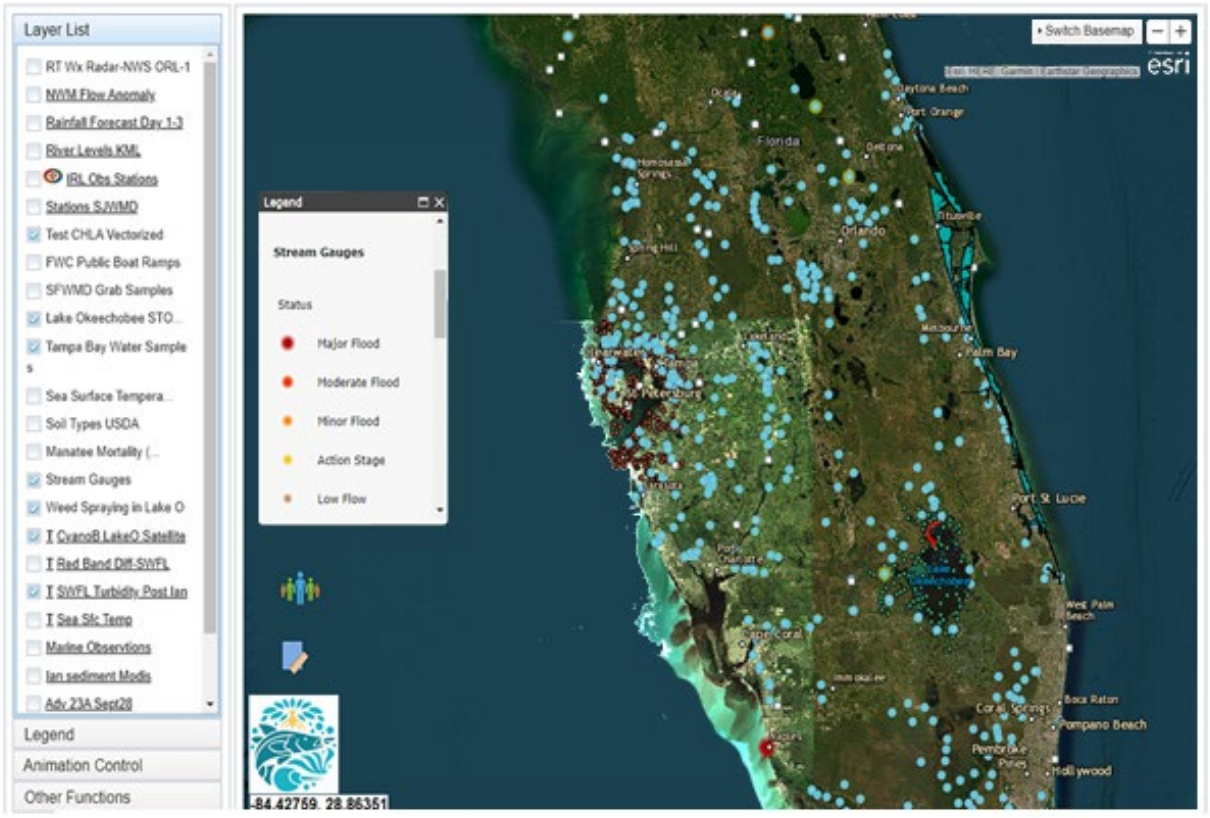
INV 13 Final Report:
Integrating Harmful Algal Bloom (HAB) Data Access Across Platforms and Establishing a Virtual HAB Information Center.



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Acronyms

C-COP Collaborative Common Operating Picture
DOH- Department of Health
ESRI – Environmental Systems Research Institute
FAU – Florida Atlantic University
FAU-HBOI – Florida Atlantic University Harbor Branch Oceanographic Institute
FDACS – Florida Department of Agriculture and Consumer Services
FDEP – Florida Department of Environmental Protection
FFWCC – Florida Fish and Wildlife Conservation Commission
FWRI - Fish and Wildlife Research Institute
GC® – GeoCollaborate
GIS – Geographic Information Systems
INV – Innovative Technology Grant
IRL – Indian River Lagoon
IRLNEP – Indian River Lagoon National Estuary Program
QAPP – Quality Assurance Project Plan
QAQC – Quality Assurance and Quality Control
REST – Representational State Transfer
SaaS – Software as a Service
SCCI – StormCenter Communications Inc.
SFWMD – South Florida Water Management District
SJRWMD – St. Johns River Water Management District
SWOT – Strengths, Weakness, Opportunities and Threats

Project Background:

Florida has experienced severe and long-lasting harmful algal blooms (HABs) of multiple microalgal and cyanobacterial species in fresh, estuarine, and nearshore oceanic waters. The spatial and temporal variability of these HAB events, coupled with a diverse array of taxa have presented a number of challenges to the effective, timely and accurate communication of bloom conditions, trends and potential human and ecological health risks.

Florida's leading experts and scientists on the Florida Blue-Green Algae Task Force and Harmful Algal Bloom Task Force have highlighted the need for more effective water quality monitoring, data sharing, enhanced coordination among multiple stakeholders and improved communication with citizens and community leaders. To address these needs, the State of Florida created a dedicated website and a statewide dashboard to communicate the status of HABs statewide. This website includes the Blue-Green Algae Task Force Consensus Document #1 (Donaldson, 2019) as well as annual updates of Progress and Recommendations Regarding Red Tide (*Karenia brevis*) Blooms issued by the Florida Harmful Algal Bloom (Red Tide) Task Force (2021).

Preparation and submission of the innovative technology proposal to FDEP by the IRLNEP and partners was initiated after many interagency discussions about how to respond to intense, long-duration and expansive HABs impacting the Indian River Lagoon, FL that began in 2011 with a pico-cyanobacteria bloom (now referred to as the "super bloom"). In 2012 an intense bloom of *Aureoumbra lagunensis,* commonly referred to as the Texas Brown Tide, was recorded for the first time in the Northern IRL. 2013 blooms were marked by intense and long-lasting cyanobacteria blooms in the southern IRL associated with freshwater releases from Lake Okeechobee. In 2015-2016 the IRL was impacted by an intense nano-cyanobacterial bloom that transitioned into a large, intense and long-lasting bloom of *Aureoumbra lagunensis.* The collapse of the bloom in March-April 2016 caused one of the most extensive fish mortality events on record for the Banana River section of the IRL, causing great concern among IRL residents and policy makers and attracted international media exposure.

Although local, state and federal agencies mobilized quickly to respond to the fish mortality event, interagency partners recognized the need for enhanced data sharing, operational coordination, communication, and collaboration in advance of HAB events, during the events and during event recovery. Immediate action was taken to form an IRL HAB working group of scientists, resource managers and agency representatives to communicate on a regular basis about water quality conditions throughout the IRL system. This group assembles on a Zoom call monthly to report water quality conditions. During intense bloom and/or fish mortality events the group assembles weekly or as needed to share data and on-the water conditions.

The 2016 bloom and fish kill brought increased awareness for the need to evaluate opportunities for enhanced data sharing and communications among inter- and intra-agency staff and the general public. Ongoing discussion with Department of Health (DOH), Florida Department of Environmental Protection (FDEP), the Water Management Districts (SJRWMD and SFWMD), and local/state governments recognized the need to evaluate available technologies that might enhance data sharing and communication of disparate data sets, collected across multiple agencies.

This FDEP Innovative Technology Grant Proposal (INV #13) was a partnership among the IRL Council-IRLNEP, SJRWMD, Florida Atlantic University – Harbor Branch Oceanographic Institute (FAU-HBOI), and StormCenter Communications Inc. (SCCI). SCCI was chosen as a proposal partner to evaluate their GeoCollaborate® technology developed through the federal Small Business Innovation Research Program (SBIR) to meet a grand challenge by NASA and later awarded NOAA SBIR Phase III sole source contracts. The GeoCollaborate® Software as a Service (SaaS) application provides real-time, map-based, trusted data visualizations, data sharing, and synchronous collaboration across disparate systems and platforms. It creates a collaborative common operating picture (C-COP) that provides superior situational awareness to guide quicker, more relevant decision making. GeoCollaborate is being used effectively to:

- share data from disparate sources to improve situational awareness and decision-making related to tropical cyclones and the transportation, emergency management, utility, and supply chain industries (the All-Hazards Consortium).
- identify gaps in buoy data to improve hurricane intensity and track forecasting for NOAA.
- identify wildfire burn intensities, fire perimeters, vegetation, and fuel moisture content and more and deliver critical information to responders and communities of practice.
- monitor global flood events and drive exercises delivering new flood inundation mapping layers into states to improve response and the protection of life and property.

The technology had not been applied to nearshore water quality and harmful algal bloom data as a means for enhancing data sharing and operational decision making.

This funding award was an opportunity to test a technology that had been through the rigorous small business innovative technology funding process while leveraging previous federal investments. The project team wanted to test GeoCollaborate (GC) to determine if the technology could be useful when applied to HABs. GC has proven its utility for situational awareness and communication in weather events and emergency response. Over the course of the project, HAB data proved challenging to work with due to the inherent difficulties around the quality of HAB data spatially, temporally, and

taxonomically; as well as accessibility issues of data being available from agencies and other organizations.

Project Location

The IRL spans 156 miles of the east-central coast of Florida. Seven Florida counties are included as part of the IRL watershed (Volusia, Brevard, Indian River, St. Lucie, Martin, Okeechobee, and Palm Beach Counties) as shown in Figure 1. The Florida Department of Environmental Protection Agency (FDEP) Innovative Technology Grant (INV) #13: Integrating Harmful Algal Bloom (HAB) Data Access Across Platforms and Establishing a Virtual HAB Information Center project was delivered using water quality data collected from various sources and at various spatial and temporal scales throughout the Indian River Lagoon (IRL) and the State of Florida. The IRL Council, sponsor of the Indian River Lagoon National Estuary Program (IRLNEP) was the lead for this project. Members of the project team included StormCenter Communications Inc. (SCCI), the St. Johns River Water Management District (SJRWMD), and Florida Atlantic University – Harbor Branch Oceanographic Institute (FAU-HBOI). Powered by GeoCollaborate (GC®) and building on previous investments by the Department and other agencies, the project tested whether a HAB Information Center could be feasible for interpreting, communicating and collaborating trusted HAB data with the goal of enhancing monitoring and response efforts, aiding science-based decision-making, reducing the spread of misinformation, and helping to sustain economic use of unimpacted areas.

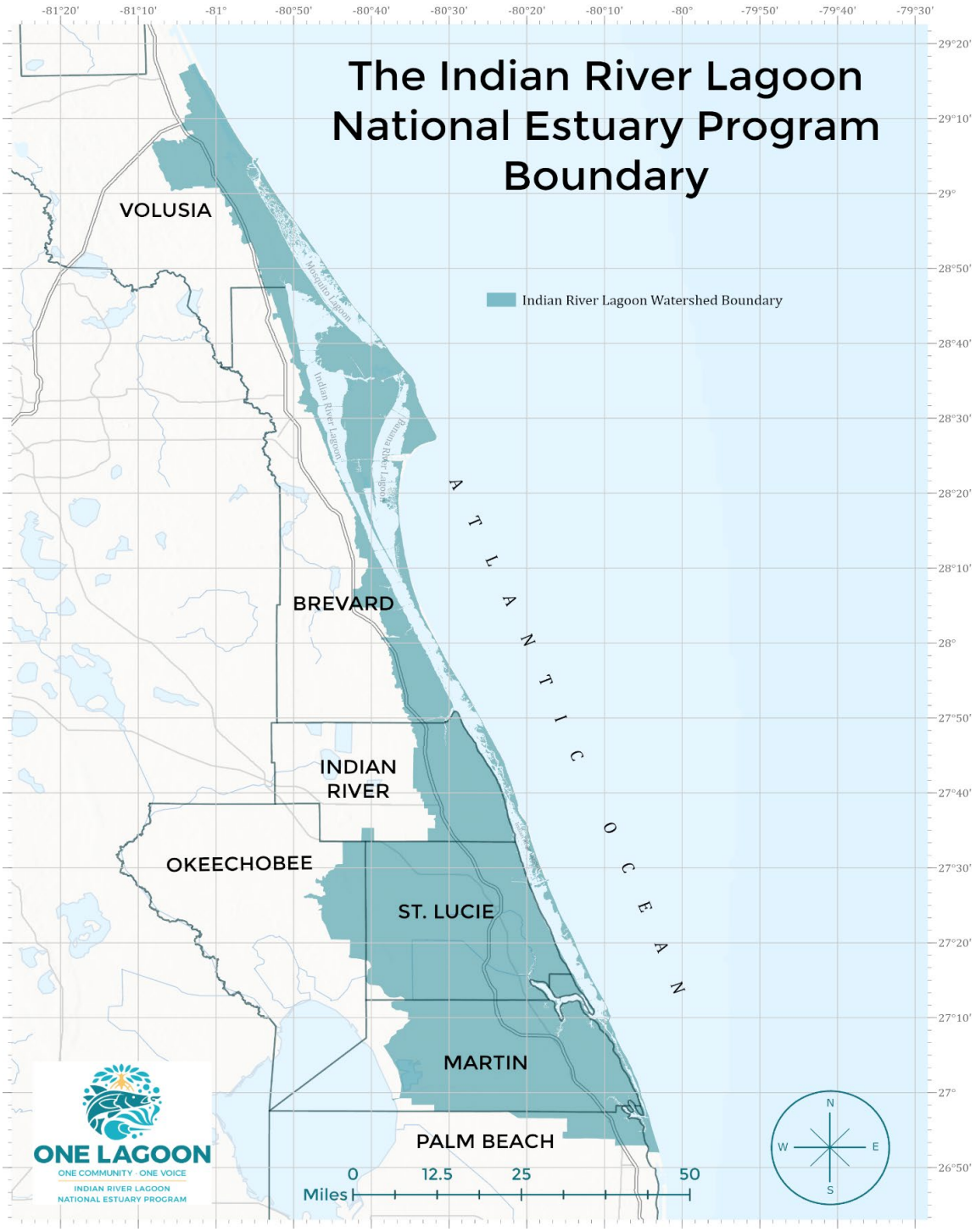

Figure 1: MAP OF INDIAN RIVER LAGOON WATERSHED BOUNDARY: A figure showing the jurisdiction of Indian River Lagoon Council and Indian River Lagoon National Estuary Program (IRLNEP). The 156-mile watershed includes the three sister waterbodies of the IRL system including Mosquito Lagoon, Banana River Lagoon, and the Indian River Lagoon.

Summary of Activities Completed by Task:

Each of the deliverables and activities by task were reported and submitted to FDEP. Quarterly reports are available here. Each of the task orders were detailed with support documentation and are also available here. Below are bulleted lists of activities completed by task:

Task 1:

- Electronic copies of the initial GeoCollaborate Instance and grant procurement documentation dated May 21, 2021.
- Agenda and attendance log for all meetings and conference calls occurring from May 24, 2021, to August 18, 2021, are available here.
- Quality Assurance Manual. Version 1 dated October 29, 2021, Revision 1 dated December 6, 2021, Revision 2 dated January 21, 2022, and Revision 3 dated February 21, 2022. Final Version of the Quality Assurance Manual can be found here.
- Summary report for completed items in this task including a description of purchases for setup of the IRL Council/IRLNEP GeoCollaborate lab and feedback from the initial GeoCollaborate instance and session demonstration. Submitted on October 29, 2021. Summary Report for the Task One deliverable is available here.
- Signed acceptance letter from the GIS IT Coordinator hired by the IRL Council signed on May 13, 2021.

Task 2:

- Summary report that identifies the data providers, data types, periods of record and other relevant metadata, and includes statements of data usability relative to the criteria defined in the QA Manual, submitted on January 28, 2022. The Task 2 report is available here.
- Summary report detailing testing results, the preliminary use cases and the communication methods, documentation of HAB/Water Quality data set test collaboration sessions and feedback from each activity, submitted on January 28, 2022. Summary Report for Task Two deliverable is available here.
- Copy of subcontracts (IRL2021-06 executed May 4, 2021, IRL2021-07 executed June 2, 2021), list of stakeholders that received case studies, and copies of case studies submitted on January 28, 2022. A list of subcontracts is available in Appendix B.

Task 3:

- A total of 10 demonstrations were performed during this task. The required eight GeoCollaborate sessions using the two instances were delivered to IRL stakeholders and the general public, as evidenced by copies of agendas, attendance lists, and presentations for each session. Sessions were completed on December 6, 2021, January 6, 2022, at 10am, January 6, 2022, at 2pm, January 10, 2022, April 14, 2022, at 10am, April 14, 2022, at 2pm, April 15, 2022, at 10am, and April 15, 2022, at 2pm. Two additional training sessions were conducted on July 26,2022 and July 28, 2022. Videos and PowerPoint presentations of each of those webinars and workshops are available as links in Appendix A.
- A summary report and presentation to Department staff summarizing the outcomes of the first three tasks was submitted to FDEP for review and comments. This was completed on May 20, 2022. Reference Appendix C for PowerPoint.

Task 4:

- Two GeoCollaborate sessions showcasing statewide HAB data were presented to state agency leaders and other key partners and stakeholders. A copy of the attendance list for both sessions is available in Appendix B. Task 4 sessions were completed on December 12, 2022, and December 13, 2022. Task 4 Summary Report is available here.
- Once approved by FDEP, a copy of the final report will be available online. Paper copies of the final report are available upon request.

Project Description and Timeline:

The IRL Council, an independent special district of the State of Florida, served as the "Grantee" and project administrator for this project and utilized GeoCollaborate®, an innovative technology developed by StormCenter Communications Inc. The team unified data from providers, portals, hubs, and websites to create a unique collaborative environment that enhanced data sharing, data analysis, decision-making, and communications. GeoCollaborate is a patented means to access and share data in disparate formats across platforms and devices. It translates these disparate data into effective communication to stakeholders such as agencies, public health officials and scientists proactively and synchronously.

The project initially configured GeoCollaborate using data from the IRL to help identify, monitor, and respond to HABs, in addition to exploring data to identify conditions that are conducive to blooms. Once the IRL demonstration phase was completed, GeoCollaborate was next applied to other datasets from around Florida. The team worked closely and communicated regularly with the FDEP, the Fish and Wildlife Research Institute (FWRI), Florida Fish and Wildlife Conservation Commission (FFWCC), Florida's water management districts (SJRWMD and SFWMD), Mote Marine Laboratory, other National Estuary Programs in Florida (i.e., Tampa Bay, Sarasota Bay and Coastal & Heartland),

Florida's three National Estuarine Research Reserves (i.e., Apalachicola, Guana-Tolomato Matanzas, and Rookery Bay), NOAA, and other data holders as applicable to integrate trusted data that highlighted scalability and demonstrated how a model HAB Information Center for the State of Florida could work.

Table 1: PROJECT TIMELINE:

Due to 508 compliance requirements, Table 1 was removed from this document. To access the full document, which does not meet 508 compliance standards, please reach out to InnTech_HAB@FloridaDEP.gov

Grant Award Amount and Financial Summary:

Table 2: ORIGINAL BUDGET BY TASK:

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Two Change orders were authorized during the term of this agreement. Reference Table 3 for both change updates. The first Change Order was executed on February 15, 2022. This order changed the hourly rate found in Attachment 3, Grant Work Plan, Salary, and Fringe Benefits by Task from $31.25 to $33.62. Changes to Budget Category or Funding amount per task were not made. The second change order was executed on October 25, 2022. This change order moved unused funds from prior task's budget categories to Task 4 budget categories. The revised Attachment 3, Grant Work Plan, Budget Detail by Task is reflected below in Table 3. Added to Table 3 is a column showing the actual expenses incurred for each budget category by task for this project.

Table 3: UPDATED BUDGET BY TASK EXECUTED ON OCTOBER 25, 2022:

Due to 508 compliance requirements, Table 3 was removed from this document. To access the full document, which does not meet 508 compliance standards, please reach out to InnTech_HAB@FloridaDEP.gov

*Anticipated costs incurred. At the time of submission of this report not all subcontractor invoices have been received, but the entire amount is expected.

Concurrent with this FDEP project, the IRLNEP has developed a draft One Lagoon Comprehensive Monitoring Plan with contract support from Dr. Dennis Hanisak (Hanisak & Heuberger, 2021). This document is available in draft format and is in peer-review by the IRLNEP Management Conference. The document shows that over 70 organizations are actively collecting data about the Indian River Lagoon's water quality, HABs, seagrasses, benthic and surface stations, etc. Each of these datasets has different temporal scales. Some data are collected discretely, bi-weekly, monthly, quarterly, annually, and some are

continuous. The project team recognized early in the contract process that combining data from multiple organizations is complex and labor intensive. Datasets from data collectors have varying levels of QAQC. Some data collectors are hesitant to share both raw and metadata due to publishing timelines and ownership interests. The project team discovered that it was difficult to find datasets in geospatial formats (OGC compliant) that GC could display, and little data was available without additional configuration.

To fulfil the need for a data sharing and communication platform, agency staff must go through data trustability or QAQC methods prior to publishing and housing data for any geospatial platform, including the GC application. In the past, this has resulted in inordinately long review times of datasets before publication and has hampered efforts for data sharing. Once data has been QAQC, published and housed with geospatial coordinates in a REST Endpoint, then sharing through technologies such as GC works very well for HAB data.

The GIS/Data Coordinator obtained agency and academic data from SJRWMD, SFWMD, and FAU-HBOI, then performed data QAQC and intensive data analysis to combine those datasets with different spatial and temporal scales. With the assistance of the SJRWMD, Kriging methods with longitudinal elongations were performed to identify areas of interest or hot spots within the past 15 years (See Figure 2 as well as this website for animations). The interpolations for these long-term datasets helped create a visual story for the implications of HABs in the IRL.

Project Schedule vs. Activity Completion:

All project deliverables were completed on schedule with two exceptions. The first was the approval of the Quality Assurance Project Plan (QAPP) due to multiple comments and edits from review by FDEP staff. Next, the summary report and presentation to Department staff summarizing the outcomes of the first three tasks was delivered after the Task 3 due date. The project team had FDEP staff in attendance for the first two webinars/ instances and assumed completion of the deliverable, but the FDEP contract staff requested a separate presentation and that occurred after the task deliverable timeline. A minor change that should be mentioned was the delivery of the Final Statewide Instance, which was pushed back a month due to the repercussions of Hurricane Ian. The deliverable of the final instance was still within the project Task timeline.

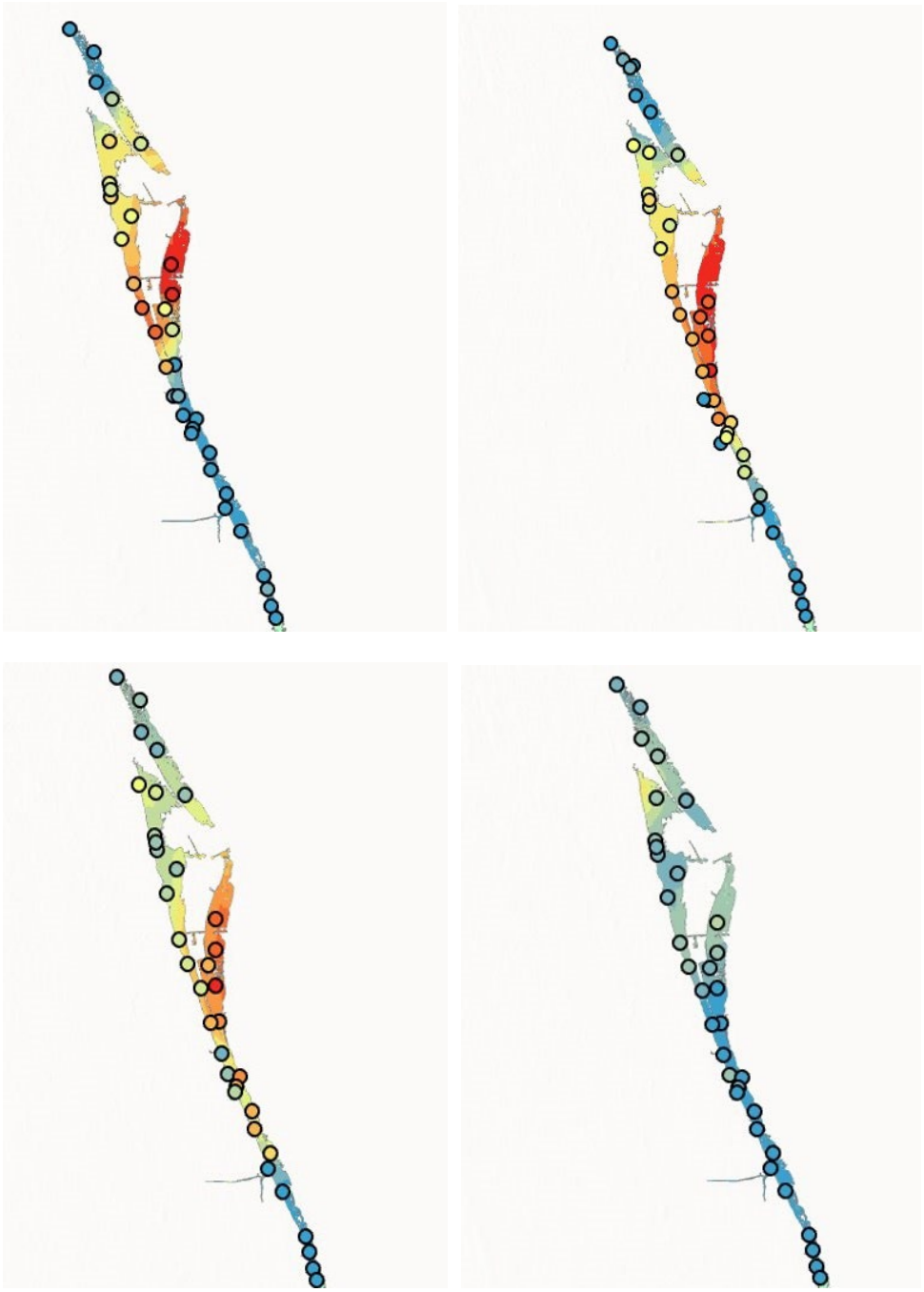


Figure 2: MONTHLY INTERPOLATIONS OF CHLOROPHYLL-A FROM JANUARY TO APRIL 2016 FOR THE *AUREOUMBRA LAGUNISIS* BLOOM: The figure above shows standard kriging methodologies with longitudinal elongation. For access to these models and animation utilized visit here or the OneLagoon Data Hub.

Defining Opportunities and Strengths, Addressing Weaknesses and Threats

As a team, IRLNEP, SJRWMD, and FAU-HBOI conducted a Strength, Weakness, Opportunities, and Threat (SWOT) analysis to evaluate the utility of GeoCollaborate and the results of the INV 13 project, Communicating Harmful Algal Blooms. SWOT analysis has become a fundamental tool for organizations to analyze internal and external environments of organizations during times of indecision (Benzaghta et al, 2021; Rozmi et al., 2018; Wu 2020). By using a SWOT analysis, the INV 13 project team discussed the anticipated benefits, situational issues, pressures, and examined how GC would be the most beneficial for communicating HABs.

Strengths

- Brings disparate data types from different data providers together.
  With a subject matter expert (leader), trusted geospatial datasets from disparate locations and multiple providers can be identified, brought together, and shared synchronously in GC. GC enables cross-platform synchronous collaboration without having to rehost geospatial datasets. This is beneficial because it can unify disparate datasets together on one map in one instance and users (followers) don't need to spend inordinate amounts of time searching for the trusted relevant data. Without GC, sharing multiple datasets from multiple providers would entail having many tabs open in a leader's browser or having a GIS professional organize data for presentation prior to the meeting. GC can quickly showcase datasets by accessing a geospatial dataset's Representational State Transfer (REST) endpoint.

- Provides a robust web-based tool for Media communications and coverage.
  GC's ability to combine and showcase highlighted trusted data that can be automatically updated in a dashboard is advantageous for media. GC contains a full-screen background option for viewing datasets and the ability to show logos, names and titles in headers and footers. The setup of the dashboard lends a polished, professional look to a leader's presentation of data, similar to what one would find during a television broadcast. Thus, potentially seamless integration with news media. The leader of an instance has the ability to determine exactly which datasets to highlight and allow media to access in a single URL location. During Hurricane Ian (October 2022), the GC dashboard was utilized for this purpose and provides a prime example of how GC may be used to communicate emergency situations and plan for emergency responses.

- Maintains original symbology.
  Another strength of GC is that it maintains the original symbology and appearance of geospatial data. The reason this is beneficial is that once standards are in place, there can be no tampering or altering the appearance of datasets. This assures original ownership and maintains the original owner's integrity of the data and intent on how the data should be represented.

- Works extremely well in low bandwidth environments.
  GC was created to work on all devices with internet access. This is useful when accessing GC from a device other than a computer, when Wi-Fi signals are poor or unstable, and when multiple users are accessing a single network. The capability to work well in low bandwidth environments is beneficial for those that may be out in the field during an emergency response event like a HAB.

- Allows for unlimited followers.
  GC has a unique scalability addition which allows for unlimited participants or "followers" accessing the session URL at the same time.

- Provides a Graphics and Drawing tool.
  One of the original recommendations from the IRLNEP and project team was altering and enhancing GC's animation tool. Once revised, the graphics and drawing tools enable areas of importance to be highlighted with points, lines and polygons and geospatial messages can be issued across all followers instantaneously in association with those areas.

- Manages datasets.
  When utilizing GC, the leader manages all datasets included in an instance and decides which are fed to followers of the session. This password-protected functionality ensures the leader maintains control of a meeting and can direct followers to specified areas of interest or concern. The followers can explore any data provided and may interact with any dataset in the session or afterward in the dashboard.

- Provides upgrades and maintenance.
  Any plugins, upgrades, maintenance, and system administration are handled by SCCI. This enables users to concentrate solely on communicating and presenting data rather than focusing on back-end development tasks. This saves staff time because web maps and service upgrades are not handled by the user.

- Expands the network of communication between data providers and partners in the IRL.
  The GeoCollaborate project expanded the network of communication between stakeholders involved with HABs in the IRL. Conversations regarding data accessibility and availability were held with SJRWMD, SFWMD, FFWCC, FAU-HBOI, FDEP, Florida Department of Agriculture and Consumer Services (FDACS), the five counties bordering the IRL, and other stakeholders. The IRLNEP/ IRL Council is viewed as a trusted, honest broker, thus enabling frank conversations about data issues and facilitating solutions for a variety of potential roadblocks and data gaps. These experiences were the most crucial steppingstones for obtaining geospatial data and overcoming hesitance to share HAB data. One very encouraging sign was the intense interest among agencies and local governments in the GC project and the

potential for improving how data could be accessed and shared to respond to HAB conditions and communicated among the partner networks.

Weaknesses

- Lacks license agreement.
  First and perhaps most importantly, SCCI does not currently use any form of licensing agreement. A license agreement is a written contract that permits a third party to use intellectual property, in this case GeoCollaborate, subject to certain conditions (Kemp, 1987). GC is patented which would prevent copyright infringement, however having a standard agreement between licensor and licensee is preferred to prevent copyright infringement or any misuse of software.

- Lacks geoprocessing or analytical tools.
  GC was originally created to bring datasets together into a single platform without altering the appearance of those datasets. The SCCI business plan works well for established atmospheric data that has unified standards (symbology, measurements, explanations etc.) and has fast turnaround times for predictions with weather. However, HAB science has not reached the point where predictions can be reliably made about potential bloom longevity, intensity or other factors. To use GC as a communication platform for HAB data, spatial analysis functions need to be built into the platform functionality. This includes symbology changes, calculations, standard error predictors, etc.

  Every agency errs on the side of caution because there is a concern with QAQC for operational data. HABs are complicated, spatially, temporally, and taxonomically. In order to make data usable there are complex factors in datasets that must be considered before making them operational. Trustable data for HABs needs to be the best data available. HABs could cause human health, safety and welfare threats. Currently, GC lacks the ability to geoprocess or analyze HAB datasets in order to keep available data in an unmodified form. It thus falls on agencies and other data providers to format data so that it can be displayed in geospatial formats.

- Lacks ability to show time-enabled data.
  GC does not contain the ability to show temporal data. Time-enabled data is crucial for HABs because phytoplankton monitoring in the IRL has mostly relied on *in situ* chlorophyll-*a* fluorescence via deployed or adaptive instrumentation (Lopez et al., 2021). These instruments have varied time scales, but time is a key factor for identifying bloom initiation and senescence. As part of the project, the GIS coordinator developed a time series visualization of water quality data as an aid to understanding the long-term datasets; however, this animation could not be displayed in GC. For other use cases, temporal datasets may not be crucial but for HAB data, additional time-enabled visualization technology would need to be added to GC to improve overall utility.

- GC business model is geared towards large agencies.
  GC costs approximately $20,000 per instance (URL) for the first year and $10,000 thereafter annually. This falls out of the budget range for smaller organizations that are not responsible for emergency operations and response. During webinars, there was ample interest from academics, non-profits, smaller for-profit organizations, and local governments regarding utilizing and gaining access to GC. It may be a future opportunity for SSCI to rethink their offerings and adjust their pricing structure to attract smaller organizations to utilize GC as their data sharing platform.

Opportunities

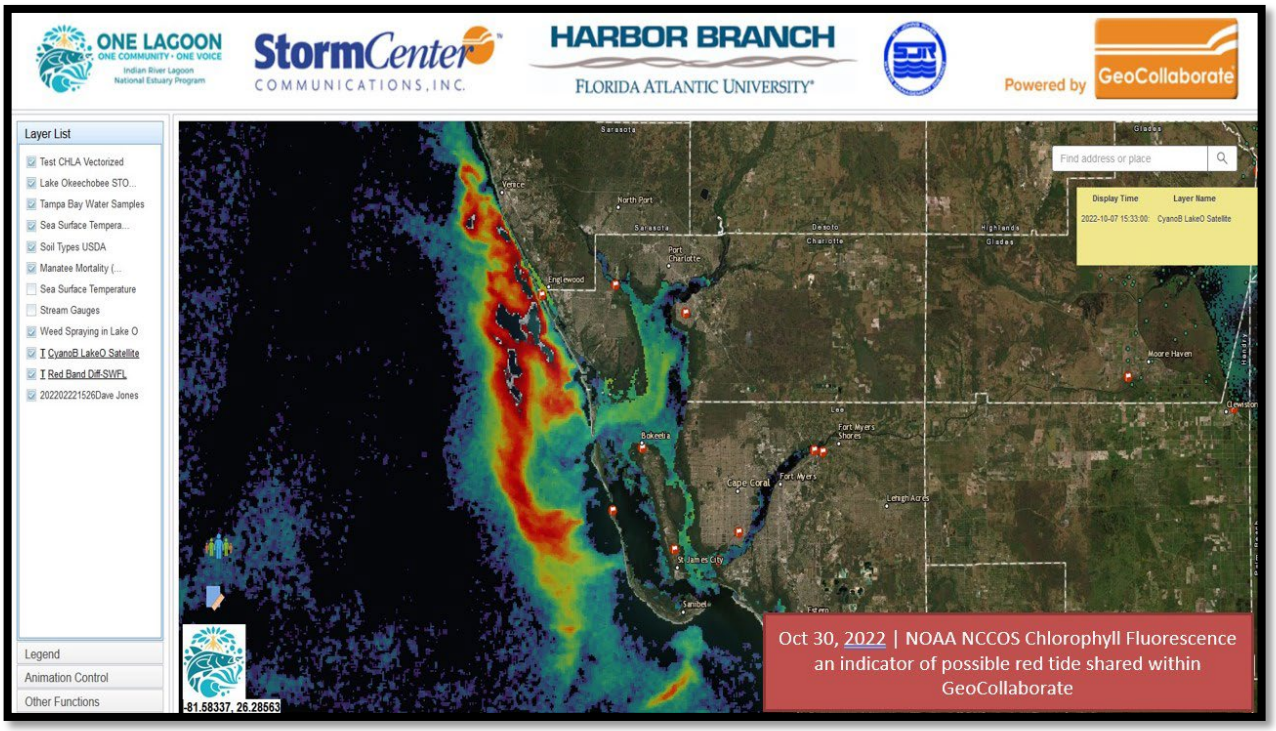
- Emergency response and recovery.
  GC is highly beneficial for emergency response and recovery management. During Hurricane Ian and Tropical Storm Nicole
  (October 2022), SCCI utilized GC to give live updates and coverage of both storms' projections. Information included windspeed and direction, radar, buoys, and aerial imagery. It was very impressive and gave the IRLNEP project team a high degree of confidence that GC could be particularly useful for coordination during emergency situations when agencies would be coordinating a regional or statewide response.

- Agency-prepared datasets.
  As the purpose of the project was to explore GC's utility for accessing, sharing and showcasing datasets regarding communicating HABs, the platform was somewhat hampered in its usefulness due to limits on the data being provided. Data providers are the limiting factor in the quantity and quality of HAB data that gets released. While all participants in data sharing for this project saw the utility of the GC platform in utilizing data, there were QAQC issues encountered to get data to a trustable state, to share it in a timely manner, and to work through agency concerns about making data available intra- or inter-agency and to the public. Agencies will need to consider their data QAQC processes and sharing policies to bring more of the right data to a place of trustability and accessibility before platforms like GC can be fully utilized in addressing HABs. Having GC available does highlight the benefits of connecting people in a real-time data sharing and collaboration environment and is a strong motivator for data providers to establish their geospatial data infrastructure such that more agency data can be put to work serving citizens and decision makers.

- Adding datasets to GC.
  SCCI's staff showed great willingness to work with end-users about accessing and displaying a wide range of hosted geospatial datasets. They have addressed concerns about data formats by adding, and continuing to add, to the library of data types GC accesses and shares. They have provided advice about various methods to bring data to a trustable state for use. This expertise was invaluable throughout the

project and would be an asset in moving state agencies forward in their abilities to host and share data amongst themselves, with the media and with the public. An example of this was accessing the Sentinel-3 satellite data from NOAA's NCCOS data portal as a GeoTIFF, reformatting it and offering it as a web map tile to be unified with other map and data products. Below is an example of the GC-enabled image of a possible Red Tide event off the FL SW coast.

Figure 3: AERIAL AND MODELED IMAGE OF RED TIDE OFF THE COAST OF TAMPA, FL.



- <u>Making data serviceable is potentially a large, labor-intensive task.</u>
  Given the current state of HAB data in Florida, it is potentially a large and staff-intensive task for data providers to prepare data for sharing in geospatial platforms such as GC. GC can only be utilized when data has reached a level of trustability, has been prepared and formatted for sharing and made available so it can be accessed. Data used for assessing HABs include water quality data such as temperature, nutrients (TN & TP), salinity, pH, Chlorophyll-a, algal cell count data, and other datasets. These measurands are processed only for a specific location, meaning one point at a unique latitude and longitude within a system. Whether dealing with *in situ* measurements or grab samples, it takes time to analyze those results and apply appropriate QAQC methodologies.

  HABs are dynamic, shifting, and organic. Meaning, by the time a sample has been analyzed and undergoes QAQC, the bloom could have moved laterally in a system,

moved vertically in the water column, died off, or another bloom species could have become dominant (Phlips et al., 2021). Due to this complexity, the current measurement and QAQC time frame is not quick enough to make use of the dynamic changes and shifts that occur during these emergency scenarios. Often, trustable, shareable and accessible data is released by agencies well after their usefulness to situational awareness has passed.

This challenge is not the responsibility of SCCI, but rather, for data providers. The water management districts (SJRWMD and SFWMD) have large archives of water quality data with a high degree of QAQC applied to it. Provisional data could be useful in emergency situations. SJRWMD, SFWMD and FAU-HBOI provide real time sampling. If these provisional datasets were available as REST endpoints, other platforms like GC could gain access to those datasets and stakeholders would be able to easily view data to improve situational awareness and ability to communicate about current conditions.

Making this data accessible and available will take a lot of effort and require some procedural and policy changes to initiate the work needed. The results of this INV 13 project have brought the conversation to the data providers and agencies. Project partners were quick to see the utility in a platform such as GC. They realized that prioritizing data QAQC and formatting of service data into easily accessible and sharable formats is the future of data sharing, collaboration and communication.

Threats

There were two major threats identified by this study.

- Potential loss of historical data.

  Being able to refer to past data, particularly during emergency response, is essential. For HAB data, showing past data helps display a bloom's timeline from initiation through senescence. There is the potential to lose data timelines in GC should agencies hosting data overwrite their datasets. GC shows only the most current data from hosts, so the ability to utilize prior datasets would be lost unless the agency host saves these datasets and makes them separately available. This aspect, while not a weakness of the GC platform, does place the archival and curation of past events in the hands of the data provider. Data providers must ensure that historic data is tagged and archived, otherwise there is a potential decrease in overall functionality for HAB data. For other use cases and when collaboration and communication about emergency response is critical, GCs ability to show the most recent data is most definitely an asset.

- Potential loss of public trust related to how agencies make data available and ensure the QAQC of data

  There is an associated threat to credibility, accountability and maintaining trust with the general public when sharing and communicating data about harmful algal blooms. Failure to address the gaps or weaknesses of how we communicate, share, and develop models with data is a threat that leaves the general public at risk from a

human health and safety standpoint. Especially, with species of cyanobacteria that have direct human and wildlife safety threats. There are real-time monitoring stations throughout the entirety of the State of Florida. Due to data not always being made available in a timely manner, the public is not always informed appropriately about water quality conditions.

Recommendations

Over the duration of this project, the IRLNEP and project team have seen the power of the GC platform and demonstrated its usefulness in sharing data, collaborating on and communicating HAB data and assisting with operational response during and after a bloom. The team spent a significant amount of time working with available datasets to perform QAQC methodologies, formatting data for sharing, and working with GC in optimizing collaboration and communication about data being presented during sessions. This intimate familiarity with the platform assisted the team in developing a vision for how GC could best be used today and optimized in the future.

GC represents a potential powerful platform for state agencies seeking better collaboration, coordination and communication either within or between agencies, particularly when improved situational awareness or emergency response are required. Hurricanes and tropical storms afford the best examples of GC's utility in unifying disparate data into a single platform, providing briefings on data, being media-ready, and allowing session followers to explore data on their own during a session.

The state of HAB data in Florida represents a significant obstacle for showcasing data sharing technology such as GC in coordinating HAB data and making decisions about emergency response. All levels of data providers, whether state, academic, municipal, or non-profit collect data at a variety of timescales and with various levels of QAQC applied. Not all organizations make these data available. Not all organizations apply standardized levels of QAQC for provisional data. To be most effective, agencies will need to examine the entire environment of their data collection, data QAQC, data formatting, data sharing, and ability to utilize provisional data operationally to best optimize data sharing platforms like GC.

This project has initiated a conversation with agency stakeholders about how to move forward. The project has demonstrated the utility of GC regarding how HAB data could be better utilized, shared and communicated. Agencies are appropriately careful about their QAQC practices (Indian River Lagoon National Estuary Program. 2019), generally taking extended periods to ensure data trustability prior to public release, often with significant delays between data collection and release. Policy changes at the management level of agencies could allow for the release of provisional data, or additional emphasis on a more timely release of data that has undergone QAQC to achieve trustability, particularly when communication within or between agencies is crucial and time sensitive.

The project partners recognize that making decisions based on provisional data can be a high-risk proposition; however, with HABs, environmental conditions are often highly dynamic. Enhanced communication platforms like GC hold great promise to improve communication and collaboration, however stakeholders must be aware of the provisional nature of data. The project team is hopeful that this project has opened avenues for continued discussions among HAB agencies and determination of next steps to make data more accessible and available. When that occurs, a platform such as GC will shine in its utility.

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Appendix A – Links to YouTube Videos

Instance 2: GeoCollaborate: Putting HAB Data to Work: January 10 & 11, 2022, Video

Instance 3: Informing Harmful Algal Bloom Emergency Response: May 12 & 13, 2022, Video

Summary Report and Presentation to FDEP Staff: May 20, 2022 PowerPoint

Training Sessions - July 26 & 28, 2022 Video

Instance 4: Demonstrating a Statewide Collaboration Tool and Dashboard for HAB's in Florida - December 12 & 13, 2022 Video

Appendix B – Attendance Records

Instance 1:

Name & Organization

1. Adams, Susan, Indian River County.
2. Bournique, Doug, SJRWMD.
3. Brower, Jeff, Volusia County.
4. Thurlow-Lippisch, Jacqui, SFWMD.
5. Hetherington, Stacy, Martin County.
6. Watkins, Aaron, FDEP.
7. Smith, Curt, Brevard County.
8. Dzadovsky, Chris, St. Lucie County.
9. Bromberg, Mel, WaterSHED International.
10. Carey, Tom, Volusia County.
11. Carlisle, Paul, City of Sebastian.
12. Catanese, Tony, Florida Institute of Technology.
13. Fuss, David, Indian River Land Trust.
14. Glass, Stu, Space Coast League of Cities.
15. Hamilton, Layne, MINWR.
16. Hart, Hannah, FWC.
17. Hendricks, Chris, Treasure Coast Sotheby's Realty.
18. Hughes, Dianne, Martin County.
19. Jacoby, Chuck, IRLNEP STEM.
20. Jones, George, ORCA.
21. LaMartina, Kathy, SFWMD.
22. Lamb, Vince Citizen, Brevard County.
23. Leslie, John, Citizen.
24. McCabe, Mike, Melbourne-Tillman WCD.
25. Mitts, Matthew, City of Vero Beach.
26. Musser, Robert, Canaveral Port Authority.
27. Orcutt, Judy, Citizen, Indian River Co.
28. Shropshire, Kevin, City of Rockledge.
29. Thompson, Laurilee, Brevard TDC.
30. Vogt III, Charles, FDOH.
31. Wilson, Greg, Riverside Conservancy.
32. Day, Bob, IRLNEP (Retired).
33. Hanisak, Dennis, FAU/Harbor Branch.
34. Jacoby, Chuck, SJRWMD.
35. Krimsky, Lisa, University of Florida/IFAS.
36. McGinnis, Dale, Eastern Florida State College.
37. Paperno, Rich, FFWCC.
38. Powell Beth, Indian River County.
39. Souto, Leesa, Marine Resources Council.
40. Walters, Linda, University of Central Florida.
41. Young, Kelly, Volusia County.
42. Bamberger, Christine, Brevard County.

43. Braun, Greg, Martin County.
44. Catino, Frank, Brevard County.
45. Cox, Graham, Indian River County.
46. McPhillips, Cheryl, Brevard County.
47. Stapleton, Heather, Indian River County.
48. Wayles, Jessie, Volusia County.
49. Winsten, Keith, Brevard County Kreifl, Kristen Canaveral National Seashore.
50. Agviar, Laura, NASA.
51. Murdock, Nick, NASA.
52. Klinepeter, Molly, Indian River County.
53. Garland, Ed Sebastian Inlet Tax District.
54. Gray, James, Sebastian Inlet Tax District.
55. Collins, Jeffrey, NASA.
56. Dankert, Don, NASA.
57. Fojtik, Jake, Florida Farm Bureau Foundation.
58. Charest, Eric, Indian River County.
59. Scheidt, Doug, NASA.
60. Venuto, Charles, NASA.
61. Phill, Thomas, NASA.
62. Powell, Elizabeth, Indian River County.
63. Hall, Lauren, SJRWMD.
64. Murdock, Nick, NASA.
65. LaMartina, Kathy, SFWMD.
66. Hughes, Dianne, Martin County.
67. Carey, Tom, Volusia County.
68. Friedman, Brandon, St. Lucie County.
69. Stephen, Robert, Citizen.

*Differences in information between the instances are due to different recording techniques. Task one was given to the IRLNEP management board. Tasks two & three were presented to the audience via webinar series. Task 4 was given as an interactive session.

Instance 2: GeoCollaborate: Putting HAB Data to Work: January 10 & 11, 2022

*Differences in information between the instances are due to different recording techniques. Task 1 was given to the IRLNEP management board. Tasks 2 & 3 were presented to the audience via webinar series. Task four was given as an interactive session.
*Duplicates in tables are from sharing registration links.

Name	Organization	Job Title
Dennis Hanisak	Florida Atlantic University	Research Professor
Thomas Farrugia	Alaska Ocean Observing System	Alaska Harmful Algal Bloom Network Coordinator
Benjamin Skinner	Pacific Salmon Foundation	GIS Specialist
Keith Bouma-Gregson	U.S. Geological Survey	Research Biologist
Ashley Malcolm	IRLNEP	Administrative Coordinator
Morgan Gilligan	Florida Oceanographic Society	Research Associate
Chip Deutsch	Florida Fish & Wildlife Conservation Commission	Assoc. Res. Sci.
Emily Dark	Martin County	Coastal Management Coordinator
Kristen Kneifl	Canaveral National Seashore	Resource Manager
Eric Charest	Indian River County	Natural Resources Manager
Kelly Fannon	Florida DEP	Program Consultant
Martina Rutti	Fish & Wildlife Research Institute	Operations Management Consultant
yun sun	UNESCO	Post Doc
Emily Richardson	USGS	Physical Scientist
Laura Korman	SECOORA	Program Coordinator
Elizabeth Stratton	ERT for NOAA	Disaster Response Coordinator
Marissa Vigar	CDC	Health Scientist
STACIE FLOOD	SFWMD	scientist
Lorae Simpson	Florida Oceanographic Society	Director of Research
Jessica Frost	SFWMD	Manager
Ellen Prager	StormCenter Communications	Chief Scientist
Amy Hamilton	Maryland Department of Natural Resources	Natural Resource Biologist
Duplicate 1	Maryland Department of Natural Resources	Natural Resource Biologist
Svetlana Esenkulova	Pacific Salmon Foundation	biologist

Dan Wiltsie	North Carolina Division of Water Resources	Algal Bloom Response Coordinator
Maggie Broadwater	NOAA	Program Manager
Andrea Krzystan	Florida Fish and Wildlife Research Institute	Assistant Research Scientist
Kirstin Wakefield	MARACOOS	Stakeholder Outreach Liaison
Duplicate 1	MARACOOS	Stakeholder Outreach Liaison
Ellen Prager	StormCenter Communications	Chief Scientist
Cathy Foerster	ATM, a Geosyntec Company	Senior Planner
Jeff Flashinski	DEM	Environmental Engineer
Tyler Harman	NOAA NCCOS	Biological Research Assistant
Dennis Hanisak	Florida Atlantic University	Research Professor
Amanda Marshall	Louisiana Department of Environmental Quality	Environmental Scientist 3
Chip Deutsch	FFWCC	Assoc. Res. Sci.
Virginia Roberts	CDC	Epidemiologist
Justin Grubich	Pew Charitable Trusts	Officer, Conserving Marine Life in the U.S.
Catherine Wazniak	MD DNR	Program Manager
Emily Bores	SC DHEC	Environmental Scientist
CHRISTINE EASTWICK	USFWS	Coastal Program Biologist
Jessica Frost	SFWMD	Manager
Heidi Stiller	NOAA Office for Coastal Management	South Regional Director
Hannah Hart	FWC	Regional Biologist
Ashley Malcolm	IRLNEP	Administrative Coordinator
Mitchell Roffer	Self	Social Director
Vincent Encomio	FL Sea Grant UF IFAS	Extension Agent
Rhonda Watkins	Collier County	Principal Environmental Specialist
jen maucher	NOAA	marine biologist
Jessica Garland	Martin County BOCC	Coastal Project Manager
Duplicate 1	Martin County BOCC	Coastal Project Manager
Jeff Glenn	RS&H, Inc.	Water Resources Leader
Susan Dye	USEPA	Aquatic Ecologist

Emily Powell	FSU	Climate specialist
Meghan Abbott	FFWCC	Associate Research Scientist
René Baumstark	FWC FWRI	Section Leader
J. Cho	Bethune-Cookman University	Professor
Kathrny LaMartina	South Florida Water Management District	Regional Representative
Marcus Beck	Tampa Bay Estuary Program	Program Scientist
Russell Hansen	National Parks Service	Biological Science Technician
M. Dennis Hanisak	FAU Harbor Branch	Research Professor
Jennifer DiMaio	EPA	IRLNEP Regional Coordinator
Valerie Paul	Smithsonian Institution	Head Scientist
Derek Tremain	Florida Fish and Wildlife Conservation Commission	Assistant Research Scientist
Sherry Larkin	Florida Sea Grant	Director
Debbie Leffler	Florida Fish & Wildlife Conservation Commission	Research Administrator II
Marcy Frick	Tetra Tech, Inc.	Senior Water Resource Engineer
Duplicate 1	Tetra Tech, Inc.	Senior Water Resource Engineer
Quay Dortch	NOAA/CSS	Senior HAB Scientist
Jim Lappert	St Lucie County	Water Quality Director
Diana Turner	FDEP	Environmental Consultant
Ashley Malcolm	IRL Council	Administrative Coordinator
Annie Roddenberry	Florida Fish and Wildlife Conservation Commission	Biological Scientist
Duplicate 1	Florida Fish and Wildlife Conservation Commission	Biological Scientist
Eric Charest	Indian River County	Natrural Resources Manager
Sandra Bogan	St Lucie County	Resilience Navigator
Nicole Raineault	Florida Institute of Oceanography	Chief Scientist
Gina Alvarez	Florida Fish and Wildlife Conservation Commission	Biologist
Douglas Scheidt	Herndon Solutions Group	Biologists

Duplicate 1	Herndon Solutions Group	Biologists
Maggie Broadwater	NOAA	Program Manager
Monty (David) Montgomery	Self	Env. Eng.
Edward Garland	Sebastian Inlet District	public information associate
Richard Paperno	Florida Fish & Wildlife Conservation Commission	Research Administrator I
Gregory Wilson	Riverside Conservancy	Board Director and Chief Scientific Officer
Morgaine McKibben	NASA GSFC/NASA NPP	Postdoctoral fellow
Christianne Ferraro	Grove Scientific & Engineering Co	Vice President of Engineering
Dianne Hughes	Martin County	Environmental Programs Coordinator
Jamie Kilgo	NPS	Marine Ecologist
Jeff Brower	Volusia County	Chair
Jessy Wayles	Marine Discovery Center	Conservation Science Coordinator
Kori Blitch	LDEQ	Env Sci
Gary Ritter	City of Okeechobee	City Administrator
Charles Vogt	FDOH Indian River	Environmental Specialist III
Danny Hunt	NASA, NEMCON	Data Scientist
Greg Doucette	NOAA/National Ocean Service	Research Oceanographer
Ed Sherwood	Tampa Bay Estuary Program	Executive Director
Halle Berger	NOAA	Knauss fellow
James Gray	Sebastian Inlet District	Executive Director
Naresa Cancro	NEMCON	Sr GIS Analyst
Lisa Krimsky	UF	Water Resource Regional Specialized Agent
Derek Cox	FWC	Biologist
Stacie Flood	SFWMD	Scientist
Betty Staugler	Florida Sea Grant	NOAA HAB Liaison
Vivienne Main	Florida Oceanographic Society	Research Associate
Kelsey Mack	City of Cocoa Beach	Environmental Specialist
John Leslie	John Leslie	environmental analyst

Graham Cox	Pelican island Audubon Society	PIAS volunteer
Mark Rains	DEP	Chief Science Officer
Katherine Hubbard	FFWCC	Research Scientist
Nancy Campbell	StormCenter Communications	Contracts Manager
Ellen Prager	StormCenter Communications	Chief Scientist
Mary Kate Rogener	NOAA	Program Analyst
Duplicate 1	NOAA	Program Analyst
Chris Schumann	HSG	Data Scientist
Don Anderson	Woods Hole Oceanographic Institution	Senior Scientist
Ashley Malcolm	IRLNEP	Administrative Coordinator
Michael Mccabe	Melbourne-Tillman Water Control District	District Engineer
Meghan Abbott	FWC Fish and Wildlife Research Institute	Associate Research Scientist
Sarah L Burnsed	Florida Fish and Wildlife Research Institute	marine fisheries biologist
Daniel Slone	U.S. Geological Survey	Research Ecologist
Barbara Kirkpatrick	GCOOS	Senior Advisor
Holly Abeels	UF/IFAS Extension	Florida Sea Grant Extension Agent
Sarah Barrett	FFWCC	Assistant Section Leader
Svetlana Esenkulova	Pacific Salmon Foundation	biologist
Duplicate 1	Pacific Salmon Foundation	biologist
Duplicate 2	Pacific Salmon Foundation	biologist
Duplicate 3	Pacific Salmon Foundation	biologist
Hyun Jung Cho	Bethune-Cookman University	Professor of Environmental Science
Ellen Prager	StormCenter Communications	Chief Scientist
Elizabeth Nystrom	New York Water Science Center	Hydrologist
Paige Lester	Indian River County BoCC	GIS Analyst
Daniel Levine	NOAA	Disaster Support Specialist
Alexandra Carvalho	CMar Consulting, LLC	President and Principal
Daniel Young	YBE CONSULTING, INC.	Consultant / Contractor
Vanessa Strohm	Virginia Institute of Marine Science	Graduate Student

Dennis Hanisak	Florida Atlantic University	Research Professor

Total: 138 Participants

Instance 3: Informing Harmful Algal Bloom Emergency Response: May 12 & 13, 2022

*Differences in information between the instances are due to different recording techniques. Task one was given to the IRLNEP management board. Task 2 & 3 were presented to the audience via webinar series. Task four was given as an interactive session.
*Duplicates in tables are from sharing registration links.

Name	Organization	Job Title
Yuliya Danyuk	Florida Department of Environmental Protection	Environmental Consultant
Jeffrey Collins	NASA	Environmental Protection Specialist
Duplicate 1	NASA	Environmental Protection Specialist
Duplicate 2	NASA	Environmental Protection Specialist
Duplicate 3	NASA	Environmental Protection Specialist
Duplicate 4	NASA	Environmental Protection Specialist
Duplicate 5	NASA	Environmental Protection Specialist
Vincent Encomio	Florida Sea Grant	Extension Agent
Quay Dortch	CSS, Inc/NOAA	Senior HAB Scientist
Greg Doucette	NOAA/National Ocean Service	Research Oceanographer
Ellen Prager	StormCenter Communications	Chief Scientist
Melinda Simmons	Jacksonville University	Biology & Marine Science Professor
Kellie Ralston	Bonefish & Tarpon Trust	VP Conservation and Public Policy
Dennis Hanisak	FAU Harbor Branch	Research Professor
Kathy Hill	IRLNEP	communication
Jill Fleiger	FDACS	Environmental Administrator

Janis Morrow	Florida Department of Environmental Protection	Environmental Administrator
Andrew Morris	FDEP	Environmental Consultant
Anne Birch	The Nature Conservancy	FL Oceans and Coasts Strategy Director
Brian Chalfant	Pennsylvania Department of Environmental Protection	Deputy Policy Director
Christianne Ferraro	Grove Scientific & Engineering Company	Vice President of Engineering
Edna Fernandez-Figueroa	Auburn University	Postdoc
Rajan Anbiah	Environment Agency	Scientist-Marine Water Quality
Emily Dark	Martin County	Coastal Management Coordinator
Heather Krempa	US Geological Survey	Hydrologist
Lisa Van Houdt	FDEP	EC
Kelley Barfoot	Mobile Bay National Estuary Program	Program Analysis/GIS Specialist
Danielle Nathanson	West Virginia Department of Environmental Protection	Environmental Resources Specialist III
Baylin Bennett	University of Alabama at Birmingham	Research Ecotoxicologist
Duplicate 1	University of Alabama at Birmingham	Research Ecotoxicologist
Matthew Mitts	City of Vero Beach Public Works	Public Works Director
William Klein	Self	Retired Nuclear Engineer
Danielle Stanek	Florida Department of Health	State Public Health Veterinarian
Melissa Partyka	Auburn University	Asst. Extension Professor
Laura La Beur	St. Johns River Water Management District	Education and Outreach Coordinator
Deinna Dalton	FDEP	Senior Program Analyst
Duplicate 1	FDEP	Senior Program Analyst
Laura Marklley	FWC-FWRI	Research Associate
David Koerner	Florida Department of Health	Environmental Manager
Ann St Amand	PhycoTech, Inc.	President
Mike McCann	MBARI	Software Engineer
Ellen Prager	StormCenter Communications	Chief Scientist

Derek Cox	FWC	Biologist
Rhonda Watkins	Collier County Government	Principal Environmental Specialist
Jeff Eble	Florida Tech University	Research Assistant Professor
Denise McCafferty	Lloyd's Register	Senior Environmental Specialist
CV Vogt	FDOH IR	ESIII
Kathleen Hill	IRLNEP	Deputy Director
Marlys Breckle	Speak Up Titusville	Secretary
Eric Charest	Indian River County	Natural Resources Manager
Rashmi Krishnapuram	LDEQ	ESIII
Emily Marquis	CT Department of Agriculture/Bureau of Aquaculture	Fisheries Biologist I
Jennifer Winters	County of Volusia	Activity Manager
Chad Murch	Volusia County Environmental Management	Manatee Protection
John Grosch	LDEQ	Environmental Scientist
Kristina Broussard	Mississippi Department of Marine Resources	Biological Program Coordinator
Noelani Boise	Pacific Northwest National Lab	Earth Scientist
Tiffany Weidner	Mississippi Department of Marine Resources	Biological Program Coordinator
Travis Thompson	All Florida	CEO
Savannah Judge	Yokogawa Fluid Imaging Technologies, Inc.	Aquatics Sales
Heather Krempa	US Geological Survey	hydrologist
Martha Guyas	American Sportfishing Association	Southeast Policy Director
Christine Bamberger	I R L Advisory Committee	Resident
Ashley Malcolm	IRL Council	Administrative Coordinator
Melanie Parker	South Florida Water Management District	Science Supervisor
Gina LaLiberte	WDNR	water resource management specialist
Maggie Broadwater	NOAA	Program Manager
Tracie Barry	Washington State Department of	Marine Biotoxin Specialist
Stacie Flood	SFWMD	Scientist

Duplicate 1	SFWMD	Scientist
Dianne Hughes	Martin County	Environmental Programs Coordinator
Lissa Strohecker	St Johns River Water Management District	Communications Coordinator
Jeff Flashinski	Rhode Island DEM	Env Engineer
Mailin Sotolongo Lopez	FDEP	Environmental Consultant
Astrid Schnetzer	North Carolina State University	Associate Professor
Ellen Prager	StormCenter Communications	Chief Scientist
Cheryl Swanson	Dept. of Environmental Protection	Program Administrator
Martha Guyas	American Sportfishing Association	Southeast Fisheries Policy Director
Stephanie Abbe	Fish and Wildlife Institute	Research Associate
Kathleen Hill	Indian River Lagoon nep	communications
Kevin Johnson	Florida Tech	Professor
CHRISTINE EASTWICK	USFWS	Coastal Program Biologist
Kori Blitch	LDEQ	Environmental Scientist
Holly Abeels	University of Florida IFAS Extension	Florida Sea Grant Extension Agent
Danielle Nathanson	West Virginia Department of Environmental Protection	Environmental Resources Specialist III
Brian Chalfant	Pennsylvania Department of Environmental Protection	Deputy Policy Director
Dan Levy	AECOM	Vice President
Lisa Krimsky	UF/IFAS	Water Resources Regional Specialized Agent
Emily Bores	SC DHEC	Environmental Scientist II
Ashley Evitt	SJRWMD	Media Outreach Manager
Gretchen Smith	St Johns River Water Management District	Communications Manager
Tammy Cleveland	US Army Corps of Engineers	Supervisory Biologist
Naresa Cancro	HSG	SR GIS Analyst

John Ferry	University of South Carolina	Professor
EDNA FERNANDEZ	Auburn University	Postdoc
BILL HEDDENDORF	NJ DEP Bureau of Marine Water Monitoring	Environmental Specialist 4
Tiffany Weidner	Mississippi Department of Marine Resources	Biological Program Coordinator
Ellen Prager	StormCenter Communications	Chief Scientist
Marcy Frick	Tetra Tech, Inc.	Senior Water Resources Engineer
Amy Hamilton	Maryland Department of Natural Resources	Natural Resource Biologist
Duplicate 1	Maryland Department of Natural Resources	Natural Resource Biologist
Duplicate 2	Maryland Department of Natural Resources	Natural Resource Biologist
Duplicate 3	Maryland Department of Natural Resources	Natural Resource Biologist
Theresa Cody	Fl Fish and Wildlife	Associate Research Scientist
Duplicate 1	Fl Fish and Wildlife	Associate Research Scientist
Duplicate 2	Fl Fish and Wildlife	Associate Research Scientist
Danielle Nathanson	West Virginia Department of Environmental Protection	Environmental Resources Specialist III
Douglas Scheidt	Herndon Solutions Group	Ecologist
Meghan Abbott	FWC-FWRI	Associate Research Scientist
Meghan Abbott	FWC-FWRI	Associate Research Scientist
M Roffer	retired but will take consultancy	President
Duplicate 1	retired but will take consultancy	President
Duplicate 1	retired but will take consultancy	President
Tammy Karst-Riddoch	AECOM	Senior Limnologist
Celia Villac	Fish and Wildlife Research Institute	Research Scientist
Monica Samit	FDOH	HAB Environmental Consultant
René Baumstark	FWC Fish & Wildlife Research Institute	Section Lead
Laurilee Thompson	Dixie Crossroads Seafood Restaurant	Co-owner
Melissa McIntyre-Meisenburg	Indian River County	Lagoon Plan Environmental Specialist

Terry Williamson	Brevard County Natural Resources Management Department	Environmental Section Supervisor
Dan Wiltsie	North Carolina Department of Environmental Quality	Algal bloom response coordinator
Nick Daigle	Florida Department of Environmental Protection	Environmental Consultant
Laura Korman	SECOORA	Program Coordinator
Betty Staugler	Florida Sea Grant - UF	NOAA HAB Liaison
Virginia Barker	Brevard County Natural Resources Management Department	Director
Ling Ren	George Mason University	Research Assistant Professor
Kristen Davis	FAU Harbor Branch	IRLON Manager
Haley McQueen	FAU Harbor Branch	PhD Candidate
Alicia Hogue	Florida Department of Environmental Protection	Program Administrator
Gillian Gilbert-Wason	GA EPD	Water Quality Standards Coordinator
Monty Montgomery	Virtucon Industries	Dr. Evil's Assistant
Jim Duncker	USGS	Hydrologist
Dennis Hanisak	FAU Harbor Branch	Research Professor
Mel Bromberg	League of Women Voters, St. Lucie County	Retired
Chip Deutsch	Florida Fish & Wildlife Conservation Commission	Associate Research Scientist
Kyle Luba	Florida Fish and Wildlife	Biological Scientist II
Miranda Barrington	Florida Gulf Coast University	Research Lab Coordinator
Thomas Farrugia	Alaska Ocean Observing System	Program Manager
Amanda Marshall	LDEQ	Environmental Scientist
Ashley Malcolm	IRL Council	Administrative Coordinator
Krista Thomas	National Research Council - Biotoxin Metrology	Research Council Officer
Sharmila Thenuwara	University of Toledo	Graduate student
Douglas Gibson	City of Oak Hill	Mayor
Diana Turner	FDEP	EA
Stu Glass	Town of Indialantic	Deputy Mayor

Andrew Reich	H2oConsulting	Public Health Scientist
Rick Clark	Florida Dept of Health	Environmental consultant
Andi Fitzgibbon	US Army Corps of Engineers	Aquatic Biologist
Nicole Bonine	US Army Corps of Engineers	Environmental Compliance Program Manager
Greg Doucette	NOAA/National Ocean Service	Research Oceanographer
Kelsey Mack	City of Cocoa Beach	Environmental Specialist
Jennifer Shafer	SHAFER CONSULTING LLC	scientist
Debbie Wright	Volusia County, Environmental Management	Manatee Protection Program Manager
Mark Rains	DEP	Chief Science Officer
EDNA FERNANDEZ	Auburn University	Postdoc
Mike McCann	MBARI	Software Engineer
Kirstin Wakefield	MARACOOS	Stakeholder Outreach Liaison
Kristen McGovern	Galveston bay Estuary Program	Monitoring and Research Coordinator
Charles Vogt	FDOH IR	Environmental Specialist III

Total: 160 Participants

Instance 4: Demonstrating a Statewide Collaboration Tool and Dashboard for HAB's in Florida - December 12 & 13, 2022

*Differences in information between the instances are due to different recording techniques. Task 1 was given to the IRLNEP management board. Task 2 & 3 were presented to the audience via webinar series. Task four was given as an interactive session.

*Duplicates in tables are from sharing registration links.

Name	Organization
Jessy Wayles	IRLNEP
Dave Jones	StormCenter Communications
Gary Franklin	St. Lucie County
Adam Rose	FDACs
Melissa Meisenburg	Indian River County
Warren Falls	ORCA
Gina Alvarez	FFWCC
Wendy Durden	HSWRI
Eric Charest	Indian River County
Heather Stapleton	IRLNEP
Charles Jacoby	SJRWMD
Caleta Scott (IRLNEP) (Caleta Scott)	IRLNEP
Erin Bergman	IRLNEP
Kathy Hill	IRLNEP
Dr. Hannah Herrero	University of Florida
Daniel Kolodny	IRLNEP

Dale Ketcham	Space Florida
Lisa Krimsky	University of Florida
Kathy Hill	IRLNEP
Terri Breeden	Brevard County
Mitchell Roffer	Citizen
John Maehl	Martin County
Dennis Hanisak	FAU-HBOI
G. Kelley	St. Johns River Water Management District
Robert Rease	City of Belle Glade
Kelly Young	Volusia County
Peter Eggert	Space Florida
Peter Eggert	Space Florida
Heather Stapleton	IRLNEP
Kathy Hill	IRLNEP
Peter Eggert	Space Florida
Gina Colonna	Citizen
Commissioner Rob Feltner	Brevard County
Julie Mitchell	FFWCC
Caleta Scott	IRLNEP
Daniel Kolodny	IRLNEP
Tom Carey	Volusia County

Marina Barrineau	FFWCC
D Scheidt	NASA
Richard Paperno	FFWCC
Daniel Kolodny	IRLNEP
Gregory Wilson	Riverside Coalition
Yesenia Escribano	FDACS
Edith Widder	ORCA
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Total: 50 Participants