2021 Virginia HABs: Estuarine monitoring summary

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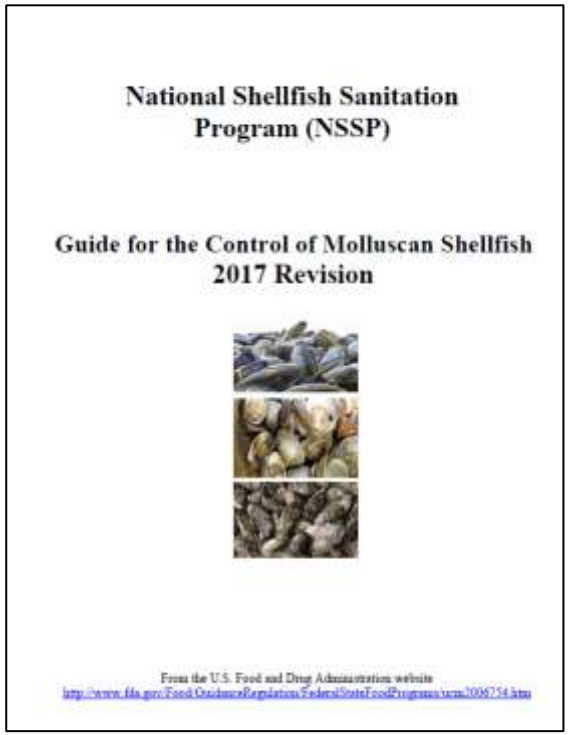
VA HAB Taskforce Meeting
Gloucester Point, Virginia
2/25/2022

Overview

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

VDH Shellfish monitoring

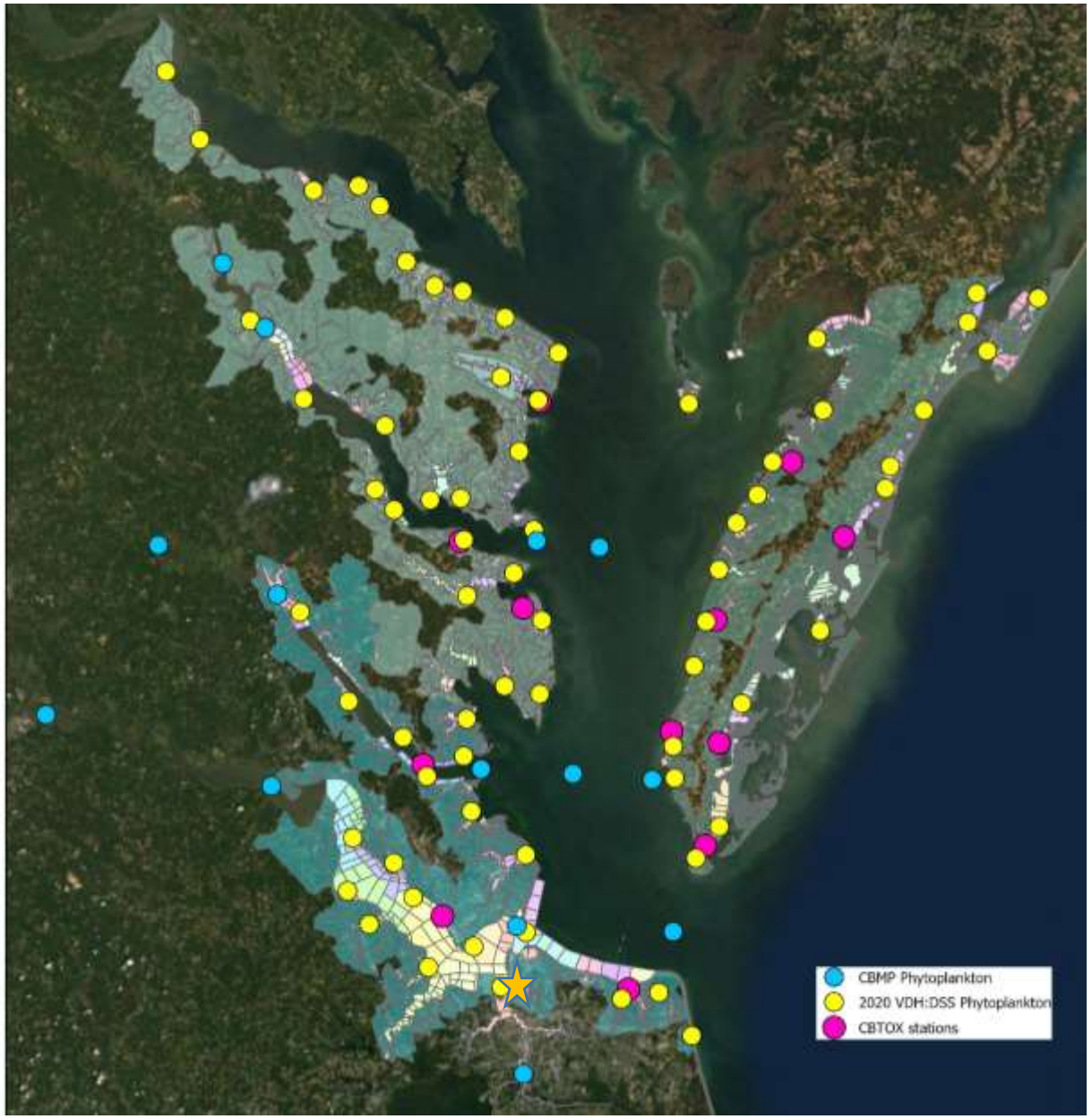
- Monthly collections- routine fixed sites
  - Lugol's solution (500mL) – phytoplankton analyses (ODU)
  - Unpreserved frozen sample (50mL)- ELISA screening (VDH)
- Bloom samples
  - Response to bloom reports or visual observation by field staff
  - VDH, CBP, HRSD, Time series site


National Shellfish Sanitation Program (NSSP)

Guide for the Control of Molluscan Shellfish
2017 Revision

From the U.S. Food and Drug Administration website

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



Virginia Estuarine Phytoplankton monitoring

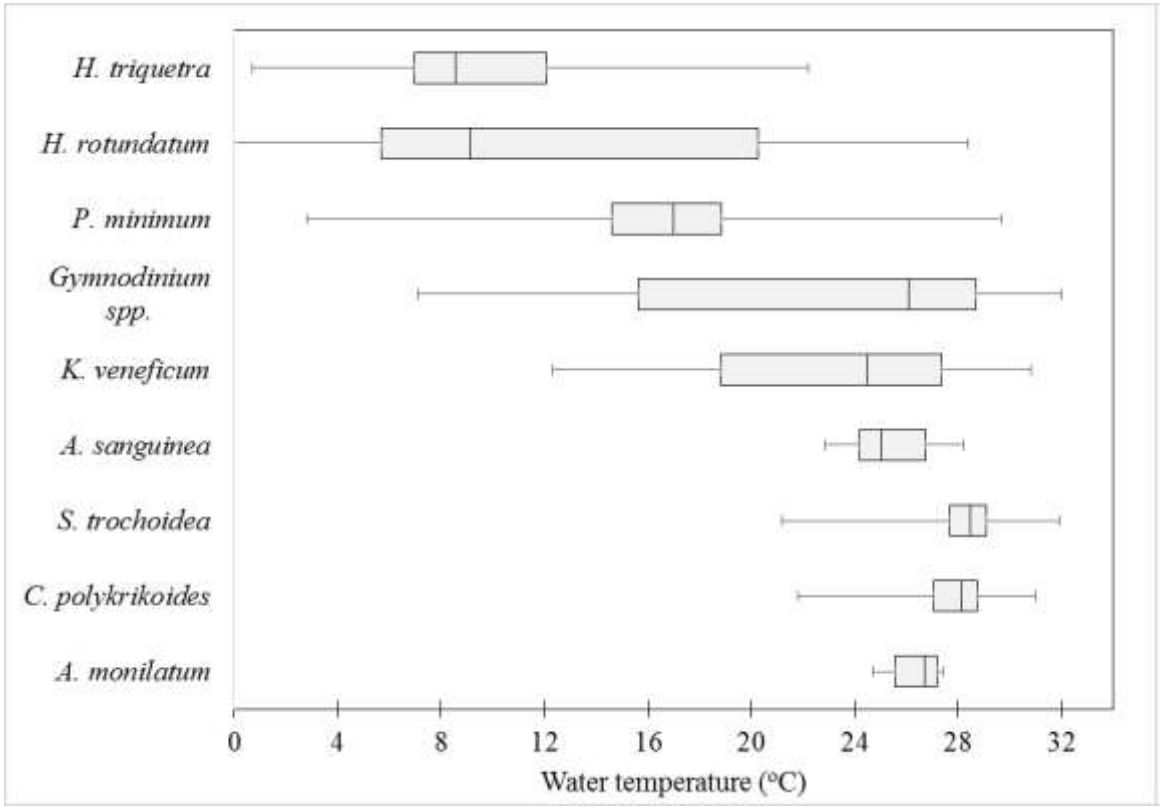
- Chesapeake Bay Monitoring Program (DEQ/ODU)
  - 14 stations
    - 7-Chesapeake Bay monthly year-round
    - 7-Tidal tributaries monthly March-October
  - Full species composition
  - Ad hoc bloom sampling
- VDH: Shellfish (DSS&WHC/ODU)
  - 69 stations
  - Monthly year-round
  - Targeted HAB identification
  - 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

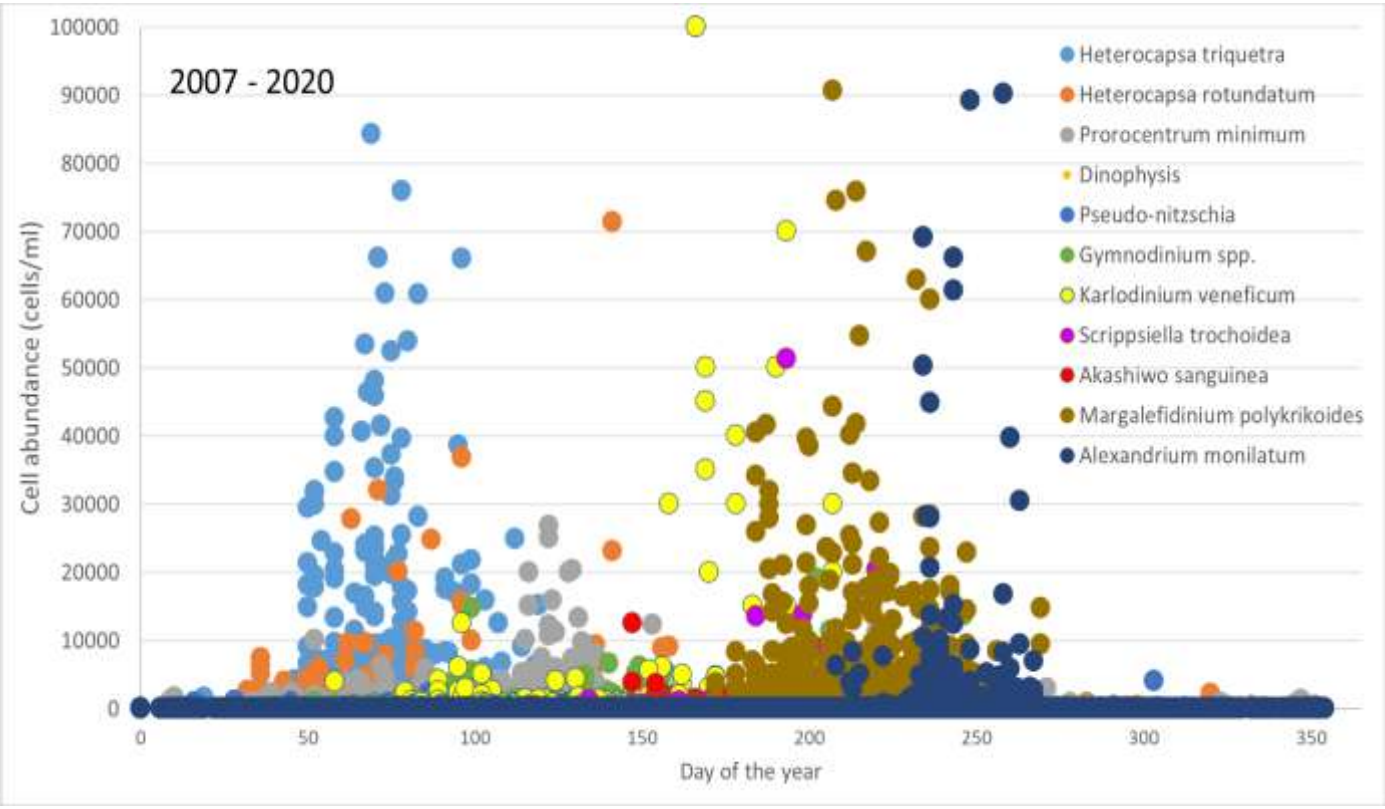
Additional monitoring: ODU, HRSD, ECOHAB Dataflow HRSD (no bloom samples in 2021)

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



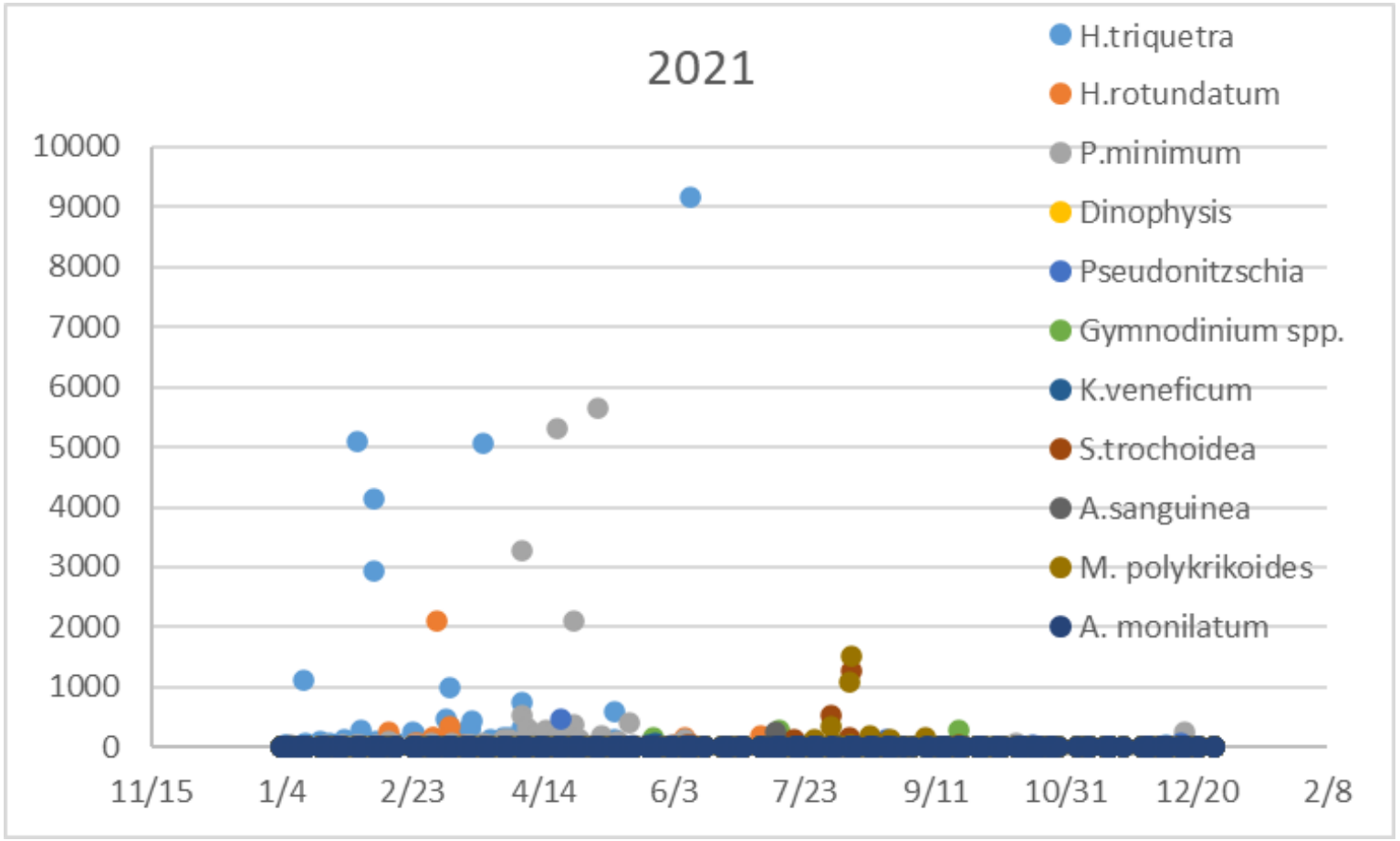


*_Pseudo-nitzschia_* and _Dinophysis_ not abundant enough to make the list

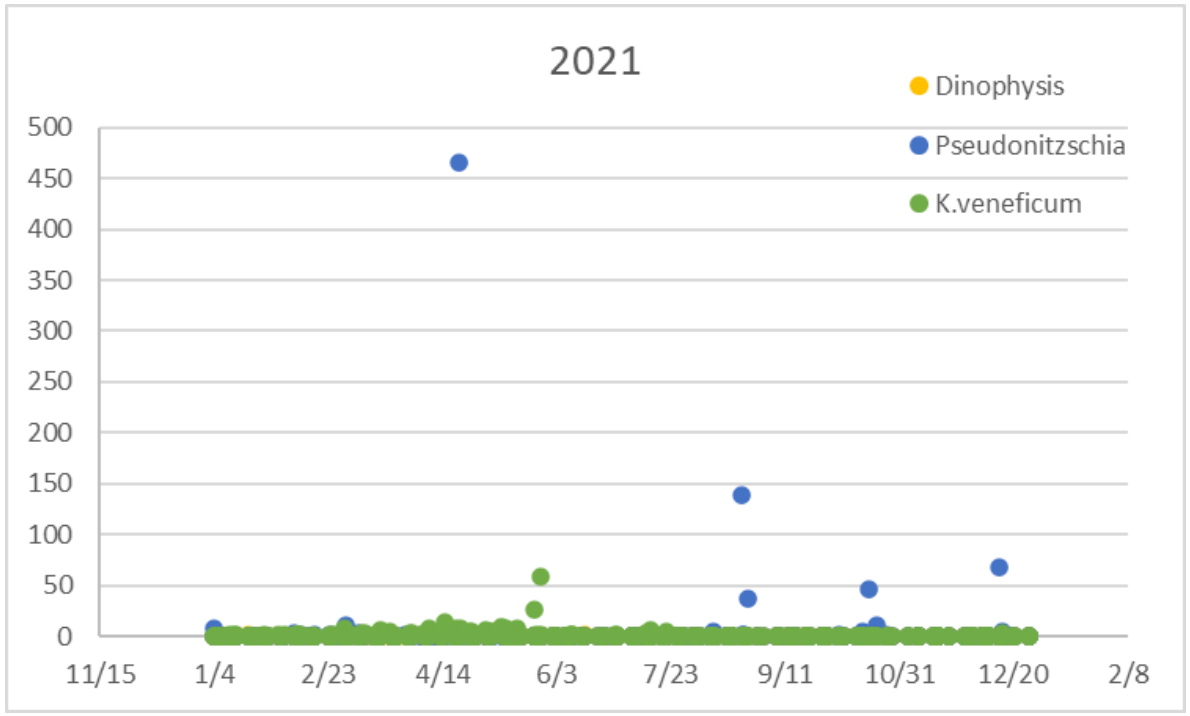
*Removed data where abundances were > 100,000 cells/ml

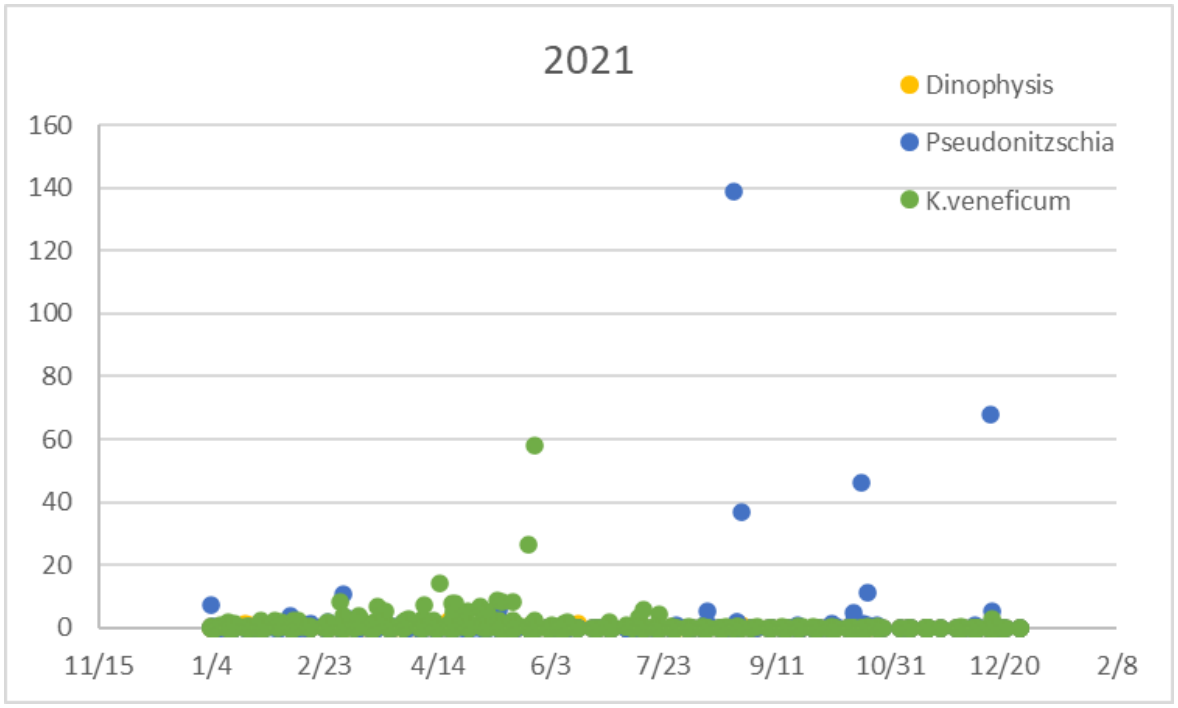
Notable 2021 Blooms:

Heterocapsa triquetra & rotundatum (January -April) - big bloom
Prorocentrum minimum (March – May)
Margalefidinium polykrikoides (July – August) - DSS data doesn't capture it all



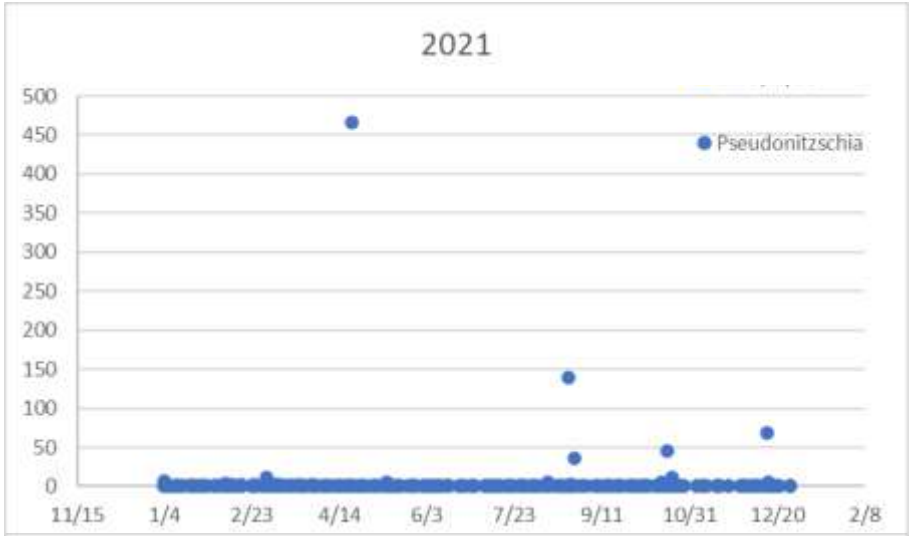
Our less abundant HAB species in 2021

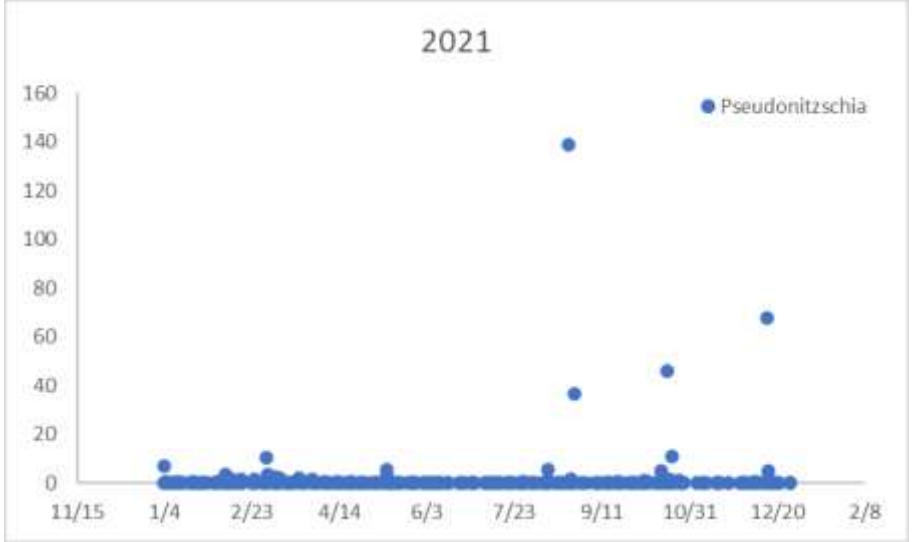




Pseudo-nitzschia spp.

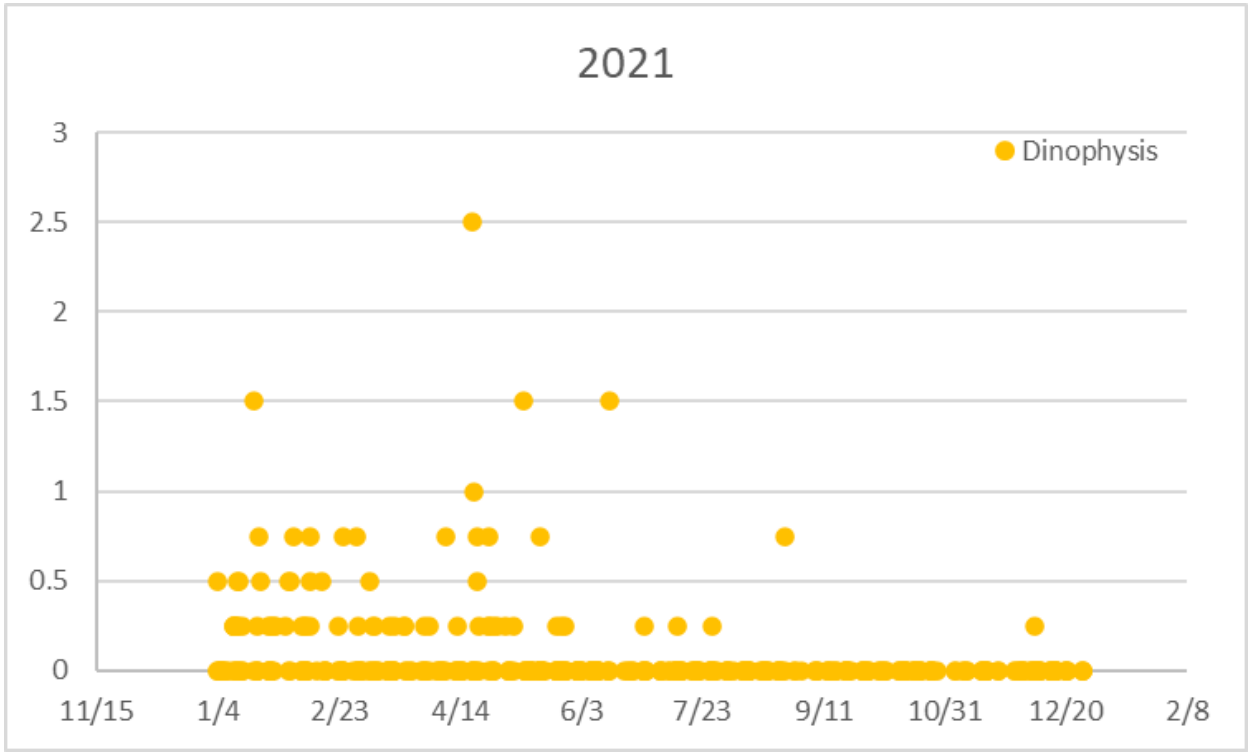
- January 2020 Potomac *Pseudo-nitzschia* event
- In 2021, generally low cell densities
- Widespread distribution in Chesapeake Bay and seaside Eastern Shore

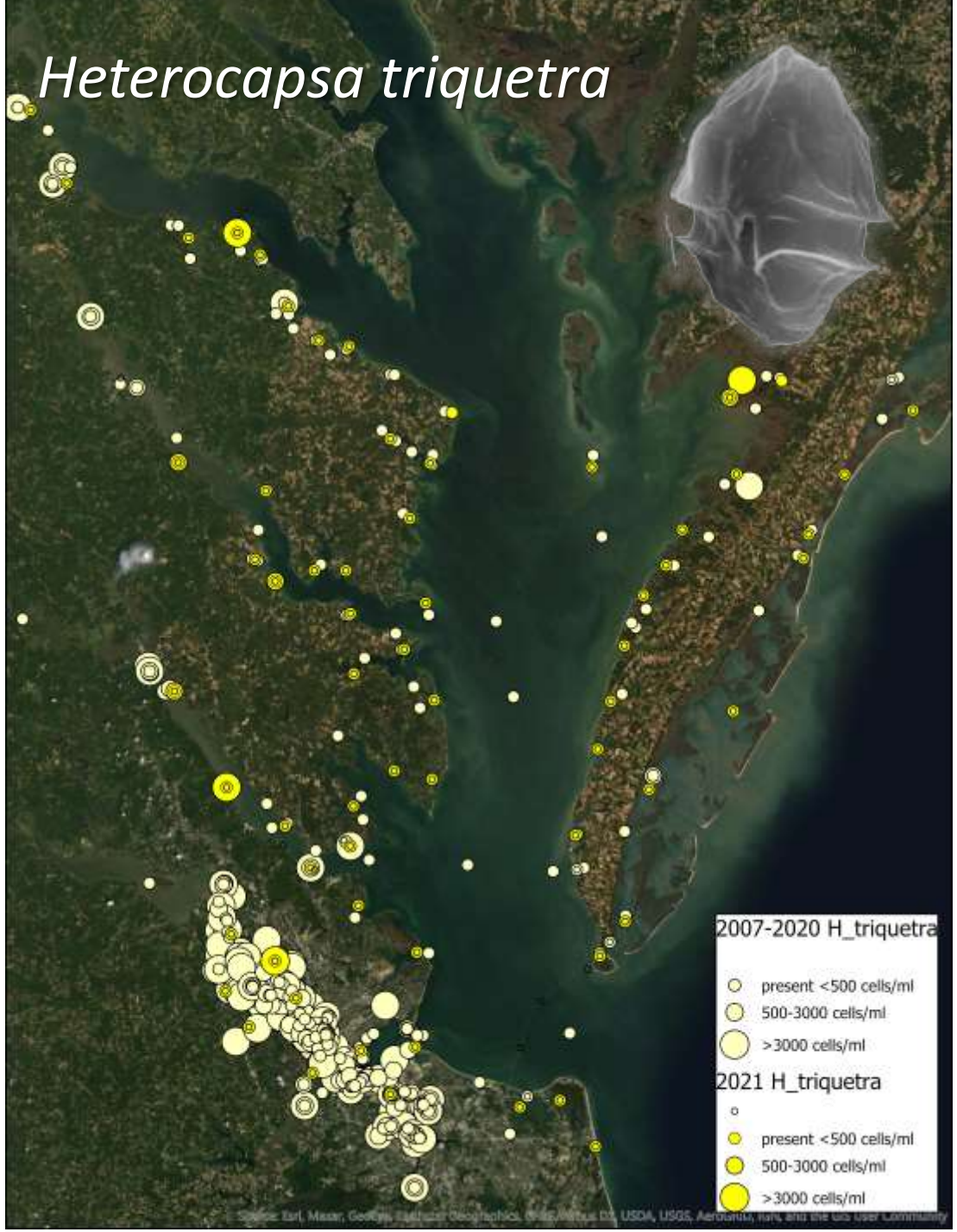




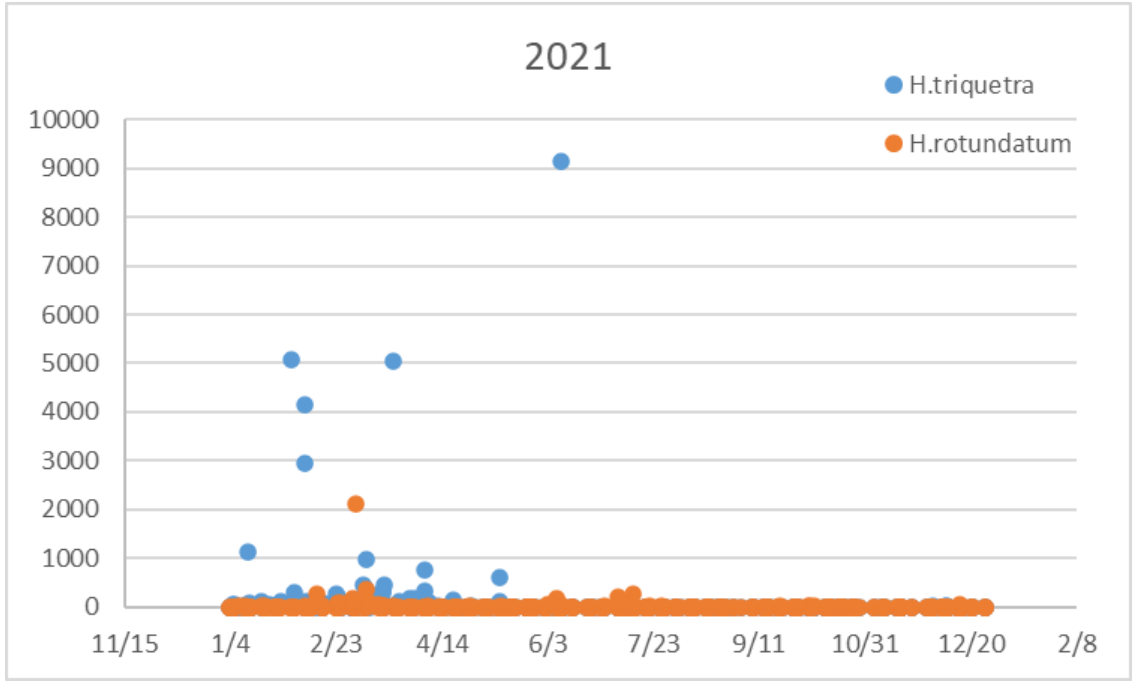
Dinophysis spp.

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



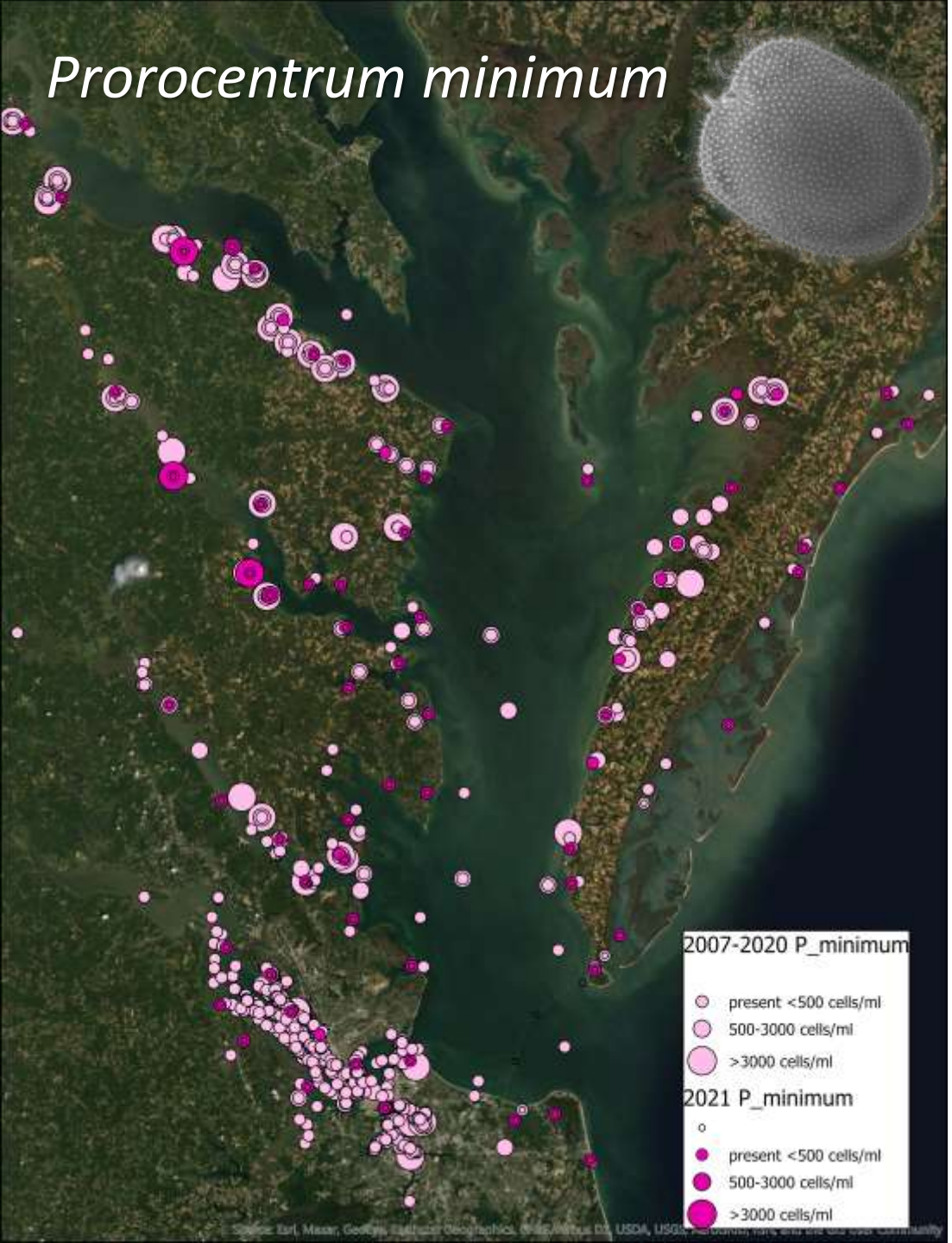


Bloom January - June

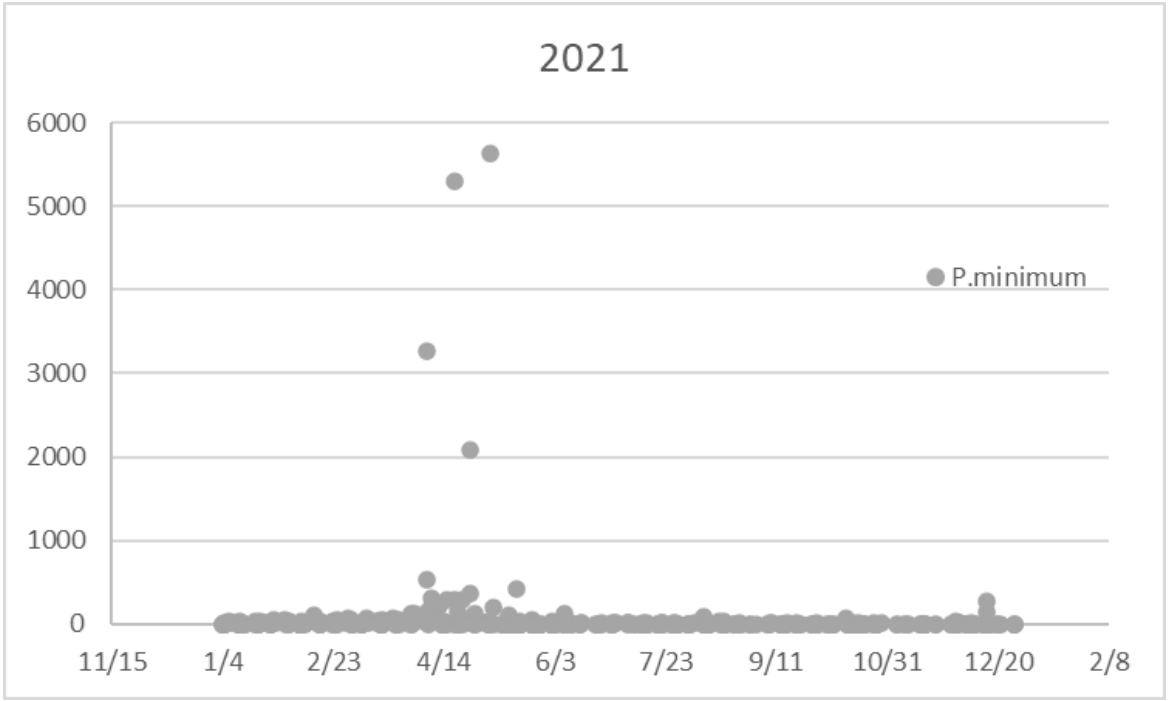


Quite a protracted bloom during winter 2021
We under-sample and overlook winter blooms (Millette et al. in prep)

Prorocentrum minimum

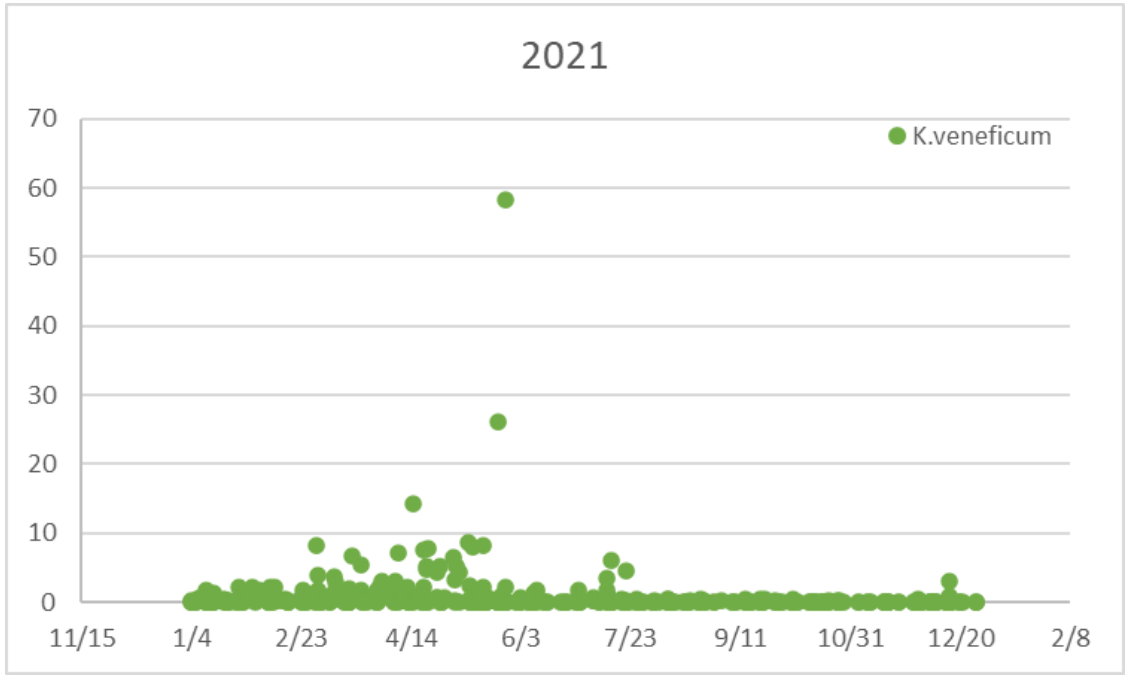


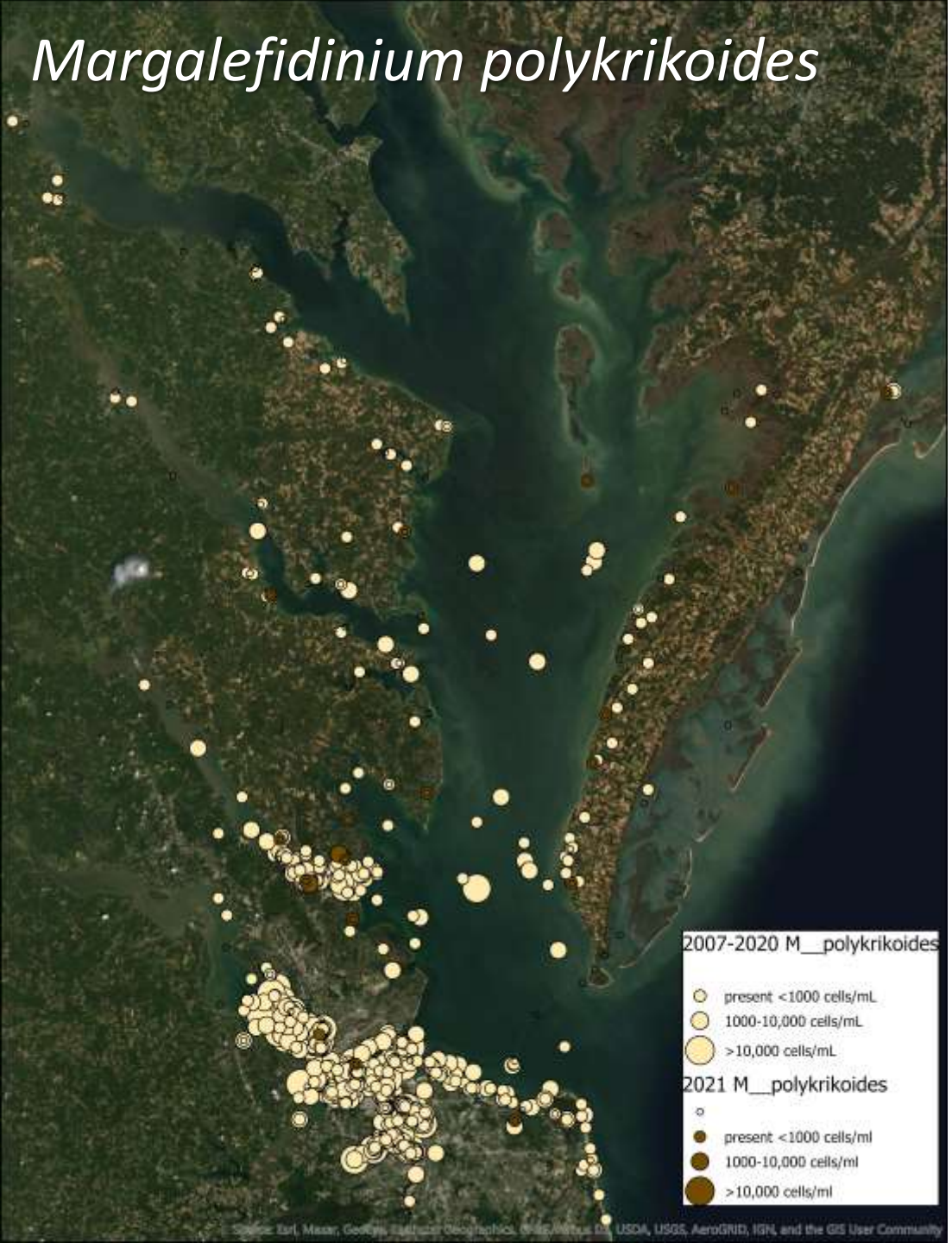
Bloom March – May



Karlodinium veneficum

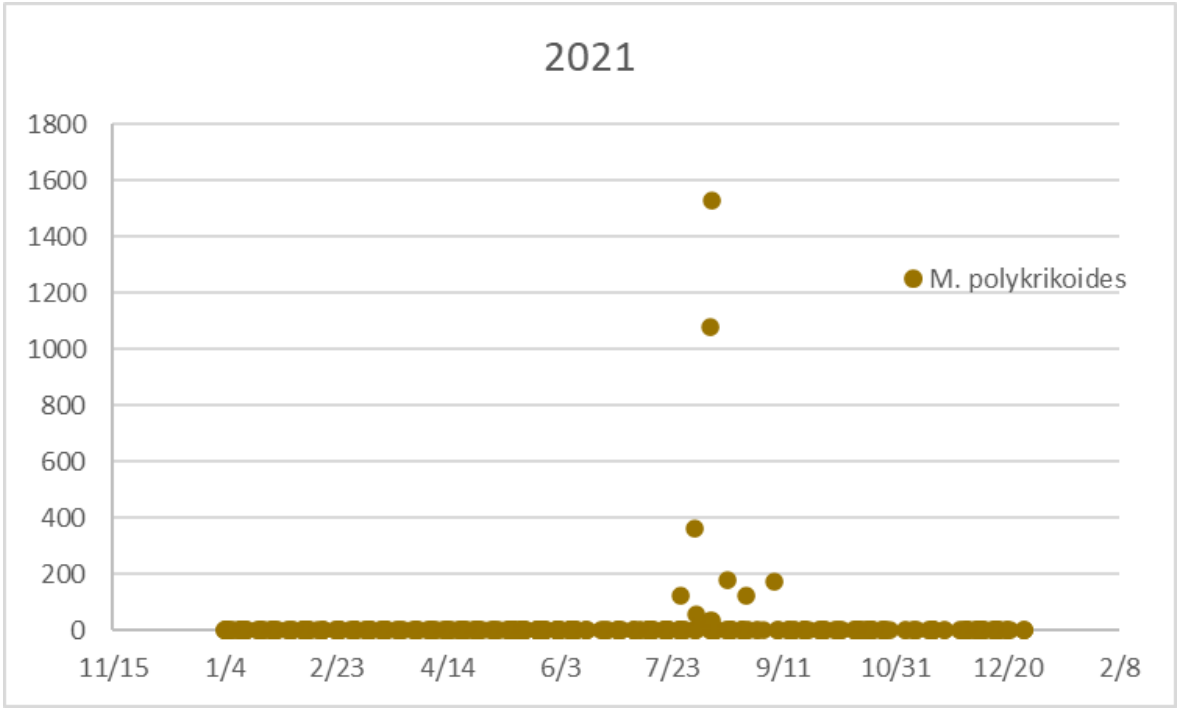
Low abundances but present

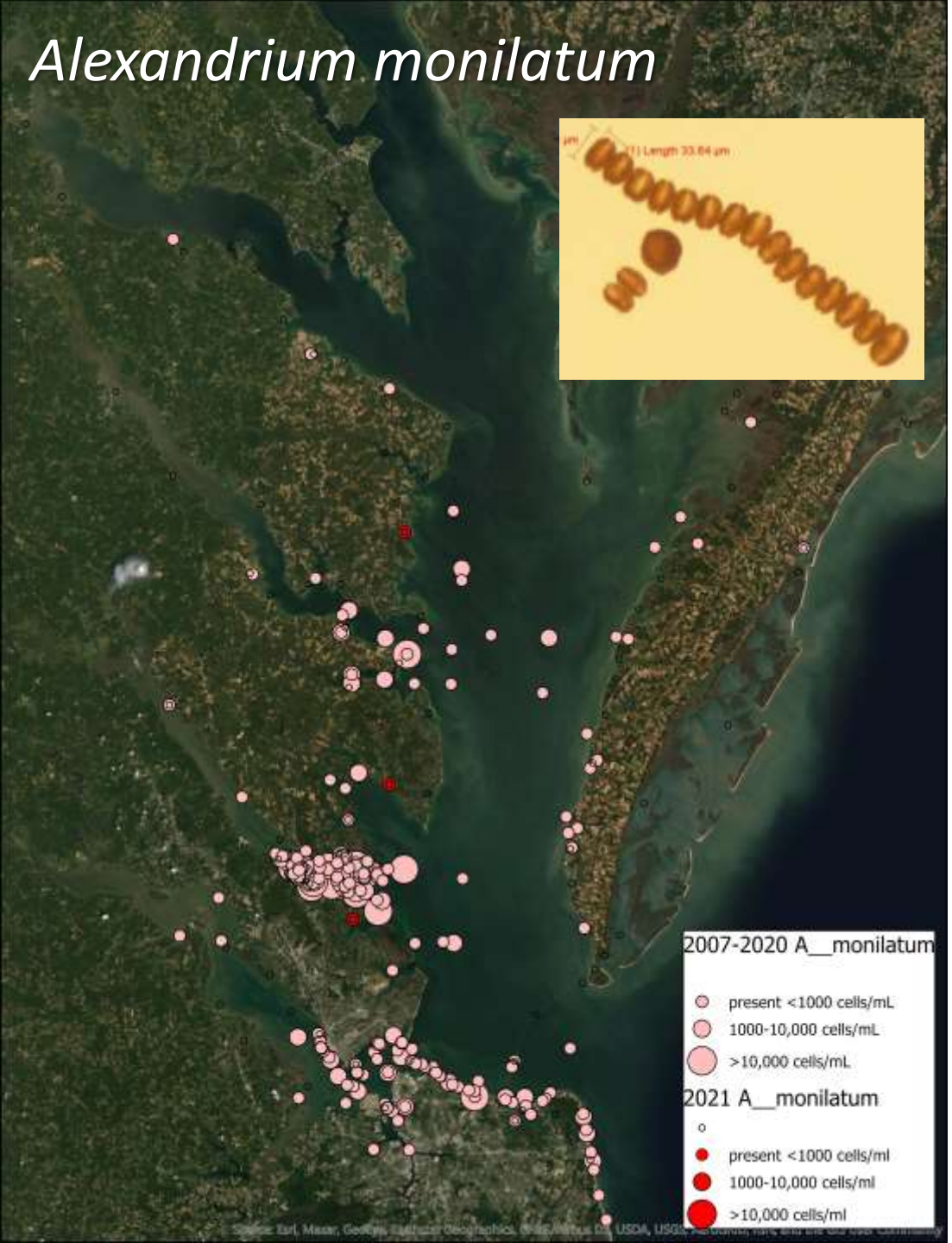




Margalefidinium polykrikoides

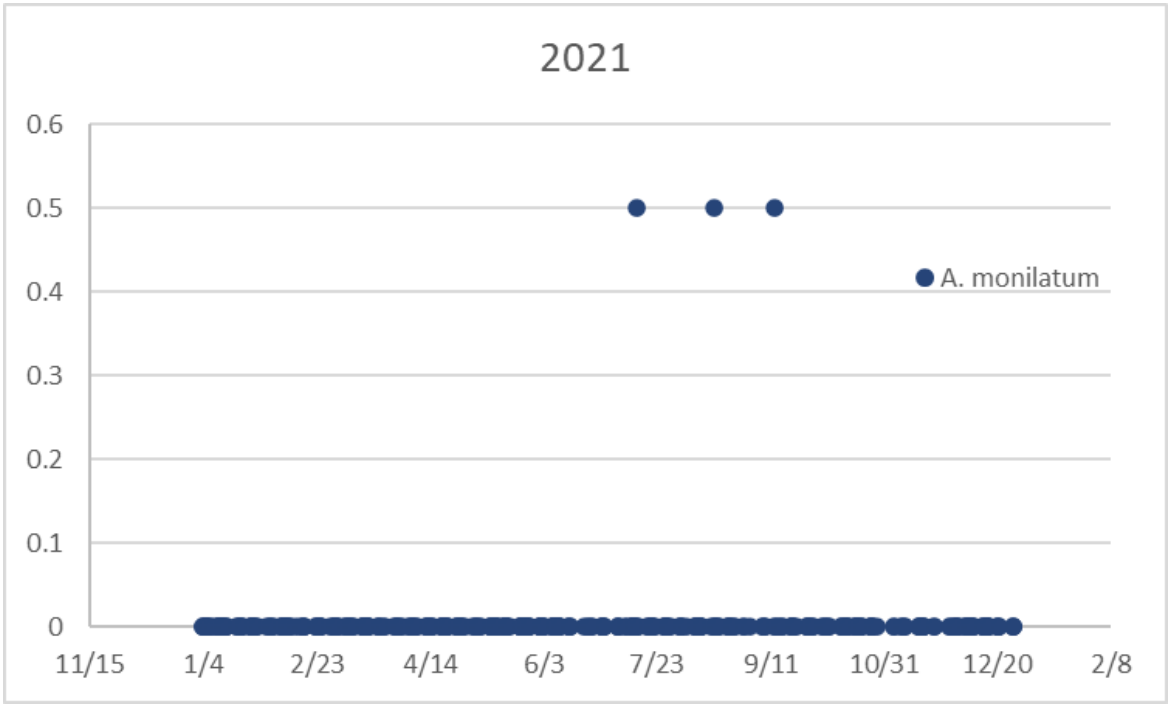
- Another bloom in 2021 – still counting time series samples
- Not as evident in DSS samples and didn't have HRSD samples
- Initiated in Lafayette River in July
- Patchy but over a month in duration





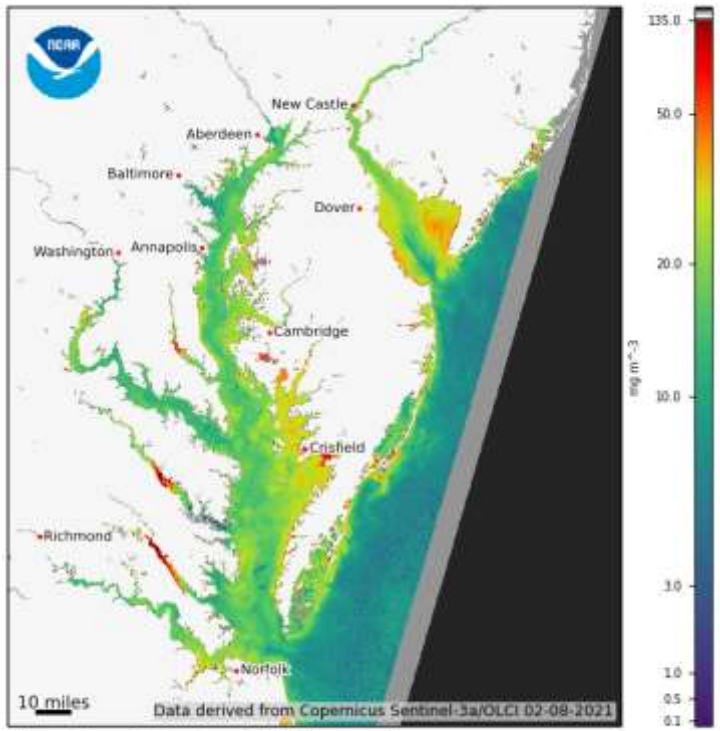
Alexandrium monilatum

- Massive bloom in 2020
  - No bloom in 2021

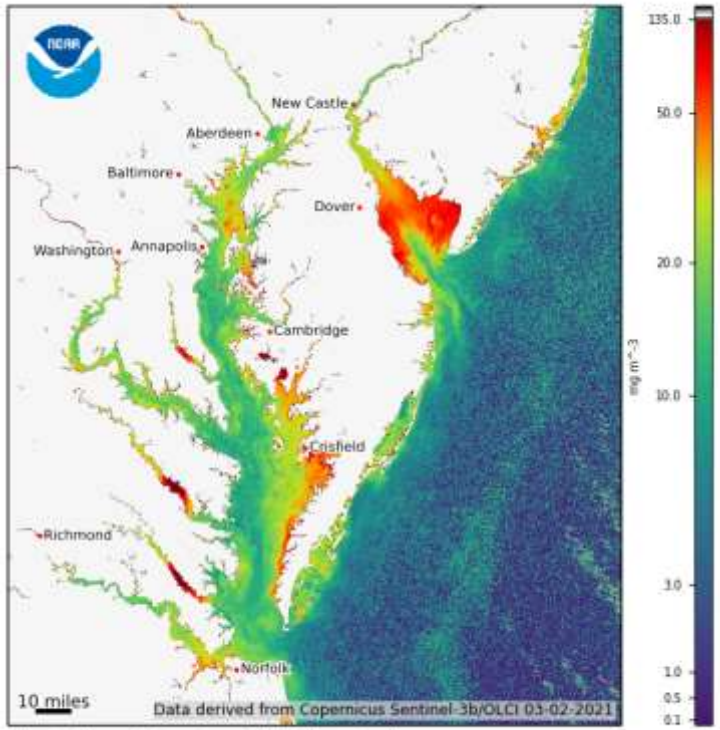


Heterocapsa in Feb and March

Prorocentrum April - May



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



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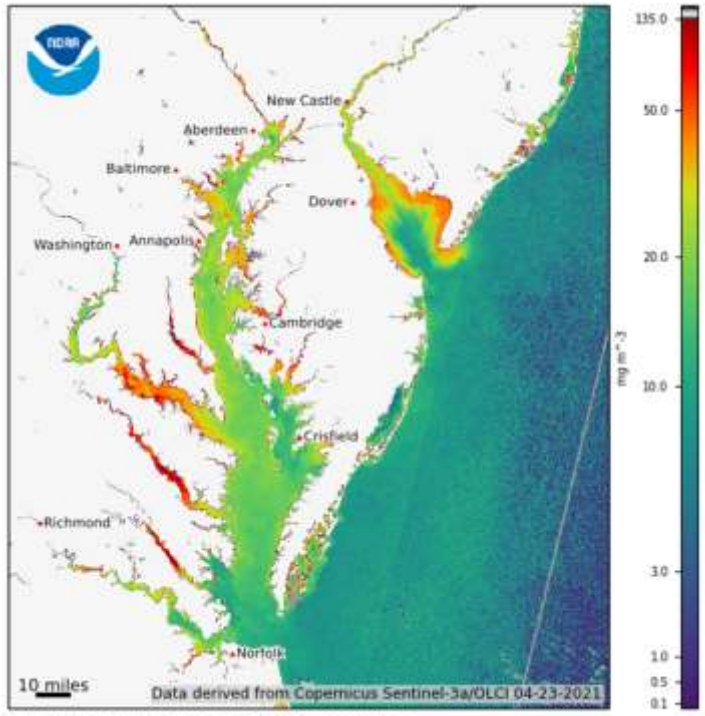
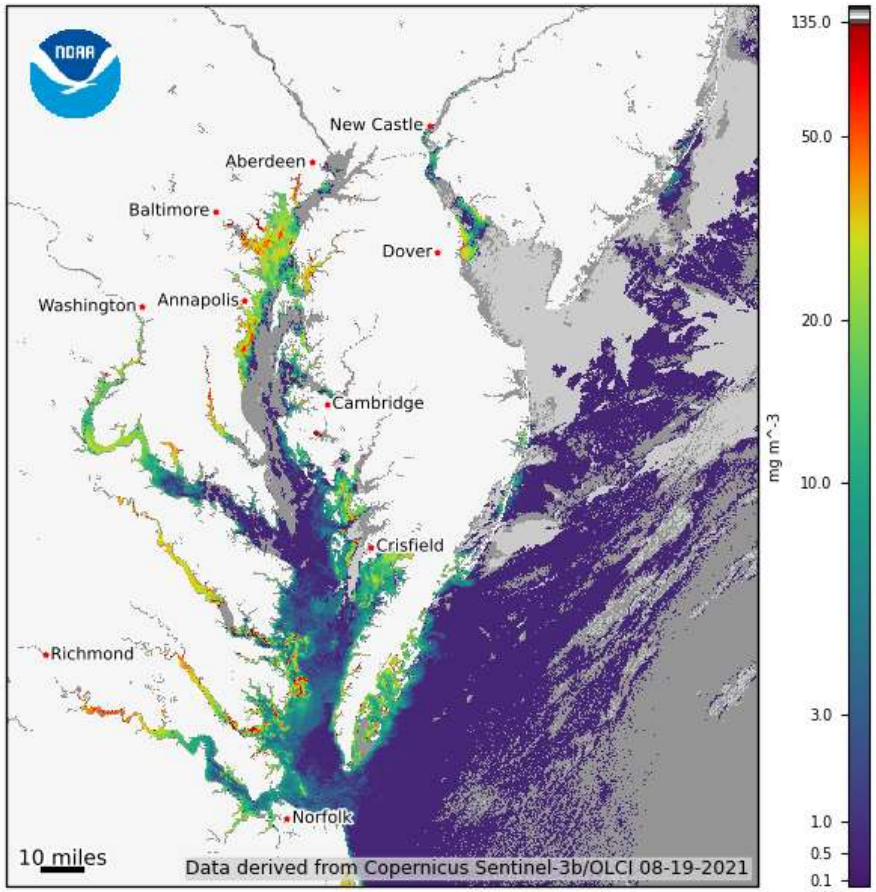


Chlorophyll concentrations (mg m^-3) for Chesapeake Bay

Satellite products

- *Margalefidinium* patchy July-August



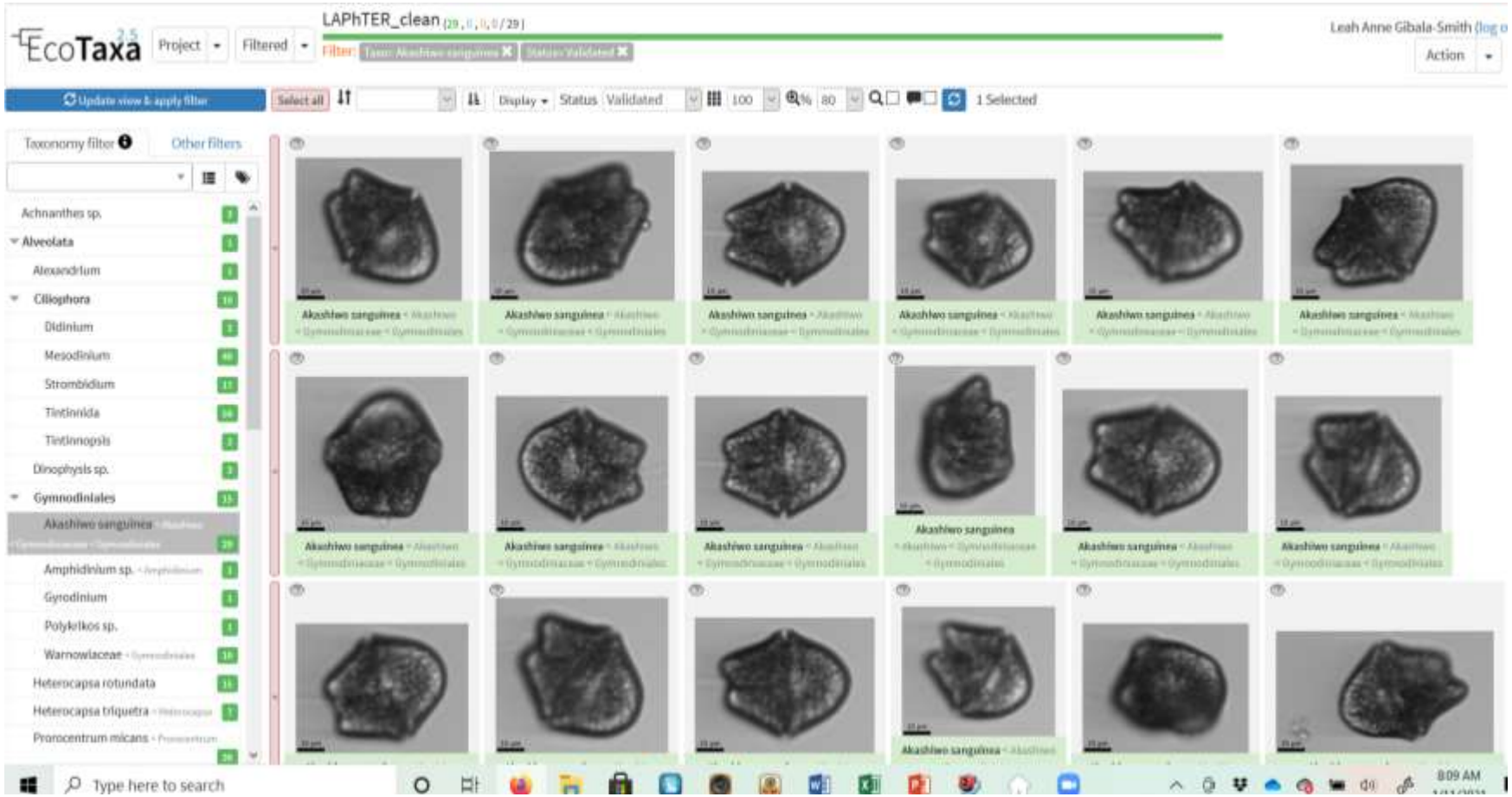
Chlorophyll concentrations (mg m^-3) for Chesapeake Bay.

New opportunities in 2021

IFCB & EcoTaxa

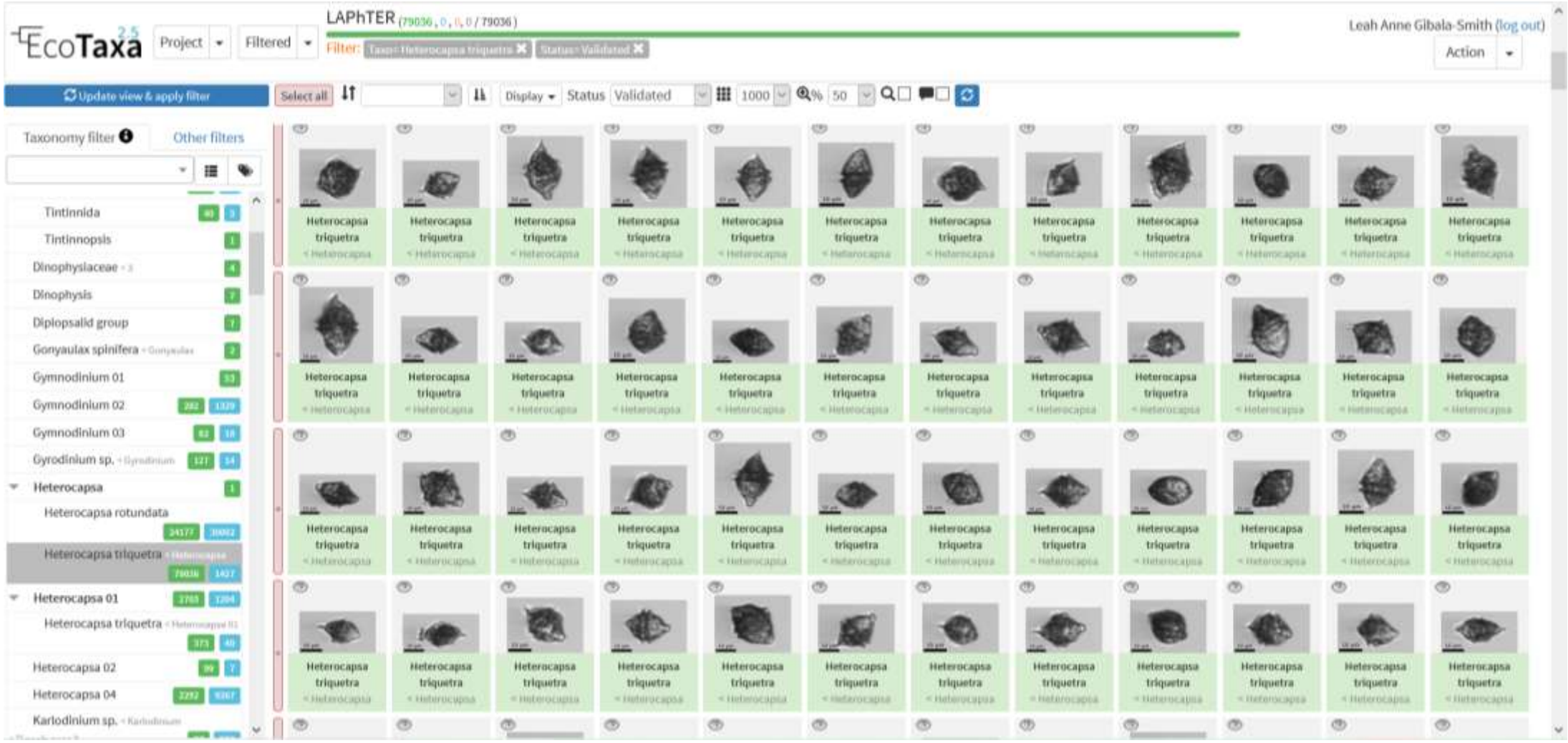
- Last year we described our use of EcoTaxa to organize our IFCB images
- Continued this into 2021 but IFCB was unavailable most of the year
- Kathryn continued to work with undergraduate intern Maci Wigginton to classify images.

Akashiwo



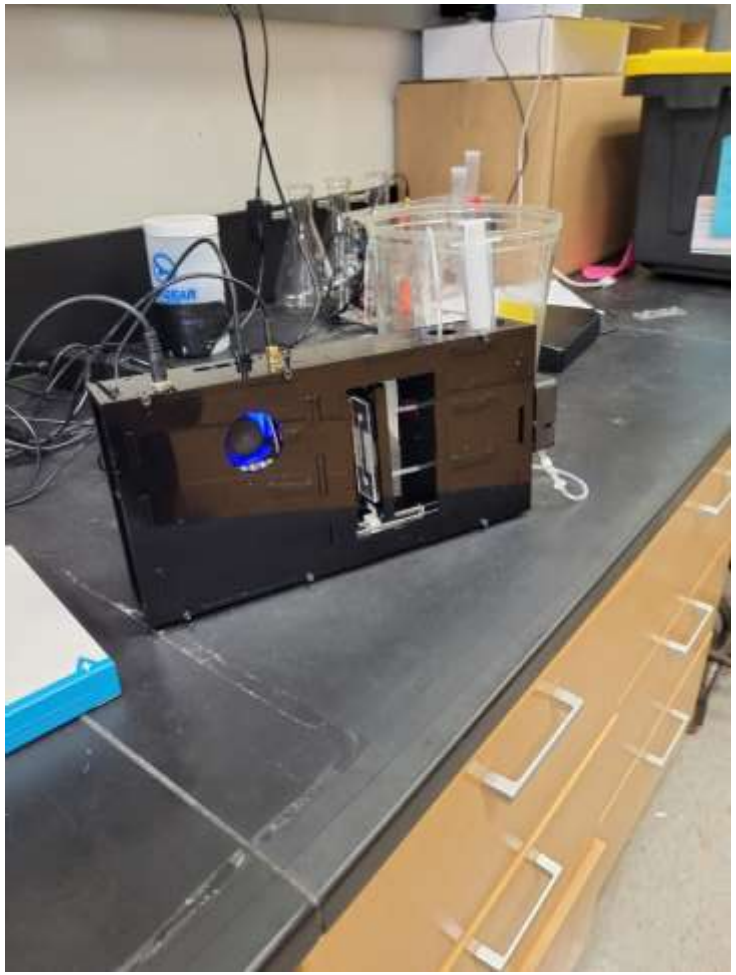
Winter sampling

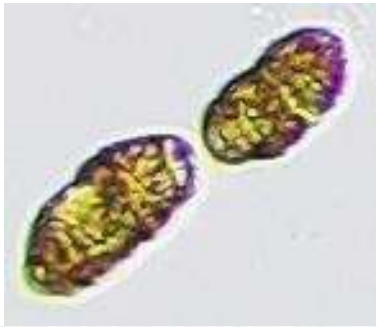
Heterocapsa triquetra – we're also learning about the organisms themselves!

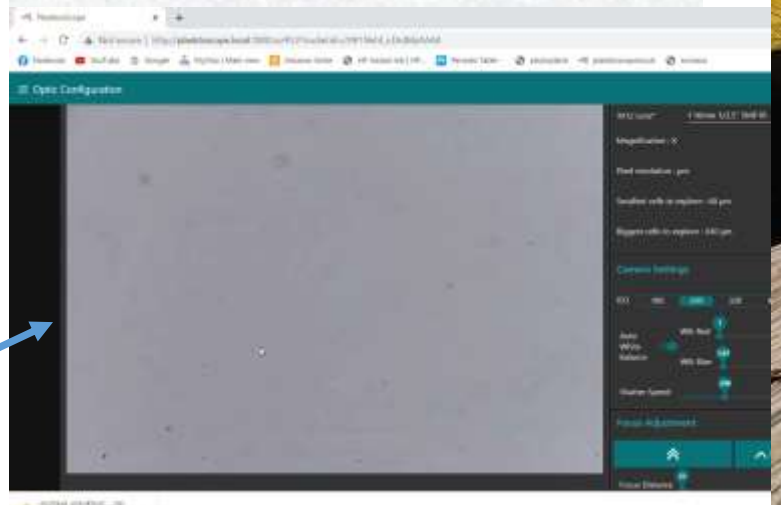


PlanktoScope – low-cost imaging

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 CO_2 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


Harmful Algae 107 (2021) 102064

Contents lists available at ScienceDirect

Harmful Algae

journal homepage: www.elsevier.com/locate/hal

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Understanding controls on *Margalefidinium polykrikoides* blooms in the lower Chesapeake Bay

Eileen E. Hofmann [a,*], John M. Klinck [a], Katherine C. Filippino [b,d], Todd Egerton [c], L. Brynn Davis [a], Michael Echevarría [b], Eduardo Pérez-Vega [b], Margaret R. Mulholland [b]

Submitted:

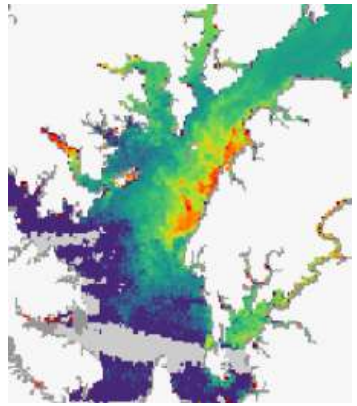
- Perez Vega et al. – *Marg.* encystment
- Zhu et al. - cyanate, nutrients and bloom

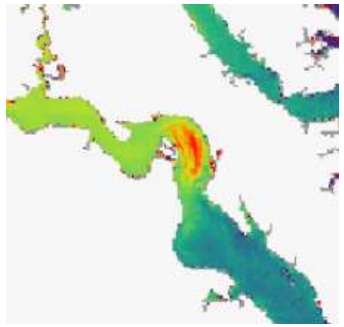
In preparation:

- 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?