

Florida Composite Red Tide Vulnerability Index



COMPOSITE RED TIDE VULNERABILITY INDEX (CRTVI): ASSESSING AND COMMUNICATING VULNERABILITY OF COASTAL COMMUNITIES TO RED TIDE IN FLORIDA

PROJECT SUMMARY

Funding Acknowledgements

Current Project



Florida FWC Fish and Wildlife Research Institute

Travel Funding



Related Past Projects



This work was supported by the Florida Fish and Wildlife Conservation Commission Florida Wildlife Research Institute [AWD13967]. Previous work was supported by the West Coast Inland Navigation District [AWD06623, 2020]; the Southwest Florida and Tampa Bay Marine Industries Association; the Gulf of Mexico Coastal Ocean Observing System Regional Association (GCOOS-RA) at Texas A&M University (TAMU) [AWD08253, 2020]; and the University of Miami Cooperative Institute For Marine And Atmospheric Studies [AWD07074, 2020].

Project Team

Economics



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FOR GULF OF MEXICO STUDIES

Project Advisory Committee

Ed Chiles: Owner - Sandbar, Beach House, Mar Vista Restaurants

Sandy Gilbert: Chairman - START (Solutions to Avoid Red Tide)

Richard Stumpf: Oceanographer - National Centers for Coastal Ocean Science

Marcus W. Beck: Program Scientist - Tampa Bay Estuary Program

Barbara Kirkpatrick: Senior Advisor - GCOOS/TAMU

Paul Hindsley: Chief Economist - The Everglades Foundation

John Lai: President & CEO - Sanibel and Captiva Chamber of Commerce

Captain Chris Wittman: Co-Founder - Captains for Clean Water

Anonymous Member: Expert in human geography

Anonymous Member: Industry/Policy representative

Project Background

- **Prior research by project team and growing literature on socioeconomic impacts of red tide events (*Karenia brevis*) in Florida**
 - Commercial fishing, aquaculture, property values, tourism, recreational activity, etc.
 - Many studies are activity-, location-, or event-specific
- **Research has not yet yielded:**
 - Framework for consistent, comparable measurement of socioeconomic impacts across events
 - Framework to assess socioeconomic vulnerability to red tide events
- **Developed the Composite Red Tide Vulnerability Index (CRTVI)**
 - Quantify socioeconomic vulnerability of coastal counties to red tide events in Florida
 - Raise awareness of vulnerability to red tide events
 - Informs decision-making related to preparing for, mitigating, or preventing the negative socioeconomic impacts of red tide events

Project Structure

Development of CRTVI



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graph TD; A[Development of CRTVI] --> B[Development of Visualization Platform]; B --> C[Development of Communication Toolkit];
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**Development of
Visualization Platform**

**Development of
Communication Toolkit**

Development of CRTVI

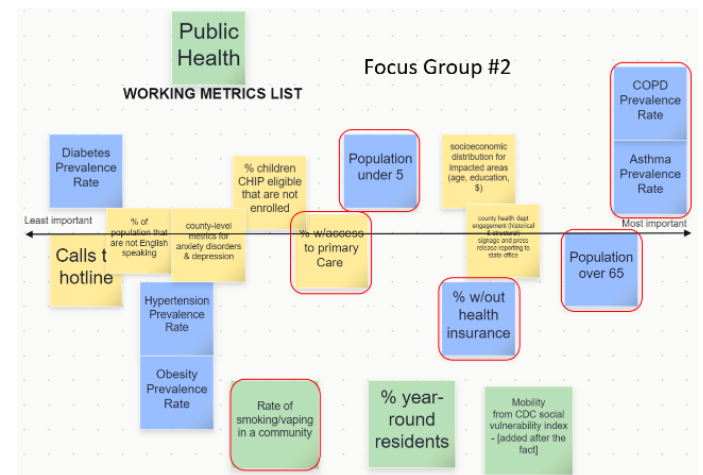
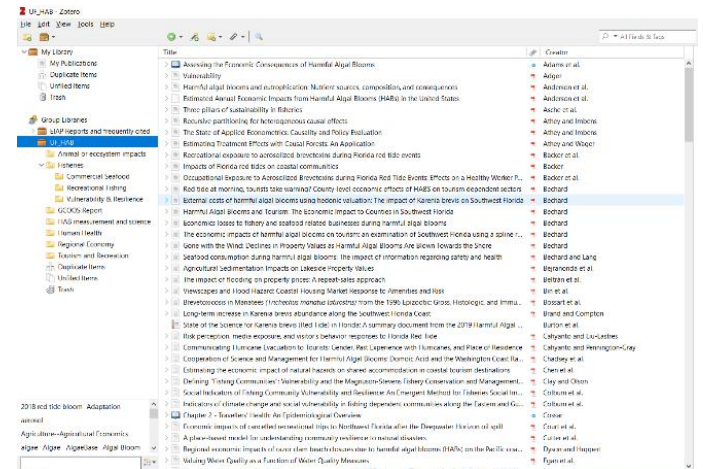
Metric Selection and Refinement

- **Literature Review**

- Completed a scoping literature review to identify metrics of interest across four domains
 1. Public Health
 2. Tourism
 3. Fisheries and Marine Activity
 4. Socioeconomic Vulnerability
- Ongoing effort to complete a systematic literature review in collaboration with UF Libraries

- **Expert and Stakeholder Input**

- Four (4) virtual focus groups with domain-specific experts and Project Advisory Committee
 - Assess metrics of interest identified in literature review
 - Identify additional metrics of interest and potential data sources



Development of CRTVI

Metric Selection and Refinement

30 metrics were selected for inclusion in the CRTVI

Public Health (8 metrics)

- Prevalence rate of asthma
- Prevalence rate of COPD
- Population over 65 years old
- Population under 5 years old
- Percent of population with no health insurance
- Adults who are currently smokers
- Population per primary care provider
- Students who vaped in the past 30 days

Fisheries and Marine Activity (7 metrics)

- Marine economic activity (USD)
- Recreational fishing trips (2 metrics)
- Total estimated value of commercial catch
- Total weight of commercial catch
- Aquaculture lease site occupied acreage
- Registered commercial fishing vessels

Red Tide Exposure (2 metrics)

- Mean *K. brevis* frequency within 12 nautical miles of coastline
- Percent of county population within 1 mile of coast

Tourism (6 metrics)

- Employment in accommodations
- Employment in recreation
- Airbnb properties per square mile
- Employment in food service and drinking places
- Employment in food retail
- Employment in transportation and travel

Socioeconomic Vulnerability (7 metrics)

- Households below 150% of poverty threshold
- Percent of labor force in service industry occupations
- GDP per capita (inverted)
- Percent of labor force not employed
- Per capita income growth (inverted)
- Total GDP (inverted)
- Percent of labor force in extractive industry occupations

Development of CRTVI

Data Collection and Processing

- Where possible, publicly available data were used for the metrics to facilitate future updating of the CRTVI and to allow for generalization to other coastal regions of the United States.
- Data were collected for years 2021 and/or 2022
 - Exception is data for red tide exposure, which captured a longer period of record
- Most metrics were normalized to ensure that the metrics in the CRTVI would not all simply be volume measures strongly correlated with total population.
- Several of the metrics in the socioeconomic domain (such as GDP per capita) were inverted to ensure that higher numerical values correspond to greater vulnerability.
- The final data pre-processing task was min-max standardization of each individual metric to ensure that each metric was on the same scale.
- Results are metrics on a scale from 0 to 1 where 0 corresponded to the minimum value and the least vulnerability, and 1 corresponded to the maximum value and the greatest vulnerability.

Development of CRTVI

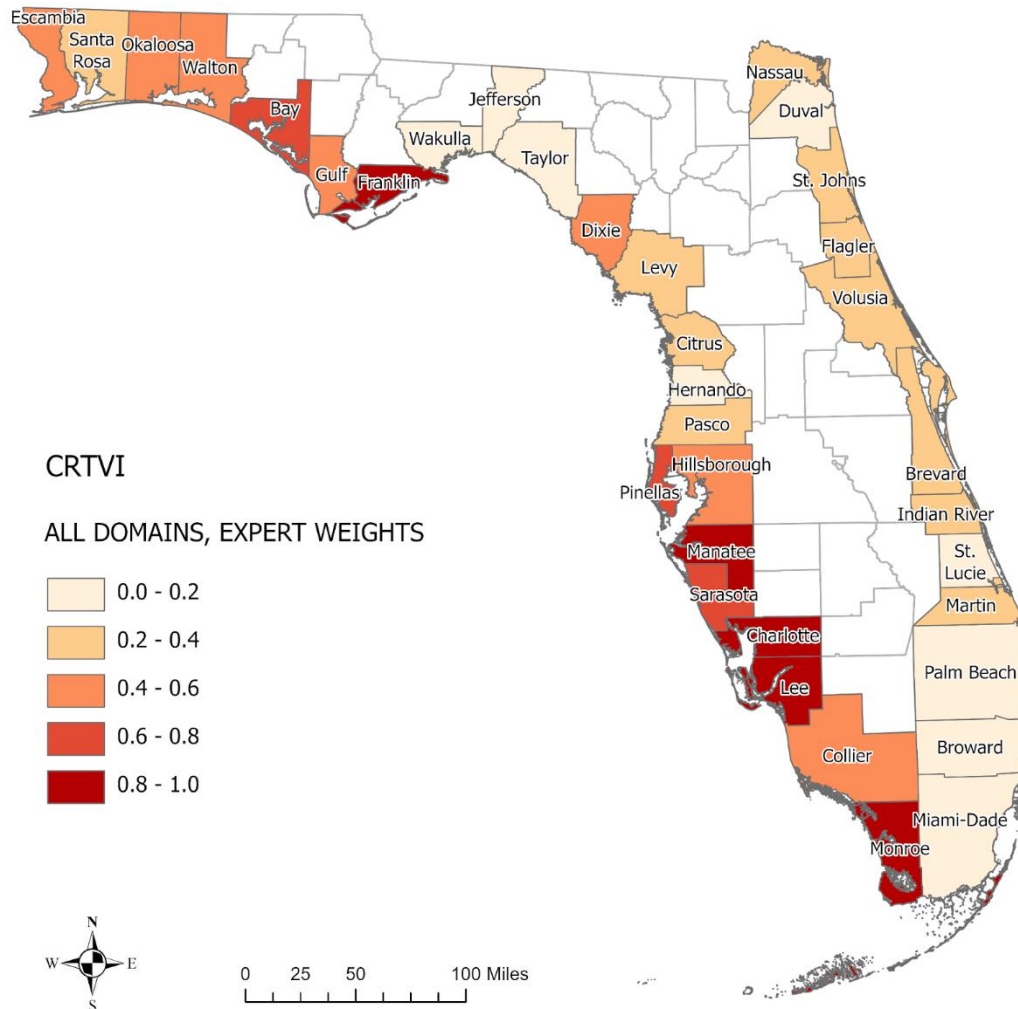
Index Development

- **Data collection, cleaning, and processing for all metrics (e.g., imputation of missing values, normalization, inversion [if applicable], min-max standardization)**
- **Expert and stakeholder input gathered on**
 - Weighting for metrics within domains
 - Weighting across the domains
- **Applied final weighting scheme to CRTVI domains and metrics**
- **Limited quantification of CRTVI to coastal counties**

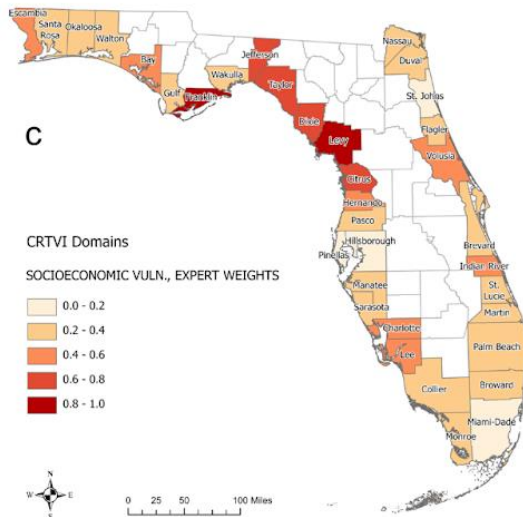
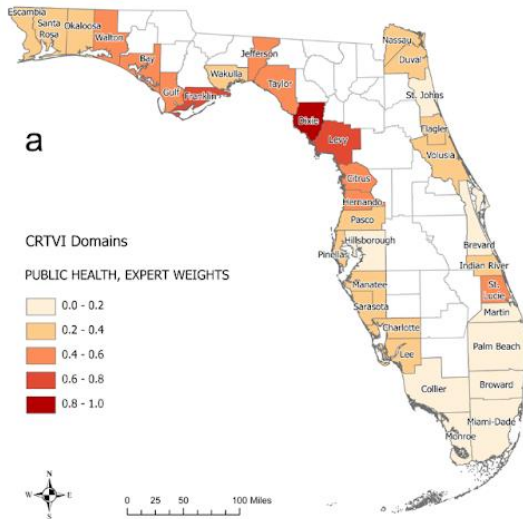
Development of CRTVI

Results

- Counties in southwest Florida, where red tide exposure has traditionally been most frequent, are most vulnerable to the socioeconomic impacts of red tide events.
- Some Panhandle counties that are often exposed to red tide via weather events or ocean currents, are also highly vulnerable to the socioeconomic impacts of red tide events.
- Counties in the Big Bend region of the West Coast and along the East Coast remain vulnerable to the socioeconomic impacts of red tide, even when exposure is less frequent.

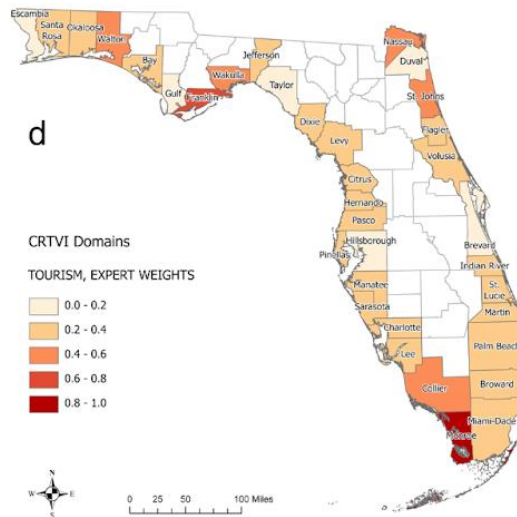
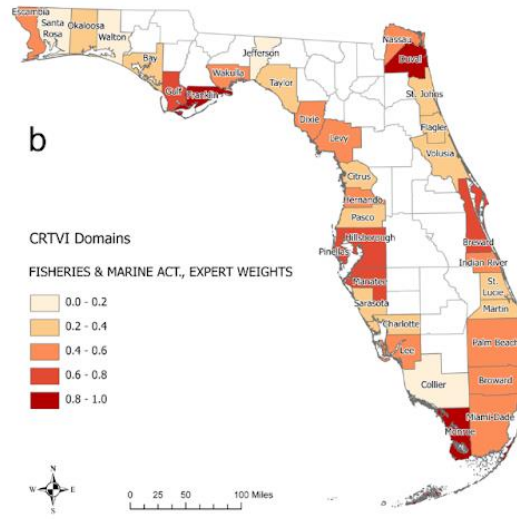


Public Health



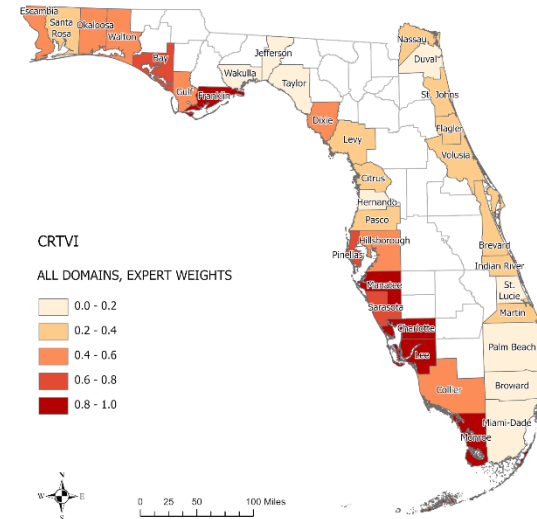
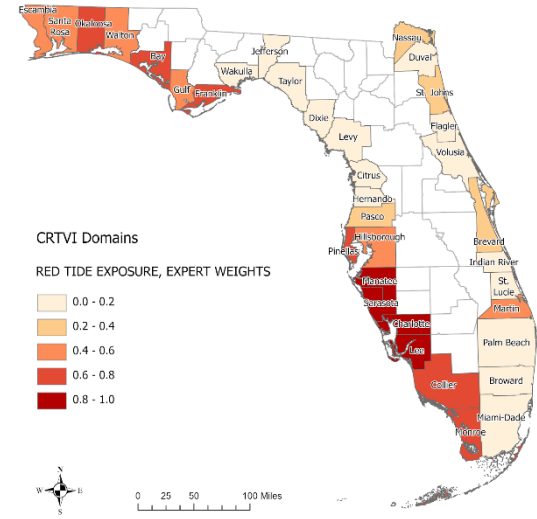
Socioeconomic Vulnerability

Fisheries and Marine Activities



Tourism

Red Tide Exposure

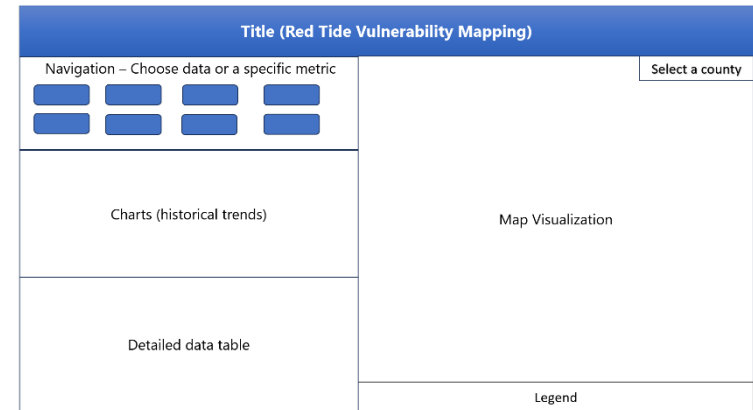


CRTVI

Development of Visualization Platform

WebGIS Design

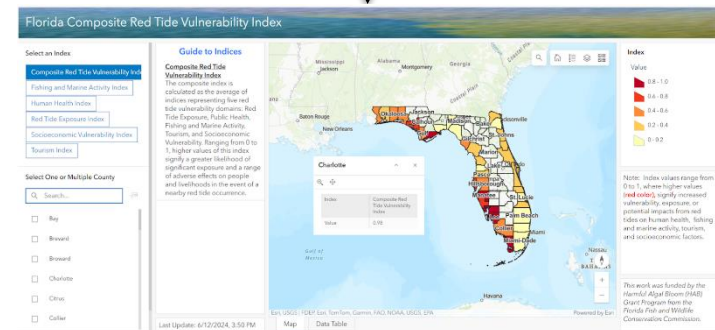
- Project team and project advisory committee assessed advantages and disadvantages of three distinct types of webGIS platforms from ArcGIS Online:
 1. Dashboard
 2. Hub Site
 3. Web AppBuilder
- ArcGIS Dashboard was selected**
 1. Offers concise and straightforward data visualization, which enhances user engagement.
 2. Can be seamlessly integrated with other ArcGIS products or embedded in websites
 3. Features a more user-friendly interface that is accessible to users with minimal GIS expertise.
- Mockup dashboard was designed to demonstrate the proposed user interface and anticipated functionalities and presented to the advisory committee and project team for feedback and further refinement.**
- Dashboard underwent usability testing and was refined based on results.**



Sponsor and Advisory Committee Feedback

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Usability Testing

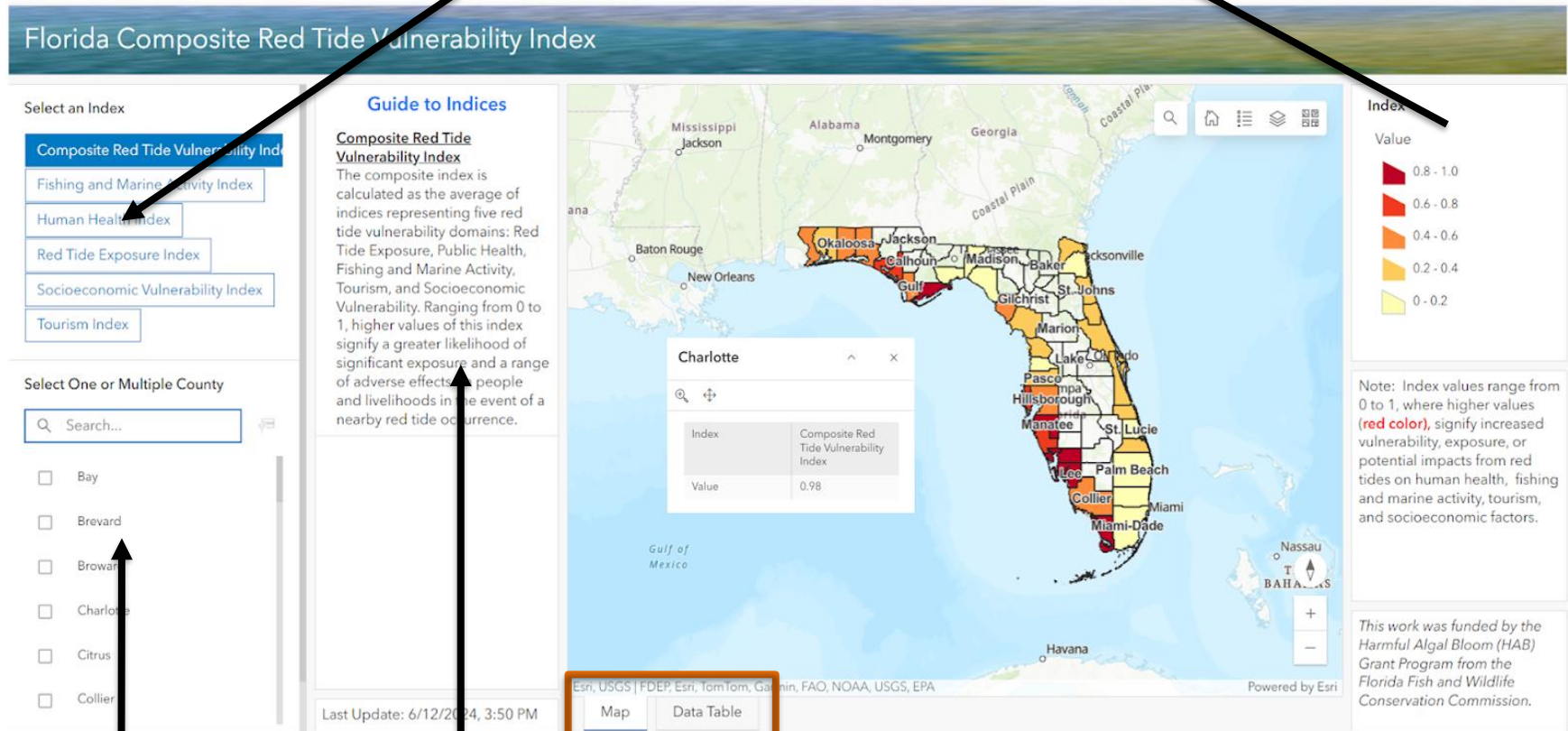


Florida Composite Red Tide Vulnerability Index Dashboard



Composite/Domain-specific
index selection

Index Legend



County Selection

Index Description

Toggle display map and data table

Development of Communication Toolkit

• Issue Guides

1. What is a vulnerability index?
How was the Composite Red Tide Vulnerability Index (CRTVI) developed?
2. Who should use the CRTVI?
Where should they use it?
When should they use it? How can/should the CRTVI be used and why?

• Guidance Documents

1. Policymakers
2. Researchers

Recommendations for Policymakers

Continued population growth and coastal development increases the likelihood and scope of the negative effects resulting from red tide events. The results of this project highlight insights for policymakers related to the socioeconomic impacts of red tide events.

It is recommended that policymakers consider the following:

- ✓ Research on the socioeconomic impacts of red tide events is essential in order to inform the development of appropriate management and mitigation policies.
- ✓ Red tide events can result in negative impacts to many industries. Improving monitoring capacity is fundamental to understand, control, and mitigate the effects of red tide events.
- ✓ Public education and outreach are critical. Communities need access to accurate and reliable information during red tide events to assess potential risks and reduce harmful impacts.
- ✓ Actions to reduce the excess loads of nutrients within freshwater and coastal systems can make conditions less favorable for event intensification and persistence.

Accurate estimates of the socioeconomic impacts of red tide events can inform discussions surrounding policies aimed at decreasing the frequency and intensity of red tide events. The diagram below illustrates opportunities for policymakers to make a difference.



*Diagram adapted from: Proceedings of the Workshop on the Socio-economic Effects of Harmful Algal Blooms in the United States. (2021, March). U.S. National Office for Harmful Algal Blooms, Woods Hole Oceanographic Institution.

Suggested Citation:

Court, C.D., S. Anderson, A. Ceballos, K. Coffey, J. P. Ferreira, S. Honeycutt, J. Kim, A. Lindsey, K. McDavid, X. Qiao, A. Ropicki, B. Saha, O. Savchenko, R. Telg, D. Yaskovitz. 2023. What should policymakers know about red tide events in Florida? Guidance document prepared for the Gulf of Mexico Coastal Ocean Observing System Regional Association at Texas A&M University (AWD08253, 2020). Food and Resource Economics Department, Institute of Food and Agricultural Sciences, University of Florida. Gainesville, FL.



Next Steps

- **Complete approvals and public dissemination of CRTVI project outputs**
- **Continue disseminating information about the CRTVI to a variety of audiences.**
 - Academic
 - Local-, State-, and Federal Government
 - Non-Governmental Organizations
 - General Public
- **Continue exploring opportunities to use an interdisciplinary and community-engaged approach to assessing and translating the socioeconomic impacts of harmful algal blooms**

Ways to Engage

- UF/IFAS EIAP Harmful Algal Bloom Research (under construction)



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- Temporary version of CRTVI Dashboard

