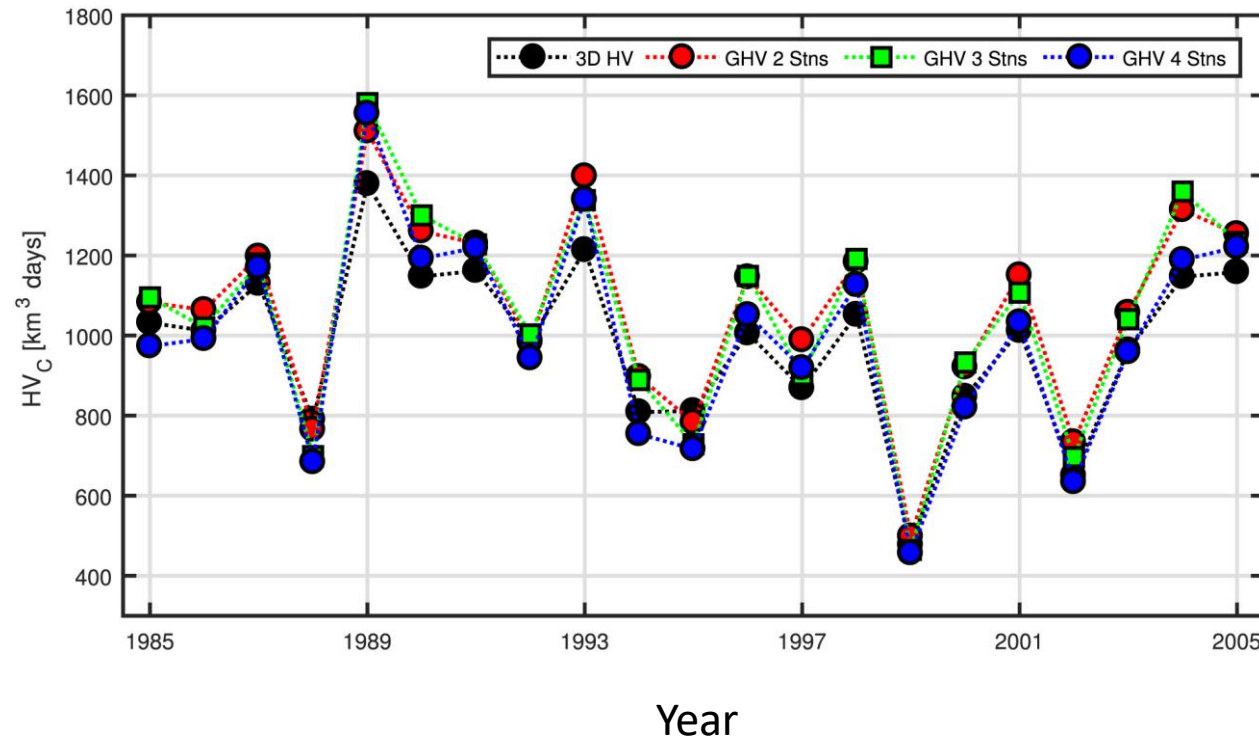


GIT-Funded Open Bay Hypoxia Assessment with New Technologies - Pilot Project. A first look at 2020 results

Peter Tango
USGS@CBPO
Modeling WG
9/10/2020

Inspiration on monitoring strategy alternatives:
Estimating annual hypoxic volume for Chesapeake Bay with as few as 2 realtime vertical profile stations in the open Bay.



3D HV = Model absolute hypoxic volume
GHV 2 = estimate from 2 stations
GHV 3 = estimate from 3 stations
GHV 4 = estimate from 4 stations

Bever, A. J., Friedrichs, M. A. M., Friedrichs, C. T., Scully, M. E., & Lanerolle, L. W. J. 2013. Combining observations and numerical model results to improve estimates of hypoxic volume within the Chesapeake Bay, USA. *Journal of Geophysical Research: Oceans*, **118**, 4924– 4944.

Bever et al. 2018. Estimating Hypoxic Volume in the Chesapeake Bay Using Two Continuously Sampled Oxygen Profiles. JGR Oceans
<https://agupubs.onlinelibrary.wiley.com/doi/full/10.1029/2018JC014129>

2020 GIT Project Goal:
Proof of concept in testing a
portable, easily deployable,
modest price sensor array for
open bay, realtime water quality
data collection.



Location: GIT funded pilot study vertical profile water quality sensing in the open Bay 2020

https://sensors.ioos.us/?#map

IOOS Environmental Sensor Map

Home

Map

5

Settings

Share

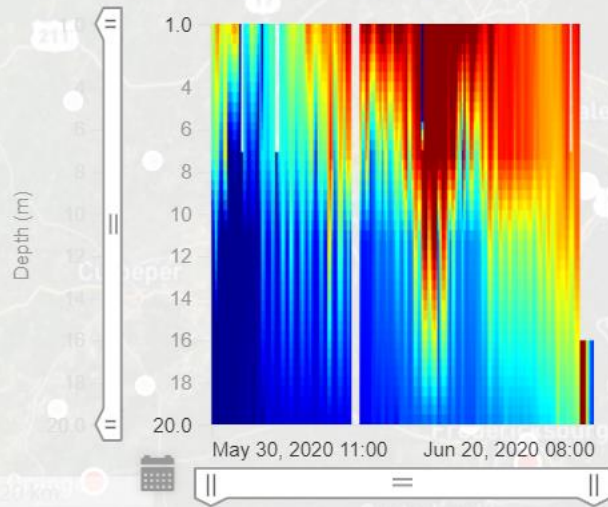
Help

Alerts

Temperature: Water Temperature

Temperature: Water Temperature

Chesapeake Bay Trust
ChesBayDox_01



Data

Time

Depth

Legend

Minimize all

Hide all

IOOS Global Sensor Map

IOOS Global Sensor Map

3,213 to 3,213 m



Air Temperature (°F)

Variable types

All

Show all

Sources

All

Platform

All

Search available sensor stations

Advanced

Total points: 34309 On screen: 243

Show all

X

20200907_085814.jpg

Open file

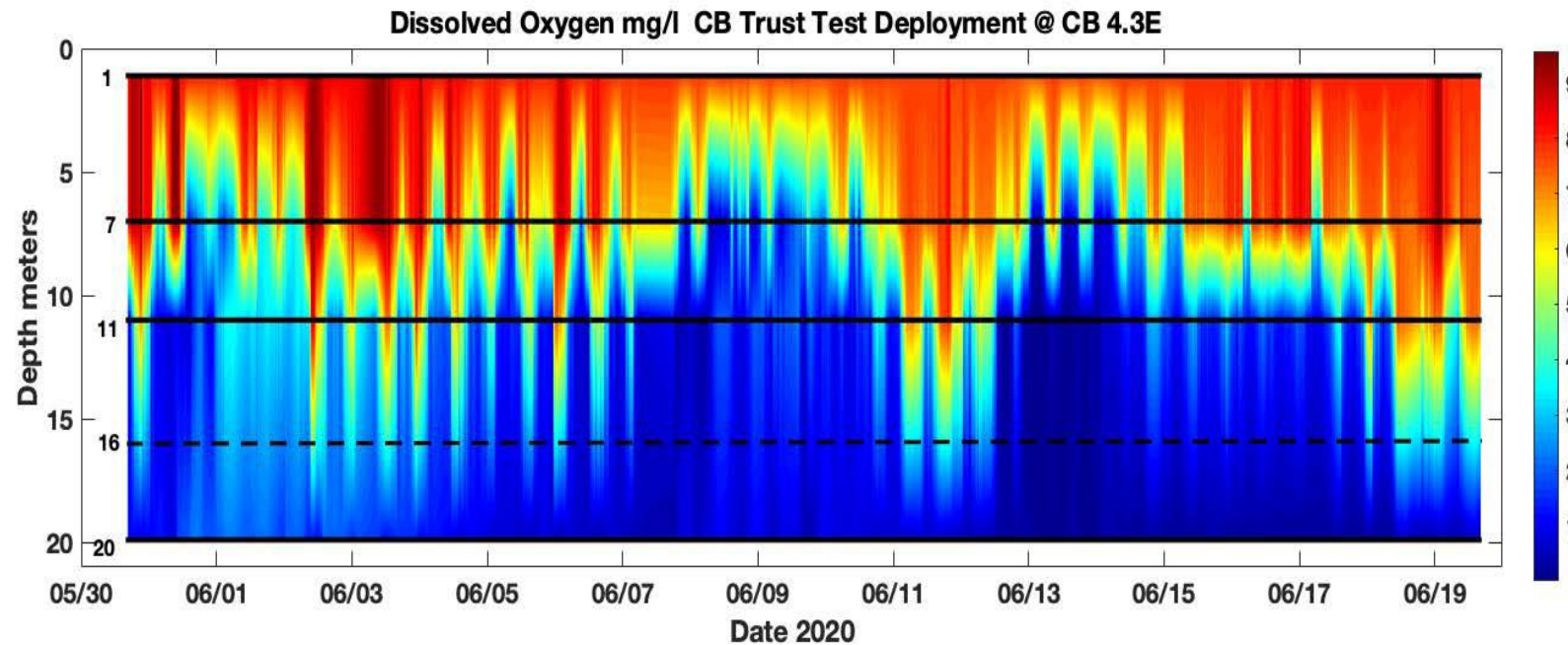
Type here to search



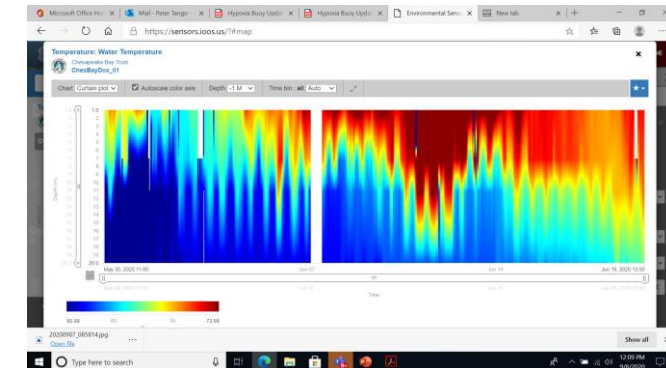
12:14 PM

9/8/2020

GIT funded Pilot study vertical profile water quality sensing in the open Bay 2020

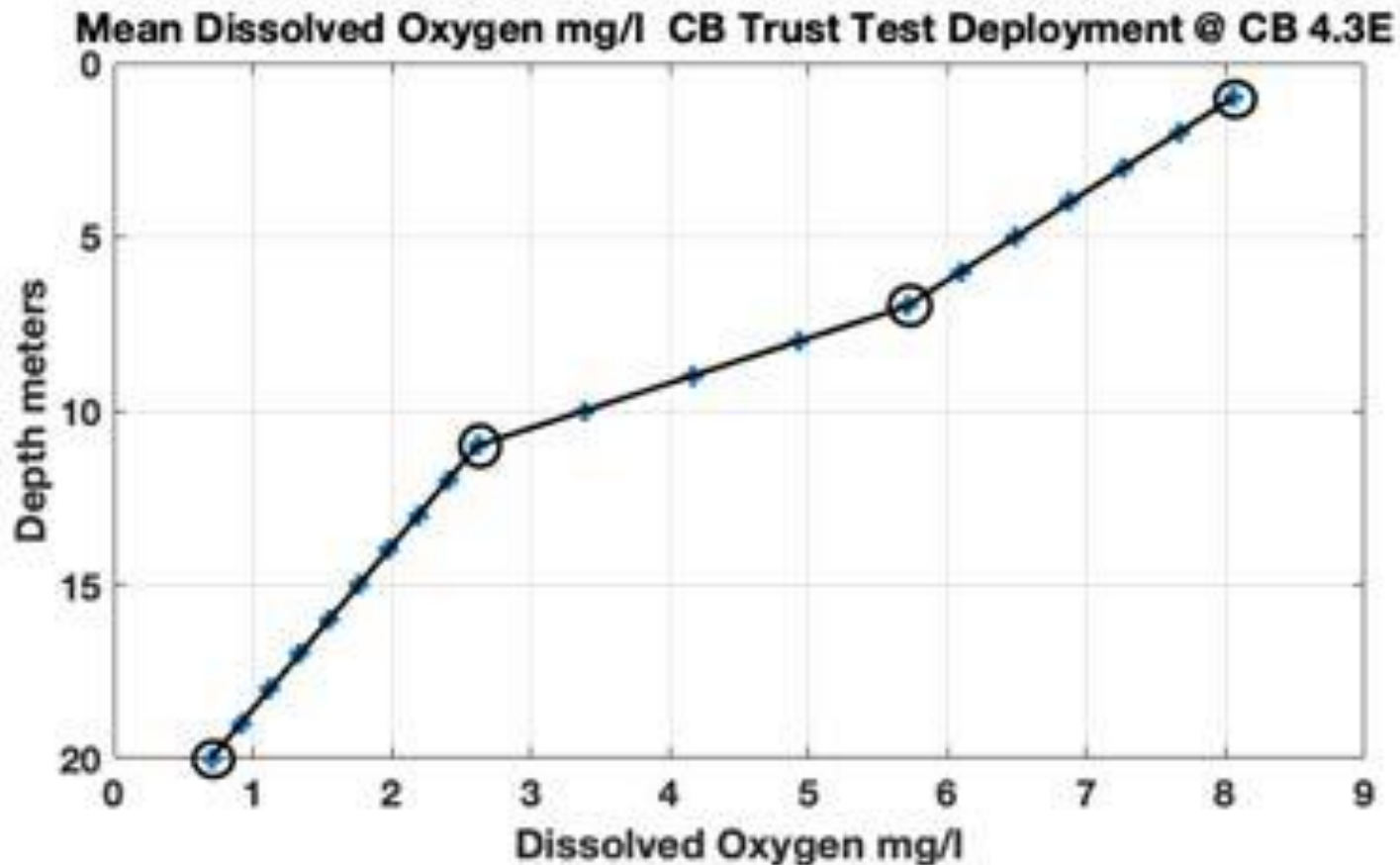


IOOS Website raw data



- * Missing data at 1m filled in with greater value of <100 % saturation OR measured value at 7 m>
- 16 m sensor malfunctioned shortly after deployment. Data missing.
- * Make sure all data manipulations programmed in S9 database to covert raw sensor data to engineering values (particularly Pressure, Conductivity, and Salinity)

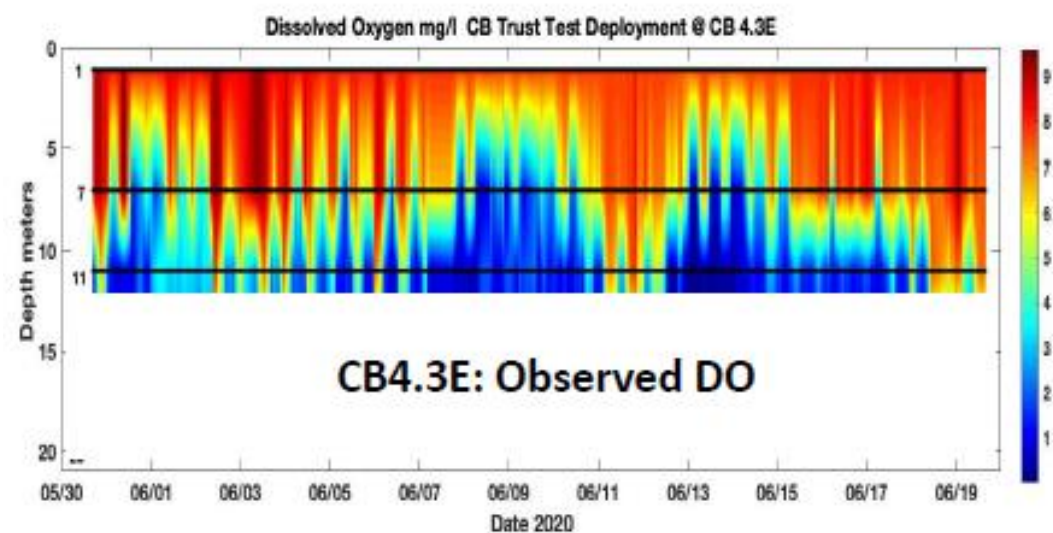
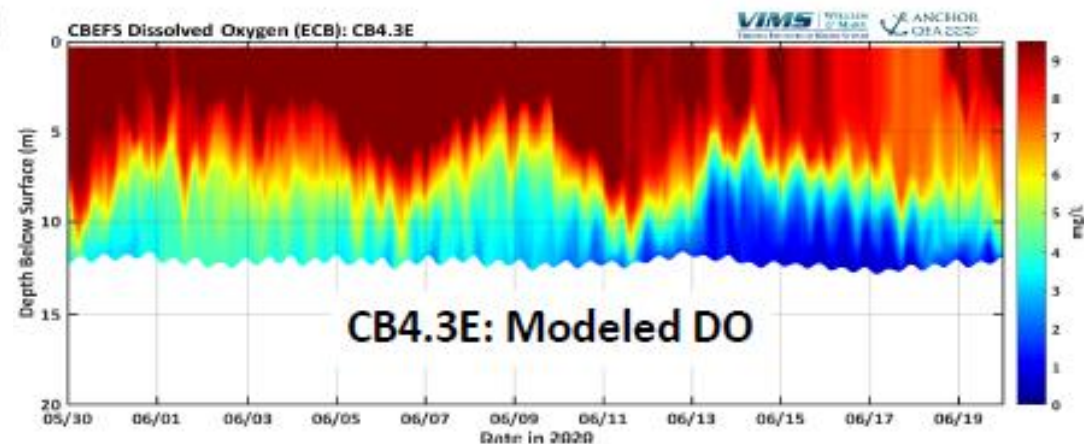
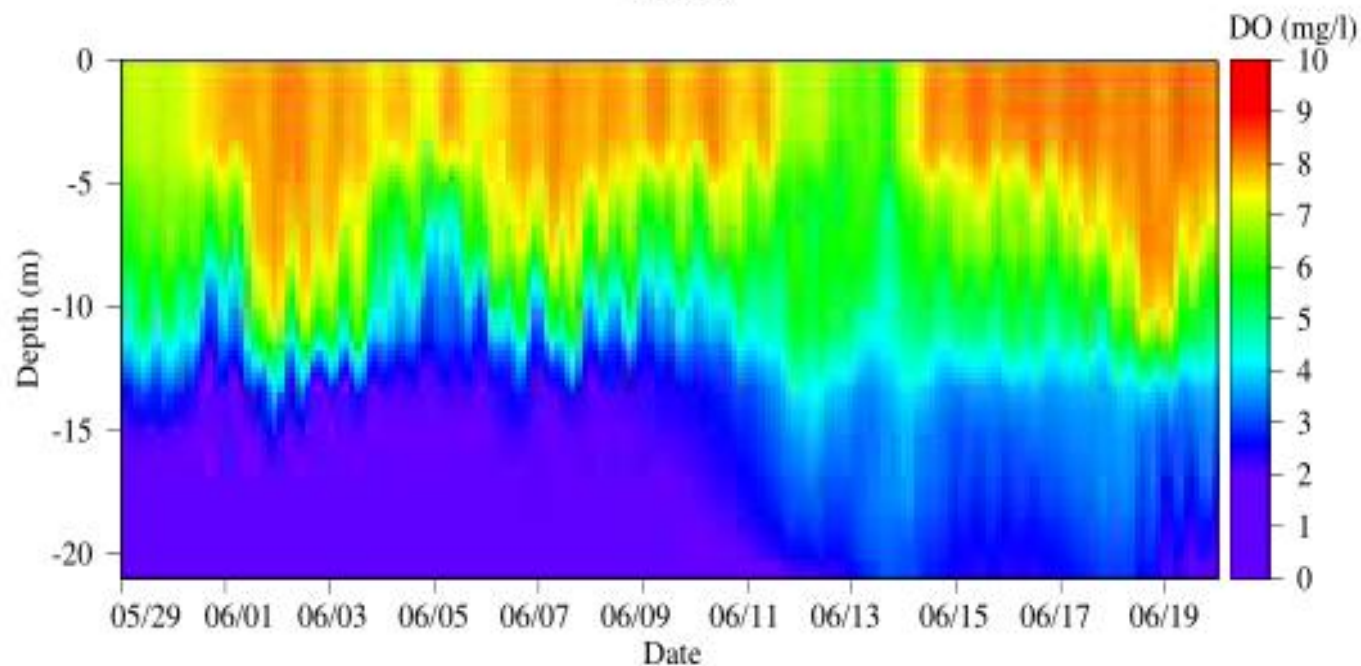
“Monthly Mean DO” (3 weeks) for June 2020



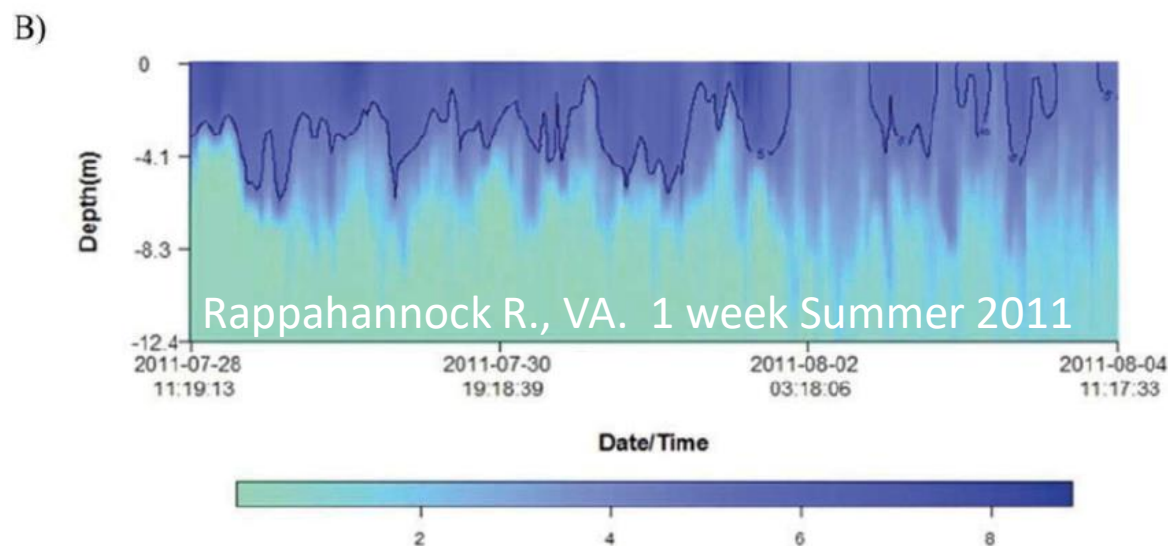
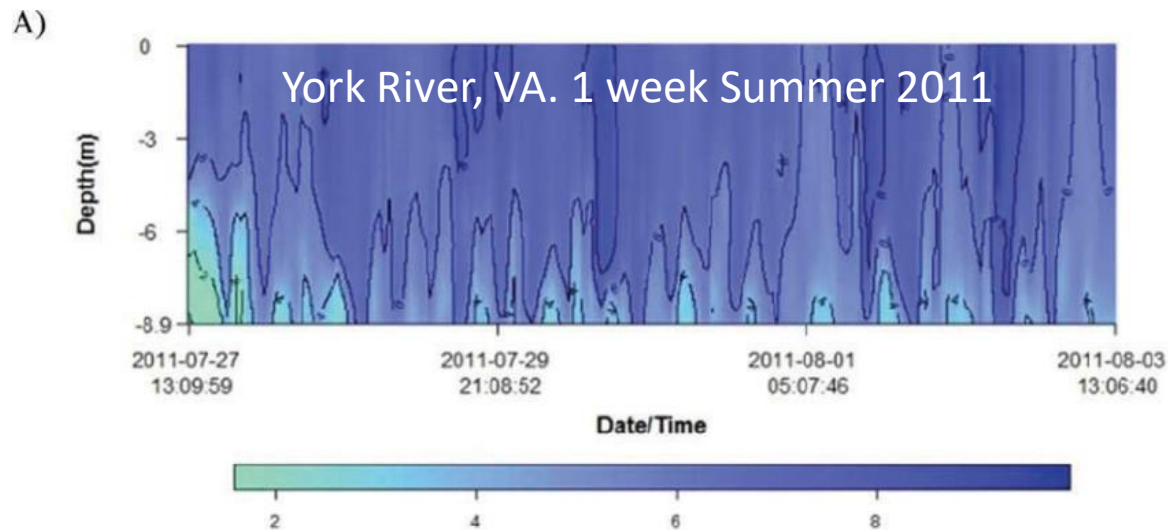
First look model comparisons...

CB3D-ICM 1994

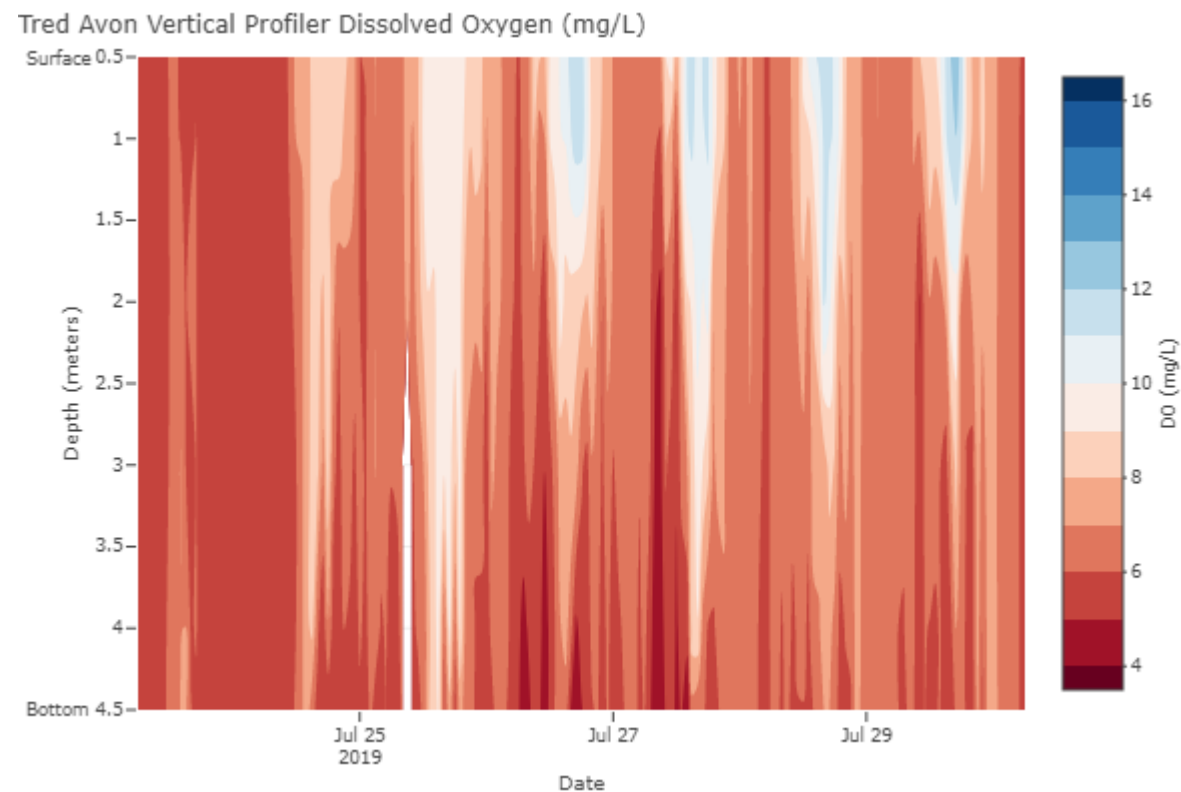
CB4.3E



Other DO profile examples from
Chesapeake Bay tributaries



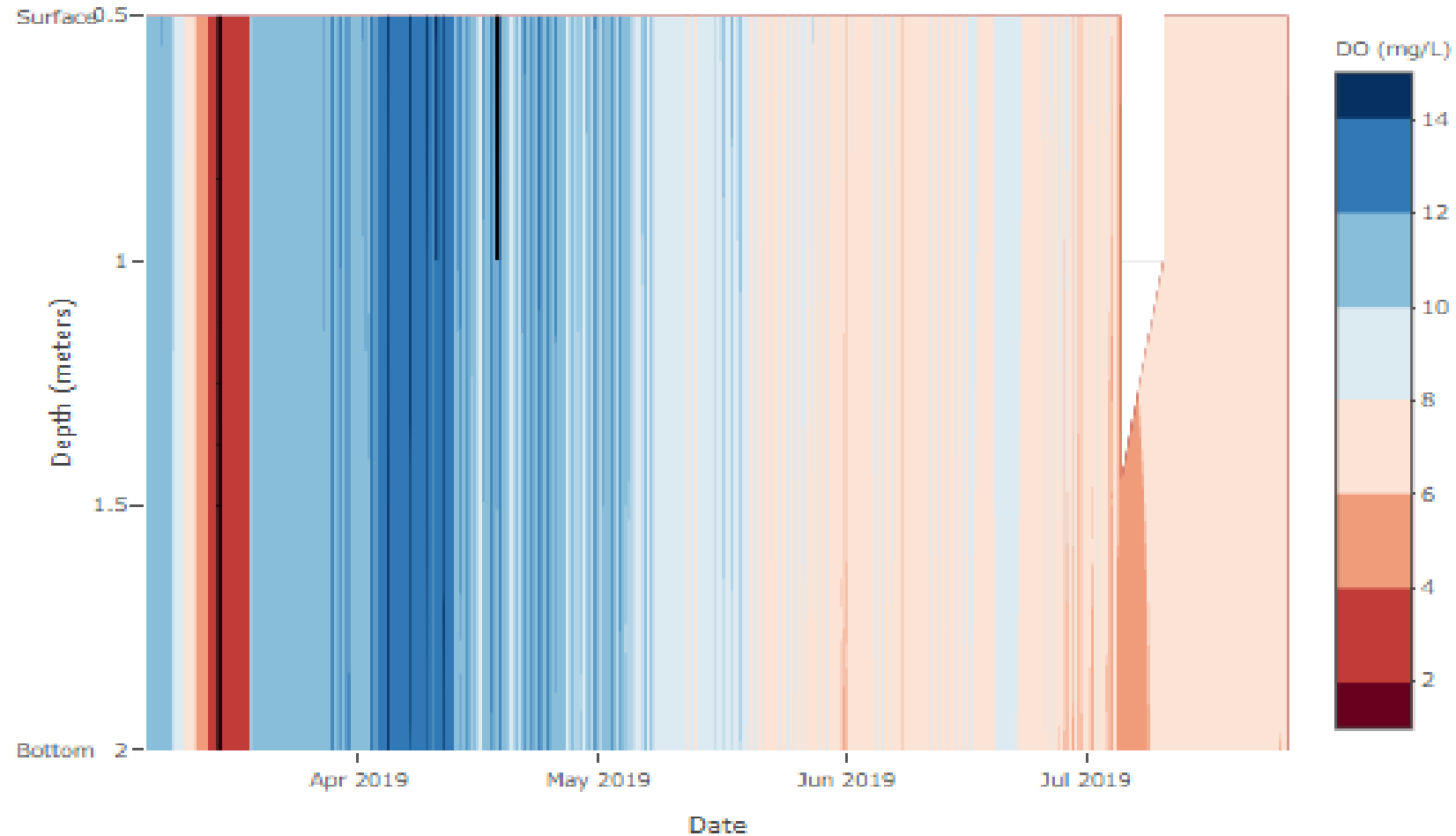
Water Quality Profiler data
(Tuckey and Fabrizio 2016)



MD DNR Water Quality Profiler - hourly
About 1 week, 4.5meter depth, Tred Avon River
July 26- July 30, 2019

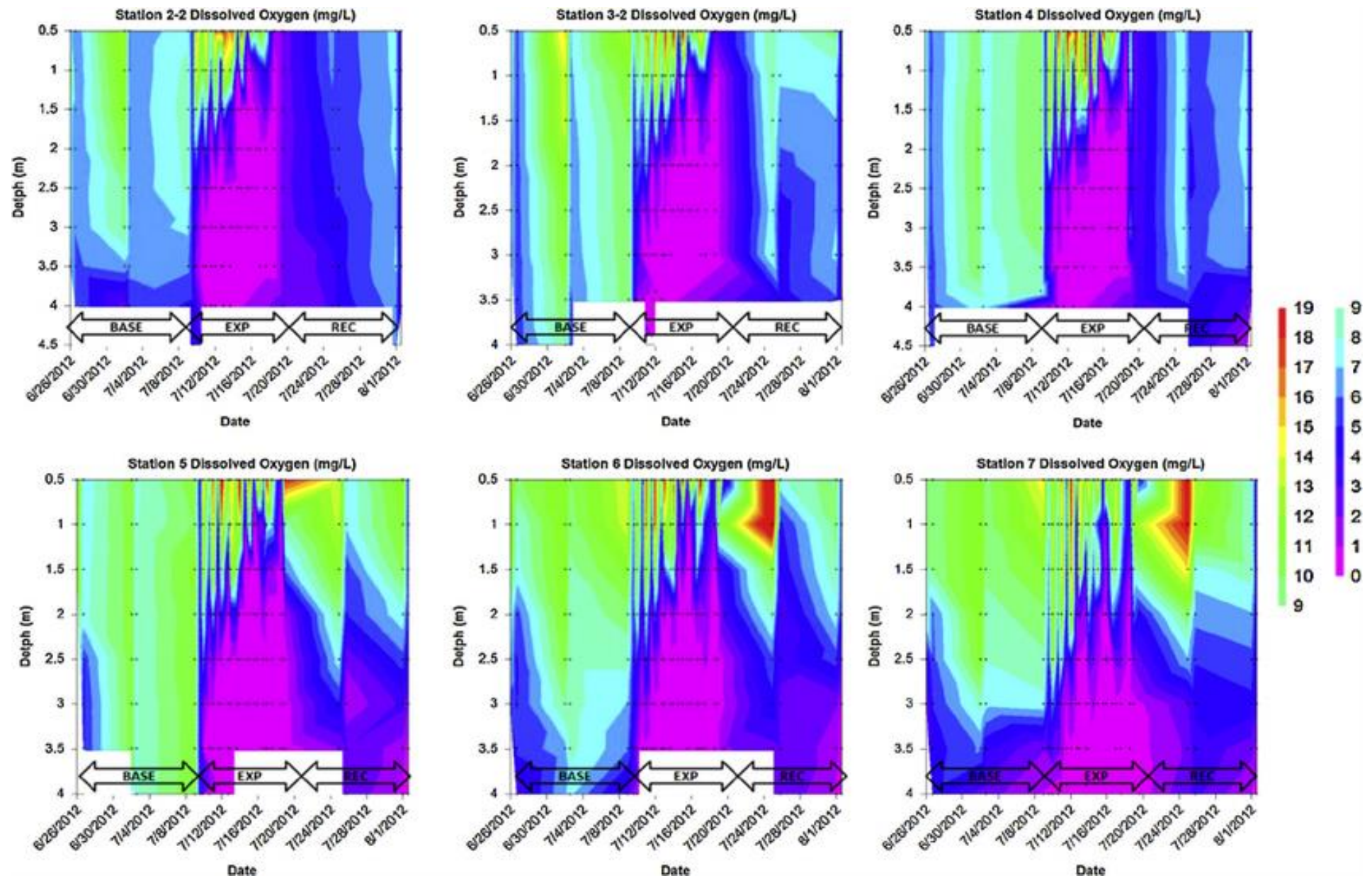
M. Trice
MD DNR

Harris Creek Vertical Profiler Dissolved Oxygen (mg/L)



M. Trice
MD DNR

**Data are provisional and have not yet been through our rigorous Quality Assurance procedures.*



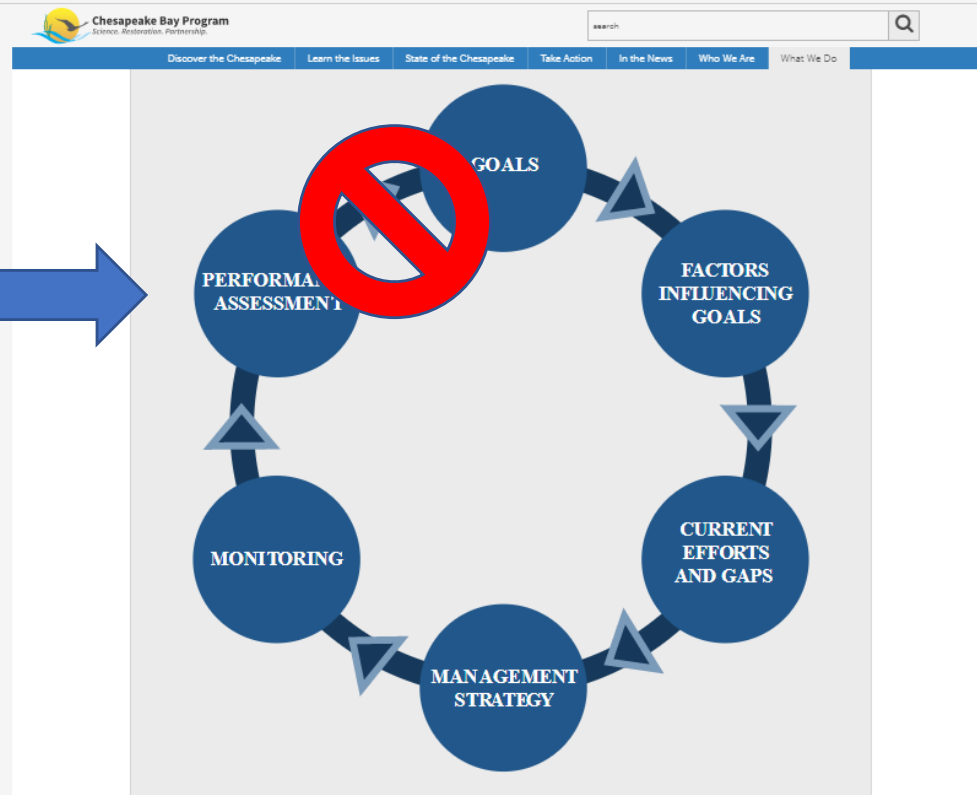
L. Harris et al. 2015. Rock Creek MD

Issue

17 years with no significant updates adopted in the CBP to address measurement and reporting on short duration criteria underpinning our water quality standards

AFTER 17 YEARS WE NEED ACTIONS TO ADOPT and ADAPT OUR PROGRAM

Performance Assessment
Has not changed.
17 years of nothing
more than 'marginal'
assessment of Bay
criteria seems beyond
time to adapt as
capacity declines



Each GIT will evaluate and describe its work using the Bay Program's adaptive management decision framework:

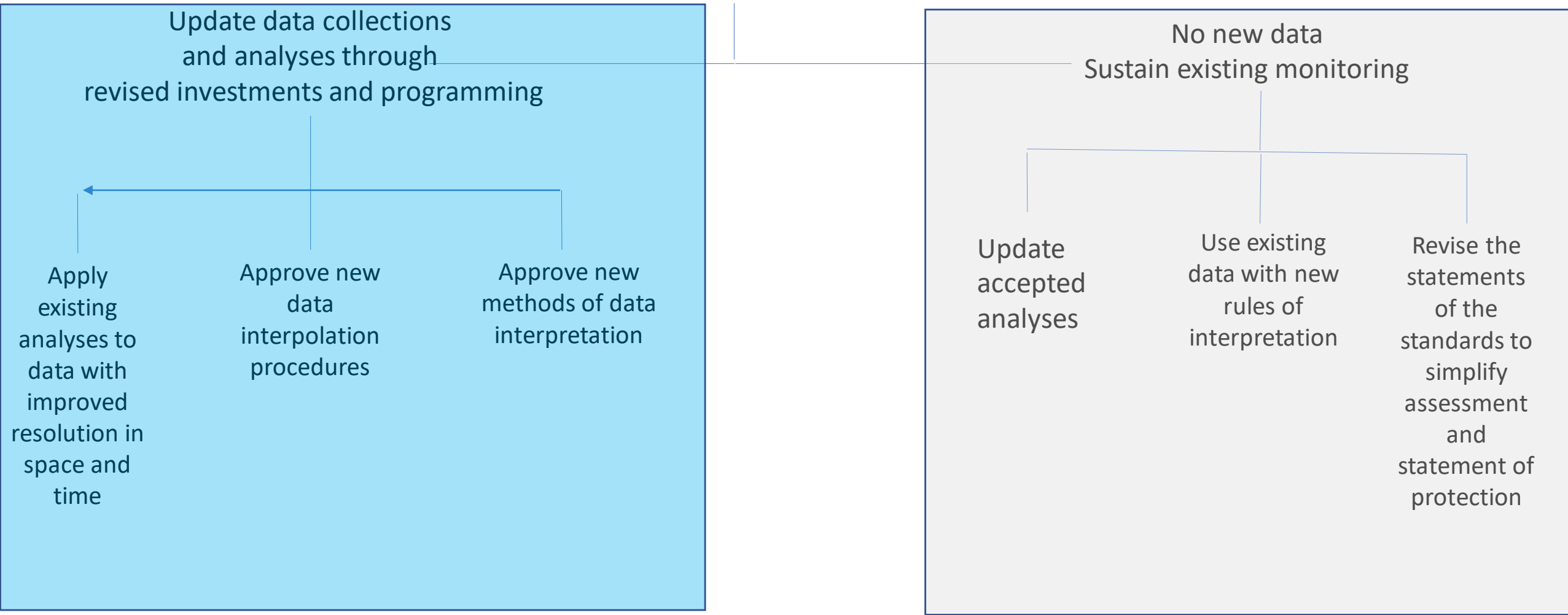
1. **Articulate program goals:** Identify the goals the GIT is working towards.
2. **Describe factors influencing goal attainment:** Identify and prioritize all factors that influence progress toward a goal. This step can help identify areas for collaboration across GITs.
3. **Assess current management efforts (and gaps):** Identify gaps and overlaps in the existing management programs that address the important factors affecting goal attainment.
4. **Develop management strategy:** Stakeholders coordinate and implement planning.
5. **Develop monitoring program.**
6. **Assess performance:** Criteria for success and failure of management efforts should be known when the strategy is developed and the monitoring program is designed. This is the analysis that informs program adaptation and next steps.
7. **Manage adaptively:** Based on the monitoring assessment, system models are amended and monitoring strategies are revised to improve program performance.

This information will ultimately provide the basis for coordination, collaboration and development of a program-wide strategy.

Visit [ChesapeakeBay.net](#) to learn more about adaptive management at the Bay Program.

AFTER 17 YEARS WE NEED ACTIONS TO ADAPT
WE NEED NEAR TERM COMMITMENT AND IMPLEMENTATION OF UPDATES TO
THE PROGRAM TO MEASURE WATER QUALITY STANDARDS ATTAINMENT

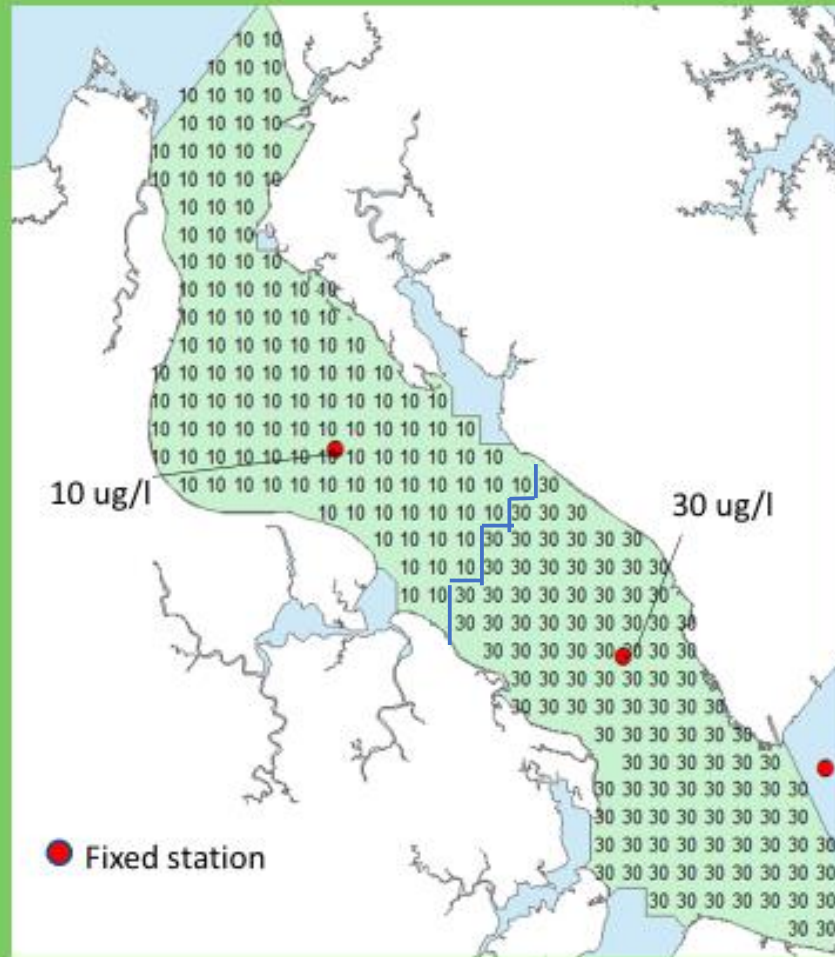
MANAGEMENT and POLICY OPTIONS



This is an IDW interpolation with 2 stations on CHLA, lower James River.

The Interpolator fills “in” and “out” so that we can calculate the aerial extent of exceedence.

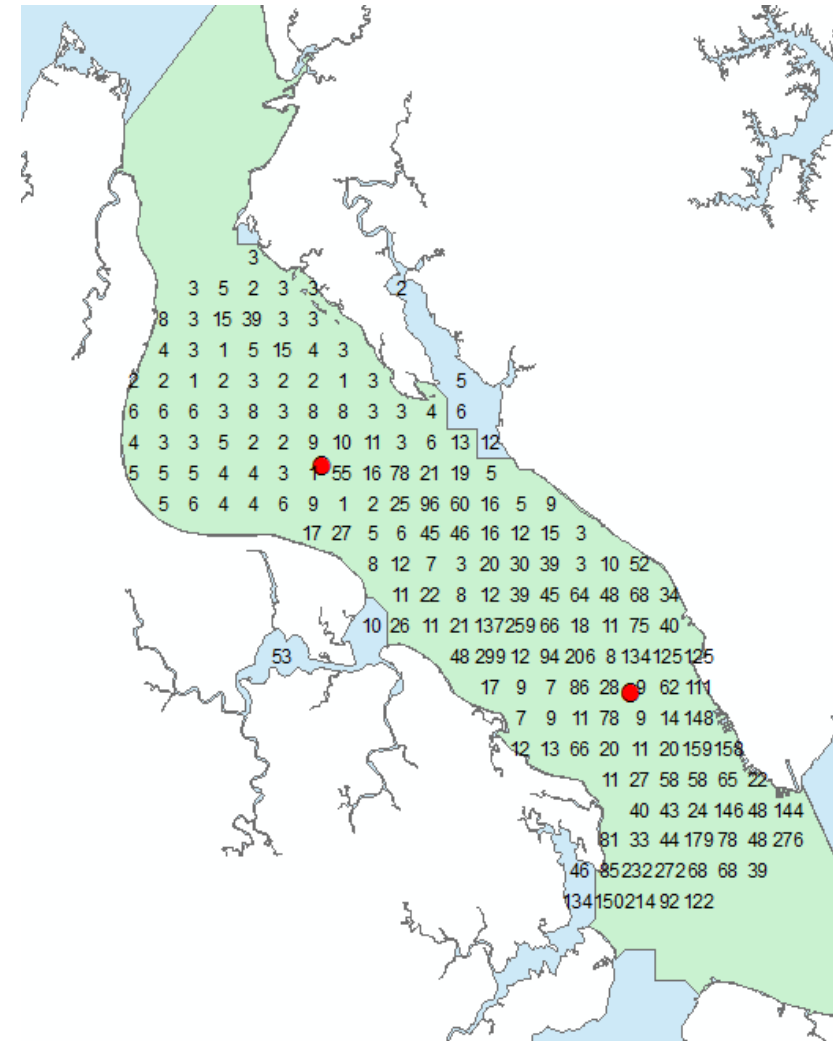
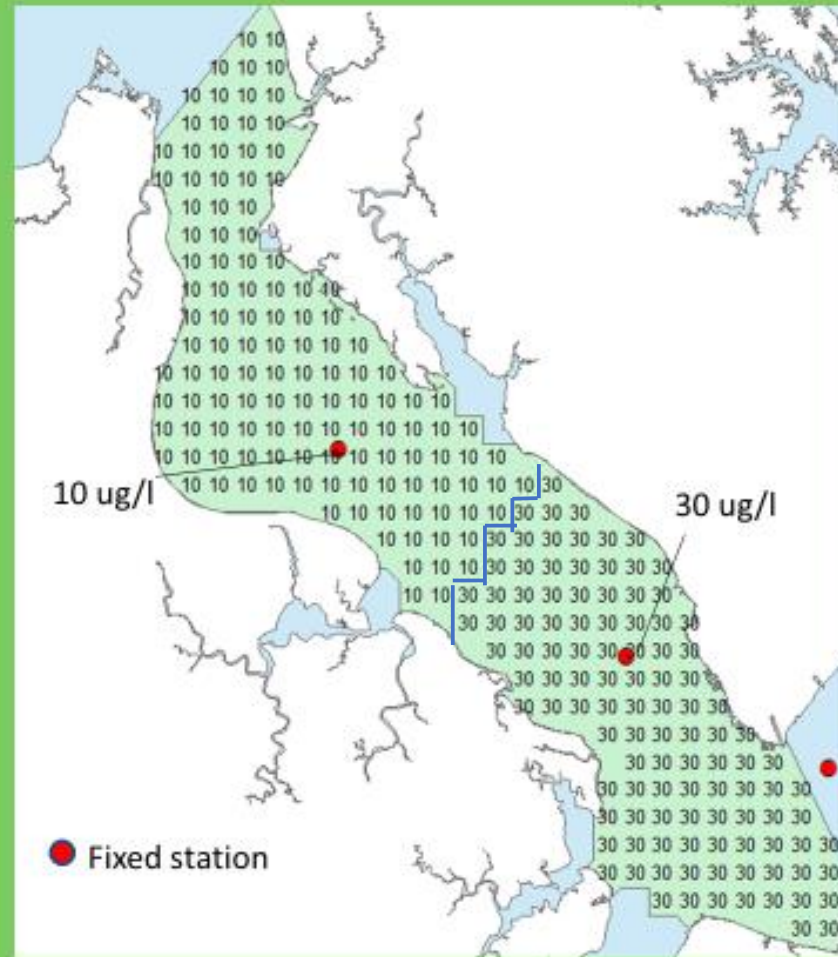
Note: It does not create or rely on any statistical model of spatial variation (e.g., a variogram).



Interpolation of Dataflow provides insights on variability missed in this case. Almost nothing actually equals 10 ug/L or 30 ug/L around those two stations. Important for criteria assessment and tracking progress.

The Interpolator fills “in” and “out” so that we can calculate the aerial extent of exceedence.

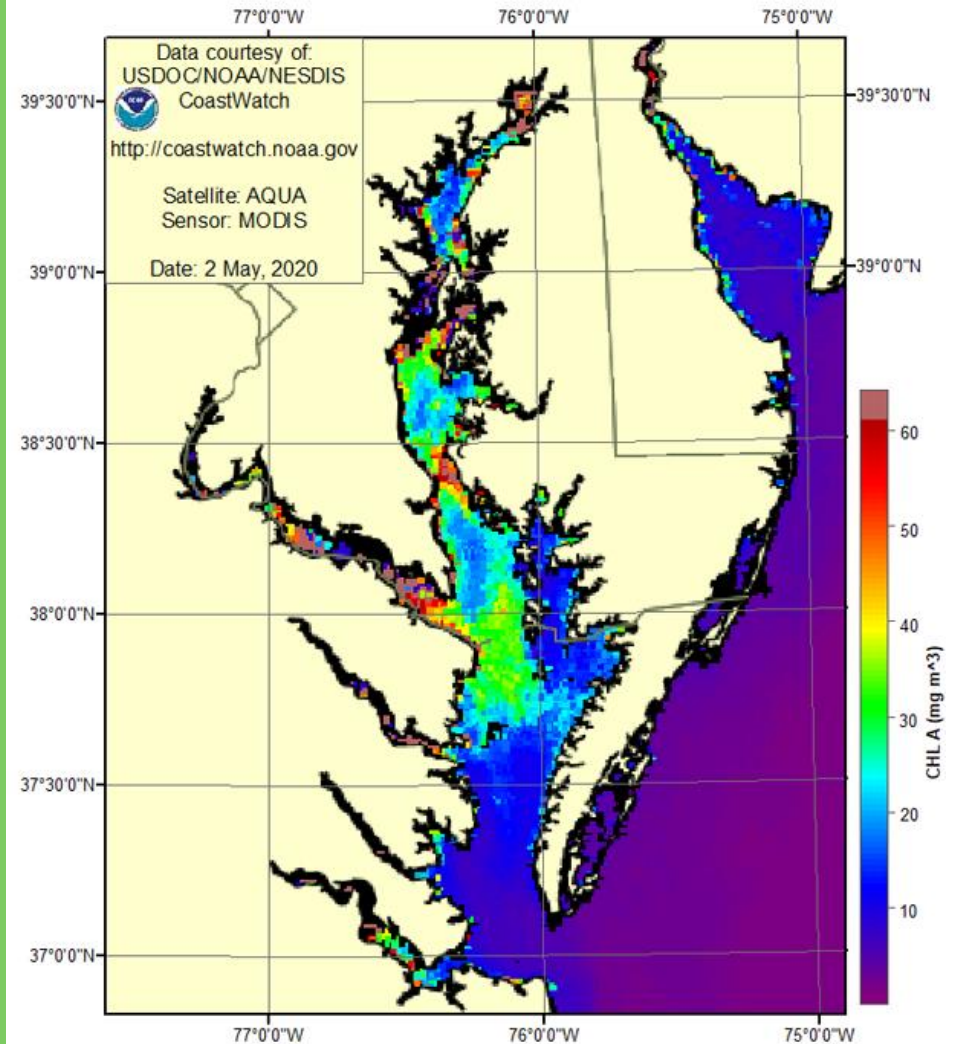
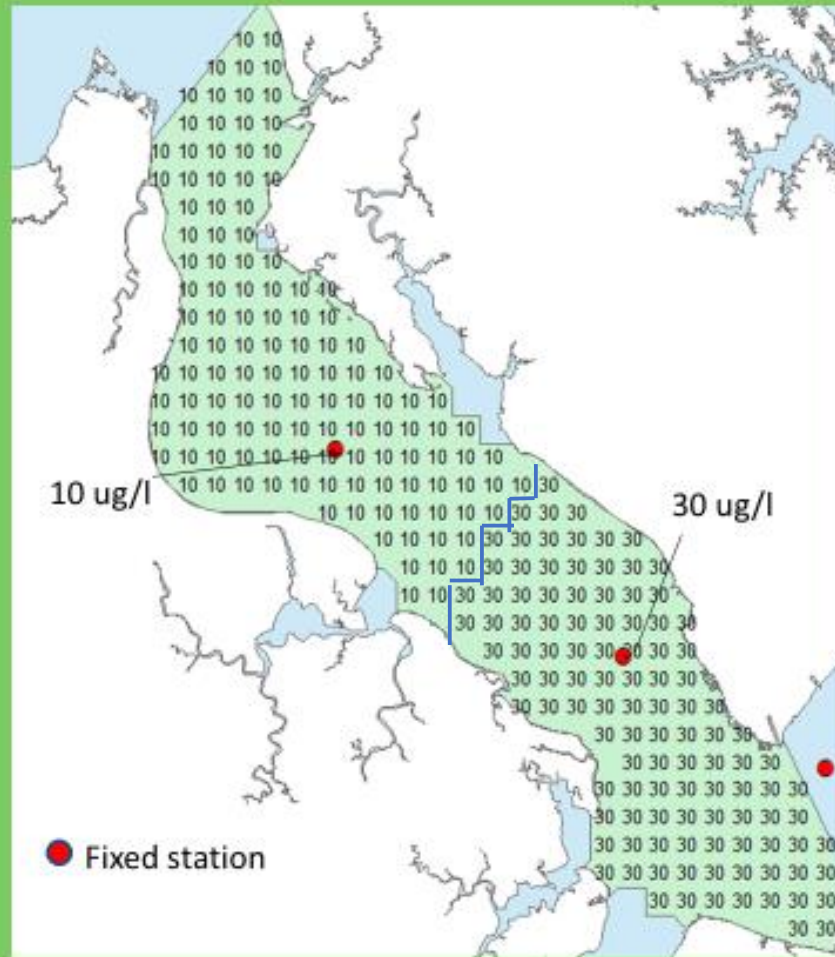
Note: It does not create or rely on any statistical model of spatial variation (e.g., a variogram).



And there are opportunities to get single day, baywide assessments with alternate assessment protocol strategies, e.g. Hi-res satellite imagery

The Interpolator fills “in” and “out” so that we can calculate the aerial extent of exceedence.

Note: It does not create or rely on any statistical model of spatial variation (e.g., a variogram).



We have ripe opportunities to expand use of our toolbox to estimate conditions over much of the Bay and its tribs

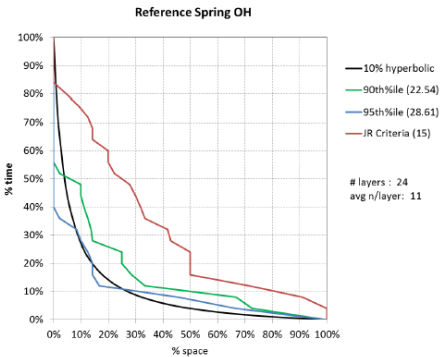
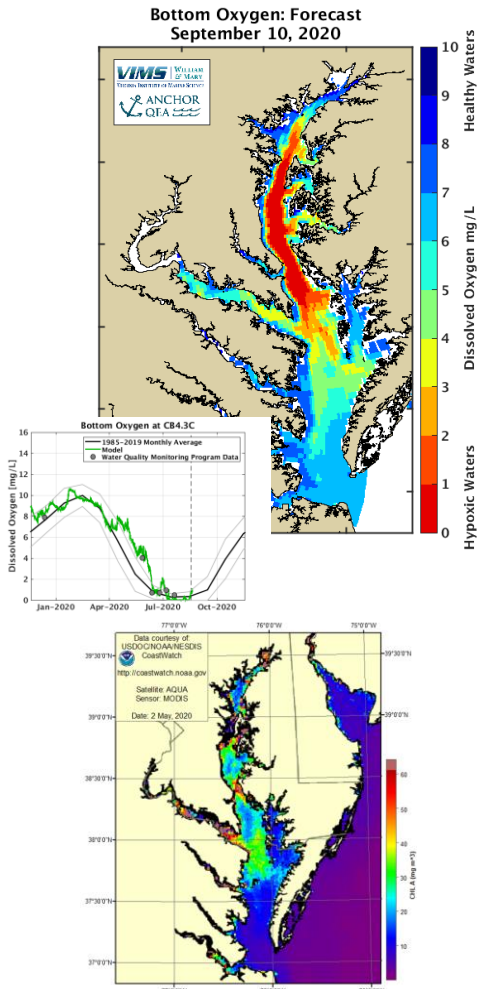
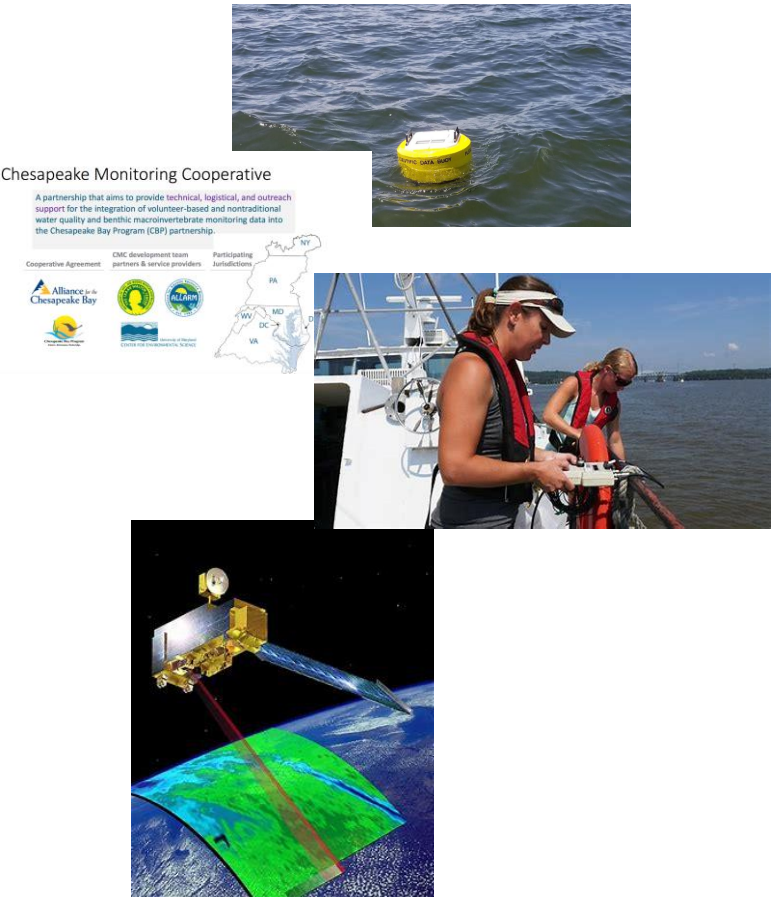


Figure 4b. Spring oligohaline CFD curves for chlorophyll a from reference water quality conditions.

Update integrated monitoring approach

Update analytical and assessment approaches

Improved capacity
Enhanced Assessments

Thank you 😊