Expanding our hypoxia monitoring network: Sampling design considerations to support recommendations on monitoring needs

PETER TANGO
USGS@CBPO
HYPOXIA COLLABORATIVE MEETING

5/13/2022

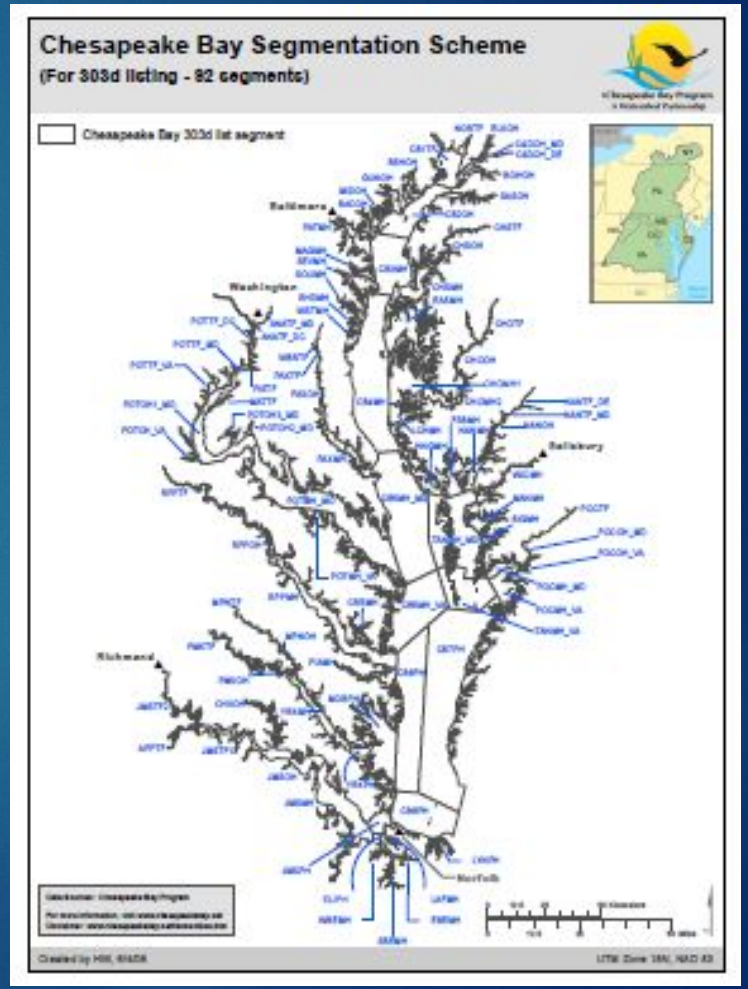
Acknowledgements

- Leadership team includes
  - Bruce Vogt
  - Jay Lazar
  - Kevin Schabow
  - Justin Shapiro
  - Sean Corson
  - Breck Sullivan
  - Amy Goldfischer

The 2021-22 Principal Staff Committee (PSC) Monitoring Review

- ***On March 2, 2021***, the PSC heard from EPA that the water quality monitoring program was characterized as **"Fair"** for addressing water quality criteria attainment assessments.
  - The PSC wanted a review and feedback on what is needed to move the CBP water quality monitoring program from "Fair" to "Good".

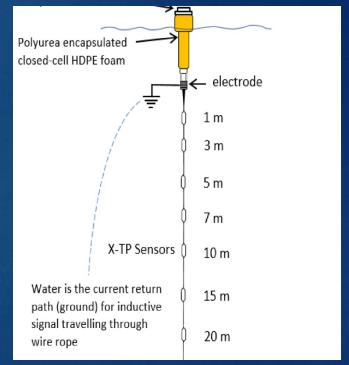
- Review process - **completed**
- Review report draft – **completed**
- Community review and feedback - **completed**
- Response to comments and finalizing report – **in progress**
- **Action on recommendations – already happening** ☺



Issues of interest in growing out the sampling design for the array network

Needed information as we discussed design considerations

- Desirable locations/regions
  - (e.g., poorly monitored/high uncertainty areas)
- All year or seasonal
  - (duration of deployment for operations and maintenance planning)
- Vertical resolution at locations
  - (sensor density using a fixed array system)



Recommendations on sampling design for the next phase of hypoxia monitoring network development

- Mainstem bay (3)
  - if we keep an east-west pair in the mainstem and
  - we have a reference array at another latitude
- Lower tributaries: Potomac and Rappahannock. (4)
  - 2 Potomac arrays
  - 2 Rappahannock arrays
- Mobile, targeted study arrays (4)
  - 3 new as a suite for evaluating scales of variability
  - 1 existing with MD DNR and their Fishing Bay study area

n=11 arrays.

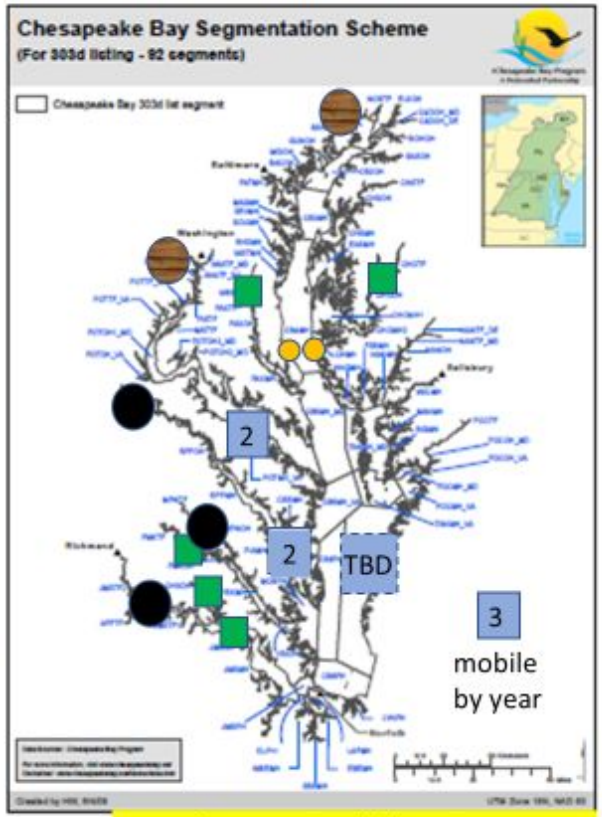
- Growing the water quality network from "Fair" to "good", addressing high frequency water quality habitat conditions with this level of investment and build out of the program.
- **Recommendation for investment to PSC is targeting support for 8 new locations for arrays.**

Recommendations on sampling design for the next phase of hypoxia monitoring network development

Expanding monitoring and assessment capacity 2021+: High frequency monitoring network

Existing

- NOAA supports 2 vertical sensor arrays
- 3 fully funded river input water quality continuous monitors (VADEQ/USGS)
- 2 river input water quality continuous monitoring sites with support ending, need funding (MD/USGS)



Network vision: D.O., Temp, Salinity

- 11 vertical arrays operating in main bay and tidal tributaries
- 10 boundary condition river input continuous monitoring stations
- Sustain existing long-term and targeted shallow water monitoring

Recommendations on sampling design for the next phase of hypoxia monitoring network development: Locations

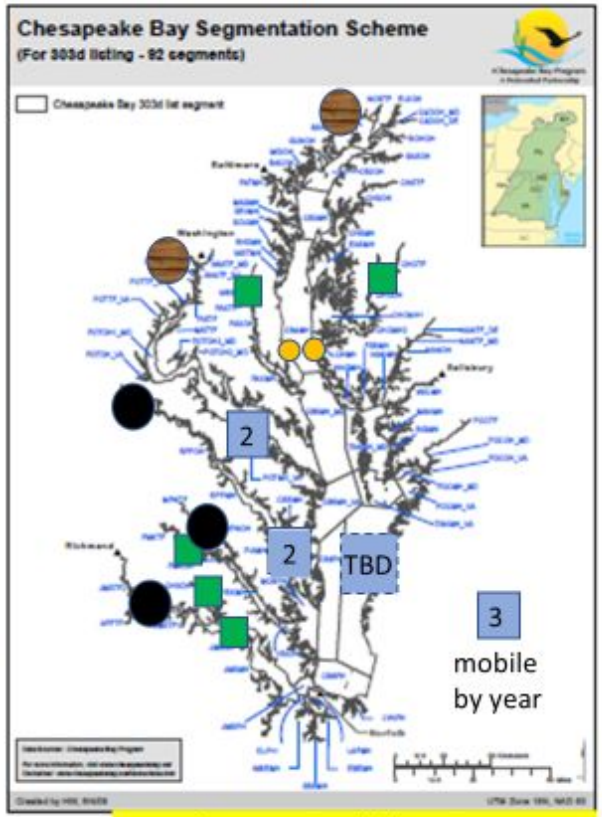
Expanding monitoring and assessment capacity 2021+: High frequency monitoring network

Existing

- NOAA supports 2 vertical sensor arrays
- 3 fully funded river input water quality continuous monitors (VADEQ/USGS)
- 2 river input water quality continuous monitoring sites with support ending, need funding (MD/USGS)

New – proposed and considered for investment

- 2021-22 PSC Monitoring Review proposal for capacity to support unassessed criteria assessment, improved fish habitat assessment, modeling calibration and verification:
  - 8 new tidal water vertical array sites
  - 5 new river input con-mons at tidal/nontidal boundary
  - New 4-D water quality interpolator tool development



Network vision: D.O., Temp, Salinity

- 11 vertical arrays operating in main bay and tidal tributaries
- 10 boundary condition river input continuous monitoring stations
- Sustain existing long-term and targeted shallow water monitoring

Recommendations on sampling design for the next phase of hypoxia monitoring network development:

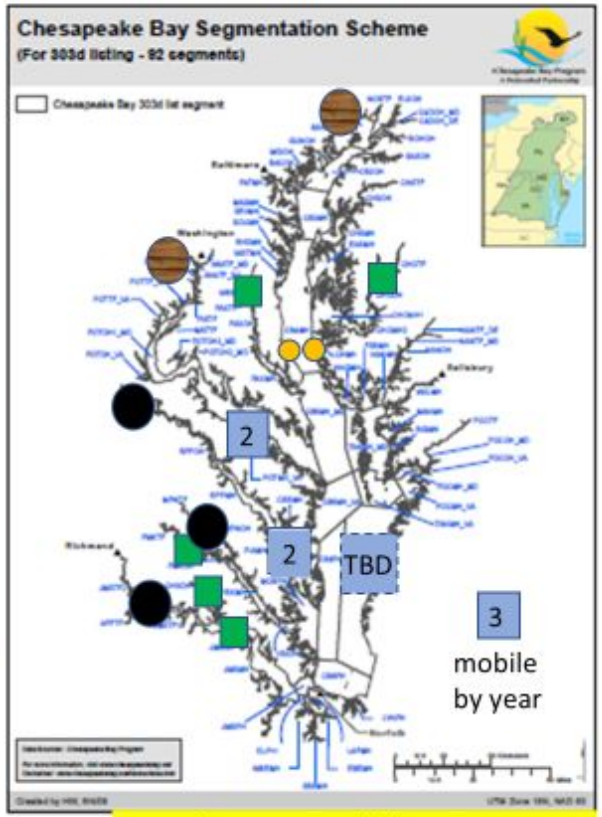
Expanding monitoring and assessment capacity 2021+: High frequency monitoring network

Existing

- NOAA supports 2 vertical sensor arrays
- 3 fully funded river input water quality continuous monitors (VADEQ/USGS)
- 2 river input water quality continuous monitoring sites with support ending, need funding (MD/USGS)

New – proposed and considered for investment

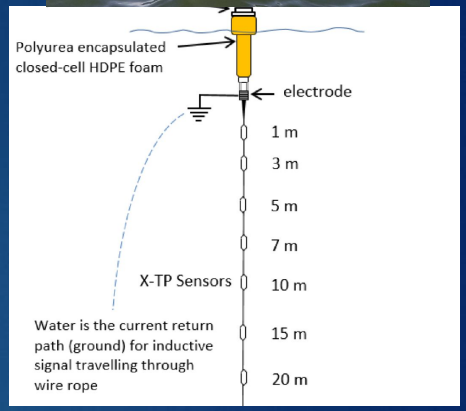
- 2021-22 PSC Monitoring Review proposal for capacity to support unassessed criteria assessment, improved fish habitat assessment, modeling calibration and verification:
  - 8 new tidal water vertical array sites
  - 5 new river input con-mons at tidal/nontidal boundary
  - New 4-D water quality interpolator tool development



Path ahead:

- Network vision was presented, welcomed during the May 2022 STAC Advanced Monitoring workshop
- Budgets have been developed with a 5 year vision in mind
- The Review Team is asking for support from the PSC for building partner support
- Agencies are already using the findings to plan investments and work

Issues of interest in growing out the sampling design



Needed information

- Locations/regions
- Vertical resolution at locations
- All year or seasonal (duration of deployment)

Suggestions

- 8 new arrays
- Thus far – we have set up the first 2 mainstem bay arrays with 2m resolution.
  - Good for 7 arrays and 1 reference array with 1m resolution?
  - Is there a basis to recommend more than 1 array with 1m resolution in sensors?

Issues of interest in growing out the sampling design

Needed information

- Locations/regions
- Vertical resolution at locations
- All year or seasonal (duration of deployment)

Designated Use	Dissolved oxygen Criteria Concentration/Duration		Temporal Application
Migratory fish spawning and nursery use	7-day mean ≥ 6 mg/L tidal habitats with 0-0.5ppt salinity		February 1 – May 31
	Instantaneous min ≥ 5 mg/L		
	Open water fish & shellfish designated use criteria apply		June 1 – January 31
Shallow water Bay grass use	Open water fish & shellfish designated use criteria apply		Year-round
Open water fish and shellfish use	30-day mean	≥ 5.5 mg/L Salinity: (0-0.5ppt)	Year-round
		≥ 5 mg/L Salinity: >0.5ppt	
	7-day mean	≥ 4 mg/L	
	Instantaneous min ≥ 3.2 mg/L		
Deep-water seasonal fish and shellfish use	30 day mean > 3mg/L		June 1 – September 30
	1-day mean >2.3 mg/L		
	Instantaneous min ≥1.7 mg/L		
	Open water Fish and shellfish designated use criteria apply		October 1-May 31
Deep channel seasonal refuge use	Instantaneous min > 1 mg/L		June 1 – September 30
	Open water F & S applies		October 1 – May 31

- Suggestions

- 8 new arrays
- Hypoxia Meeting recommendation
- TBD: Suggest yearround for some – water quality standards criteria apply in all seasons, we do not have data in all seasons to assess short-duration criteria in the way they are written and should be accounted for.

In closing

- Justification for the present stage of the sampling design reflects
  - fisheries habitat information needs
  - modeling needs
  - research interests, and
  - water quality criteria assessment requirements
- Network costs (infrastructure and O&M) were developed.
  - Funding support is under discussion (e.g., NOAA and EPA)
- Setting up the network will allow other partners to align data collection and QA with the network efforts to leverage resources

Issues of interest in growing out the sampling design

Needed information

- Locations/regions
- Vertical resolution at locations
- All year or seasonal (duration of deployment)

- Suggestions

- 8 new arrays
- Hypoxia Meeting recommendation
- Hypoxia Meeting recommendation