

Florida Red Tide Mitigation and Technology Development Initiative

2nd Technical Advisory Council Meeting

April 3, 2020, 9:00am-11:00am EST

To Join Teleconference: Please call 1-800-201-3962, Conference Code 535051

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This meeting is open to the public.

1. Welcome
2. Webinar and Phone Technical Checks
3. Agenda Overview
4. Review of 1st Technical Advisory Council meeting, January 17, 2020
 - a. Minutes available at: [Mote.org](https://mote.org)
5. Year 1 Status:
 - a. Administrative Structure
 - b. Mote Mesocosm and Culture Lab Infrastructure
 - c. Mote Projects
 - d. Partner Led Projects
6. Year 2 Timeline Plans
7. Public Comments

**Florida Red Tide Mitigation and Technology Development Initiative
Technical Advisory Council Public Webinar – April 3rd, 2020, 9:00 am-11:00 am EST**

In Attendance: Dr. Michael P. Crosby, Dr. James Powell, Dr. James Sullivan, Dr. Katherine Hubbard, David Whiting, Kevin Claridge, Dr. Michael Barbour, Kayla Bernier, & *see additional Attendee List included at the end of these meeting minutes.*

Presenters: Kevin Claridge, Dr. Vince Lovko, Dr. Sumit Chakraborty, Dr. Tracy Fanara, Dr. Rich Pierce, Dr. Kathryn J. Coyne, Taylor Armstrong, Dr. Vijay John, Dr. Don Anderson, Dr. Michael Parsons

Meeting Minutes:

Welcome, Webinar Meeting Logistics, & Agenda Overview

- Welcome remarks by Dr. Crosby
- Kevin Claridge reviewed the Agenda for this meeting.

Review of 1st TAC Meeting, January 17, 2020

- Overview of the Red Tide Initiative
- Role of the TAC and Quorum
- Sunshine and Public Record Laws
- Meeting Minutes
- Red Tide Initiative Website on Mote.org
- Florida Red Tide Background
- Statutory Reporting Requirements
- FWC Contract and Reporting Requirements
- Initiative Outreach
- Summary of Year 1 Activities

1/17 Meeting Minutes available at: Mote.org.

Year 1 Status:

Mote Marine Laboratory Aquaculture Research Park Mesocosm and Culture Lab Infrastructure

- Experimental Mesocosm Facility
 - Motivation:
 - To provide multi-scale, multi-user red tide research infrastructure for Initiative scientists
 - Goals:
 - Used by visiting Initiative scientists, graduate students, and educational groups
 - Outcomes:

- Dedicated red tide mitigation mesocosm facility will allow more ecosystem-based testing of mitigation compounds in a controlled setting to prepare for field implementation

See Red Tide Initiative 2nd TAC Meeting – April 3, 2020 PPT presentation for Mesocosm Facility Diagram & Photos of Construction progress.

- Questions from the Technical Advisory Council:
 - Dr. Hubbard asked if there was a plan for dealing with aerosolized brevetoxins.
 - Dr. Pierce stated the Mesocosm facilities were designed to:
 - Limit aerosolization of the toxins from the tanks by limited aeration in the tanks.
 - Eliminate contamination of adjacent research areas by closing off each area and installing appropriate filters in the AC system.
 - Randy Grams added that carbon filtration was added to contain as well.
- Phytoplankton Culture Facility
 - Motivation:
 - To support the Initiative with *Karenia brevis* culture
 - Goals:
 - Meet the demands of the mitigation research with consistent and reliable production of large volumes of *K. brevis*
 - Expand collection of *K. brevis* species (growing and maintaining several different strains)
 - Outcomes:
 - Leverage Mote’s strong foundation of ecology, advanced biology and physiology to collaborate at state, national, and international levels and improve scientific productivity – i.e. support this Initiative with culture and Red Tide expertise
 - Update:
 - Construction underway, walls going up, layout being finalized
 - Equipment ordered
- Questions from the Technical Advisory Council:
 - Dr. Sullivan mentioned that it looked like the Mote Aquaculture Research Park was quite a ways inland. He asked if bay water would be trucked in. Randy Grams stated, yes. Dr. Sullivan asked if there would be a large holding tank. Randy stated, yes, inside the building and a tank outside for treatment.
 - An additional question was asked if there would be LED lighting. Randy said yes.

Mote Led Year 1 Projects

- Mote Led Project Overviews
 - Technology Development in Support of Mitigation

- Programmable Hyperspectral Seawater Scanner (PHySS)
 - UAV (Unmanned Aerial Vehicle, Drone) -based Detection System
 - Beach Conditions Reporting Systems (BCRS)
 - Quantitative Polymerase Chain Reaction (qPCR)
 - Mitigation Projects
 - Compounds (Natural, Clay, Chemicals)
 - Laboratory and Mesocosm
 - *Mote scientist collaboration with Partner Led Projects*
 - *Coordination with other funding sources*
- PHySS (2.0) – Programmable Hyperspectral Seawater Scanner – Dr. Sumit Chakraborty
 - Motivation:
 - Develop an instrument to aid in the mitigation of red tide and provide early detection and warning
 - Developed at Mote; Similarity Index; fully programmable data acquisition with web-based data analysis tool
 - Goals:
 - Develop a spectral library of different phytoplankton groups with variable morphologies and physiological states, optical signatures will be obtained for a range of cell densities
 - Improve sensitivity, identify multiple phytoplankton groups
 - Achieve concurrence with direct and remote observations of the SI estimates across different biological and physical regimes
 - Outcome:
 - Form observatory providing continuous high frequency data
 - Data will be made publicly available in web based platform
 - Update:
 - Task1: Parts for new PHySS 2.0 ordered, assembly will start soon
 - Task2: Starting cultures (first set) received, phytoplankton will be grown in lab and will start creating the hyperspectral library
 - Task3: Low power alternative processor; installed and being tested
- UAV-based Red Tide Detection System – Dr. Vince Lovko
 - Motivation:
 - Patchy nature of red tide makes mitigation technology challenging
 - Airborne hyperspectral sensors could allow the mapping of HABs with a high spatio-temporal resolution at local (drone) and regional (satellite) scales
 - Goals:
 - Conduct shore-based flights in local waters
 - Collect hyperspectral data, develop data processing scheme, instrument calibration and deliver proof-of-concept

- Quality control check of algorithm performance
 - Implementation of new approaches for algorithm development
 - Outcomes:
 - Develop an application tool to assist in management of events that may involve significant risk to the public
 - Decrease costs of detection, improve mitigation application
 - Updates:
 - Ordered Equipment – laptop and a downwelling irradiance sensor
 - Evaluation of data collected
- Advance Red Tide Reporting Technology – Dr. Cynthia Heil (Kevin Claridge presented)
 - Motivation:
 - Alert the Public of Red Tide and its Effects
 - Red Tide reporting in the hands of fisherman
 - Goals:
 - Update/combine the Beach Condition Reporting System with the Citizen Science is Cool App
 - Enhance validation components
 - Bloom Zoom for cell detection, App for Chl-a
 - Outcomes:
 - Information is disseminated to BCRS/App, GCOOS, SECOORA, and NOAA
 - Reporting to/by Anyone with a Cell Phone, anywhere
 - Update:
 - Contract completed
 - Contractor began redevelopment and merging BCRS and CSIC
- Acceleration of user-friendly, smart phone integrated qPCR technology development and Citizen Science integration for *K. brevis* mitigation testing – Drs. Cynthia Heil & Tracy Fanara
 - Motivation:
 - Meet the ongoing, well-defined, need for new public-friendly, automated, web-interfaced detection methodologies that can provide accurate and timely cell monitoring data.
 - Overall Goal:
 - Accelerate the development and validation of a hand-held, qPCR based *K. brevis* and *K. mikimotoi* detector (Biomeme Three3) and develop protocols for integration into Citizen Science program.
 - Updates (and Alternatives):
 - We have ramped up *K. brevis* culturing & are obtaining an eastern Gulf *K. mikimotoi* clone (Venice) from the UNCW Algal Resources Collection.

- A PO in place for purchase of a Biomeme is delayed as the units are being used for COVID-19 tests. We are borrowing Bigelow’s unit & existing supplies for the research.
 - We have modified our subcontract with Bigelow collaborators to include remote development and Instruction as much as possible.
 - We still hope to have Collaborators (Drs. Countway & Record) visit Mote in mid/late May.
- Questions from the Technical Advisory Council:
 - Dr. Crosby asked if some of the delayed supplies for qPCR work were supposed to be coming from CA and thus delayed by COVID-19 complications. Kevin Claridge said the CA delays were affecting the UAV project. The qPCR project was having other COVID-19 delays.
- Mitigation Products & Processes Introduction – Dr. Rich Pierce
 - Motivation:
 - To build on advancements made through the on-going FWC-Mote Cooperative Red Tide Research Program to develop science-based response strategies to reduce the intensity of red tide events and mitigate impacts on coastal ecosystems, Florida’s economy, and public health.
 - Overall Goal:
 - To develop, test and implement the most effective and ecologically sound products and technologies for mitigation and/or control of adverse impacts of Florida Red Tides, in collaboration with experts from multiple external research institutions.
 - Outcome:
 - Implement a tiered approach to investigate products in a science-based protocol to identify the most effective and ecologically sound products and technologies for mitigation and/or control of adverse impacts of Florida Red Tides.
 - Tier 1. Lab-scale tests to determine the effective methodology for eliminating *K. brevis* cells and toxins.
 - Tier 2. Mesocosm-scale (larger volume, multiple organisms) to assess impacts of non-targeted marine organisms and water quality
 - Tier 3. Open Field applications: Test the most appropriate method(s) under natural field conditions (timing depends on outcome of previous tests, permission for field application and red tide events).
- Mitigation Products & Processes Applications – Dr. Rich Pierce
 - Mitigation Products Tested for Year-1; Task1:

- Natural Products
 - Ulva species; Macro Algal Allelopathy:
 - Establishing growth conditions & nutrient impacts
- Chemical Products
 - Curcumin: Polyphenol antibiotic properties
 - After 48 hrs, loss 96% of cells; 63% of toxins
- Physical Processes
 - Clay flocculation; 5g clay/M² water surface
 - Dose 1.5 x 10⁶ cells/L
 - Cells 100% loss 2 hrs; Toxins PbTx-2: 80% loss

Partner Led Year 1 Projects

- Red Tide initiative – Partner Led Proposals
 - Open to any/all interested parties
 - \$1 Million in funding for partner led projects
 - 5 Selected to present overviews to TAC
 - Support not to exceed 1 year
 - may request longer in second year RFP
 - Proposal guidelines and proposal submission:
 - Mote.org
 - Announced November 7th at US HAB Symposium
 - Webinar on RFP and to answer any questions
 - Due January 31st to proposals@redtidemtdi.org
 - Use of Mote facilities/infrastructure was encouraged
 - Partner Led Proposal Review Process:
 - Diverse set of red tide PhD level expertise from NOAA, EPA, FWC, Universities, Estuary Programs, and Mote
 - Each scientist reviewed 3-5 proposals using provided questionnaire
 - Additional Non-Conflicted Mote Scientist Review
 - Mr. Claridge organized and provided all reviews together for Dr. Crosby's decision
- Red Tide Initiative – Partner Led Projects
 - Dr. Kathryn J. Coyne, University of Delaware: *Optimizing production of a dinoflagellate-specific algicide for control of Karenia brevis*; Co-PIs: Dr. Dana Wetzel and Dr. Vincent Lovko, Mote Marine Laboratory
 - Contact with bacteria is not necessary for algicidal activity
 - Algicidal compounds in the filtrate include a number of amines
 - These compounds act synergistically to induce cell death in dinoflagellates

- Sensitivity to amines differs depending on species of dinoflagellate
- Overall Goals: *(for more details, see PPT presentation)*
 - Optimize production of algicide by the bacteria for use on *Karenia brevis*
 - Identify algicidal compounds (amines) that have the greatest impact on *Karenia brevis*
 - Evaluate risks of algicide application: Does it increase the release of brevetoxin?
 - Validate laboratory culture experiments with natural communities of phytoplankton.
- Dr. Allen Place and Taylor Armstrong (presenting), University of Maryland: *Pushing Karenia Over the Edge with Beer Derived Flavonoids*; Co-PIs: Dr. Richard Pierce and Dr. Vincent Lovko, Mote Marine Laboratory
 - Barley straw
 - Used as mitigation technique for cyanobacteria
 - Effective against toxic dinoflagellates in the lab experiments
 - BUT, dispersal can be time consuming, labor intensive, and its effectiveness is dependent on deploying bales ~ 12 weeks prior to the bloom formation
 - Beer Waste:
 - Readily available at little to no cost
 - 5x concentration of phenolic acids/flavonoids
 - Research Objectives *(for more details, see PPT presentation)*
 - Impact on cell growth and brevetoxins
 - Sublethal effects on cells
 - Identify algicide(s)
 - Test on natural bloom
- Dr. Vijay John (presenting) and Dr. Tim McLean, Tulane University: *A Thin Shroud with Integrated Algaecide to Flocculate and Sink Karenia brevis*
 - Findings:
 - The concept of the shroud
 - Metal Phenolic Networks (MPNs) form the shroud
 - High sinking efficiencies with engineered system
 - Chitosan extends the shroud
 - Optical micrographs
 - Cryo SEMs
 - Proposed Work: *(for more details, see PPT presentation)*
 - Halloysite nanotubes (HNT) as targeted delivery systems
 - System optimization for sinking efficiency and algaecide delivery
 - Collaboration with Mote and FWRI

- Other considerations: Logistics & Cost
- Dr. Don Anderson, Woods Hole Oceanographic Institute: *Fate and Effects of Karenia brevis Cells, Toxins, and Nutrients Following Clay Application for Bloom Control*; Co-PIs: Dr. Richard Pierce, Jim Culter, Dr. Emily Hall, and Dr. Vincent Lovko, Mote Marine Laboratory & Dr. Kristy Lewis, University of Central Florida
 - Overall objective: Evaluate the use of clay flocculation as an effective and ecologically sound method for mitigation and decreasing the impacts of red tide (*for more details, see PPT presentation*)
 - Determine long-term fate of Karenia cells, toxins, metals, and nutrients removed from surface waters after clay application
 - Assess benthic impacts resulting from clay flocculation of Karenia
 - Communicate results of the study to managers and stakeholders
- Dr. Michael Parsons, Florida Gulf Coast University: *Examining the Feasibility of Removing and Composting Fish Carcasses to Mitigate Red Tide*; Co-PI: Dr. Cynthia Heil, Mote Marine Laboratory
 - Proposed Study: (*for more details, see PPT presentation*)
 - Better quantify the nutrient inputs to red tide from fish kills in southwest Florida;
 - Conduct a cost/benefit analysis of fish removal as a mitigation tool;
 - Evaluate composting and use of a compost accelerator compound to repurpose the dead fish as fertilizer for local stakeholder use.
- Questions from the Technical Advisory Council:
 - To Kathryn Coyne: Dave Whiting asked what size containers would be used in lab bench scale analysis. Dr. Coyne stated they would use varying scales. Have done up to 100 liters at their sites, but are happy about being able to scale up at the new Mote Mesocosm facility currently under construction.
 - To Vijay John: Dave Whiting asked about it performing under varying wave conditions. Dr. John stated that, yes, they can get it to perform under energy conditions.
 - To Don Anderson: Dr. Powell asked if they considered the implications for endangered species such as Manatees or other bottom feeders. Dr. Anderson stated that it is difficult to address because of concerns over oexposure studies; they would compare the impacts against the impact of red tide alone though.

Red Tide Initiative Year 2 Timeline Plans

- Continue Admin, Contracting, Invoicing, etc.
- Continue Website updates and Outreach
- Develop Year 2 budget
- Mote preparing concepts in April 2020

- Request For Proposals (RFP) May 1 – June 30
- Operation and Maintenance of infrastructure
- TAC Meeting in September after proposal review
- Statutory Required Report (due Jan 2021)
 - Progress and Strategic Steps toward “Red Tide Tool Box”

Questions or Comments from the Technical Advisory Council:

- Dr. Hubbard asked if there was a plan for interaction across the different teams working on Mitigation as time goes on.
 - Kevin Claridge stated that coordination and collaboration with NOAA, FWC, etc. has opened a lot of new doors. He stated that maybe a Workshop at Mote to get feedback and consolidate for the Red Tide Mitigation toolbox would be good.
 - Dr. Hubbard agreed and stated that it would create the opportunity to work together moving forward and to help reach the overall goal.
 - Dr. Crosby added that this was an extremely valuable idea to get existing Pls together to interact and brainstorm; germinating, expanding partnerships and new ideas. He could see doing this on an annual basis maybe surrounding Conferences such as the HAB conference.

Public Comments: None

Final Council Member Remarks:

- Al Place asked if the formal letters of Awards would be sent out soon. Kevin stated that Mote would be in touch next week.
- Dr. Crosby asked if the presentation would be shared. Kevin stated that it would be shared next week.

Adjourned - 10:45 am

A copy of the PowerPoint Presentation can be provided by contacting Kevin Claridge at kclaridge@mote.org.

Attendee List

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Name:	Organization:
Allen Place	University of Maryland
Emily Hall	Mote
Don Anderson	Woods Hole Oceanographic Institute
Vince Lovko	Mote
Jim Sullivan	Florida Atlantic University
Taylor Armstrong	University of Maryland
Kathy Coyne	University of Delaware
Bryan Davis	Mote
Meghan Abbott	FWC
Kevin Cooper	Mote
James Powell	Clearwater Marine Aquarium
Kate Hubbard	FWC
Mary Kate Rogener	NOAA
Vijay John	Tulane University
Maggie Broadwater	NOAA
Dave Whiting	DEP
Quay Dortch	NOAA

Name:	Organization:
Tracy Fanara	Mote
Rich Pierce	Mote
Dr. Michael P. Crosby	Mote
Kevin Claridge	Mote
Kayla Bernier	Mote
Dr. Sumit Chakraborty	Mote
Randy Grams	Mote
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