

2021 Virginia HABs: Estuarine monitoring summary

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VA HAB Taskforce Meeting
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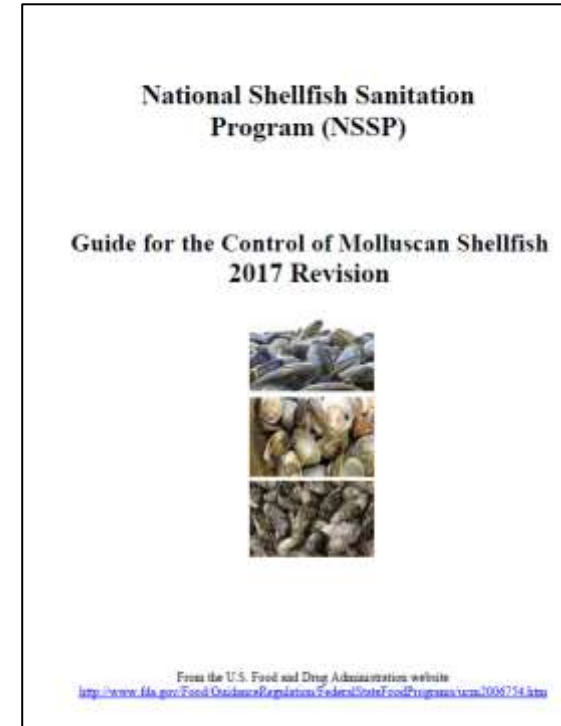


Overview

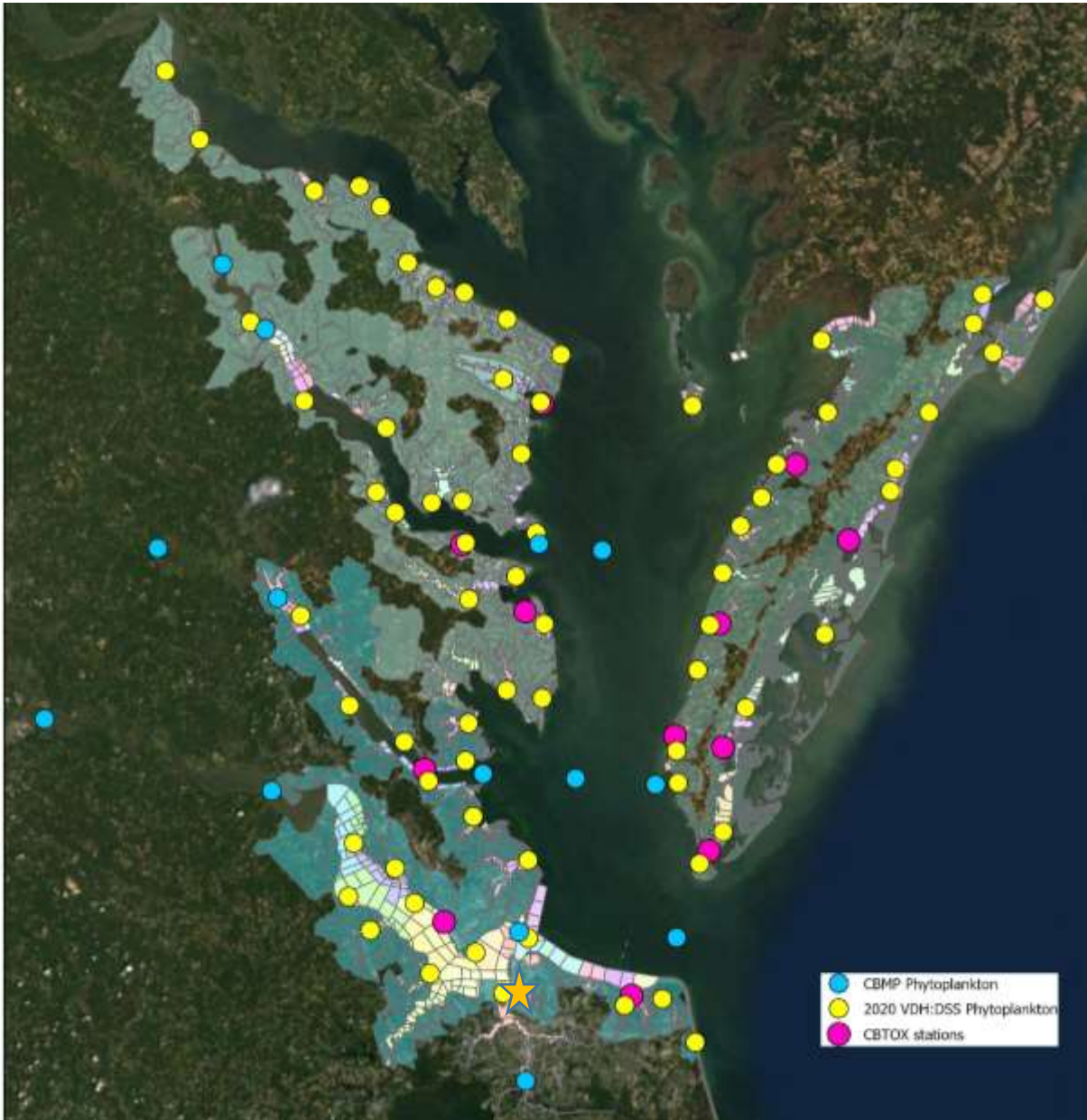
- Bloom response - ODU
- Notable 2021 blooms
- Monitoring results summary
- Related projects –transport, IFCB
- 2022

VDH Shellfish monitoring

- Monthly collections- routine fixed sites
 - Lugol's solution (500mL) – phytoplankton analyses (ODU)
 - Unpreserved frozen sample (50mL)- ELISA screening (VDH)
- Bloom samples
 - Response to bloom reports or visual observation by field staff
 - VDH, CBP, HRSD, Time series site



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



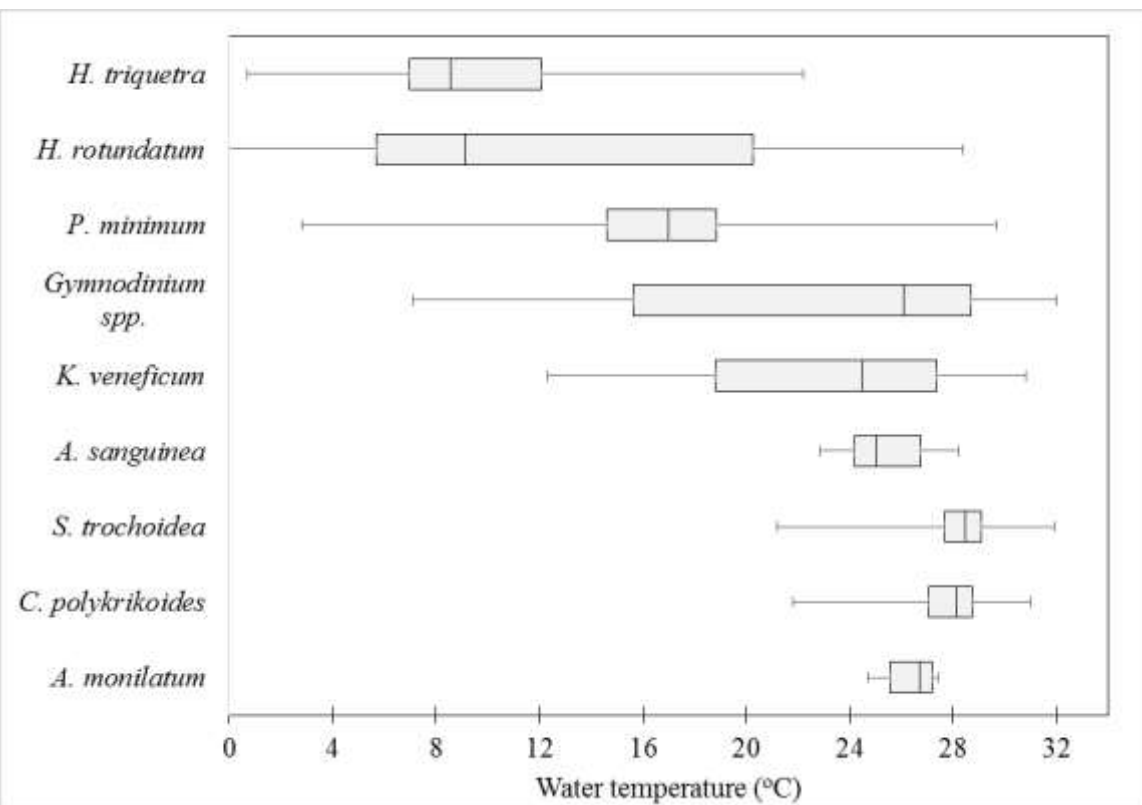
Virginia Estuarine Phytoplankton monitoring

- Chesapeake Bay Monitoring Program (DEQ/ODU)
 - 14 stations
 - 7-Chesapeake Bay monthly year-round
 - 7-Tidal tributaries monthly March-October
- Full species composition
- 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)
 - 12 stations (2017-2018)
 - 4 stations (2019-2021)
 - Bi-weekly sampling
 - Targeted HAB identification
 - Routine toxin analyses
- ★ Additional monitoring: ODU, HRSD, ECOHAB
Dataflow HRSD (no bloom samples in 2021)

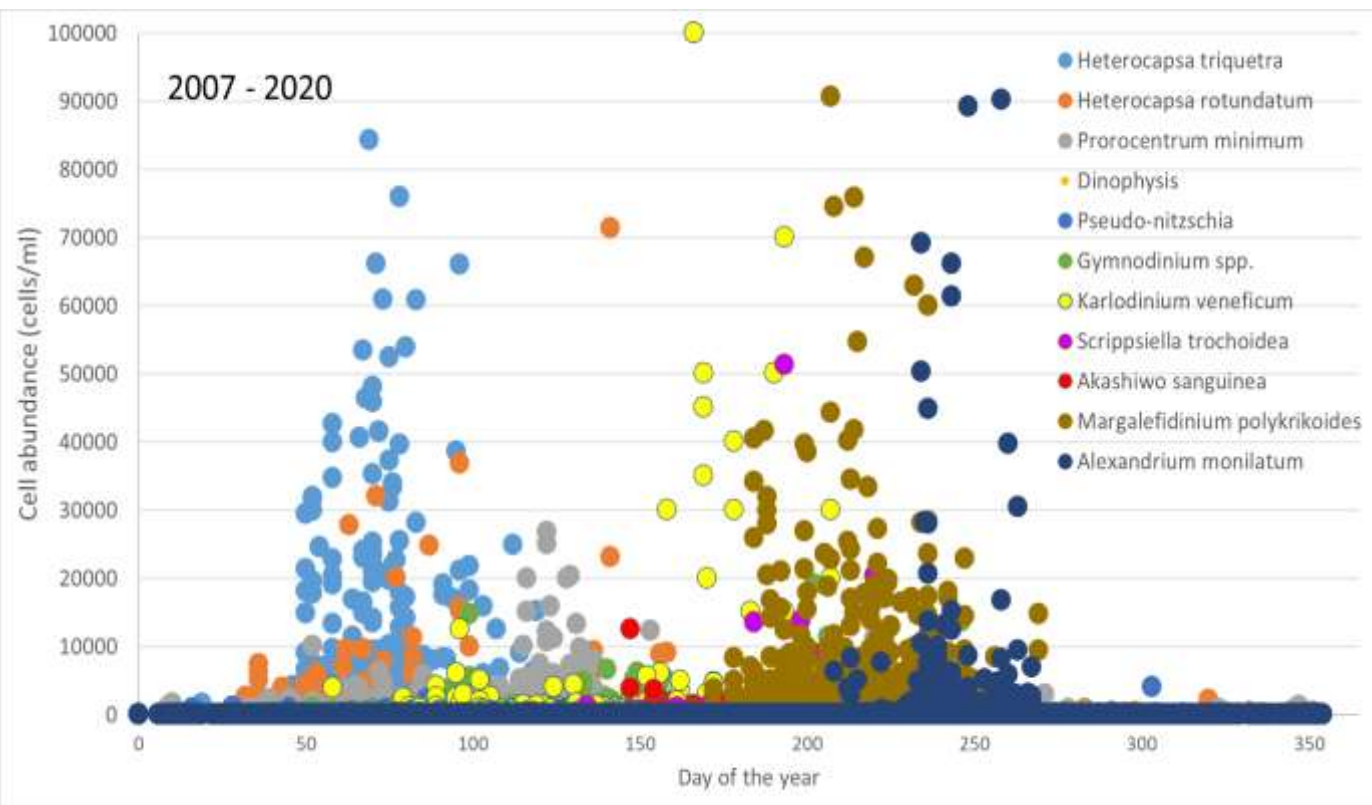
Data changes

- HRSD did not collect samples from dataflow cruises in the James River – we will seek to have these collections restored in 2022
- Added back CBP trib sampling Nov-Feb 2021-2022
- Added some (biweekly) Elizabeth and Lafayette Rivers throughout the year 2021 and 2022
- Still need to count time series data from Lafayette River

“Normal” bloom progression

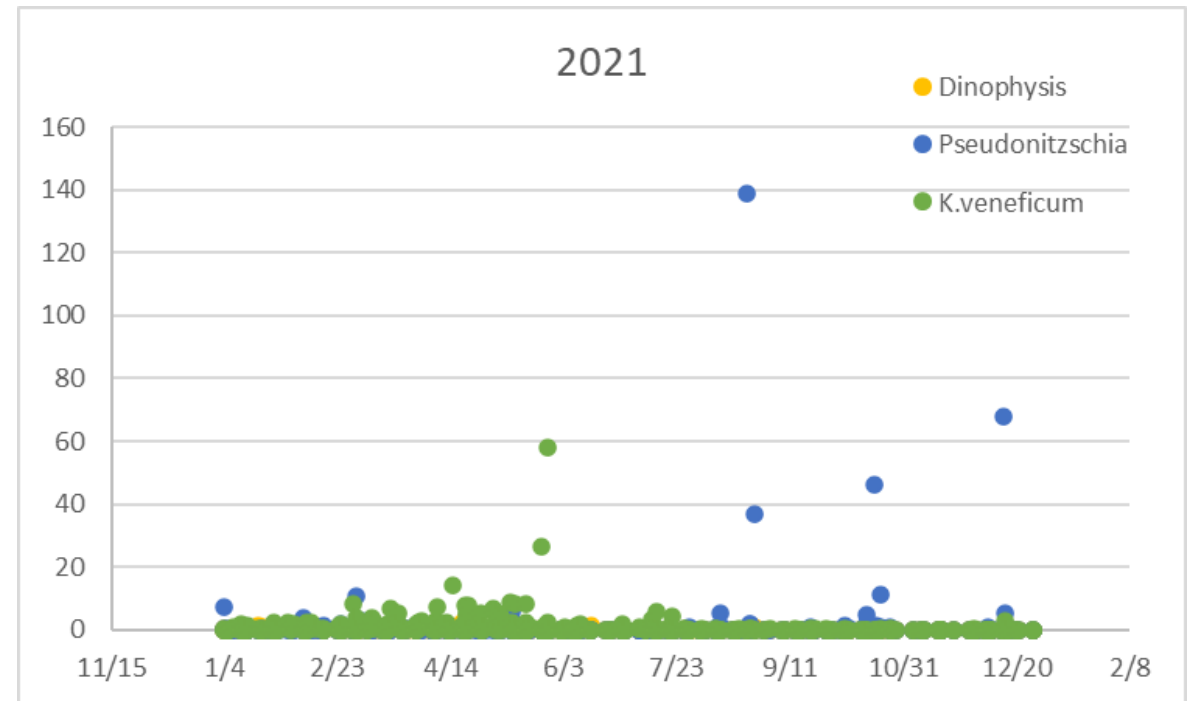
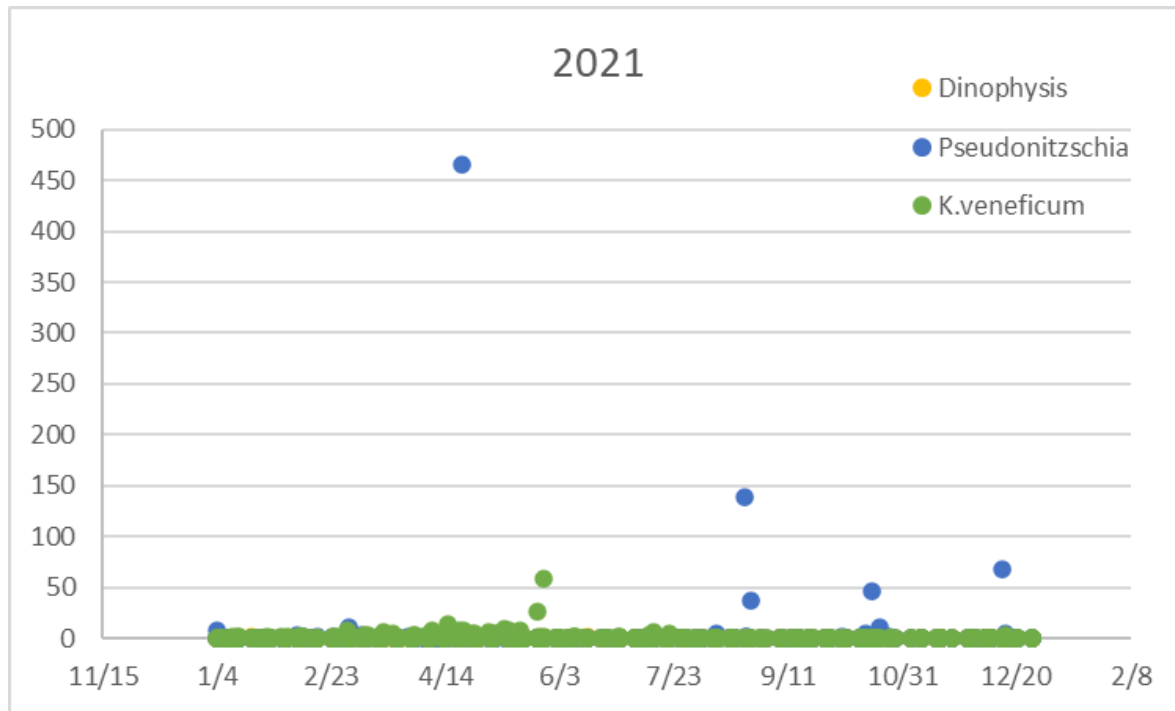


**Pseudo-nitzschia* and *Dinophysis* not abundant enough to make the list

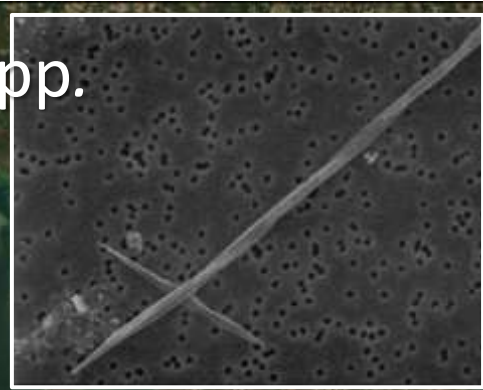


*Removed data where abundances were > 100,000 cells/ml

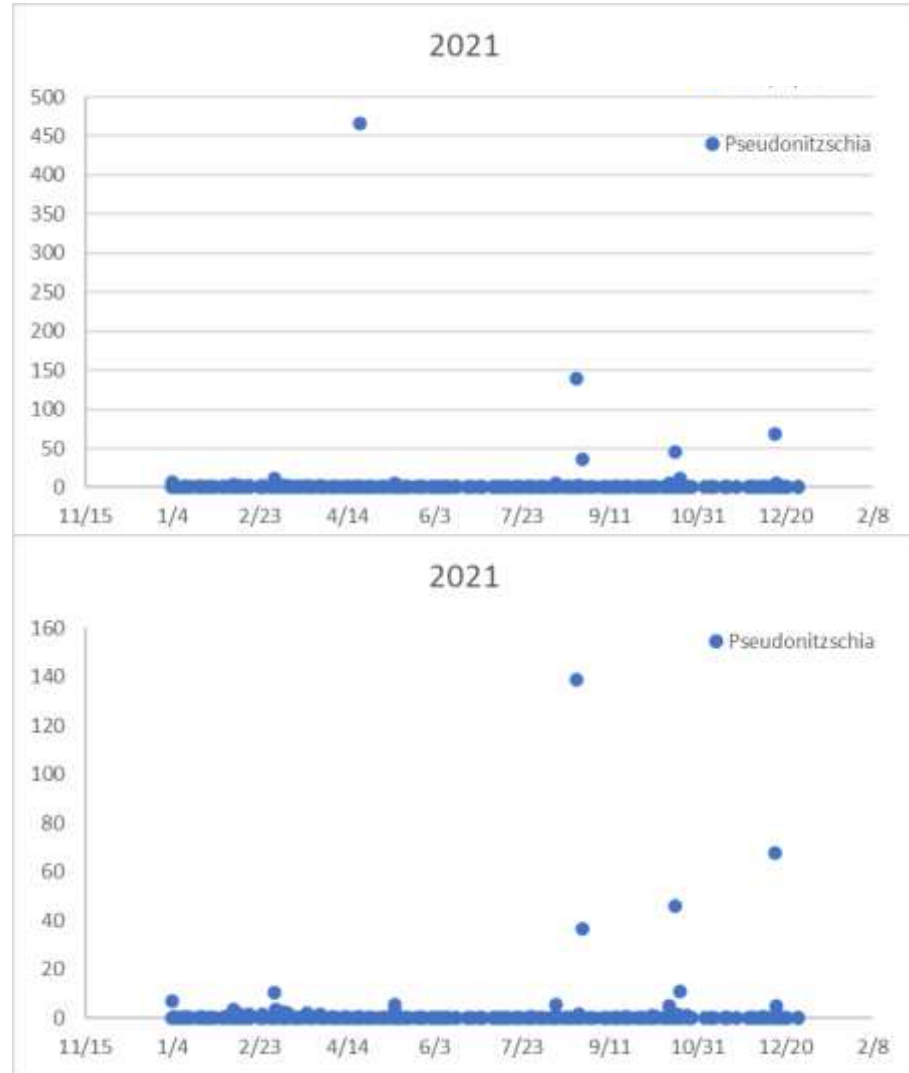
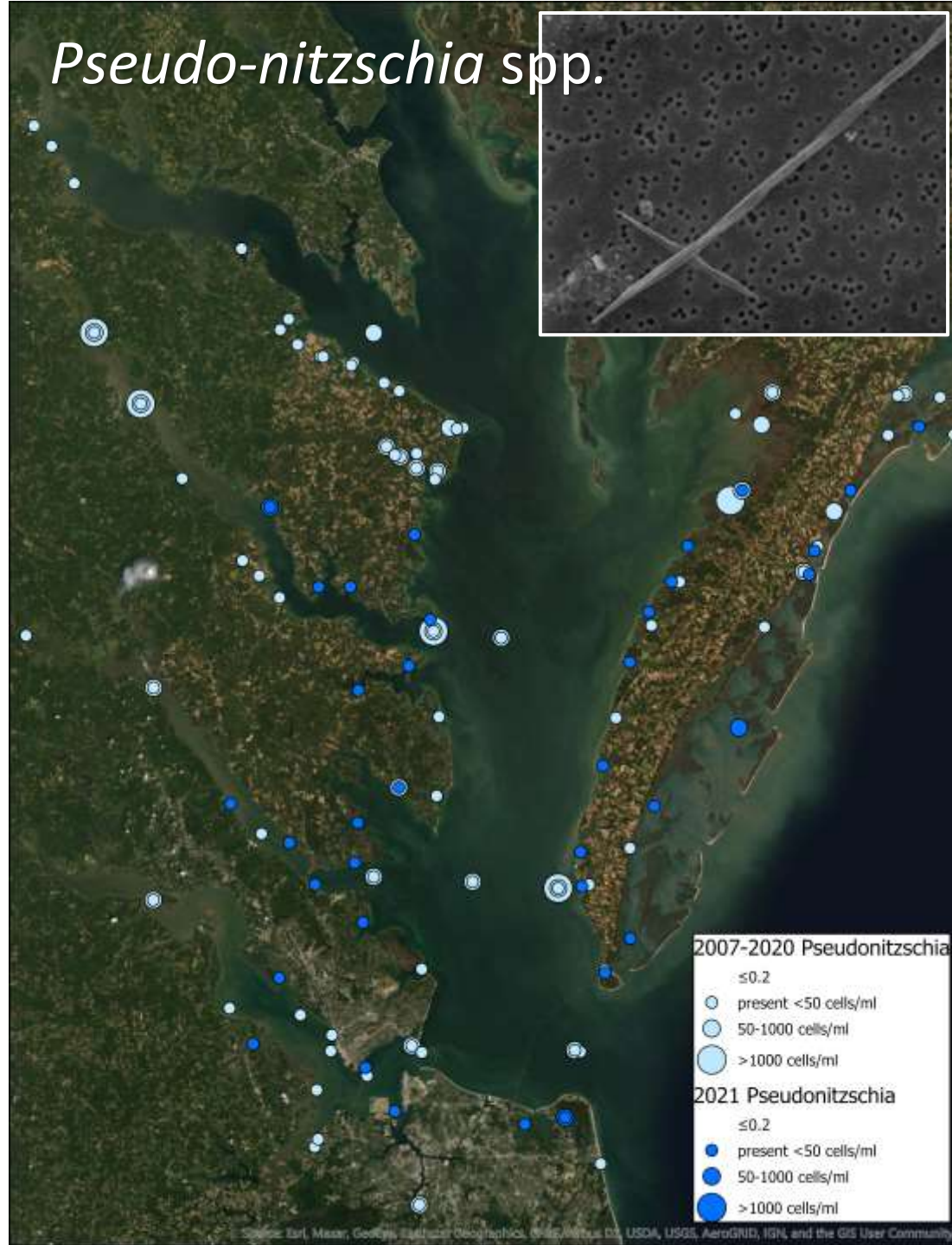
Our less abundant HAB species in 2021



Pseudo-nitzschia spp.



- January 2020 Potomac *Pseudo-nitzschia* event
- In 2021, generally low cell densities
- Widespread distribution in Chesapeake Bay and seaside Eastern Shore

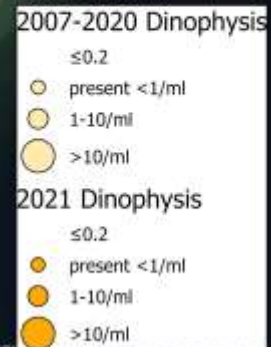
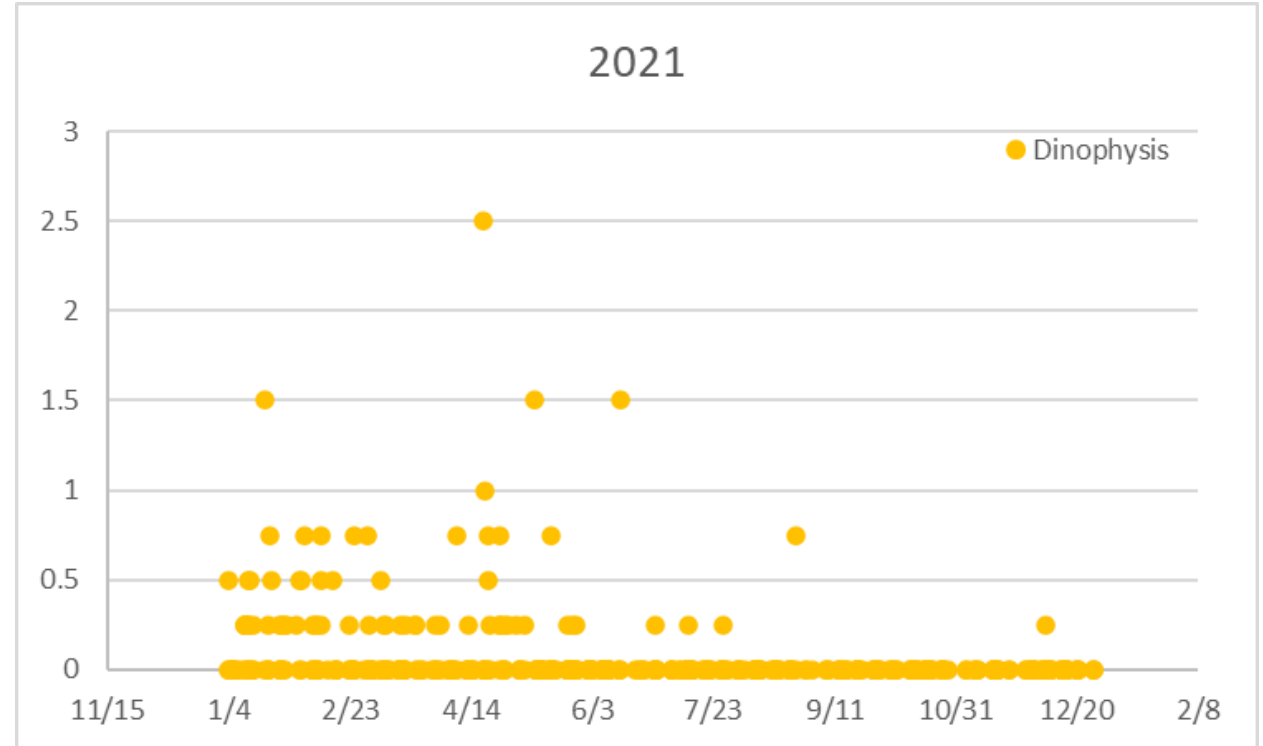


Source: Earl, Mazar, Google Earth, National Oceanic and Atmospheric Administration, USDA, USGS, AeroGRID, IGN, and the GIS User Community

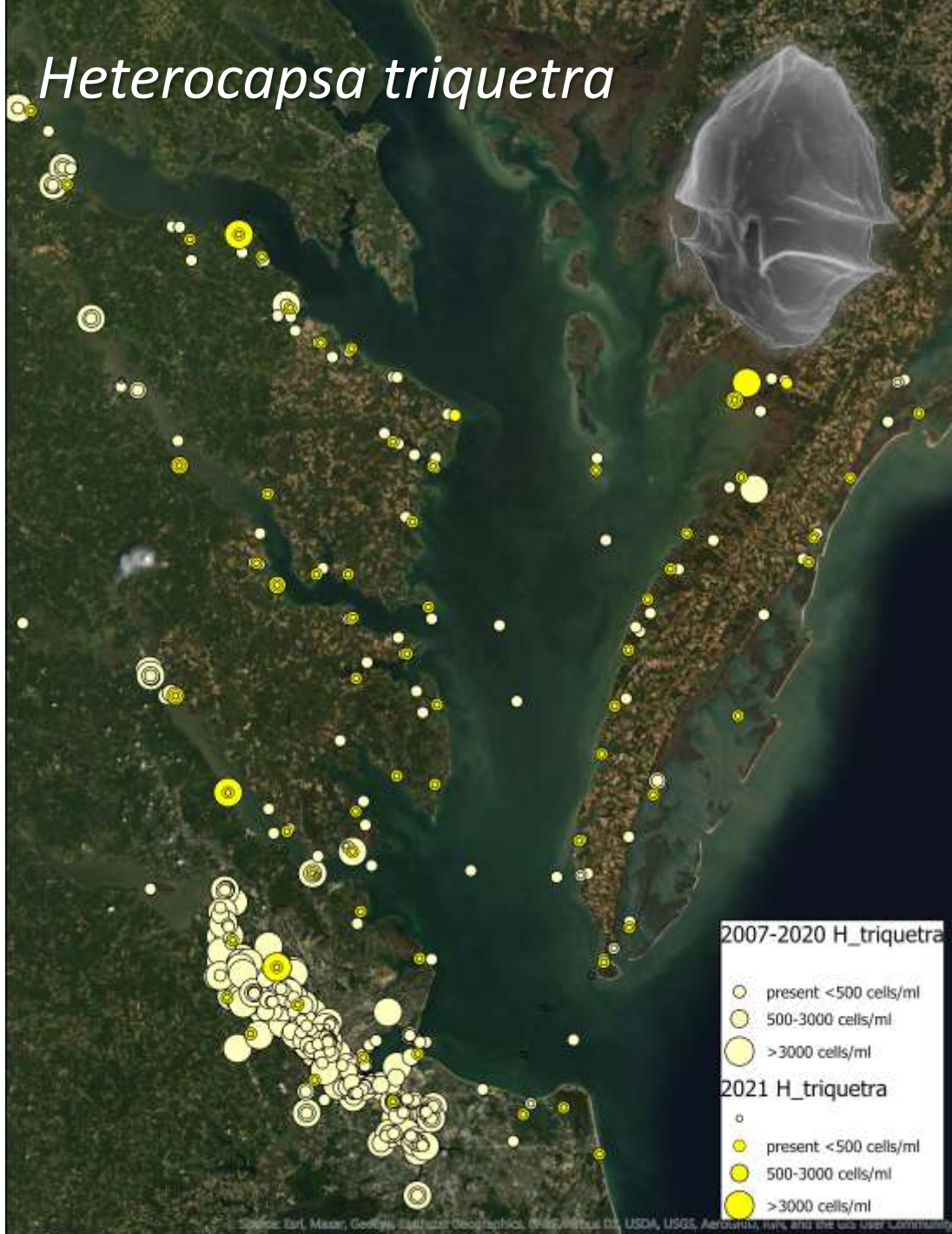
Dinophysis spp.



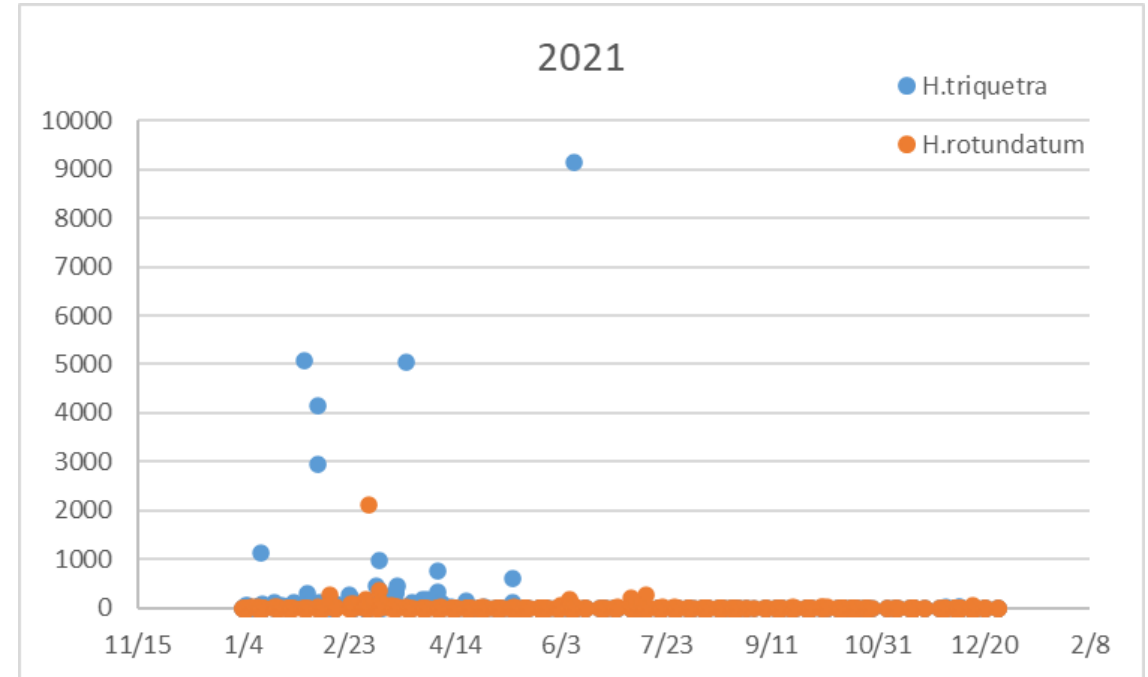
- Generally low cell densities, as in 2020
- Widespread distribution in Chesapeake Bay and seaside Eastern Shore



Heterocapsa triquetra



Bloom January - June



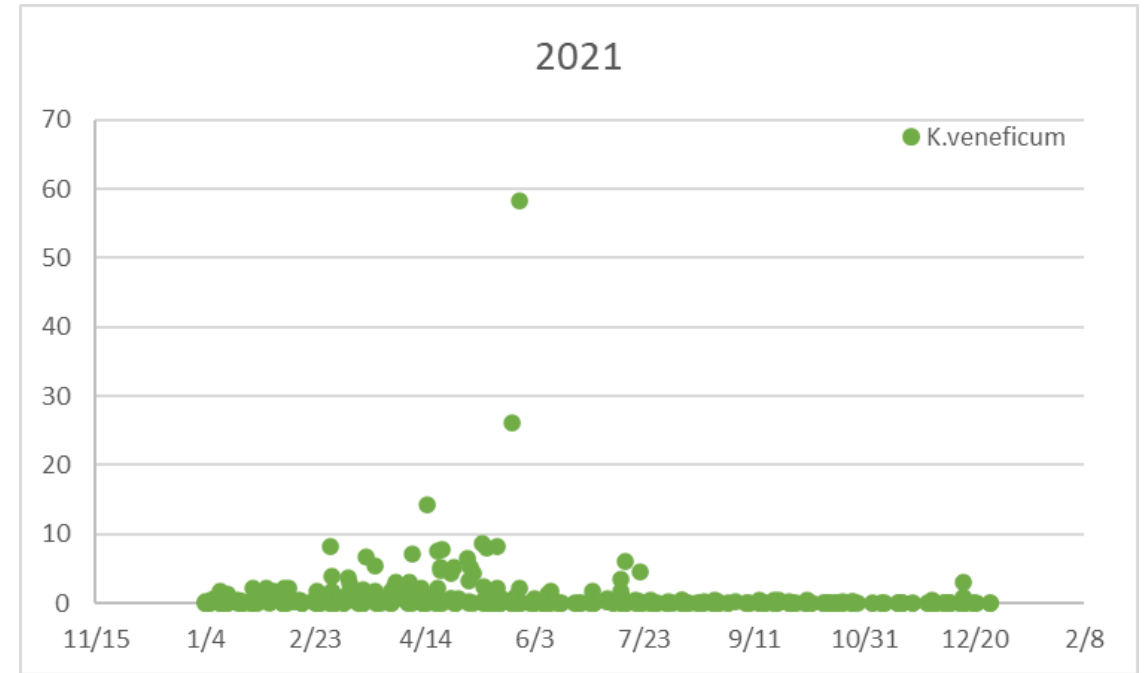
Quite a protracted bloom during winter 2021

We under-sample and overlook winter blooms (Millette et al. in prep)

Karlodinium veneficum



Low abundances but present



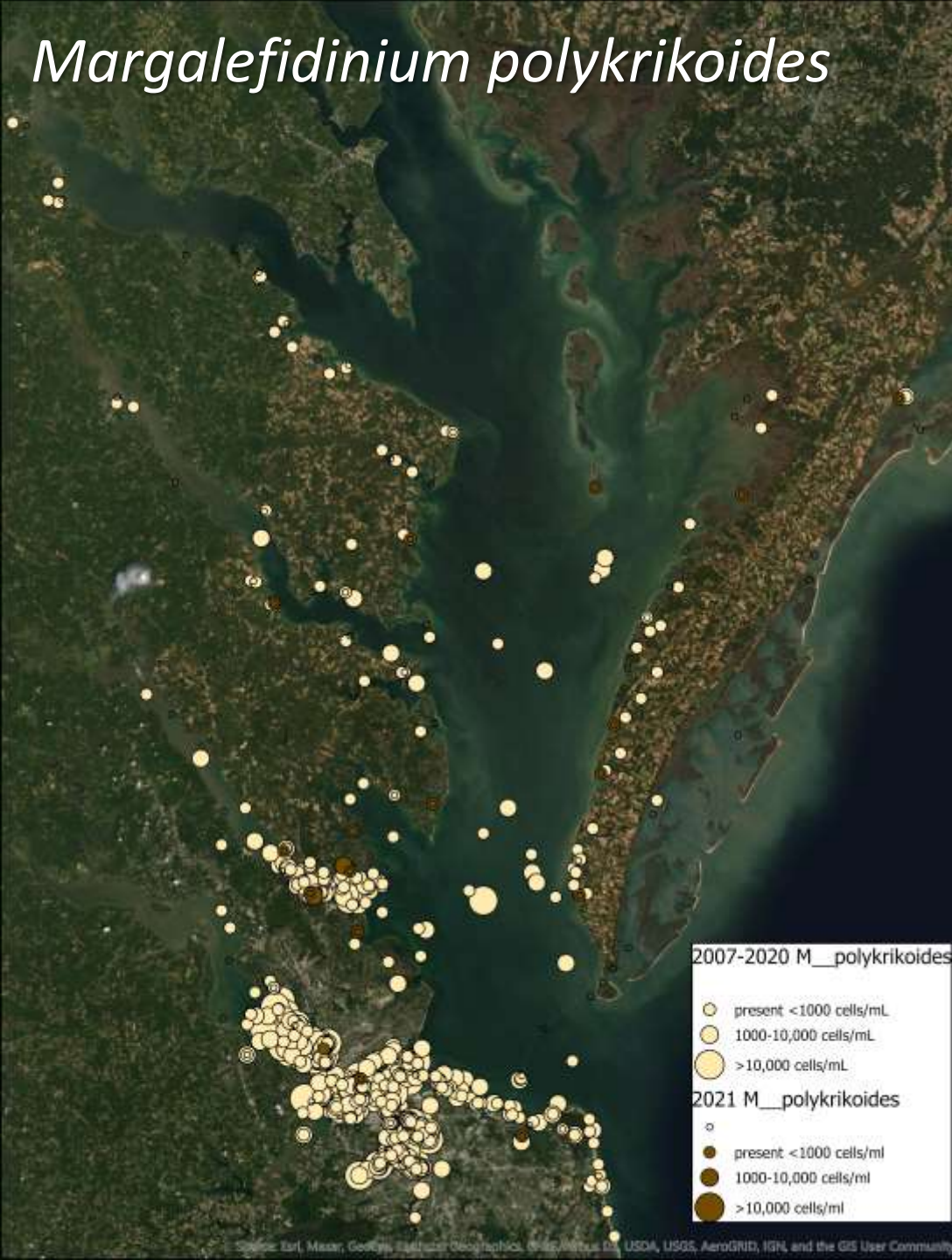
2007-2020 *K_veneficum*

- present <500 cells/ml
- 500-3000 cells/ml
- >3000 cells/ml

2021-*K_veneficum*

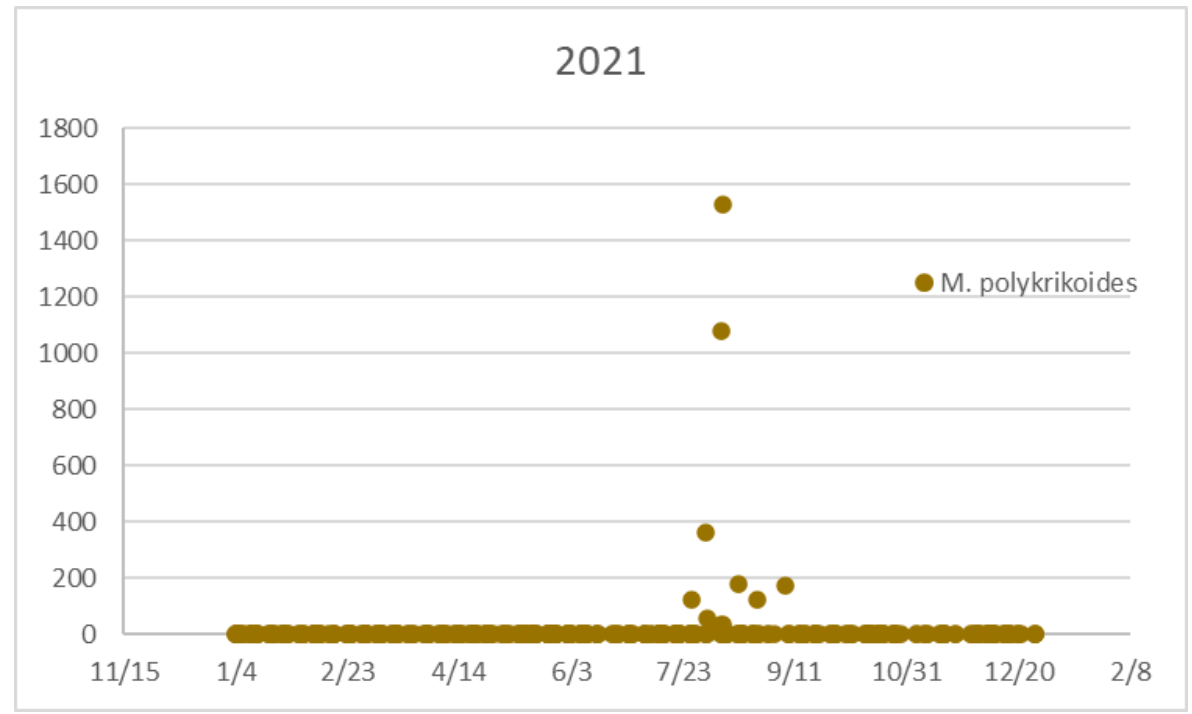
-
- present <500 cells/ml
- 500-3000 cells/ml
- >3000 cells/ml

Margalefidinium polykrikoides



Margalefidinium polykrikoides

- Another bloom in 2021 – still counting time series samples
- Not as evident in DSS samples and didn't have HRSD samples
- Initiated in Lafayette River in July
- Patchy but over a month in duration



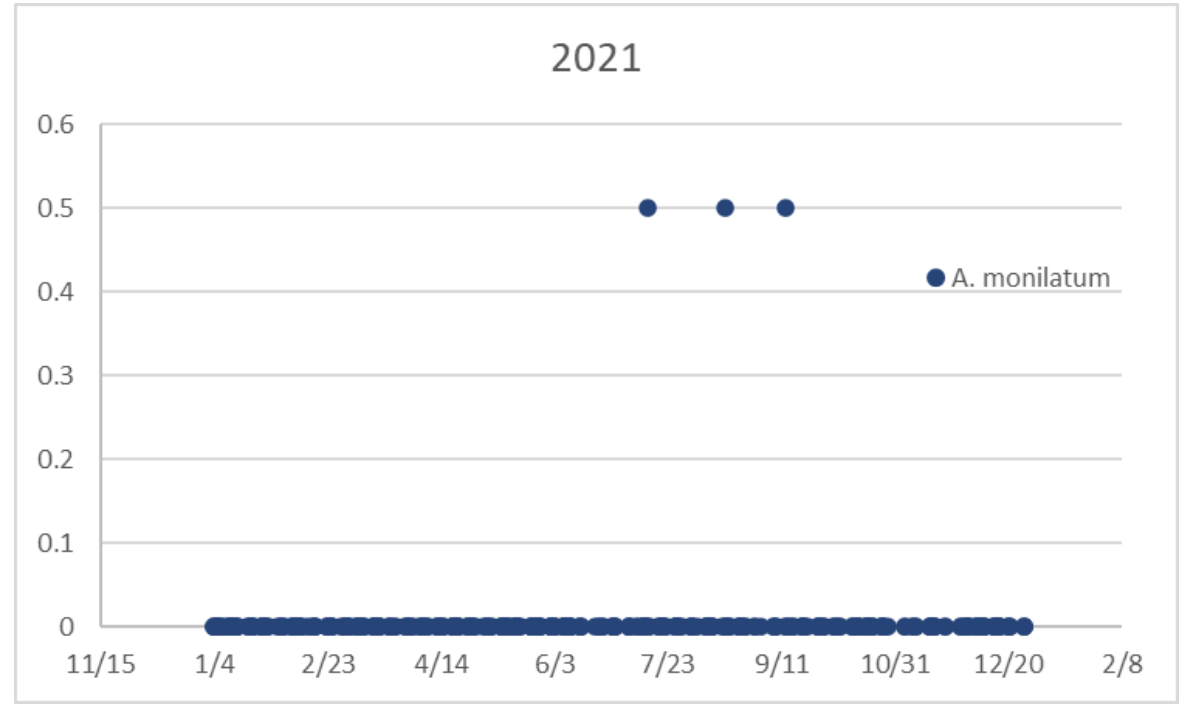
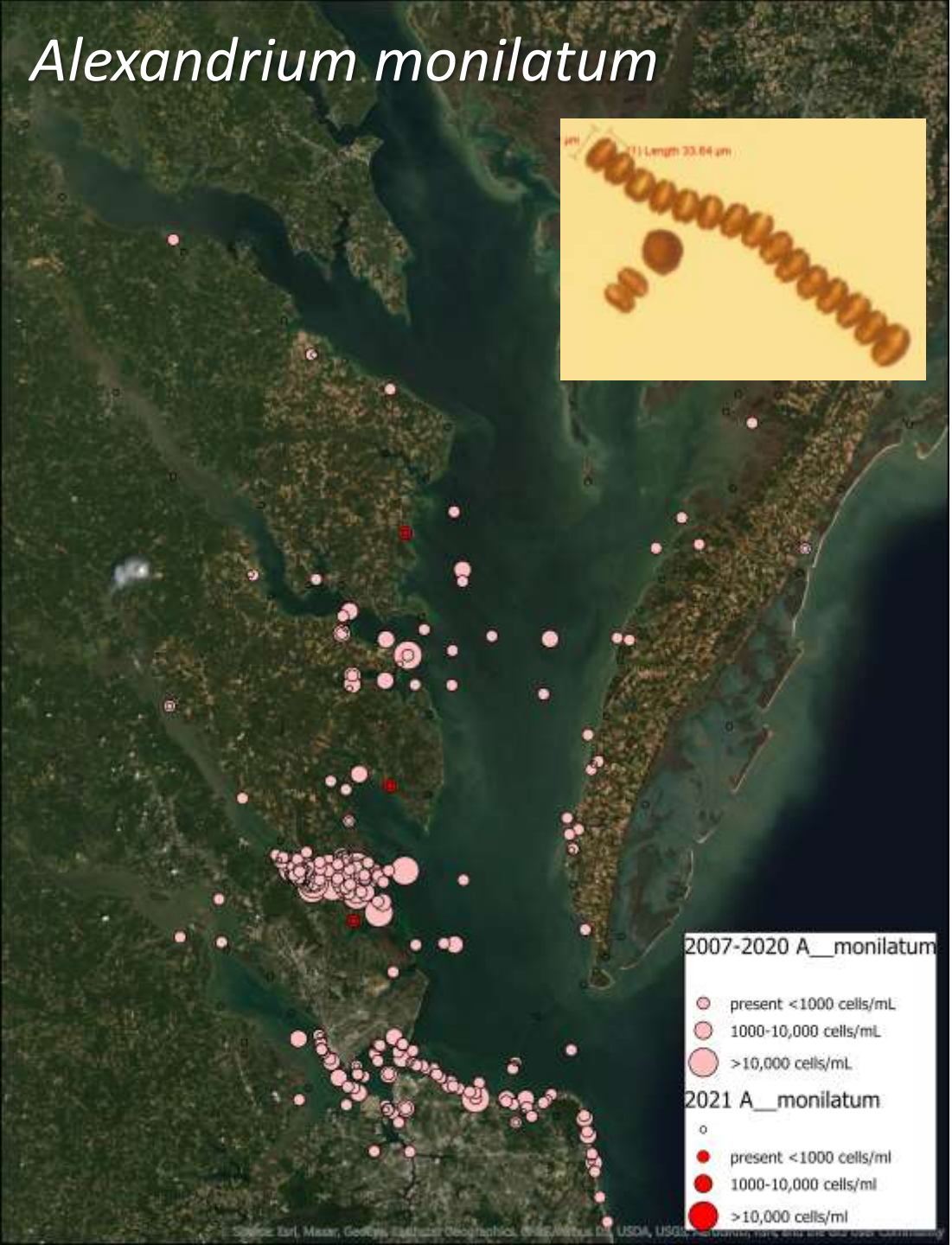
Source: Esri, Maxar, GeoEye, Earthstar, GeoEye, IGN, AerGRID, IGN, and the GIS User Community

Alexandrium monilatum

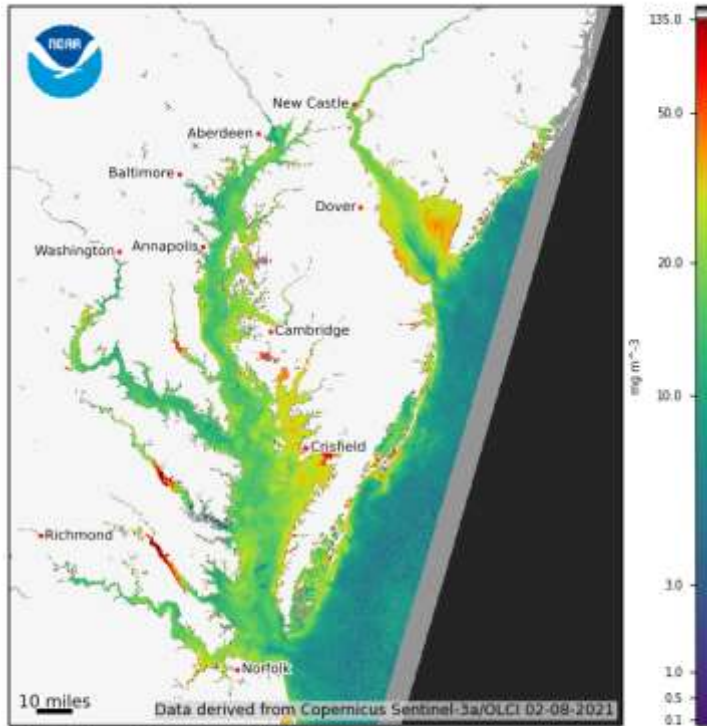


Alexandrium monilatum

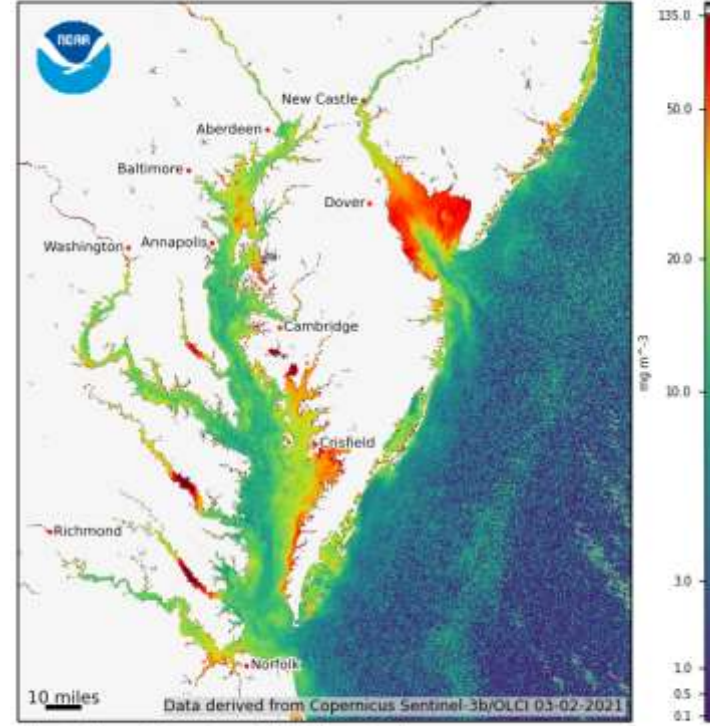
- Massive bloom in 2020
- No bloom in 2021



Heterocapsa in Feb and March

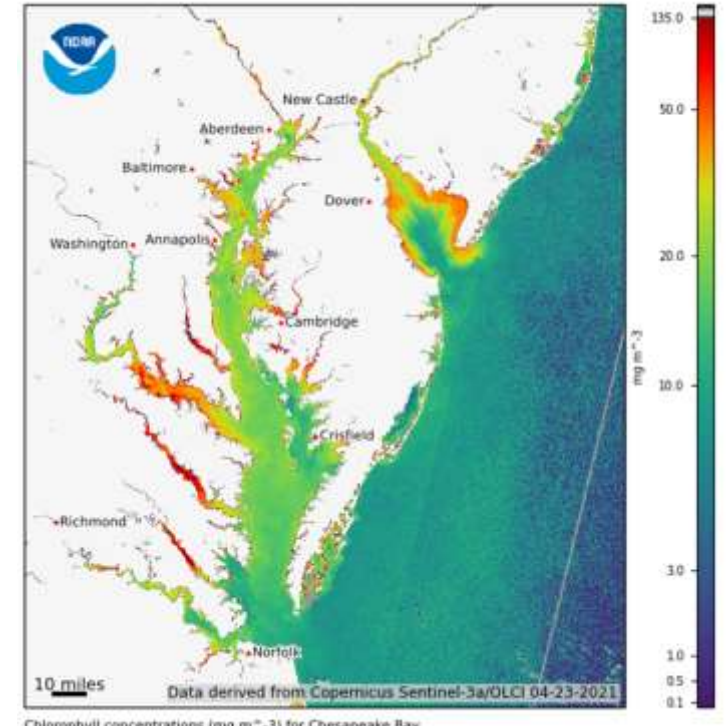


Chlorophyll concentrations (mg m^{-3}) for Chesapeake Bay.



Chlorophyll concentrations (mg m^{-3}) for Chesapeake Bay.

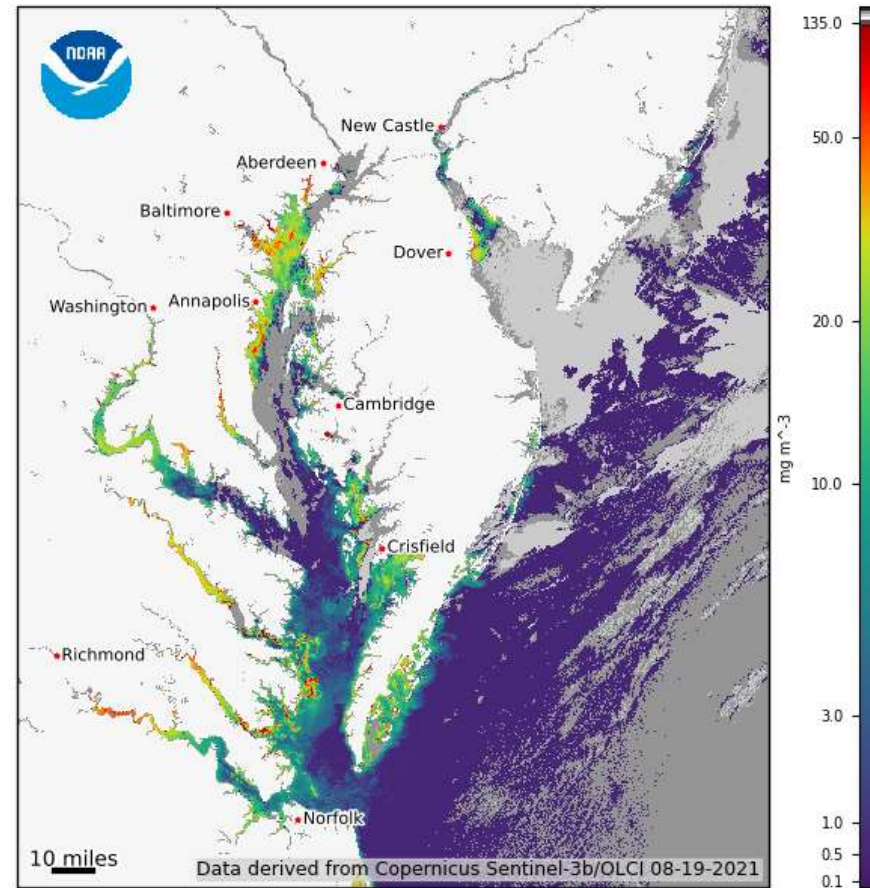
Prorocentrum April - May



Chlorophyll concentrations (mg m^{-3}) for Chesapeake Bay.

Satellite products

- *Margalefidinium* patchy July-August



Chlorophyll concentrations (mg m^{-3}) for Chesapeake Bay.

New opportunities in 2021

IFCB & EcoTaxa

- Last year we described our use of EcoTaxa to organize our IFCB images
- Continued this into 2021 but IFCB was unavailable most of the year
- Kathryn continued to work with undergraduate intern Maci Wigginton to classify images.

Akashiwo

The screenshot displays the EcoTaxa web interface for a project named "LAPHTER_clean (29, 0, 0, 0/29)". The interface shows a grid of 18 microscopy images of *Akashiwo sanguinea* cells, arranged in three rows of six. Each image is accompanied by a green label indicating the species name and its taxonomic classification. The left sidebar shows a taxonomy filter with a list of taxa and their counts. The top navigation bar includes a search bar, a filter dropdown, and a "Select all" button. The bottom of the image shows a Windows taskbar with various application icons and the system clock.

EcoTaxa Project - Filtered - Filter: Taxon: Akashiwo sanguinea X Status: Validated X Leah Anne Gibala-Smith (log o) Action

Update view & apply filter Select all 11 Display Status Validated 100 80 1 Selected

Other filters

Taxonomy filter

- Achnanthes sp. 1
- Alveolata 1
- Alexandrium 1
- Ciliophora 16
- Didinium 2
- Mesodinium 46
- Strombidium 11
- Tintinnida 14
- Tintinnopsis 3
- Dinophysis sp. 3
- Gymnodiniales 13
- Akashiwo sanguinea - Akashiwo** 29
 - Gymnodinaceae - Gymnodinales
- Amphidinium sp. - Amphidinium 1
- Gyrodinium 1
- Polykelkos sp. 1
- Warnowlaceae - Gymnodinales 16
- Heterocapsa rotundata 13
- Heterocapsa triquetra - Heterocapsa 1
- Pyrocentrum micans - Pyrocentrum 26

Winter sampling

Heterocapsa triquetra – we're also learning about the organisms themselves!

The screenshot displays the EcoTaxa 2.5 web interface. At the top, the project name 'LAPhTER' is shown with a progress bar indicating 79036 out of 79036 items. The user 'Leah Anne Gibala-Smith' is logged out. The interface includes a search bar with filters for 'Taxon: Heterocapsa triquetra' and 'Status: Validated'. A navigation bar shows 'Update view & apply filter', 'Select all', 'Display', 'Status', 'Validated', '1000', and '50%'. On the left, a 'Taxonomy filter' sidebar lists various taxonomic levels with counts. The main area is a grid of 12 columns and 4 rows of images, each labeled 'Heterocapsa triquetra' with a small icon and a 'Heterocapsa' link. The images show different views and stages of the organism.

EcoTaxa 2.5 Project Filtered LAPhTER (79036, 0, 0, 0 / 79036) Leah Anne Gibala-Smith (log out)

Filter: Taxon: Heterocapsa triquetra Status: Validated

Update view & apply filter Select all Display Status Validated 1000 50%

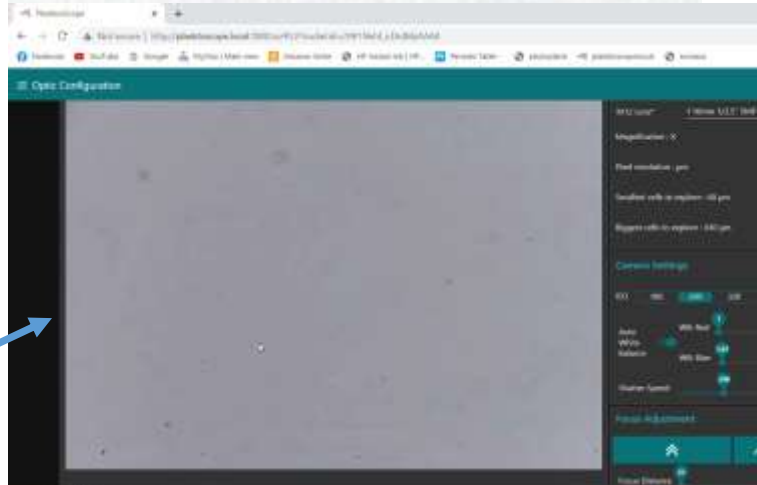
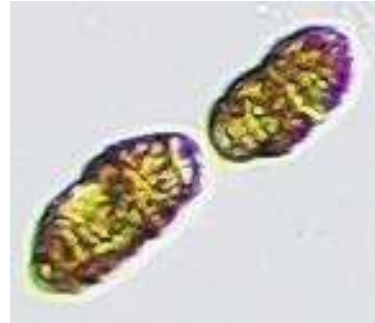
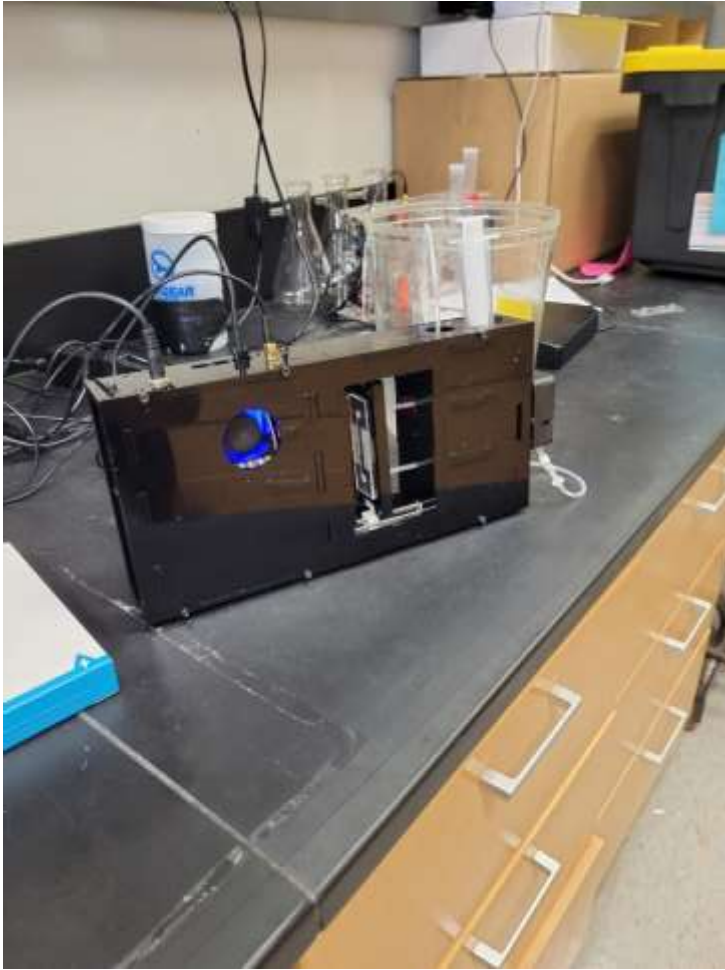
Taxonomy filter Other filters

- Tintinnida 3
- Tintinnopsis 1
- Dinophysiaceae 4
- Dinophysis 7
- Diplopsalid group 7
- Gonyaulax spinifera 2
- Gymnodinium 01 53
- Gymnodinium 02 282 1329
- Gymnodinium 03 62 18
- Gyrodinium sp. 121 34
- Heterocapsa 1**
- Heterocapsa rotundata 34177 3092
- Heterocapsa triquetra 79036 1427**
- Heterocapsa 01 3785 7284
- Heterocapsa triquetra 175 48
- Heterocapsa 02 39 7
- Heterocapsa 04 2282 9307
- Karlodinium sp.

Grid of 48 images (4 rows x 12 columns) showing *Heterocapsa triquetra* specimens. Each image is labeled with the species name and a link to the taxon page.

PlanktoScope – low-cost imaging

Got 4VA funds to hire an intern to build 2



M. polykrikoides chains racing?

Wigginton et al. in prep.



Have now built 3 PlanktoScopes
Reanalyzing archived samples on PlanktoScope
Adding to our EcoTaxa database



2021 progress

- Ran samples on the FlowCam loaner to start building image library
- Secured funding to buy a FlowCam Fall 2021
- FlowCam arrived this month – training is first week of March
- Got 4VA funding to build 3 PlanktoScopes
 - They are built
 - Loading images to EcoTaxa
- Continued sampling at the Lafayette River time series
- Extended sampling into winter using PlanktoScope to detect *Heterocapsa* blooms that go under-reported
- Continuing work to compile databases
- Continue EcoTaxa training
- Building off multiple programs – VDH, CBP, HRSD, ECOHAB
- Aliyah's culture work – high CO₂ experiments with CyanoHABs
- Continued discussions with partners and proposals
 - Phytoplankton methods- IFCB, FlowCam, remote sensing, modeling
 - Management strategies

Publications

Published this year:

- Hofmann et al. 2021
- Clayton et al. 2022 – phyto ID training

Submitted:

- Perez Vega et al. – *Marg.* encystment
- Zhu et al. - cyanate, nutrients and bloom

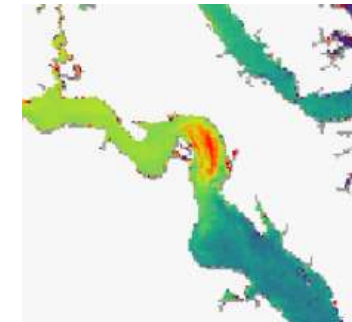
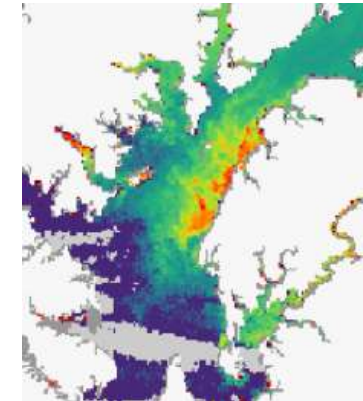
In preparation:

- Mulholland et al. – 2020 bloom paper
- Chrabot et al. – *M. polykrikoides* swimming speed and chain length
- Echevarria et al. – interannual controls on bloom initiation
- Wigginton et al. - *Marg.* chain length variability
- Clayton et al. - *Heterocapsa* and PlanktoScope
- Perez-Vega et al. – *Marg.* growth kinetics wrt temp/light



New year's resolutions/goals

- Installing FlowCam – first week of March
- SPATT analysis with GMU and NC collaborators
- Year-round sampling and analyses with undergrads and instruments
- Laboratory experiments
 - Isolation of cultures
 - Production of toxins
 - Life cycle events that influence blooms
- More student involvement – some new departmental programs for undergrad research
- Need new funding to tie in research with the monitoring to better advise management



2022 program plans – cont.

- Continue VDH & CBP sampling and merging of databases
- Resume HRSD dataflow sampling after COVID hiatus
- Continue sampling at the Lafayette River time series
- Merging of databases
- Continue to train taxonomists using EcoTaxa/FlowCam
- Culture experiments – Eduardo, Mike, Katie
- *Margalefidinium* culture experiment – encystment/exystment (Eduardo)
- *Marg.* – temp/light experiments in cultures ms preparation (Eduardo)
- Seasonal shift from diatoms to dinoflagellates
- *Marg.* mixotrophy with cultures (Katie)
- *Marg.* grazing on them and by them (PURS proposal – undergrad research support; proposal submitted)
- NOAA-OA proposal submitted

Thank you!

Funding:



People:

Leah Gibala-Smith

Kathryn Mogatas

Maci Wigginton

Todd Egerton

Michael Echevarria

Eduardo Perez Vega

Alfonso Macias Tapia

Yifan Zhu

Peter Bernhardt

Sophie Clayton

All the field crew at DEQ, VDH, & HRSD

Questions?

