grant: Research Plan**

Guana River Watershed + Estuary in NE FL – GTM NERR water sampling detected elevated [Cu] 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

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**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
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 increasing C+N storage capacity in plant tissues, mussels are increasing salt marsh blue carbon benefits

Student-led Publication:

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
Development of a red tide communication plan for Florida

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

PROJECT OVERVIEW & RESEARCH PLAN

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

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

Framework
Sources and flow of information
Content
Format

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

**Framework**

- **Localized**
- **Accurate & timely**
- **Balance health & economy**
- **Simple to complex**
- **Provide behavioral recommendations**
- **Positive messaging**
- **Streamline access to information**

**Information content**

**Format**

**Sources of information**

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**Frequency of use of trusted sources for red tide information**

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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

fiseagrant.org/redtideplan/

ACKNOWLEDGEMENTS

Thank you!

Lisa Krimsky
lkrimsky@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
Shining A Light On Sea Oats Seed Biology

Héctor E. Pérez, Ph.D.
Professor
Environmental Horticulture Dept. (Gainesville)
Ph.D. student Andrew Egesa prepares samples for antioxidant extraction.

Sea oats soil seed bank study Ft. Clinch State Park (FL)

Robotic respirometer

Germination chamber arrays

Multi-spectral machine vision system

2-D Digital X-ray System

Chlorophyll fluorometer
**Healthy Coastal Ecosystems**

By Perez

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In Prep

Seeing right through it: 2-D X-ray analyses of *Uniola paniculata* L. spikelets reveals continental-scale patterns of seed production

Héctor E. Pérez, Tia Tyler, Michael E. Kane, Ava Meena, Jhordy Sanchez

In prep

Physical and biochemical traits predict high-temperature aging stress in sea oats seeds

Andrew Ogolla Egesa, Maria Teresa Davidson, Héctor E. Pérez, and Kevin Begcy

---

1. equator; germination

2. [antioxidant]

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1/17/2024

HCE 10
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

from Lessios 1988

1/17/2024

HCE 11
RESEARCH PLAN

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

FINDINGS & IMPACTS

from Hytkema et al. 2023

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

• 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

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Sea Grant, St. Lucie & Martin County
Shelly Krueger
Sea Grant, Monroe County

Randy Penn
Sarasota County Extension
Armando Ubeda
Sea Grant, Sarasota County

RESEARCH PLAN

COLLECT SARGASSUM FROM BEACHES OR CANALS

TRANSFERRED TO GEOBIN COMPOSTERS

TREATMENTS
• 100% SARGASSUM
• 50% SARGASSUM
• 25% SARGASSUM
• 100% YARD WASTE

• 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

• 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

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<th>Collection Date</th>
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FINDINGS & IMPACTS

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

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-Ghany et al., 2023)

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

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

1/17/2024
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