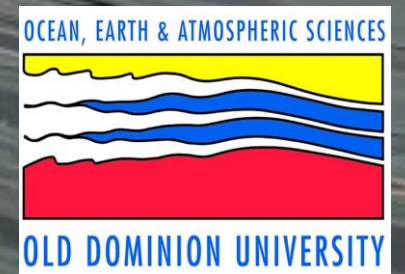


2022 Virginia HABs: Estuarine monitoring summary

Margie Mulholland
Old Dominion University
Department of Ocean and Earth Sciences

VA HAB Taskforce Meeting
24 February 2023



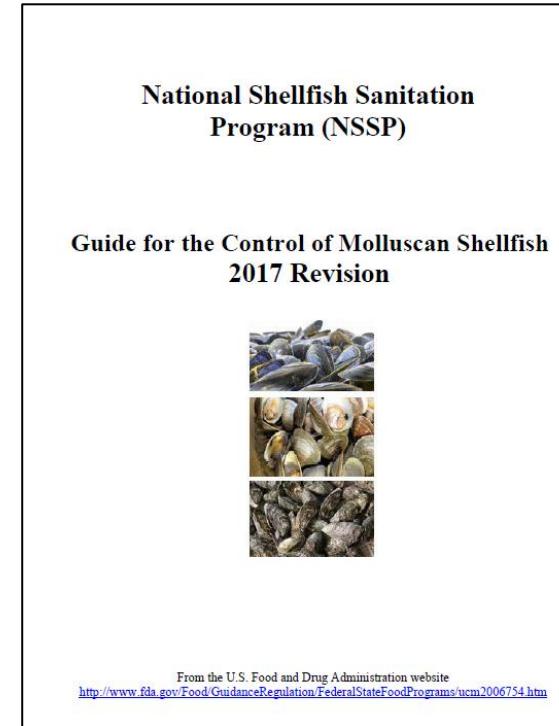
Overview

- Shellfish monitoring
- Bloom response - ODU
- Notable 2022 blooms
- Monitoring results summary
- Related projects
- 2023

VDH Shellfish monitoring

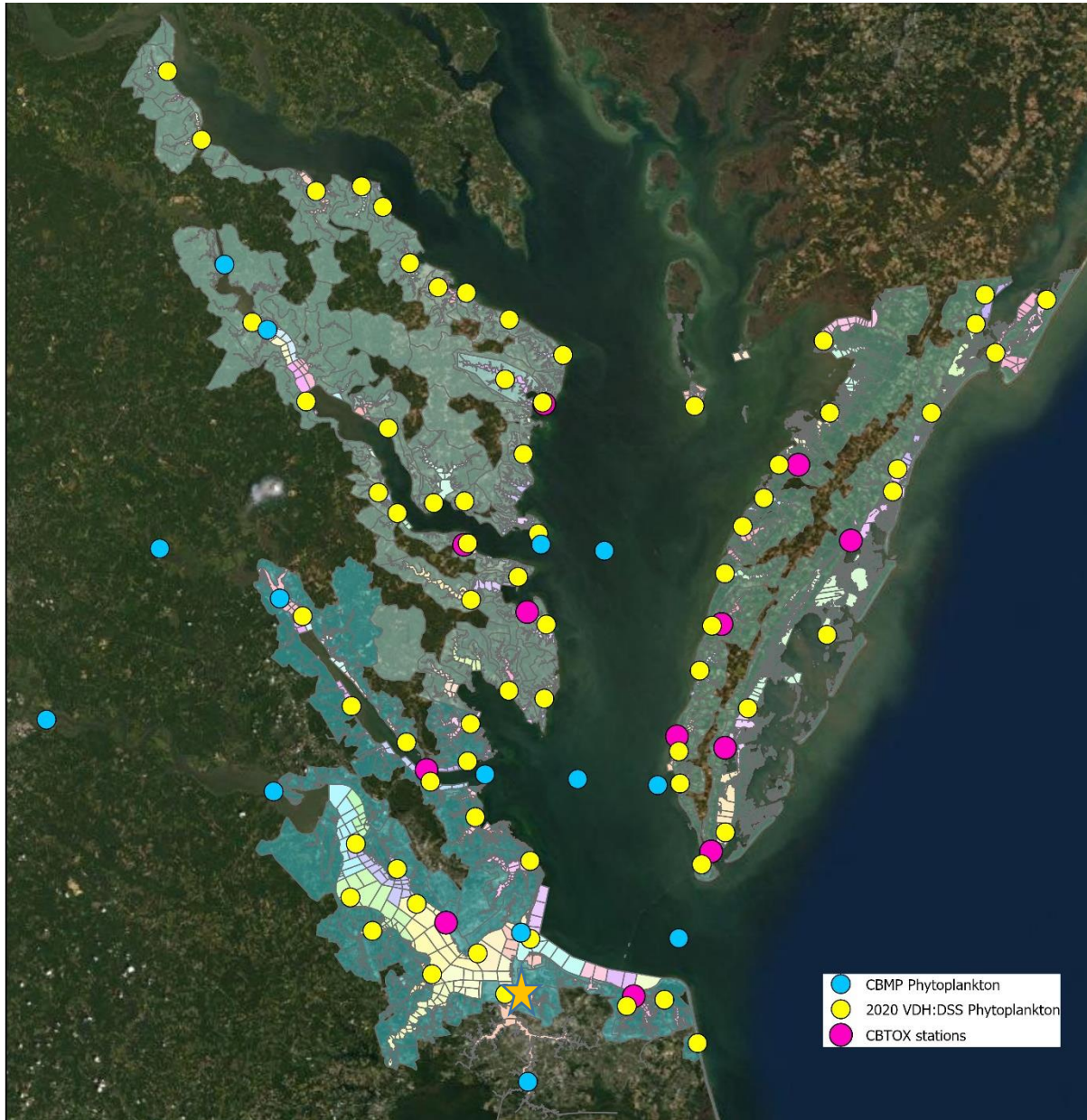
- Monthly collections- routine fixed sites
 - Lugol's solution (500mL) – phytoplankton analyses (ODU)
 - Unpreserved frozen sample (50mL)- ELISA screening (VDH)
 - 467 samples in 2022

- Bloom samples
 - Response to bloom reports or visual observation by field staff
 - VDH, CBP, HRSD, Time series site
 - 4 bloom (7 more likely blooms)



Phyto Kit: Extra bottles, vials, lugol's, rubber gloves, marker

Virginia Estuarine Phytoplankton monitoring



- Chesapeake Bay Monitoring Program (DEQ/ODU)
 - 14 stations
 - 7-Chesapeake Bay monthly year-round
 - 7-Tidal tributaries monthly **January - December**
 - Full species composition (168 samples)
 - Missing data Sept-Dec (weather/ship/ongoing health issues)
 - Ad hoc bloom sampling
- VDH: Shellfish (DSS&WHC/ODU)
 - 69 stations
 - Monthly year-round
 - Targeted HAB identification
 - Targeted toxin screening (based on cell counts)
- CBTOX (VDH:DSS/VIMS) – 6 samples to ODU
- ★ Additional monitoring:
 - Timeseries sites
 - Dataflow HRSD
 - HAB response

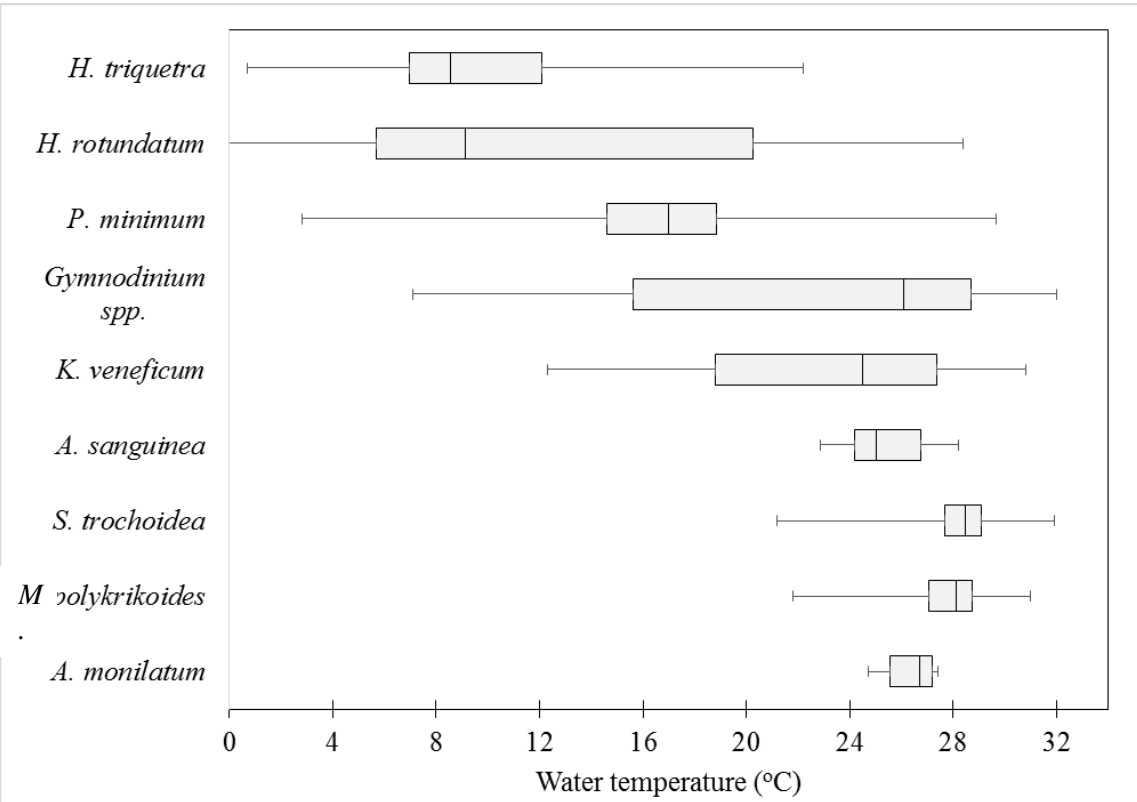
2022 sampling

- HRSD dataflow from James River now every two weeks. Had some samples but not very many
- Received DEQ CBP samples this year year-round. *Heterocapsa* blooms were observed in 2020, requested to receive phytoplankton samples from DEQ CBP monitoring year-round
- Continued thrice-weekly sampling in the Lafayette River at our time series site during summer. Have samples we need to count
- Started a FlowCam library; can now download images and upload into EcoTaxa

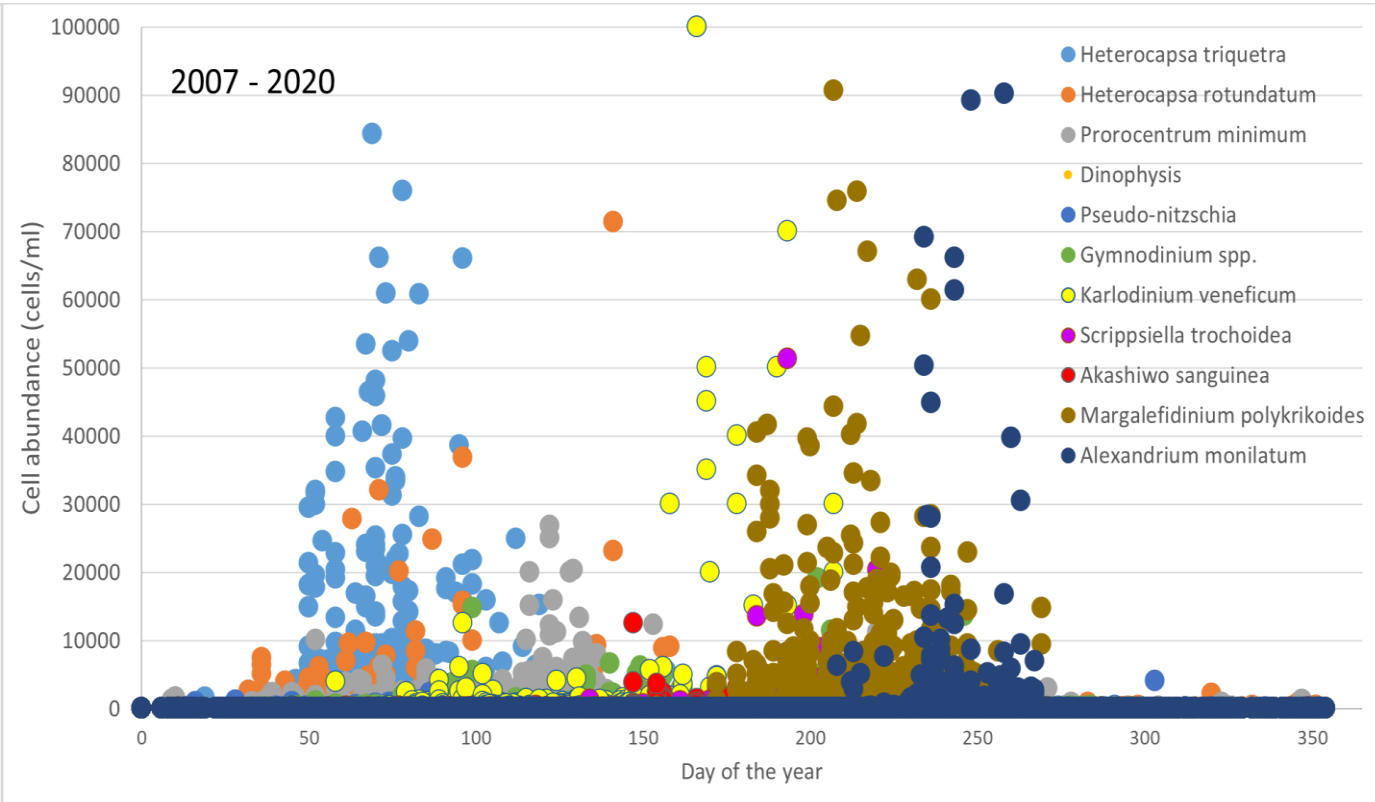
2022 results

- There were blooms
- They were not well-detected using our current sampling methods.
- We observed blooms at our time series site
- Anecdotal information suggest they were in other places too
- How do we better surveille?

“Normal” bloom progression



**Pseudo-nitzschia* and *Dinophysis* not abundant enough to make the list



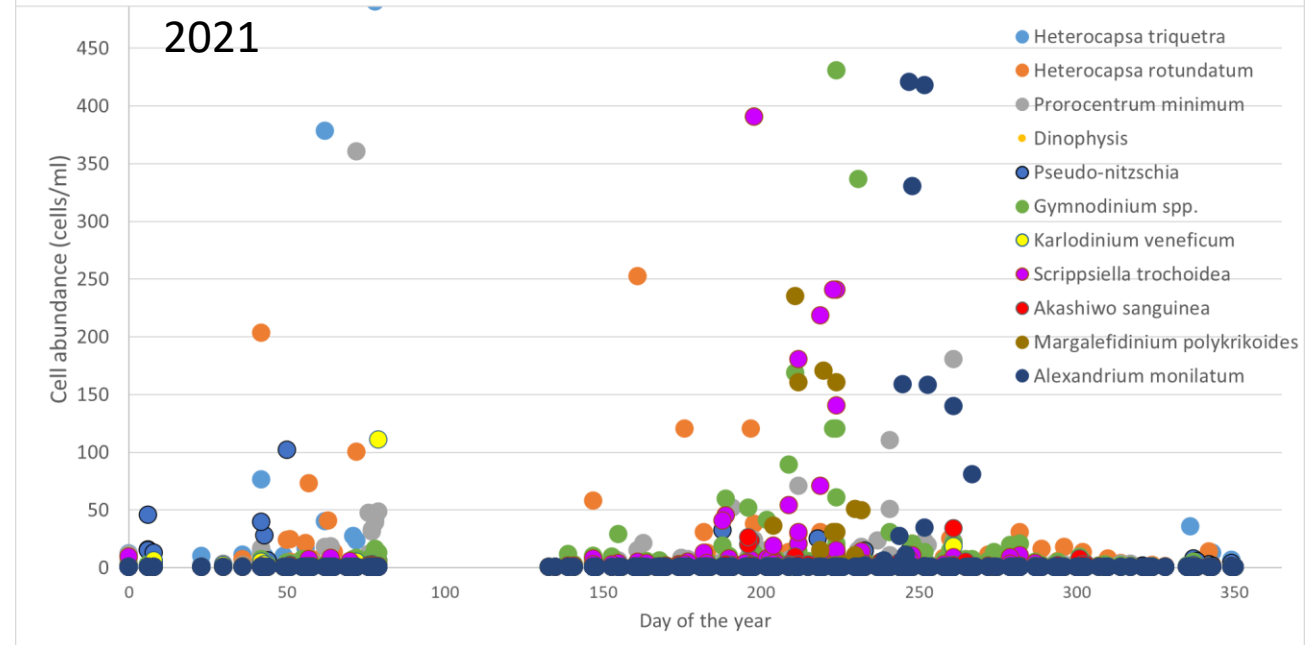
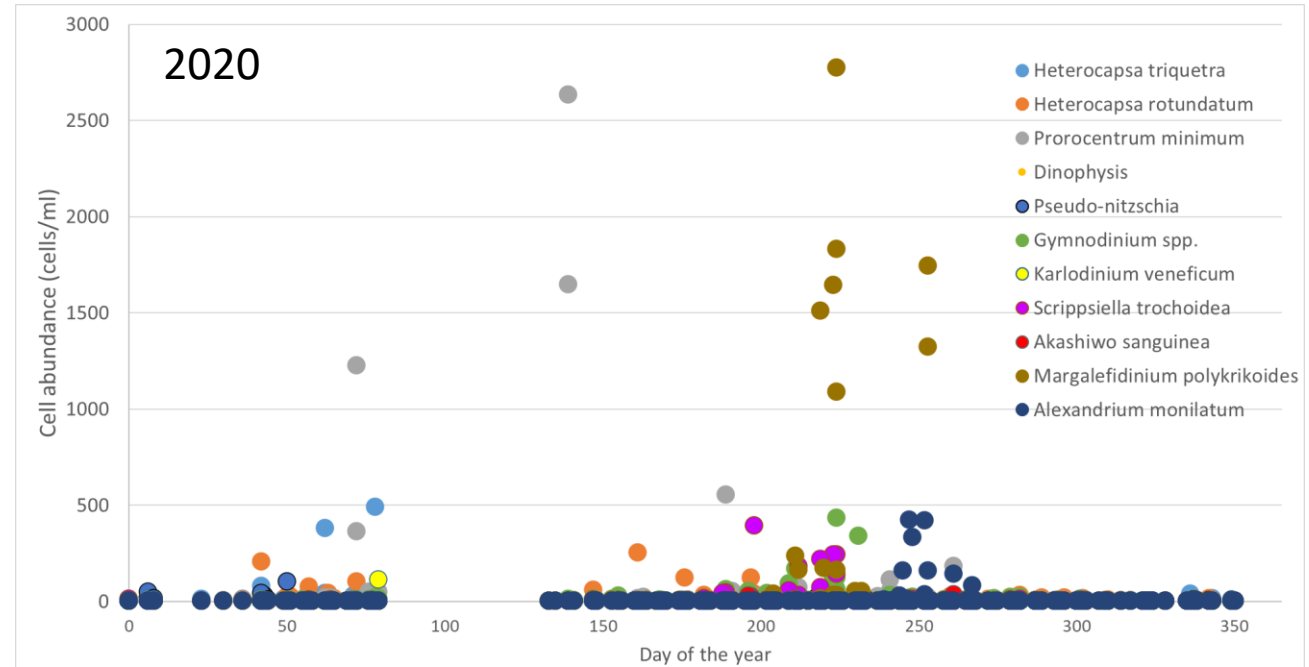
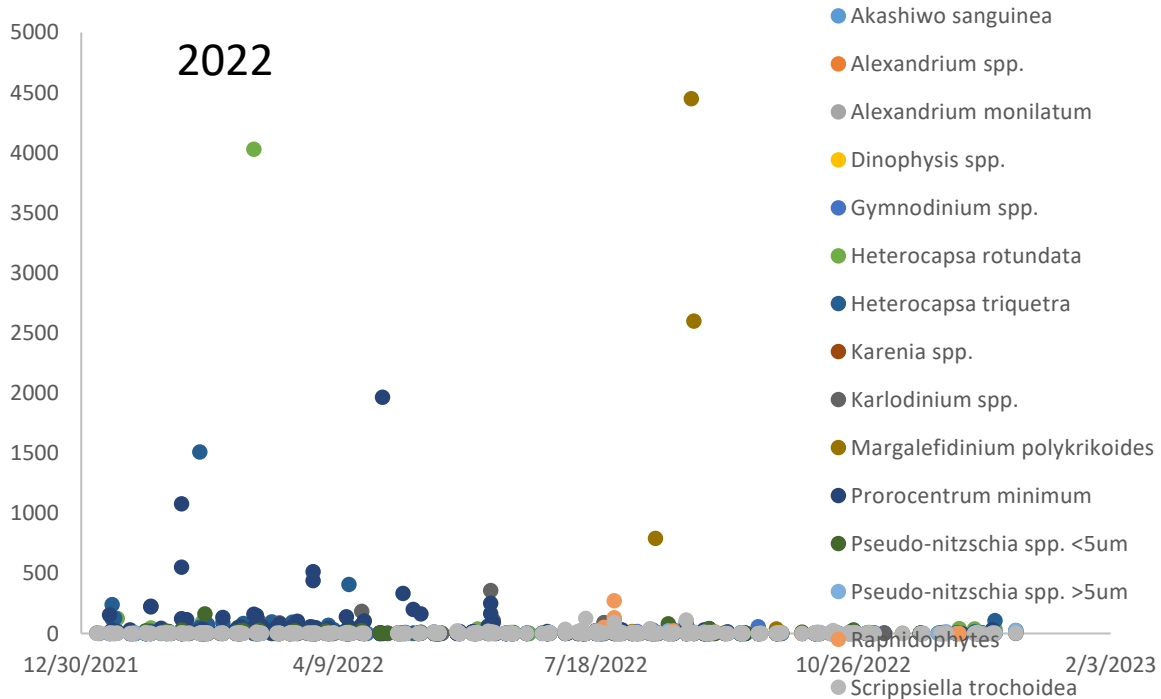
*Removed data where abundances were > 100,000 cells/ml

Notable 2022 cell concentrations:

Heterocapsa triquetra (January – Mar)

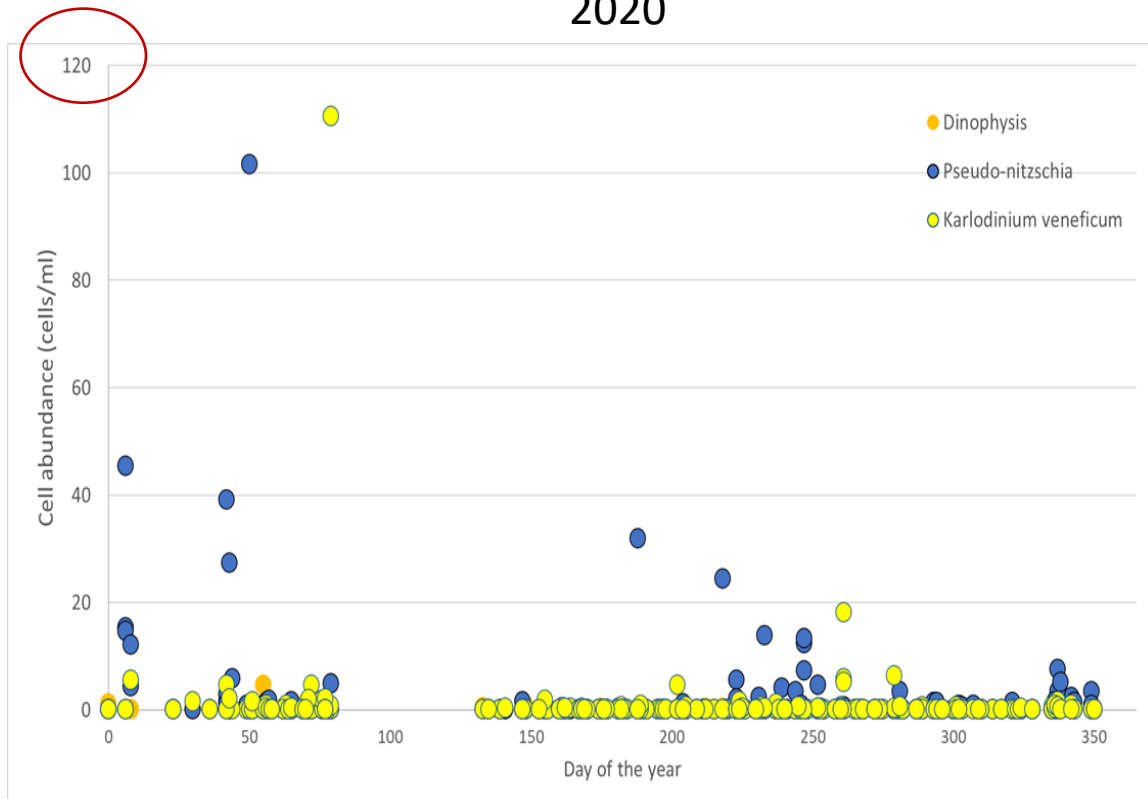
Prorocentrum minimum (late April – early May)

Margalefidinium polykrikoides (July – August)

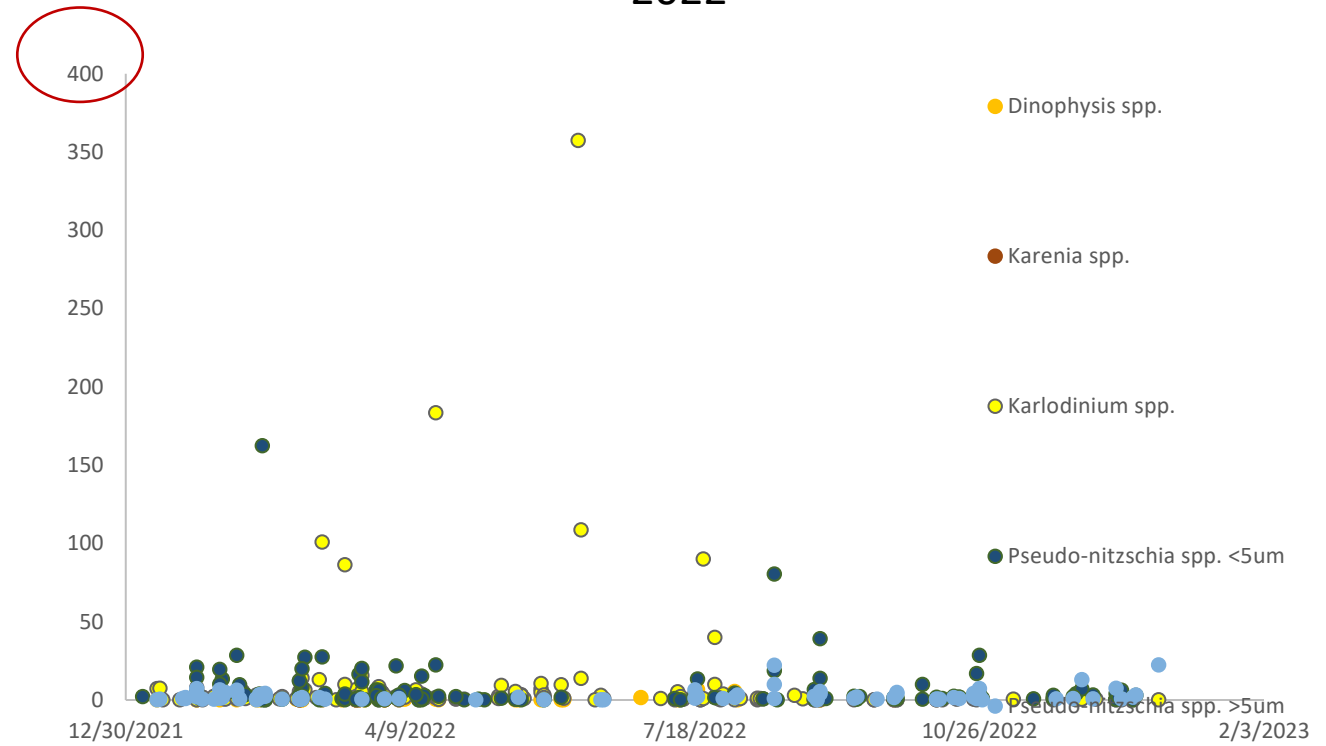


Our less abundant HAB species in 2022

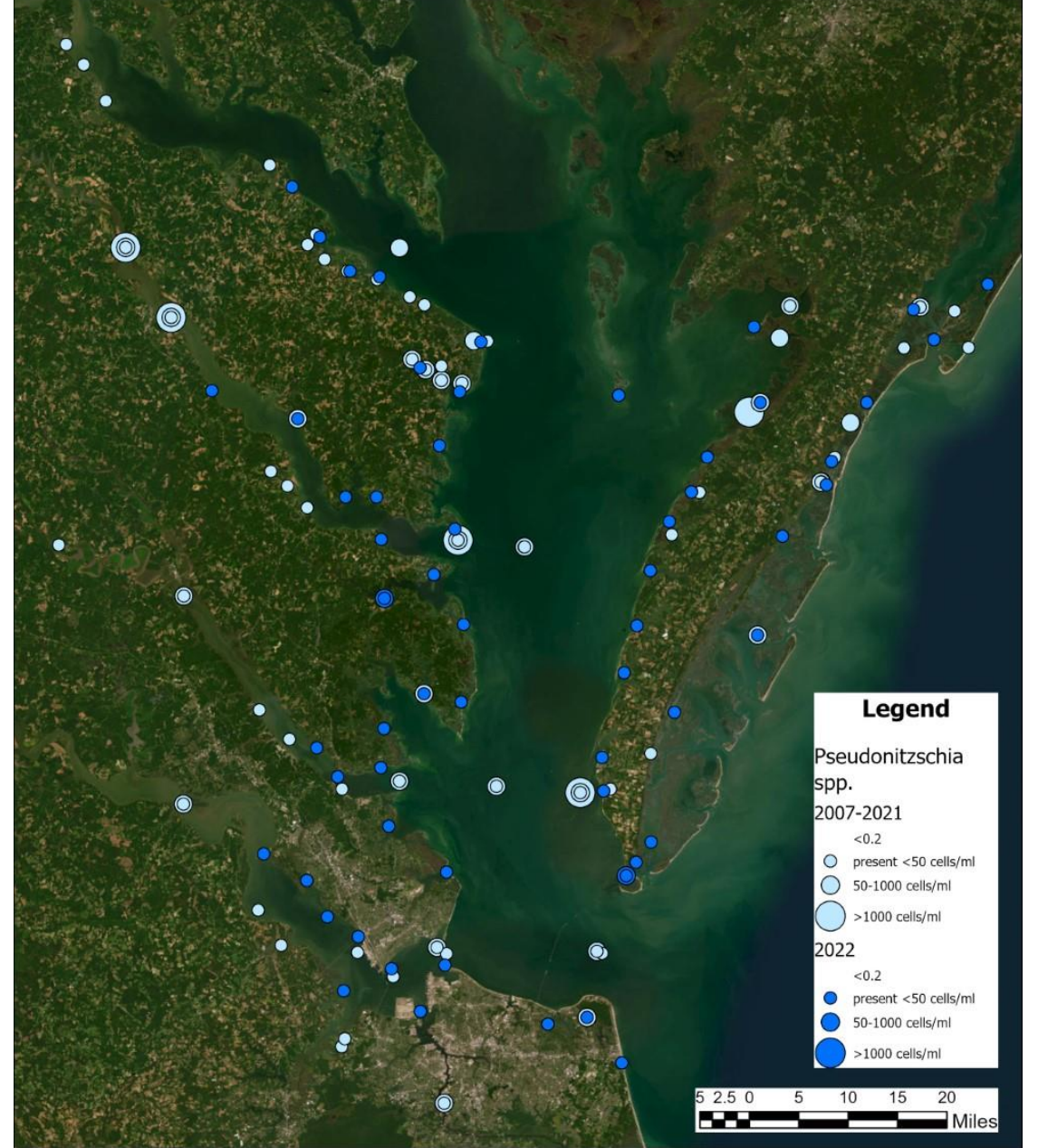
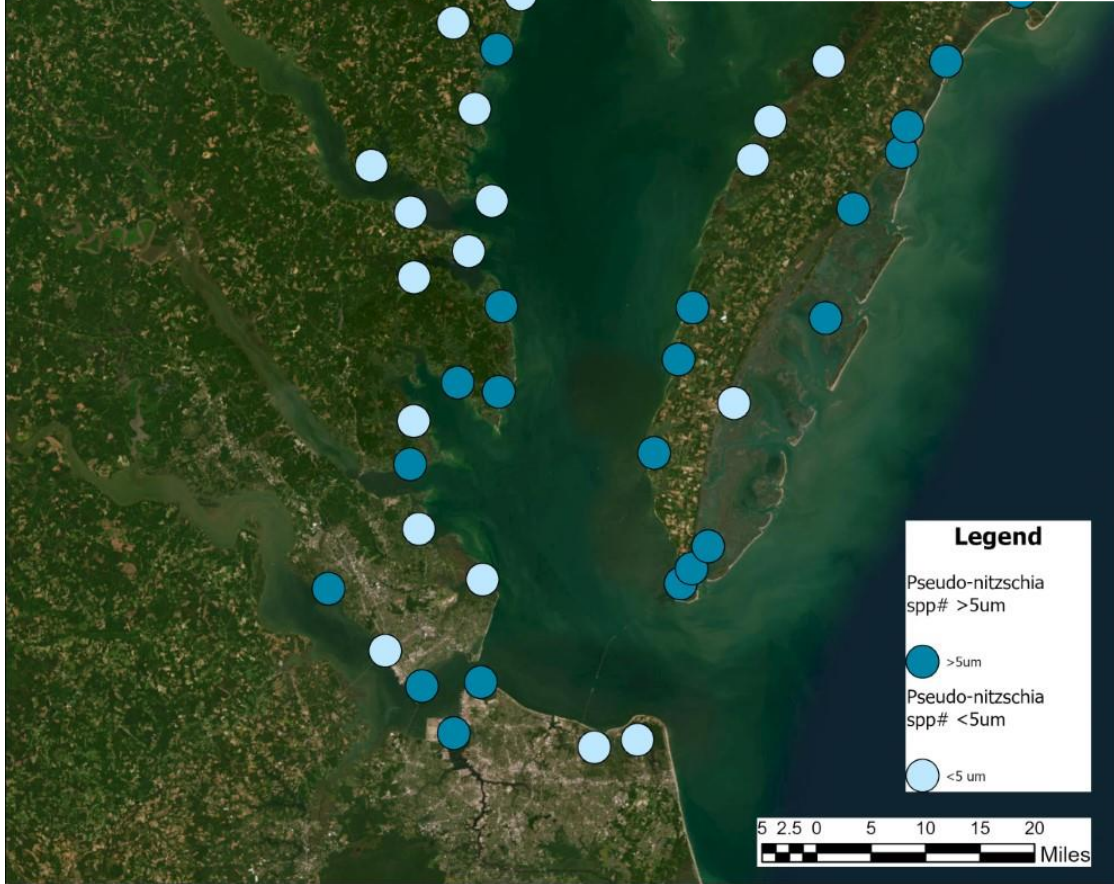
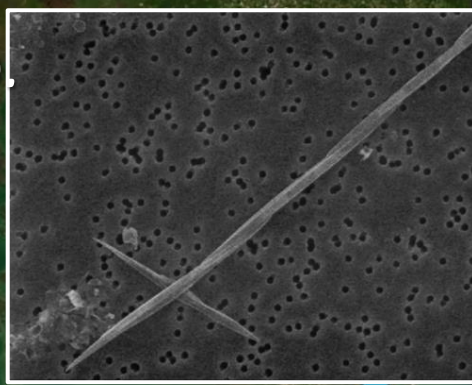
2020



2022

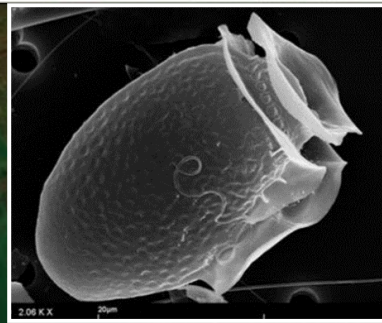


Pseudo-nitzschia spp.



- Generally low cell densities
- Widespread distribution in Chesapeake Bay and seaside Eastern Shore

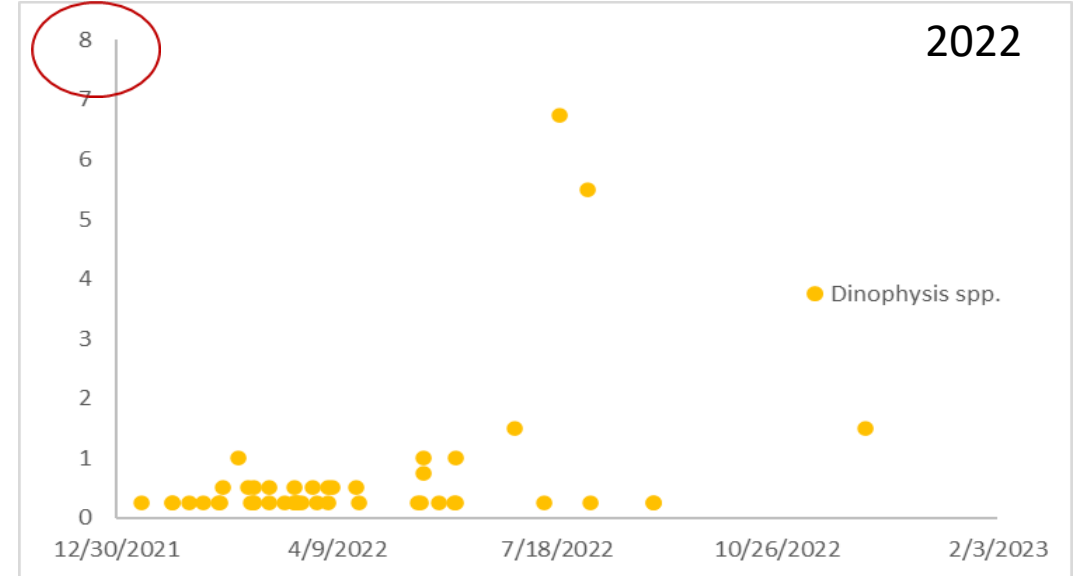
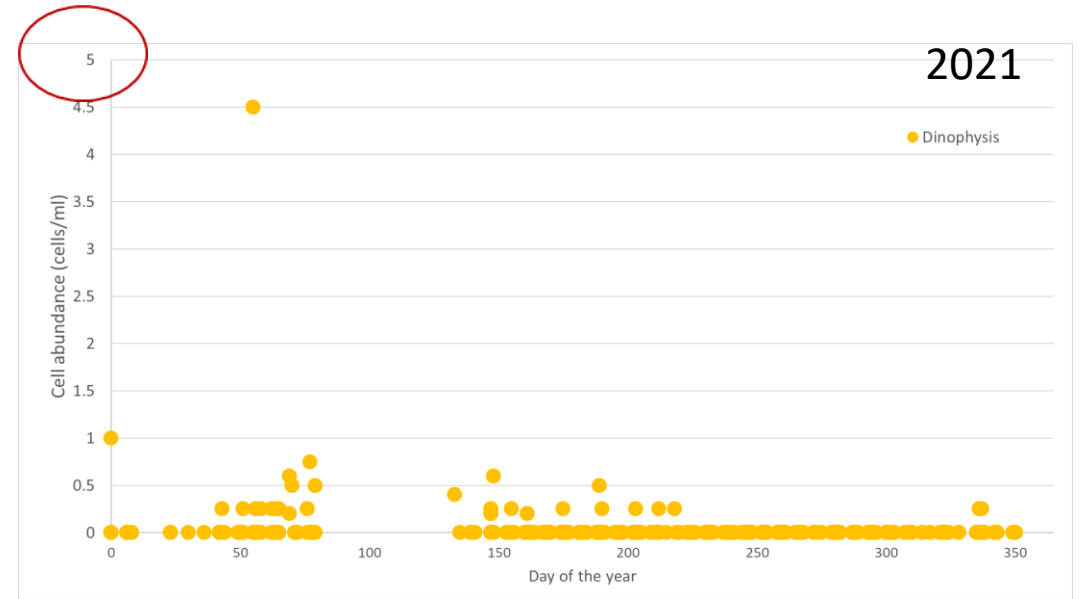
Dinophysis spp.



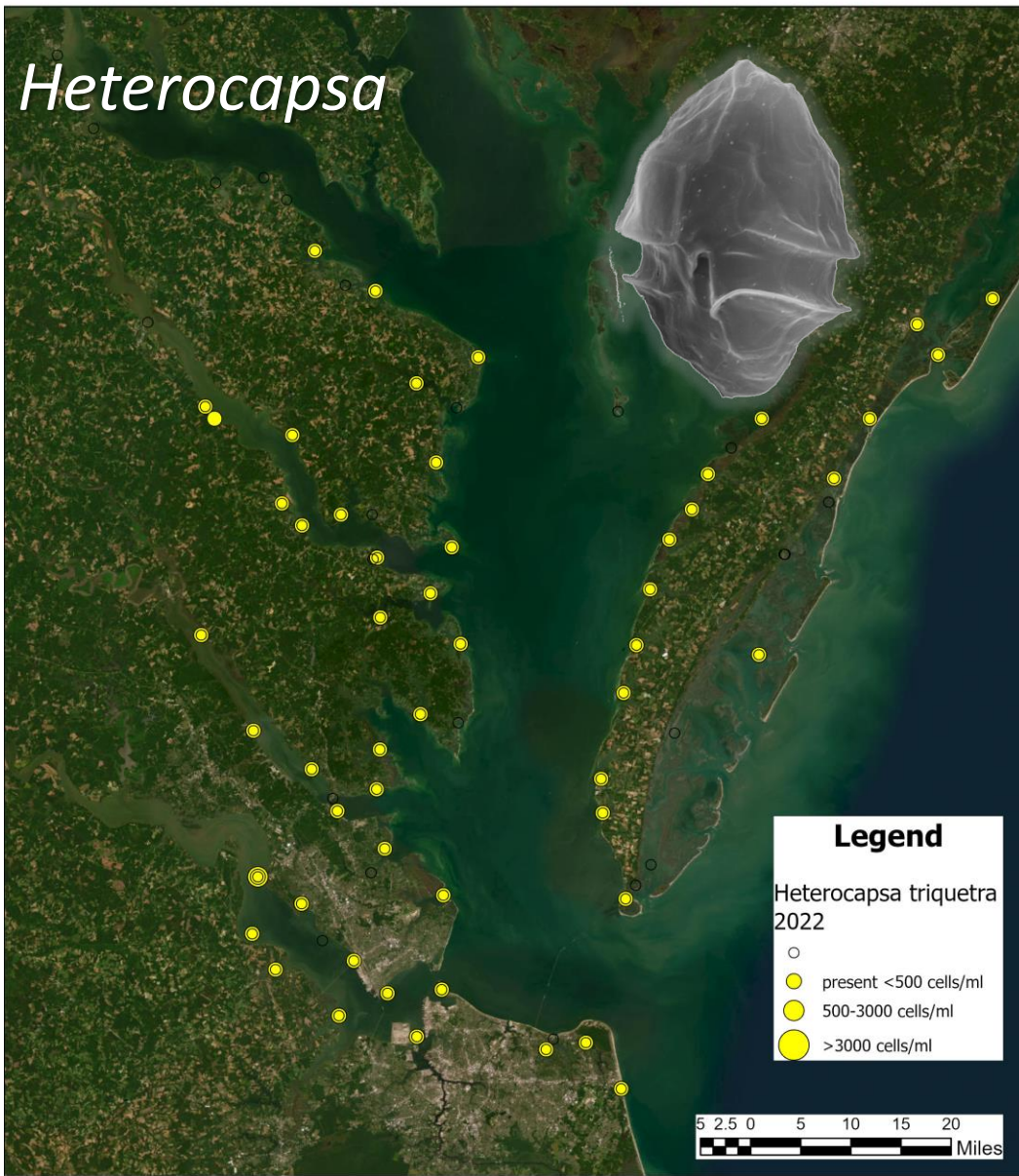
Legend
Dinophysis spp.
2007-2021
<0.2
○ present <1/ml
○ 1-10/ml
○ >10/ml
2022
<0.2
● present <1/ml
● 1-10/ml
● >10/ml

5 2.5 0 5 10 15 20 Miles

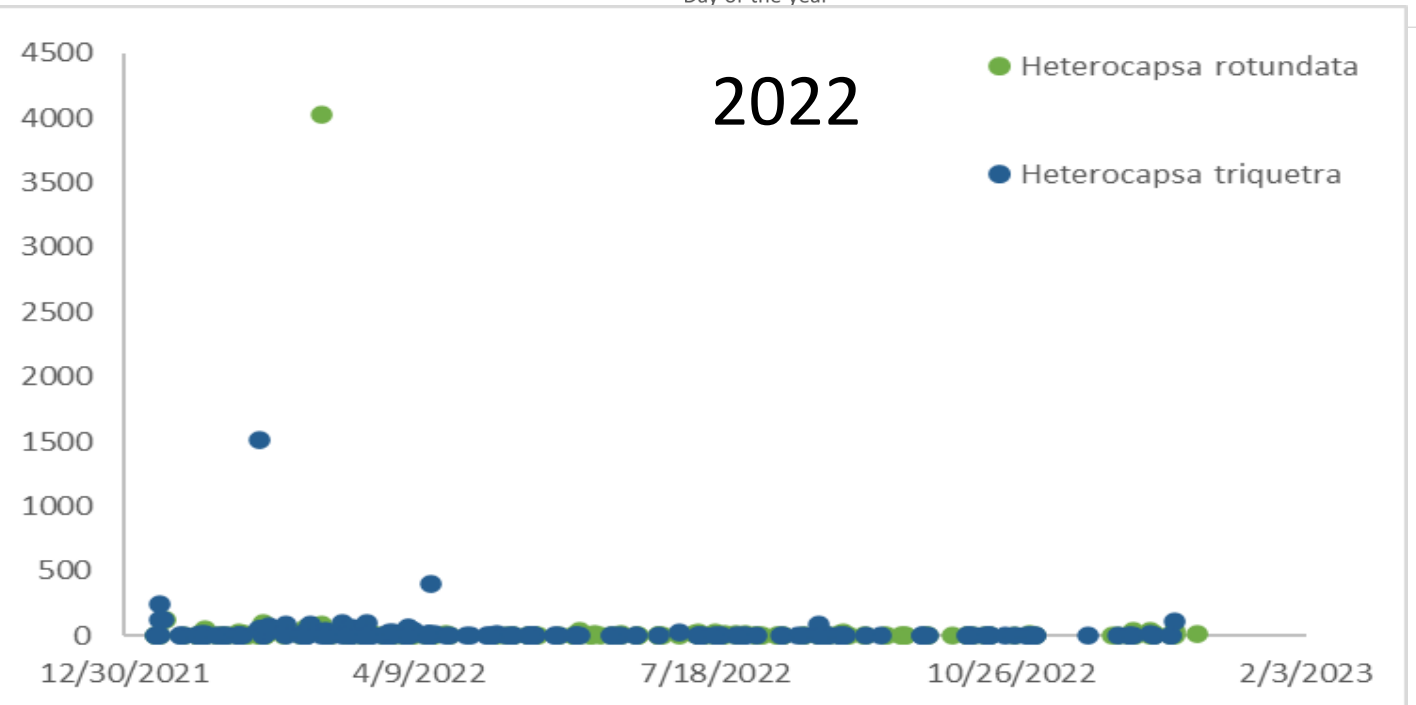
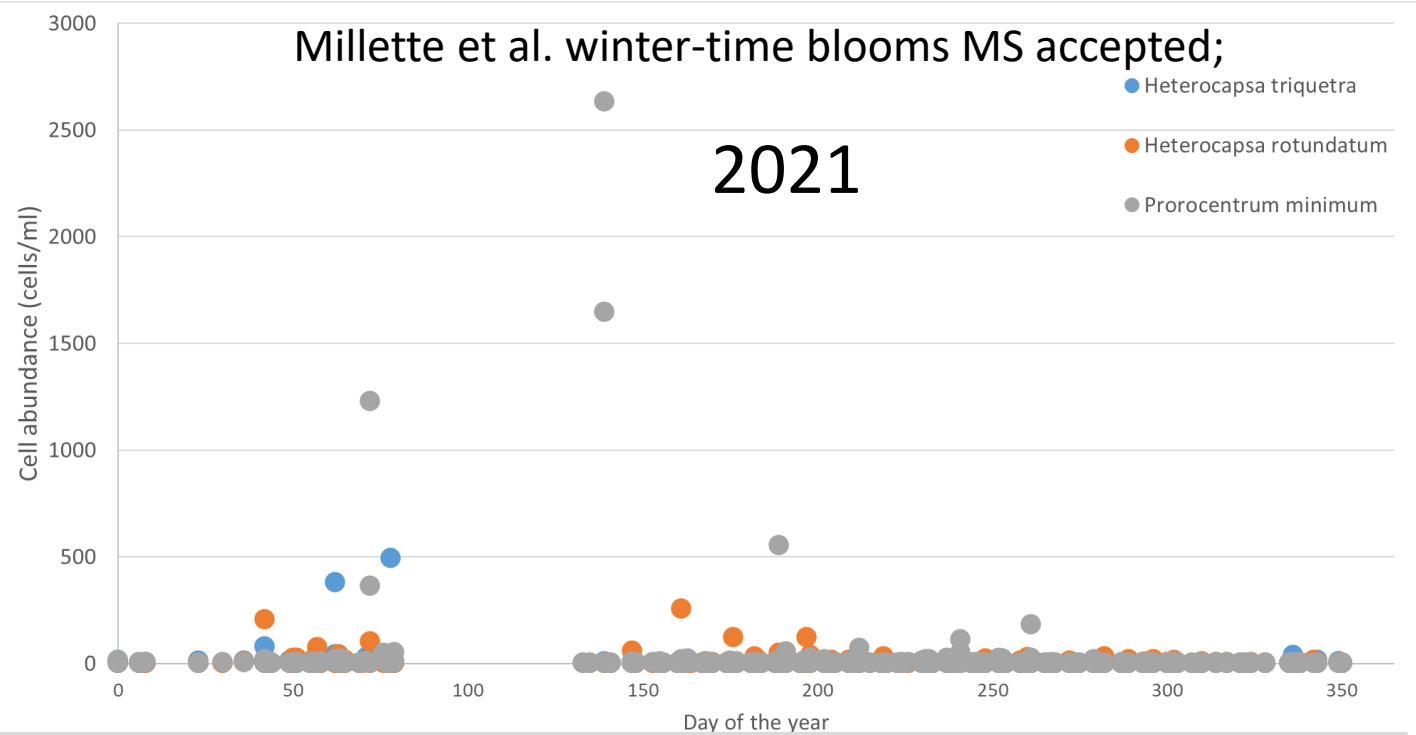
- Generally low cell densities
- Widespread distribution in Chesapeake Bay and seaside Eastern Shore



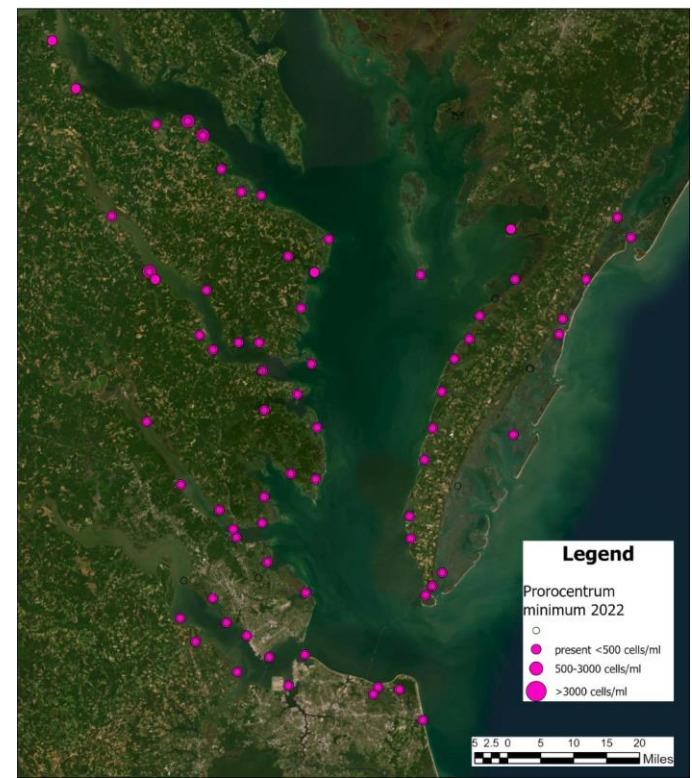
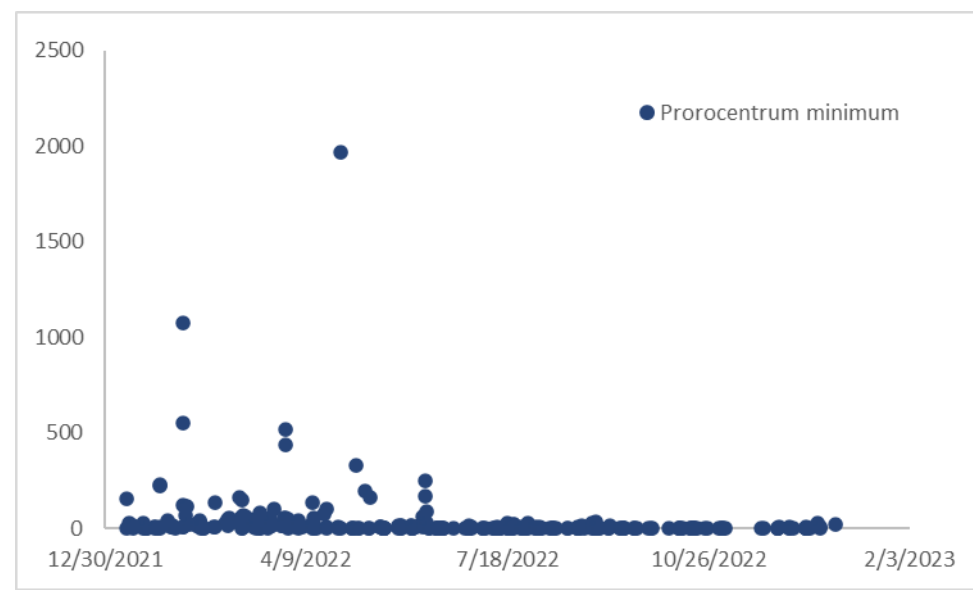
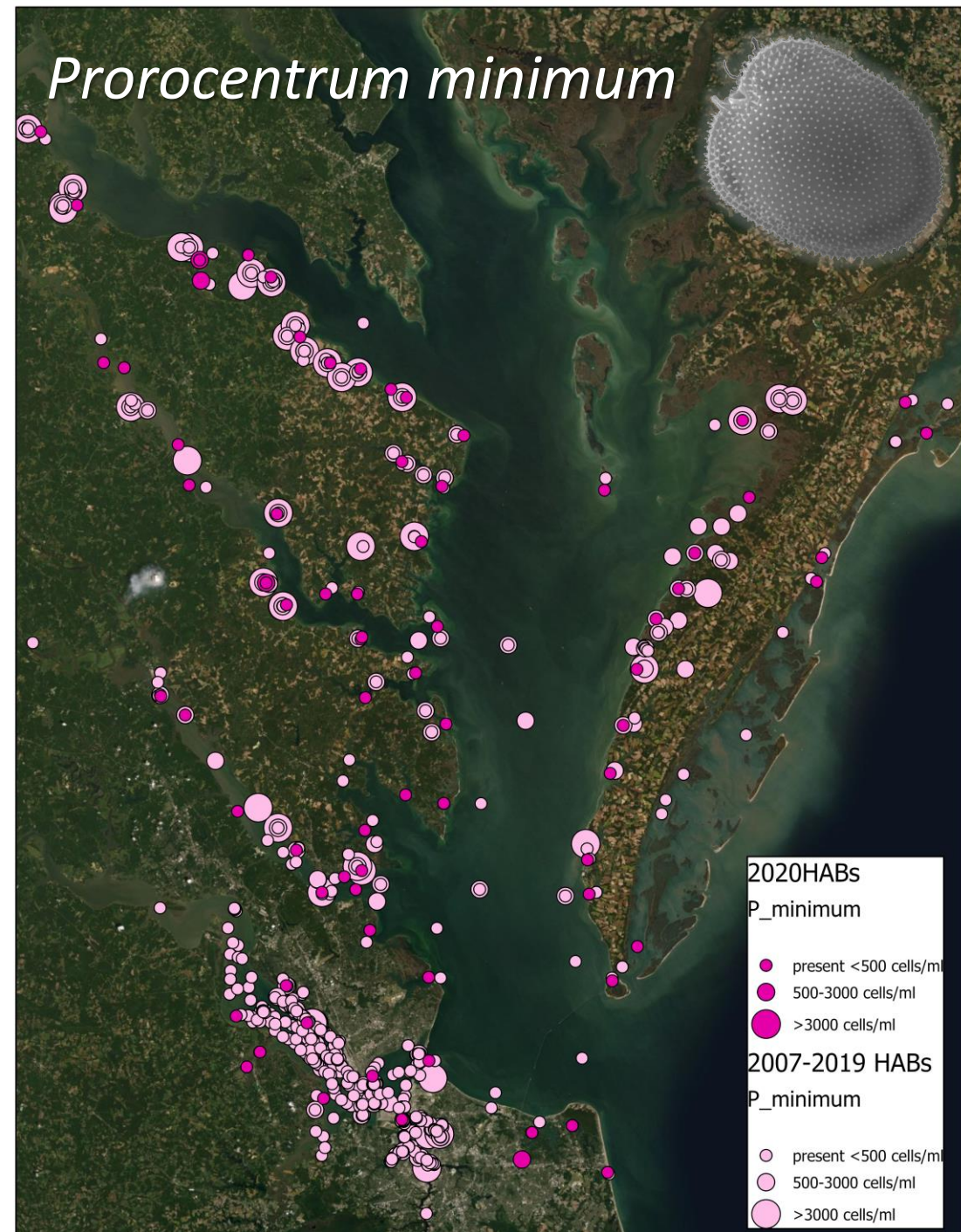
Heterocapsa



While blooms weren't reported, they happened.
We aren't looking at this time of year.

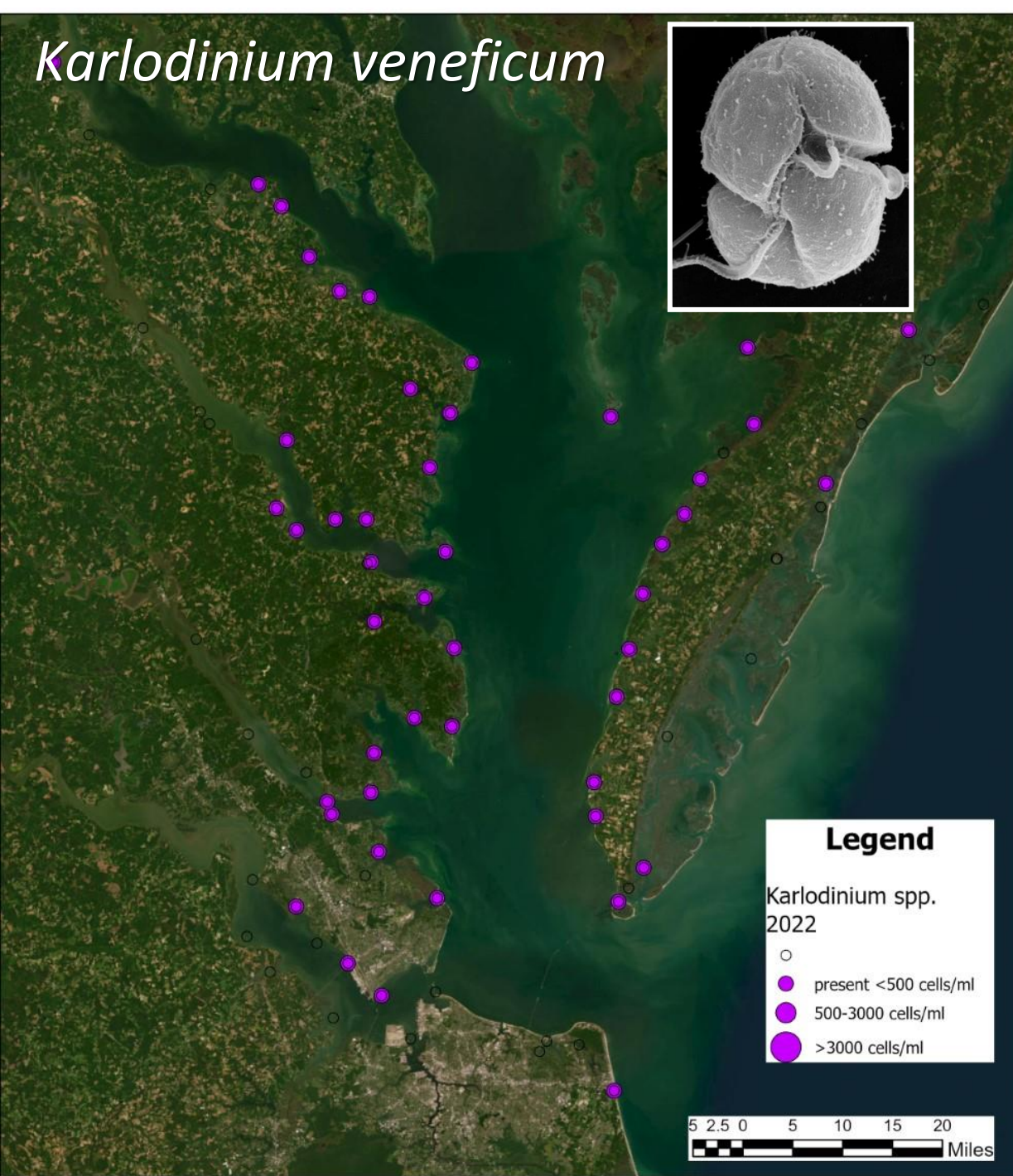
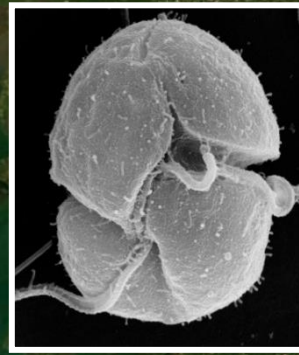


Prorocentrum minimum

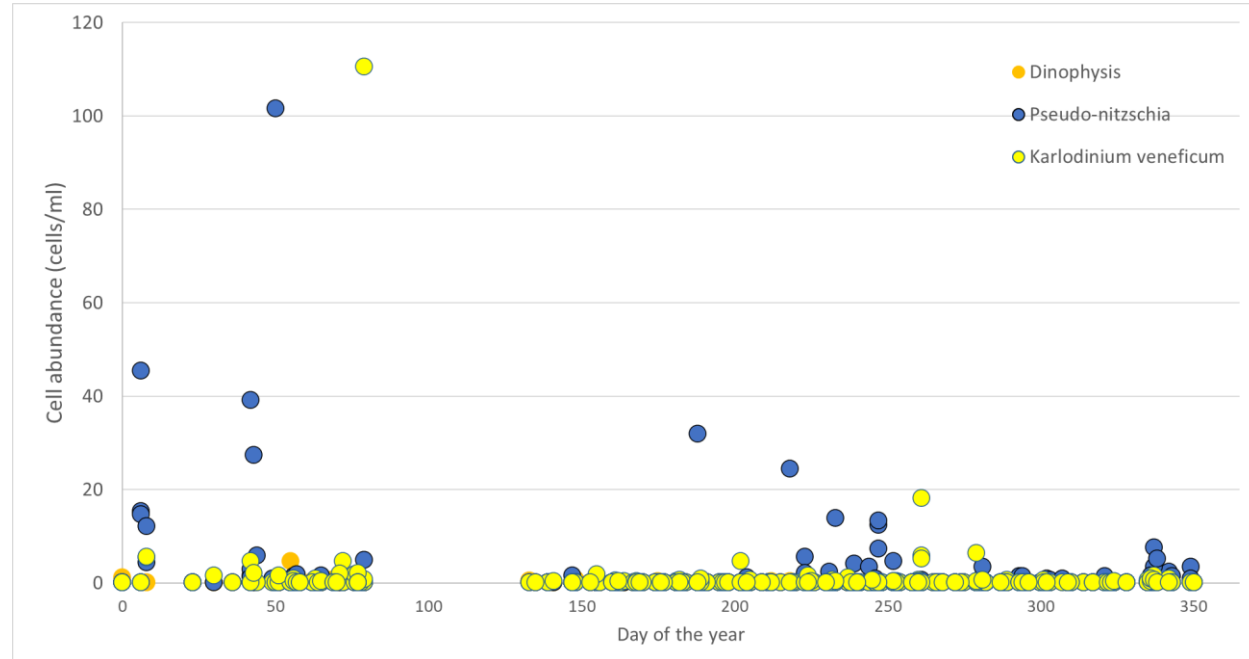


Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

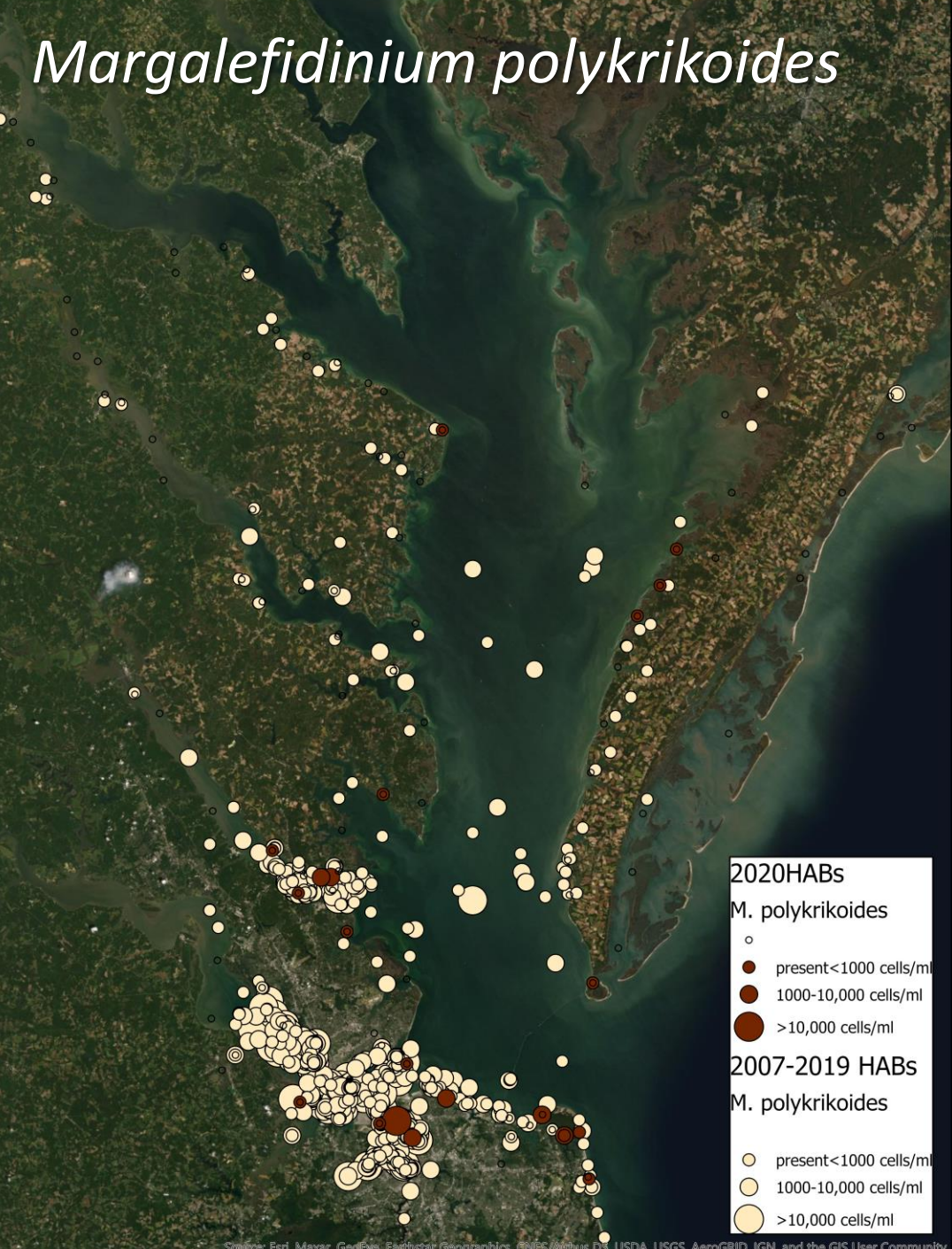
Karlodinium veneficum



Generally low abundances

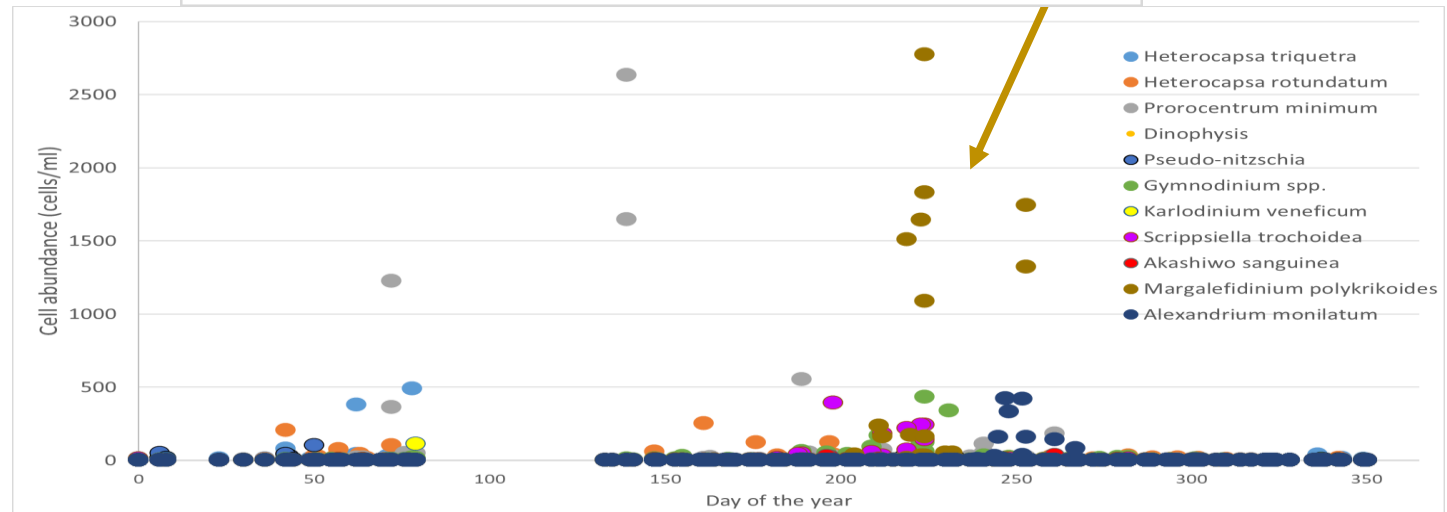
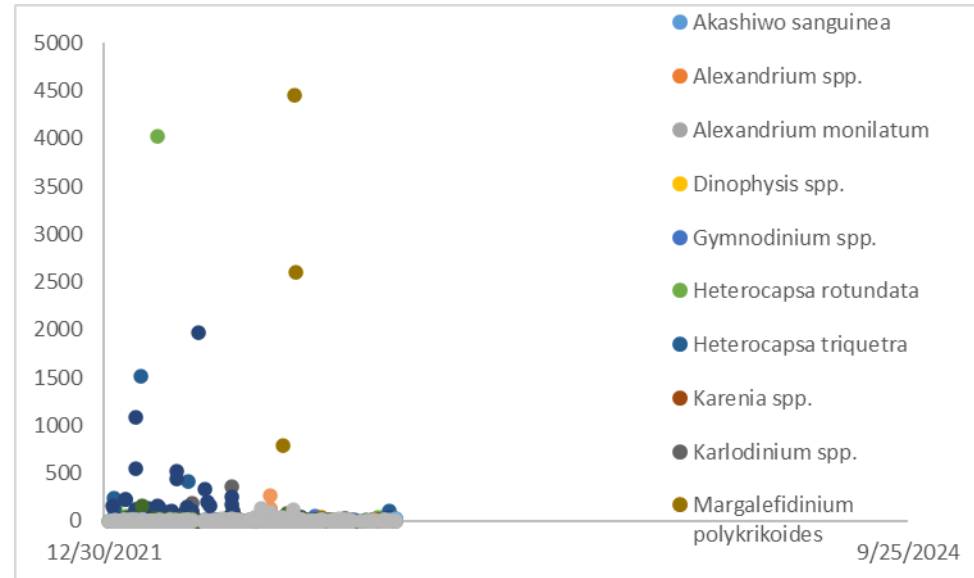


Margalefidinium polykrikoides

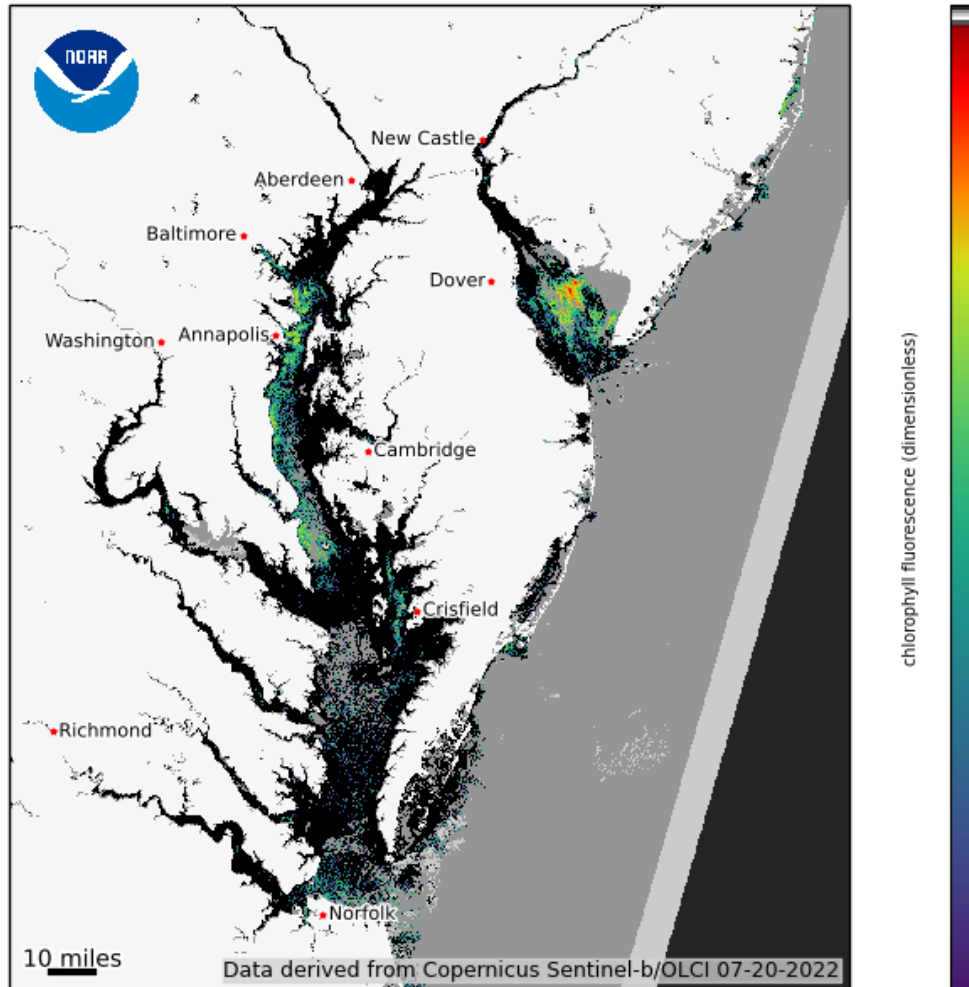


Margalefidinium polykrikoides

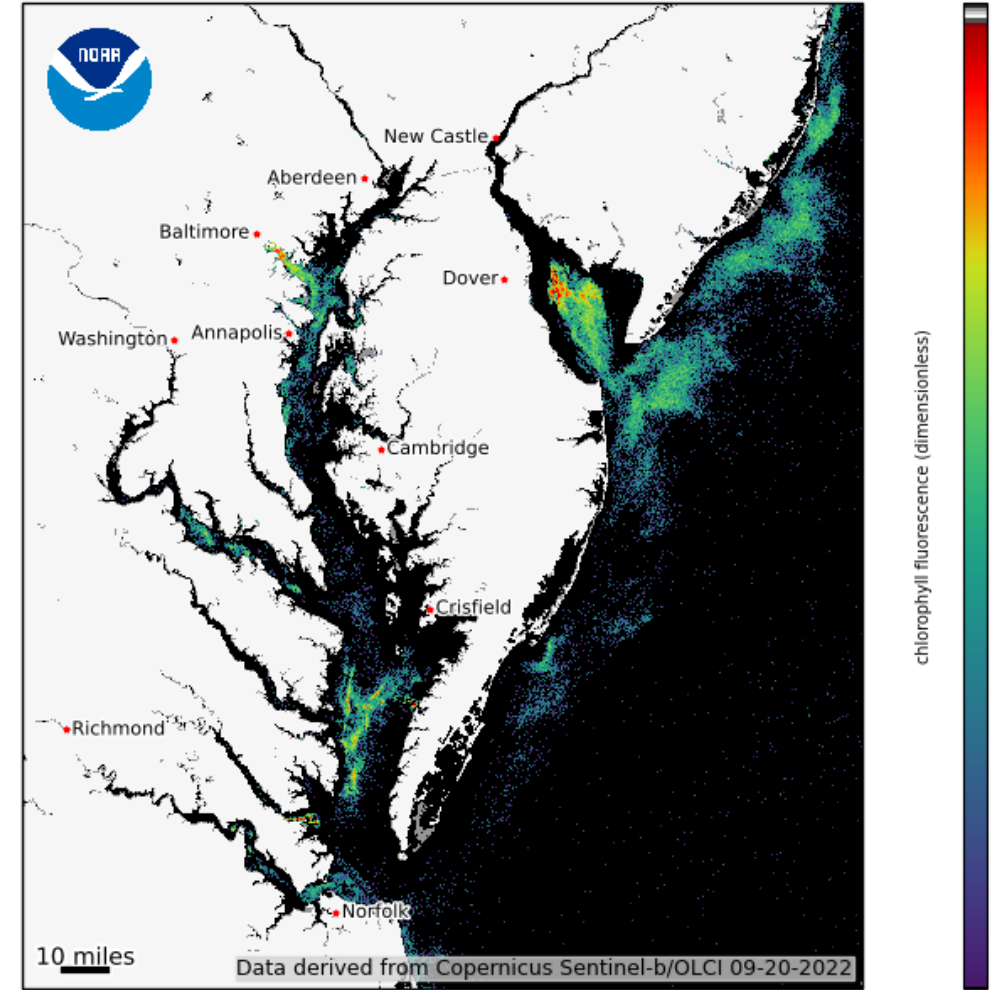
- It was blooming but largely undetected
- Initiated in Lafayette River July 20, 2022 & was transported to the oceanfront



Satellites didn't help much this year.

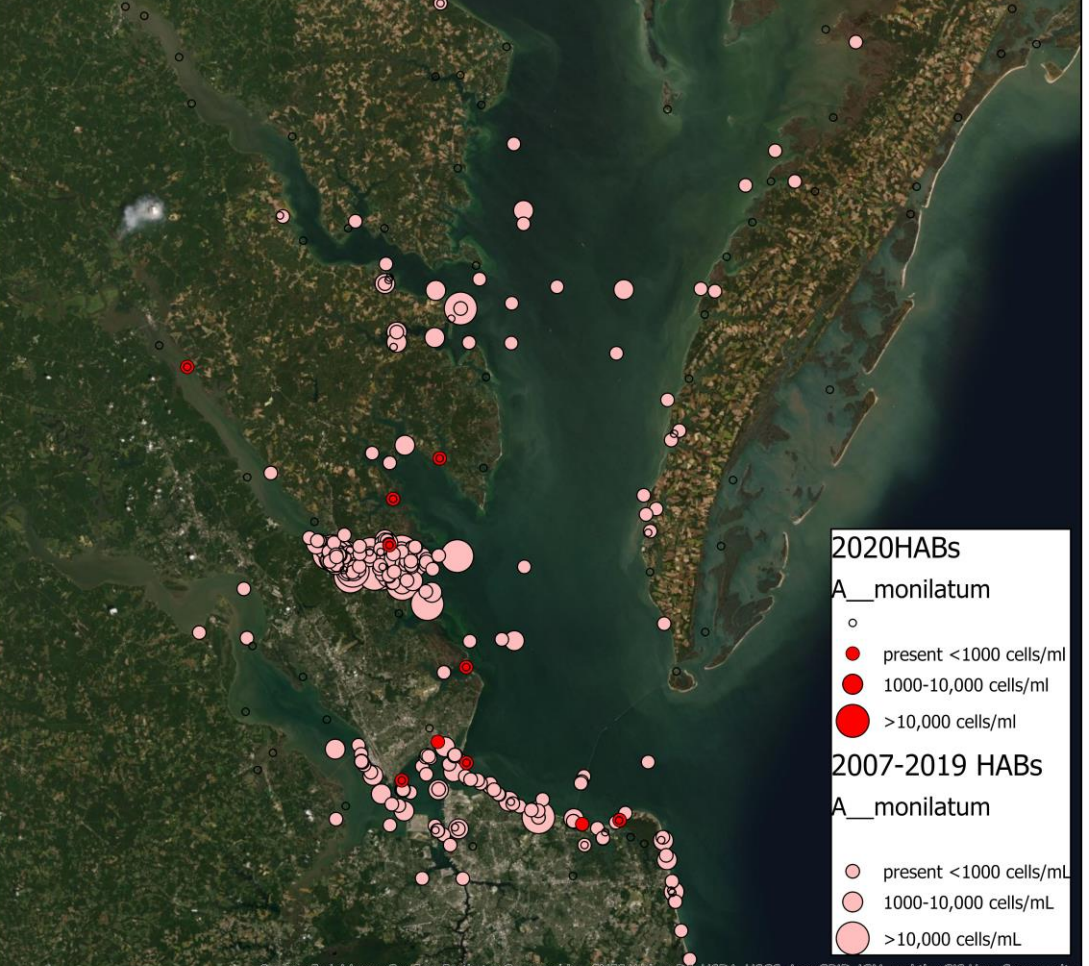


Red Band Difference (RBD) showing relative chlorophyll fluorescence from high (red) to low (violet) for Chesapeake Bay.



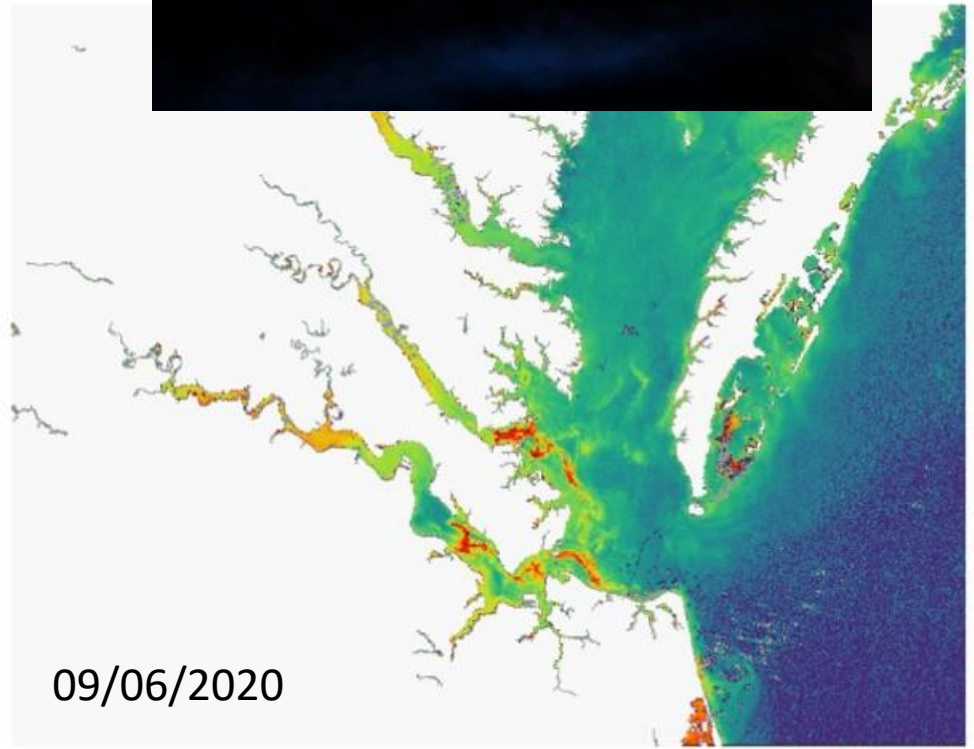
Red Band Difference (RBD) showing relative chlorophyll fluorescence from high (red) to low (violet) for Chesapeake Bay.

Alexandrium monilatum



Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

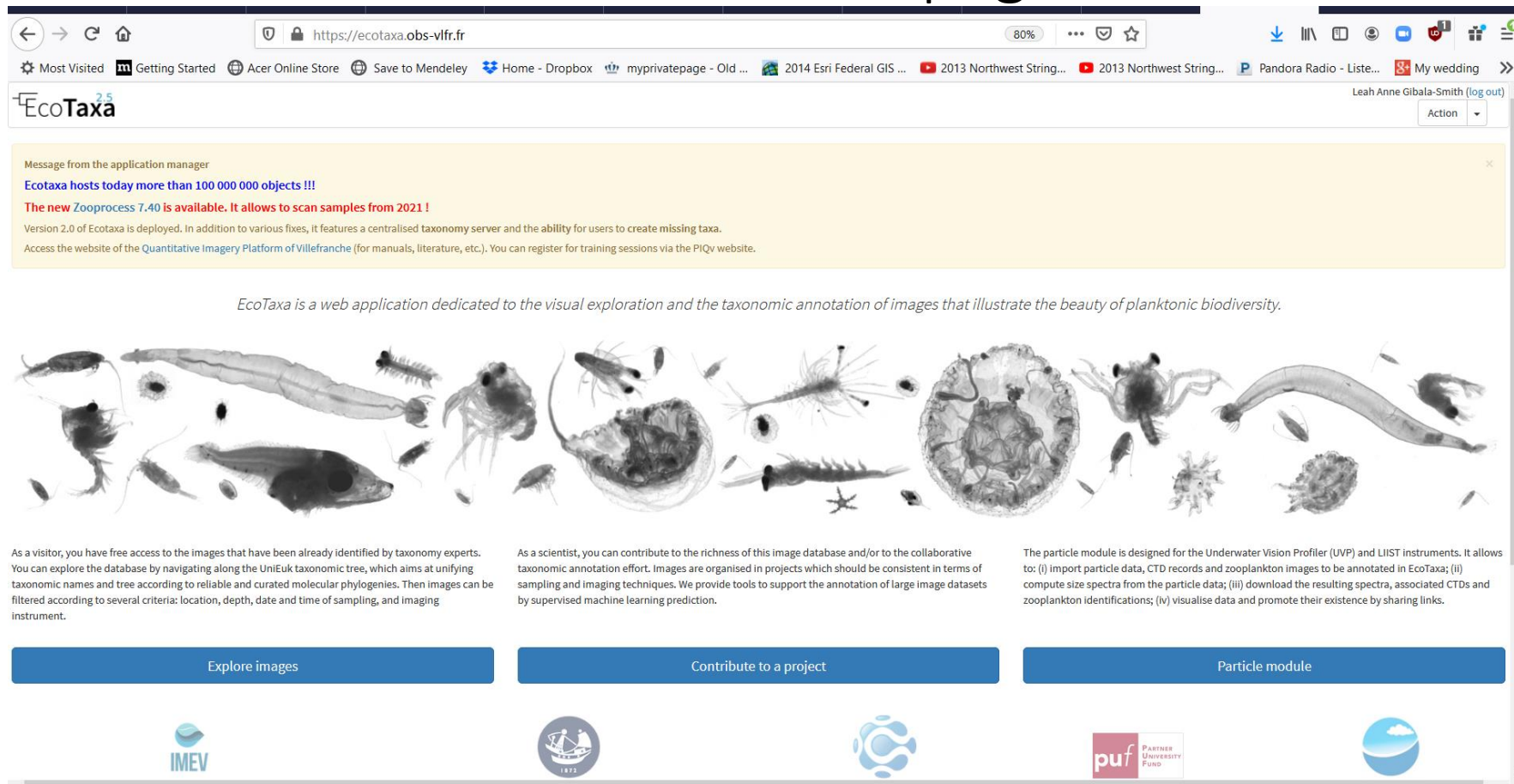
Alexandrium monilatum –2022 bloom happened but it was undersuveilied



IFCB, FlowCam, PlanktoScopes & EcoTaxa

- Images everything, even detritus, in a 5 mL sample (this was just what we fed it)
- Working with MARACOOS and Maryland to build regional image libraries
- Submitted a MERHAB proposal for development of bloom forecasting system for Alex and Marg

EcoTaxa homepage



Message from the application manager

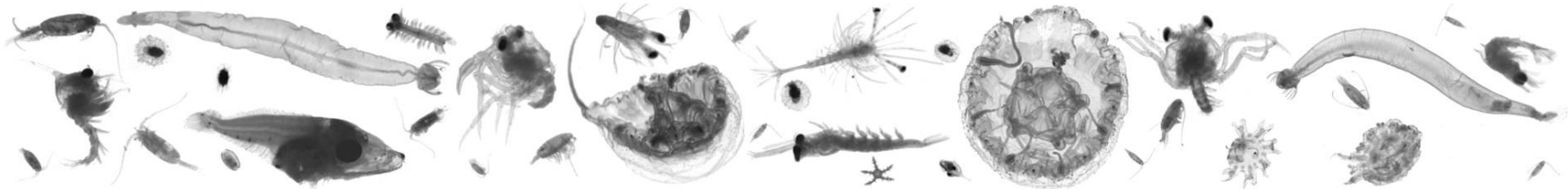
Ecotaxa hosts today more than 100 000 000 objects !!!

The new Zooprocess 7.40 is available. It allows to scan samples from 2021 !

Version 2.0 of Ecotaxa is deployed. In addition to various fixes, it features a centralised taxonomy server and the ability for users to create missing taxa.

Access the website of the [Quantitative Imagery Platform of Villefranche](#) (for manuals, literature, etc.). You can register for training sessions via the PIQv website.

EcoTaxa is a web application dedicated to the visual exploration and the taxonomic annotation of images that illustrate the beauty of planktonic biodiversity.




As a visitor, you have free access to the images that have been already identified by taxonomy experts. You can explore the database by navigating along the UniEuk taxonomic tree, which aims at unifying taxonomic names and tree according to reliable and curated molecular phylogenies. Then images can be filtered according to several criteria: location, depth, date and time of sampling, and imaging instrument.

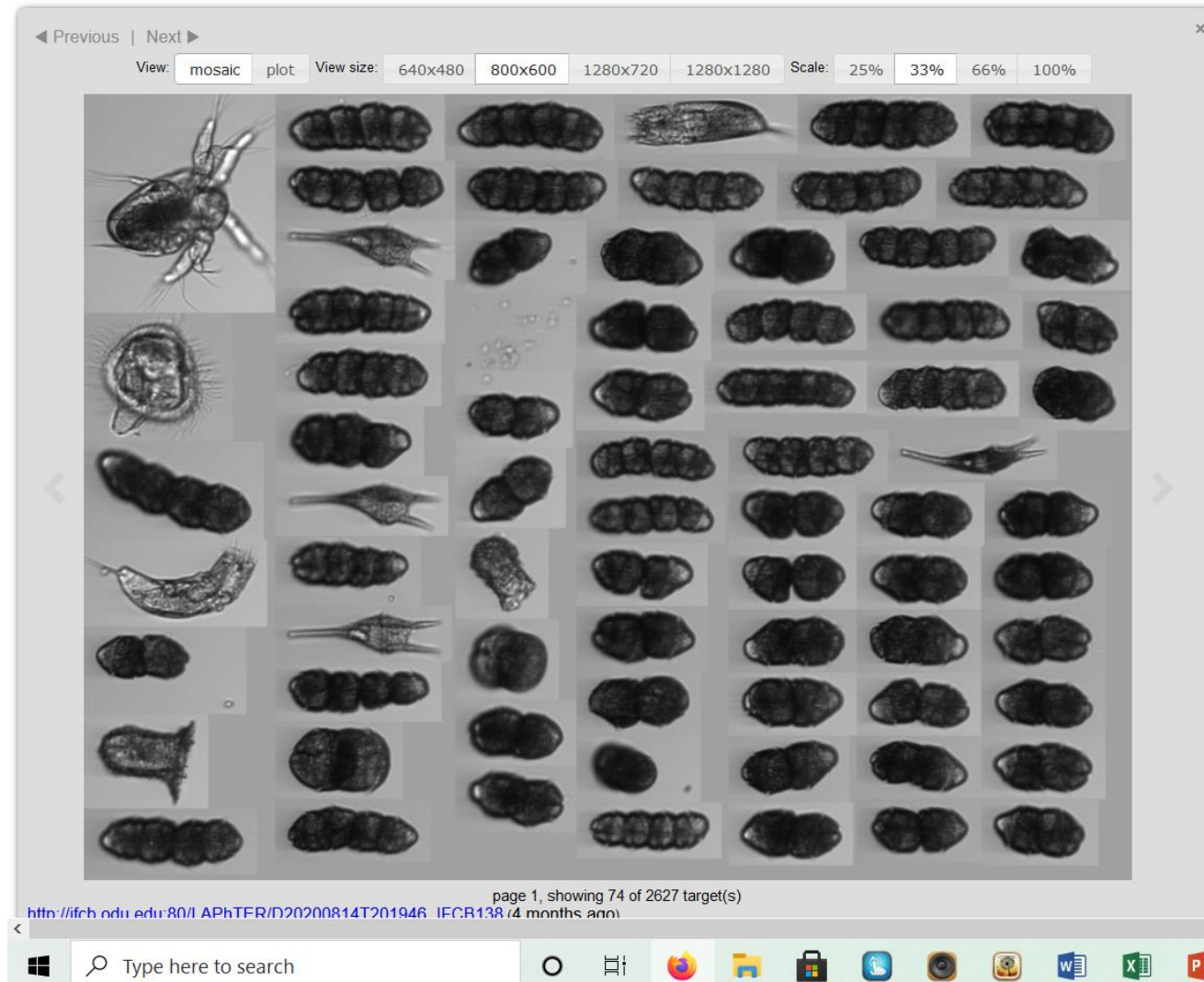
As a scientist, you can contribute to the richness of this image database and/or to the collaborative taxonomic annotation effort. Images are organised in projects which should be consistent in terms of sampling and imaging techniques. We provide tools to support the annotation of large image datasets by supervised machine learning prediction.

The particle module is designed for the Underwater Vision Profiler (UVP) and LIIST instruments. It allows to: (i) import particle data, CTD records and zooplankton images to be annotated in EcoTaxa; (ii) compute size spectra from the particle data; (iii) download the resulting spectra, associated CTDs and zooplankton identifications; (iv) visualise data and promote their existence by sharing links.

[Explore images](#) [Contribute to a project](#) [Particle module](#)



IFCB live dashboard – *Margalefidinium* bloom – images not uploaded to Ecotaxa yet
We know life stages and chain length may play an important role in the initiation and persistence of these blooms and plan to interrogate the database.

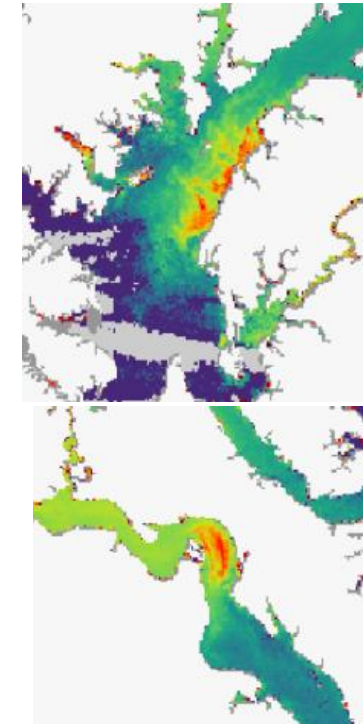


2022 program plans – how did we do?

- Continue VDH & CBP sampling and merging of databases
 - Karlodinium and other emerging HAB papers
- Resume HRSD dataflow sampling after COVID hiatus – did some/do it this year
- Continue sampling at the Lafayette River time series – done/will do again
- Establish FlowCam and work with them to allow public access to images
- Building off multiple programs – VDH, CBP, HRSD, ECOHAB – continuing; work more closely with MARACOOS to develop imaging platforms
- Year-round sampling and analyses with undergrads and instruments – using OES 307 to do weekly winter sampling
- More student involvement – 3 undergrads doing projects
- Many manuscripts in preparation

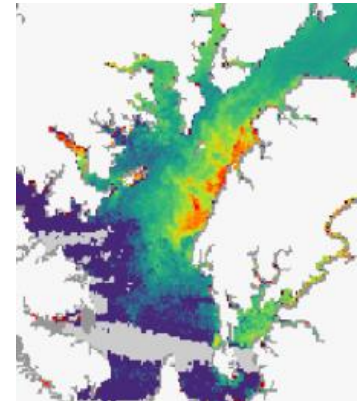
New year's resolutions 2023

- Work on submitting long overdue manuscripts
- Year-round sampling and analyses with undergrads and instruments – we now have some undergraduate research opportunities at ODU
- Laboratory experiments
 - identify projects and funding
 - Aliyah Downing, Microcystis and high CO₂; undergraduate research opportunities
 - Isolation of cultures
 - Production of toxins
 - Life cycle events that influence blooms
- Funding to tie in research with the monitoring to better advise management – MERHAB submitted



New year's resolutions (cont)

GMU collaboration on SPATTS in Potomac and Lake Gaston
Graduate student projects



Thank you!

Funding:



People:

Leah Gibala-Smith
Kathryn Mogatas
Todd Egerton
Michael Echevarria
Eduardo Perez Vega
Yifan Zhu
Peter Bernhardt
Sophie Clayton
Shelly Tomlinson
Qubin Qin
Jian Shen

All the field crew at DEQ, VDH, & HRSD

Questions?

