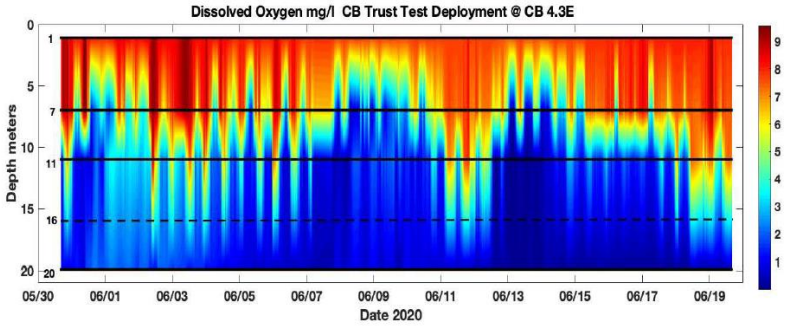
Recent GIT funded study meeting recap from the CAP WG

Peter Tango USGS@CBPO and Dong Liang (UMCES)

Hypoxia Collaborative

9/24/2025

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



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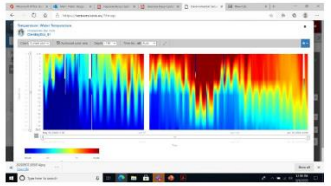


* Missing data at 1m filled in with greater value of <100 % saturation OR measured value at 7 m>

- 16 m sensor malfunctioned shortly after deployment. Data missing.

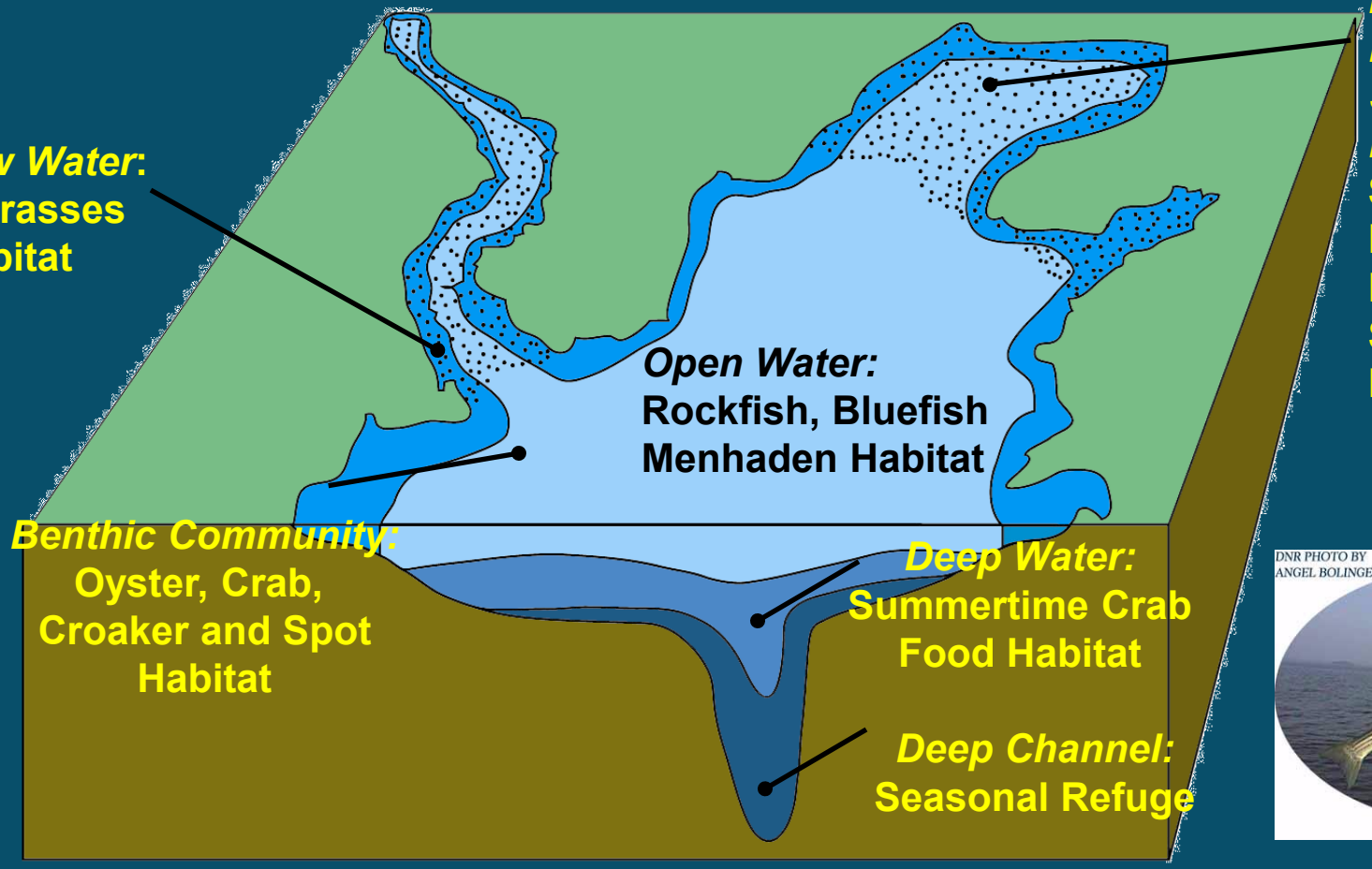
August 2025 CAP WG Hybrid meeting –

Habitat sampling design: blending nearshore and offshore monitoring resouces

- **1:15PM Practical Applications of Monitoring for Designated Use Assessments –** *Tish Robertson (VA DEQ)*
- Introduction to the workshop on designated use monitoring needs and constraints.
- **1:30 PM Previous Segment Prioritization Findings from the Hypoxia Collaborative, Additional Perspective on Infrastructure Distribution –** *Peter Tango (USGS)*
- **2:00 PM Creation and Usage of Tool for Site Distribution Presentation –** *Dong Liang, Jeremy Testa, and Lora Harris (UMCES)*
- **2:30 PM Considerations for Maintaining Vertical Arrays and Lessons Learned Presentation –** *Jay Lazar (NOAA)*
- **3:00 PM Discussion of State and Participant Priorities for Segment Selection and Segmentation Design –** *All*
- **5:00 PM Adjourn**

Orientation: Designated Uses – Clean Water Act protection connections

Chesapeake Bay Designated Uses



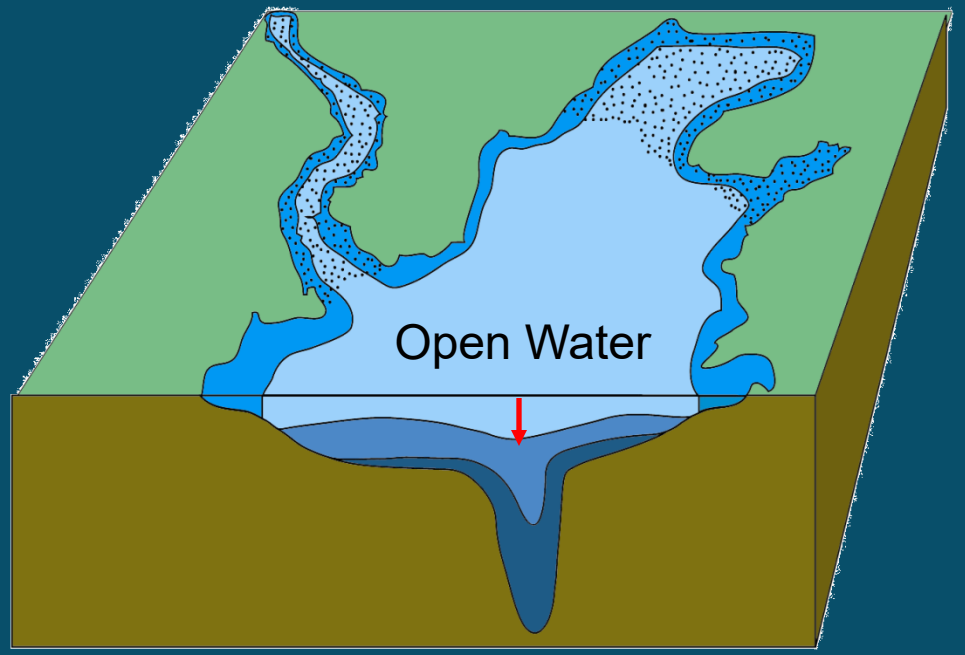
Source: EPA

Designated Uses

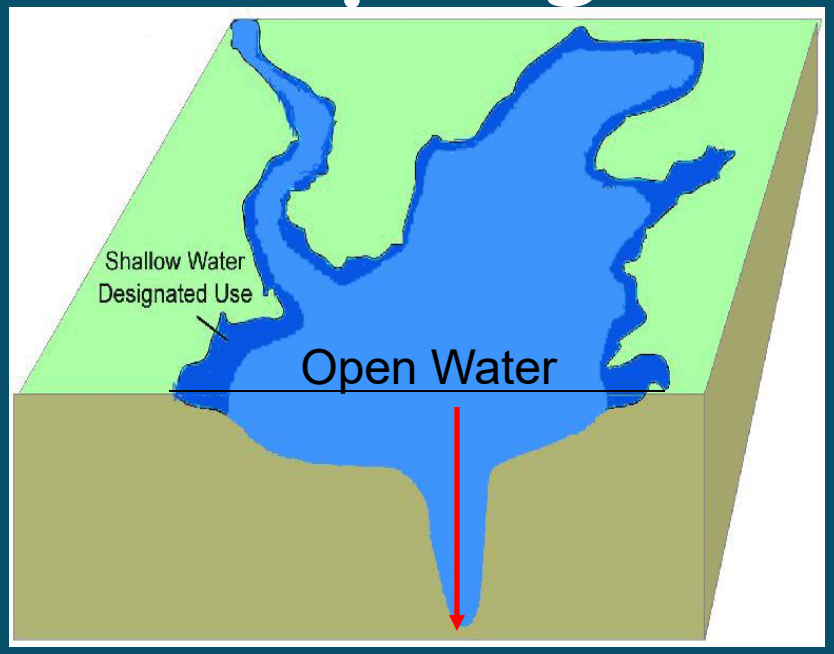
Time: Seasonal

Space:

Summer

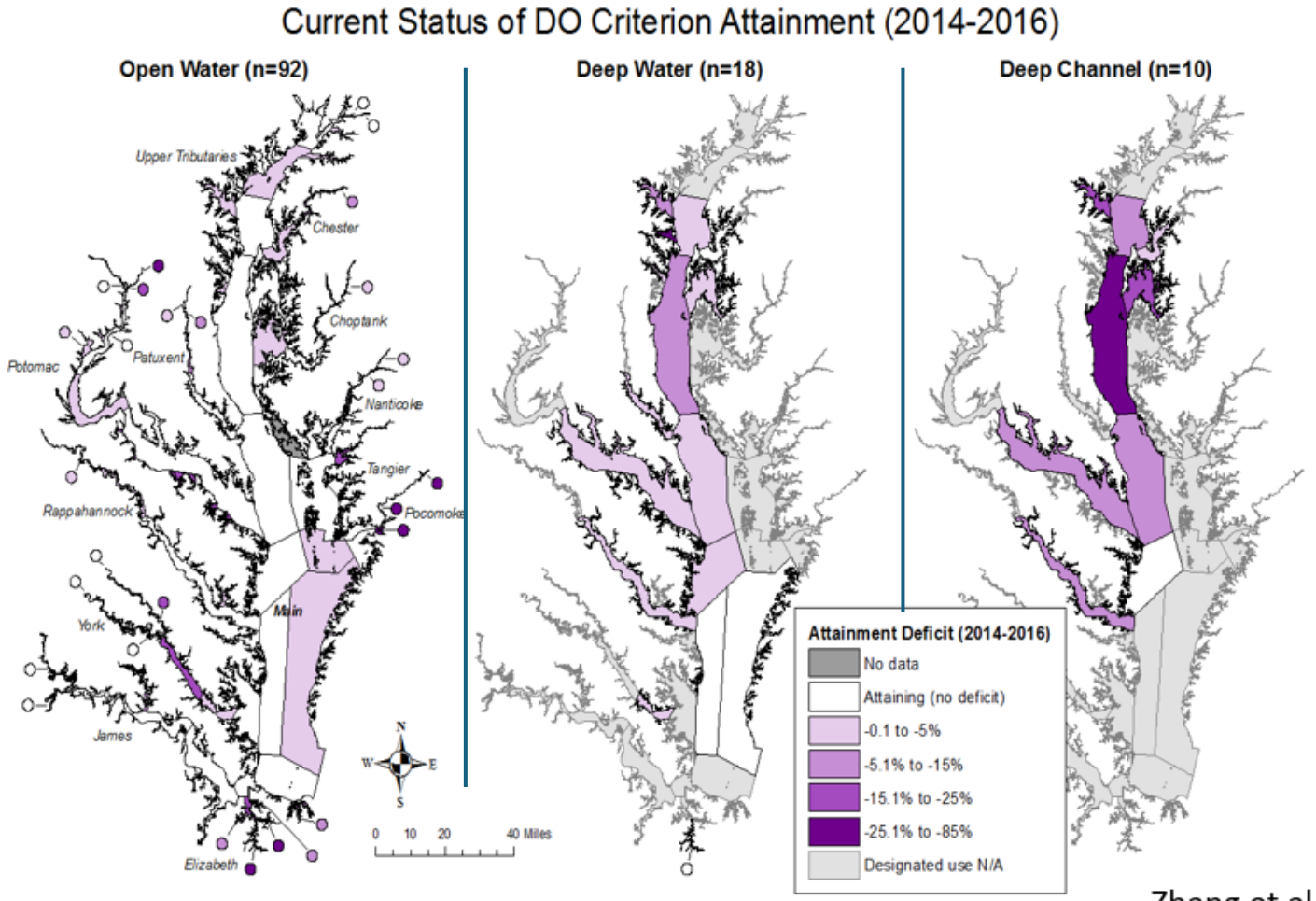


Fall, Winter Spring



Source: EPA

Chesapeake Bay – Multiple designated uses and 92 management segments; not every segment has all uses



Zhang et al 2018 DRAFT
Maps by E. Trentacoste

CB Segment focused design work

- The TMDL is actually a combination of smaller TMDLs for 92 individual Chesapeake Bay tidal segments.

- It includes pollutant loads (i.e., nitrogen, phosphorus, sediment) that EPA determined were sufficient to meet applicable state water quality standards for **dissolved oxygen, water clarity, underwater Bay grasses, and chlorophyll a.**

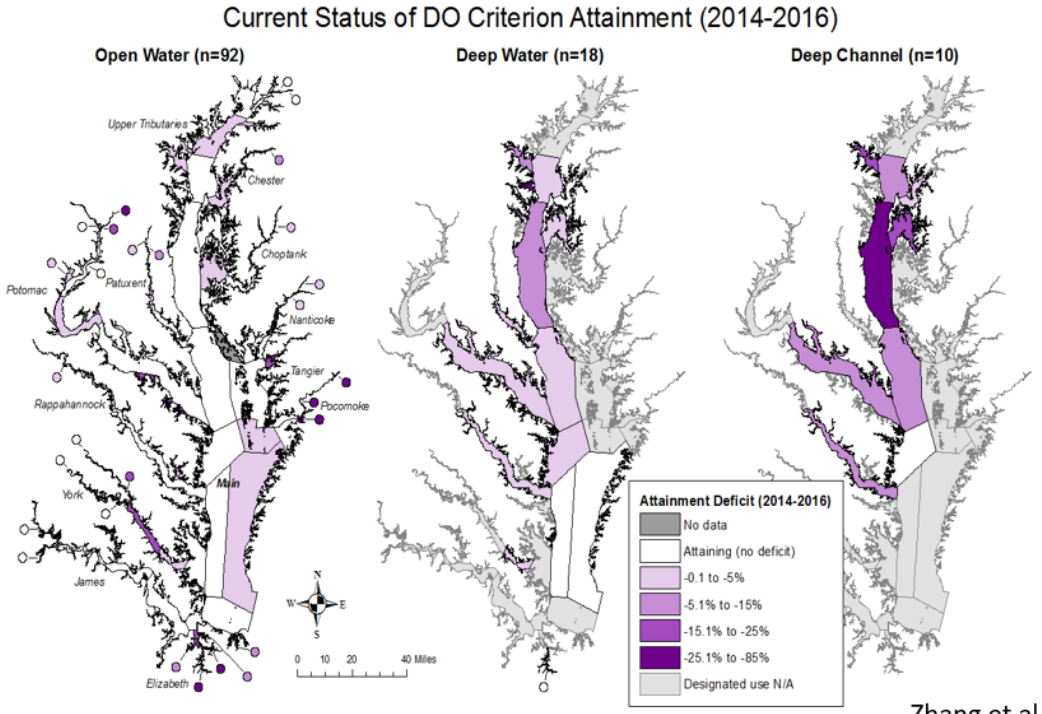
Sampling Design Study – targets water quality monitoring design with insights on site selection effects on habitat assessment

- UMCES team (Dong L.) reviewed the prior work of designing a strategy to evaluate the monitoring strategies in the lower Potomac and lower Choptank segments.

  - Inspiration for GIT project to ask for insights on informing site selection impacts on understanding DO habitat
  - Value of 1-3 arrays in a segment at offshore locations
  - Value of 1-6 nearshore continuous monitoring fixed stations in shallow water
  - Value for multiple habitat assessment needs.

Community weighing in on study segments

In-scope and out-of-scope offerings were discussed



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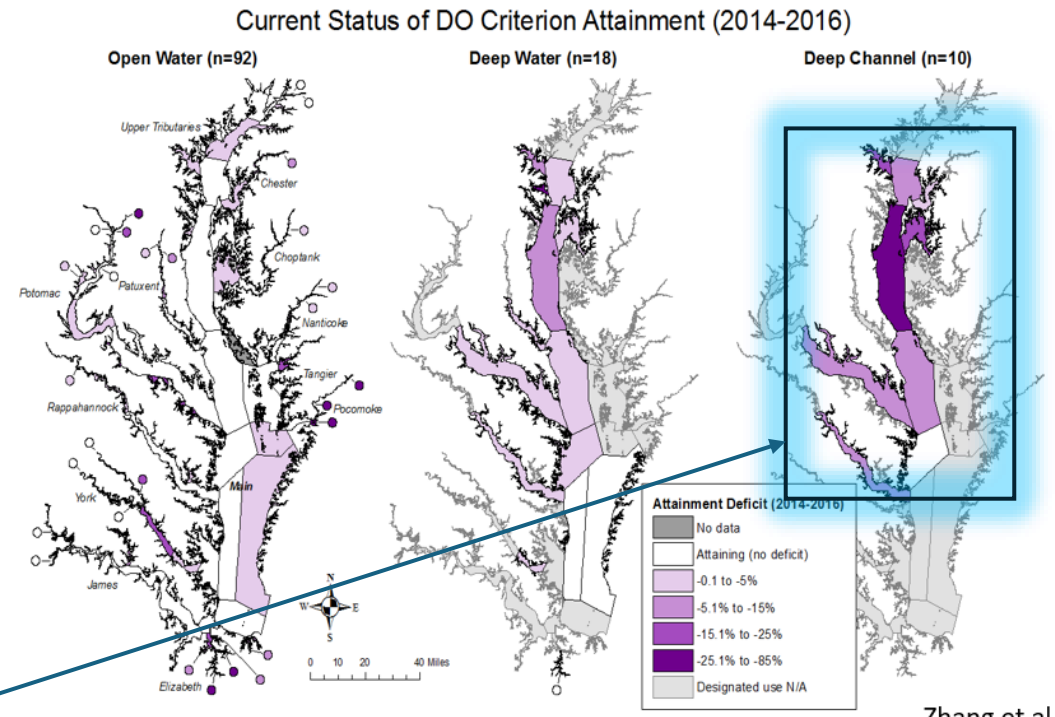
Community weighing in on study segments

In-scope and out-of-scope offerings were discussed

There was a need to come back to focus on the deepest segments as a universe for this study



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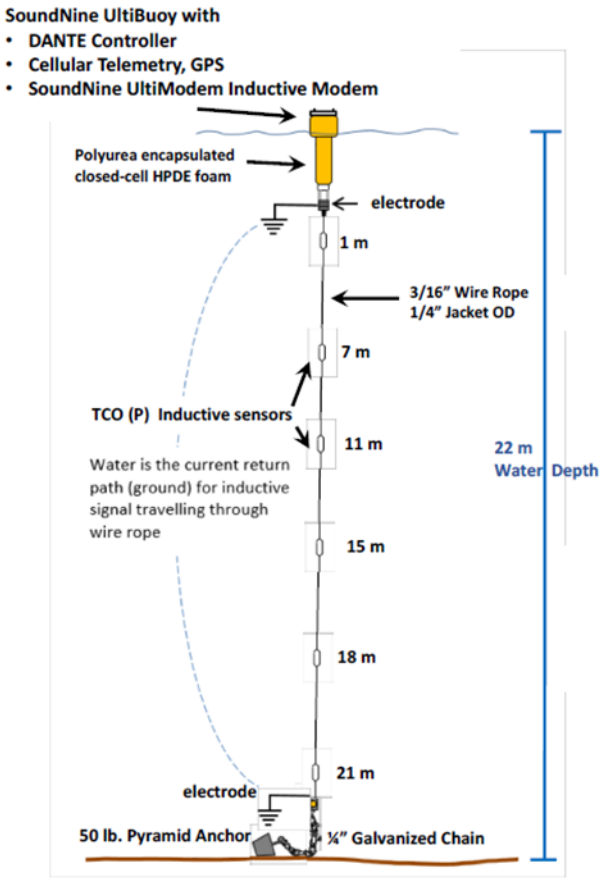
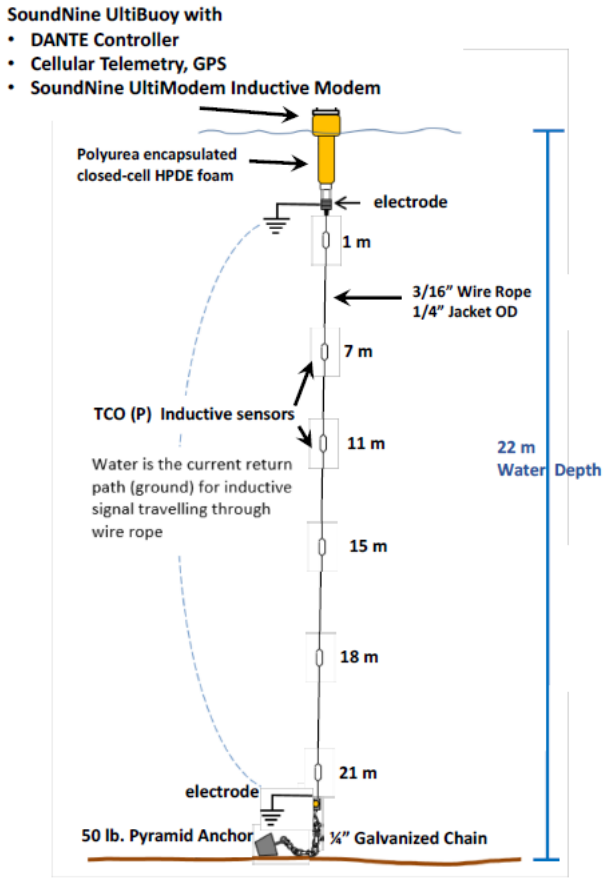
Discussions: Consideration on Vertical resolution of sensors when placed at a station

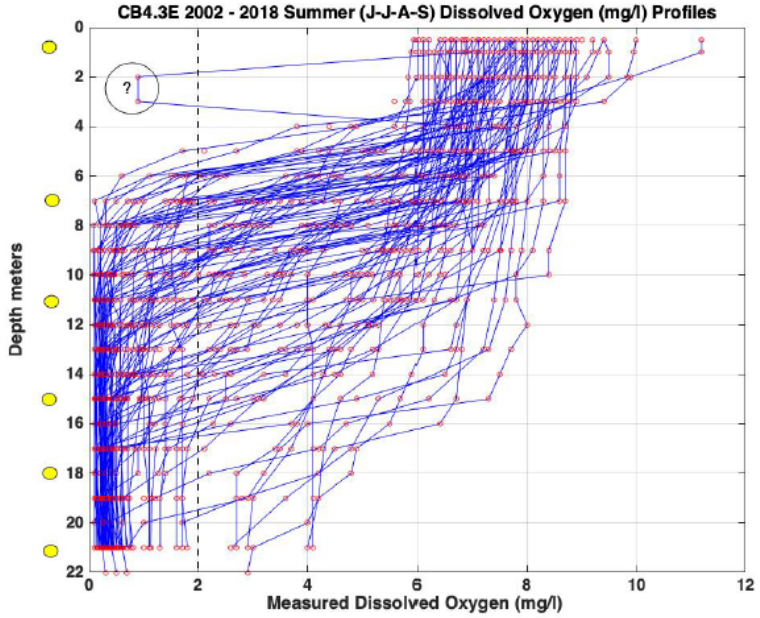


- Bruce V. **proposed a 2-5-8-meter sensor design** because SAV restoration is no deeper than 2-meter, oyster restoration is no deeper than 5 meters and it seems that 8 meter is the threshold where DO goes low (if stratified and eutrophic).

- There were several comments about whether such a design would be able to resolve the pycnocline,
  - The 4-D interpolator team reported concerns about the lack of vertical resolution of this sensor design to characterize the lower and upper pycnocline.
    - **Recommendation: >= 5 sensors to resolve vertical habitat structure**

D. Wilson 2020
Evaluated sensor distribution question
Mid-bay CB4.3E location using historical profile data





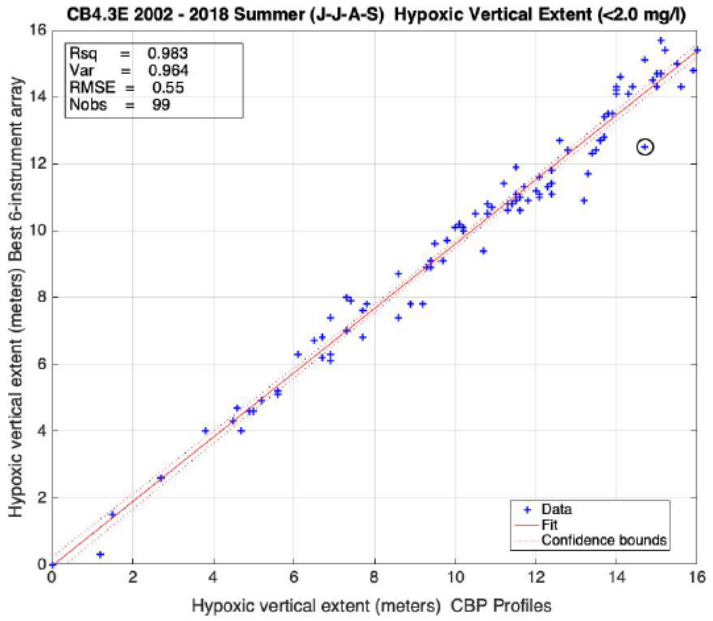
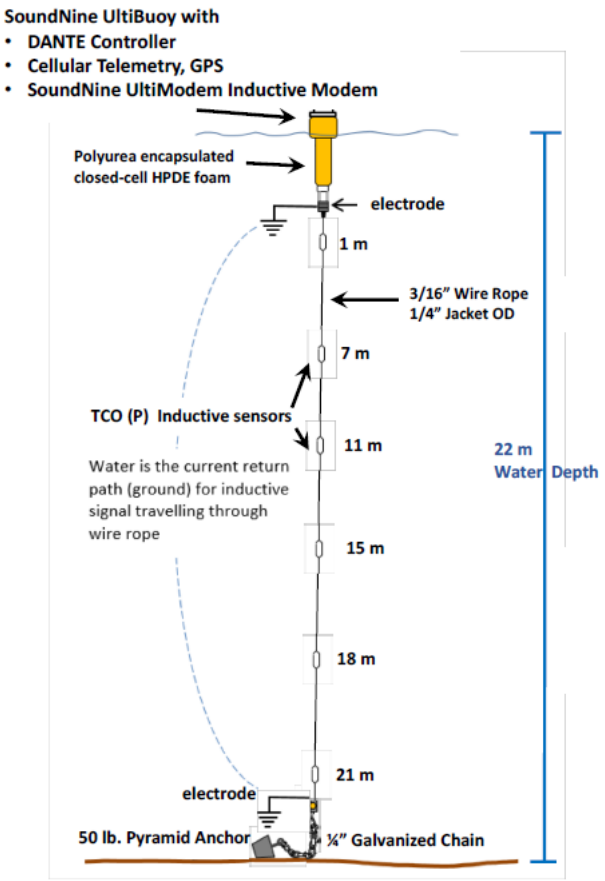
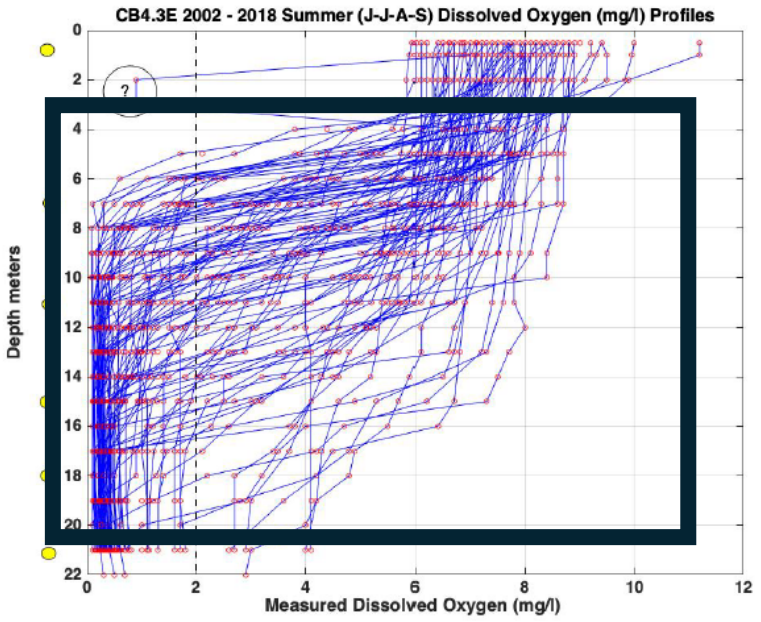
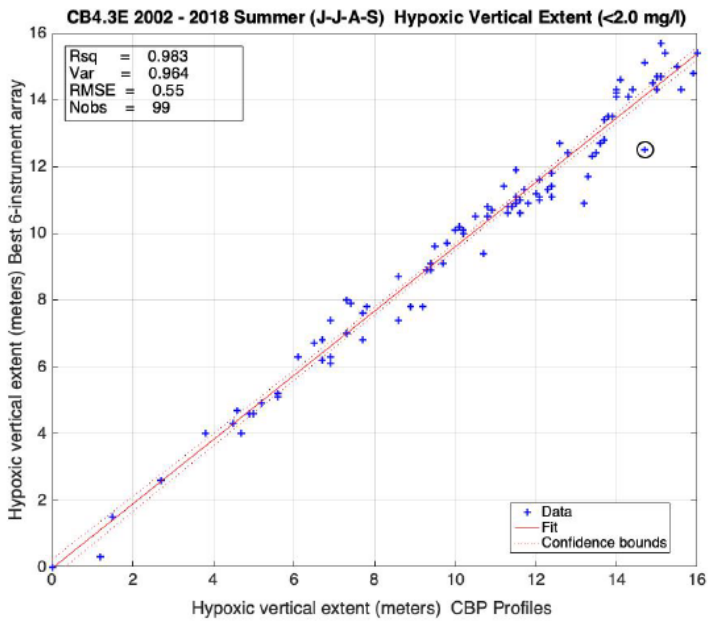


Figure 1. Measuring dissolved oxygen profiles with fixed depth sensors.
(A) Profiles of dissolved oxygen from all 2002-2018 June-September measured CBP stations at CB3.4E. Red dots are original sample depth locations, connected by blue profile lines. Yellow circles represent a six-instrument array used in (B).
(B) Comparison of 'Vertical Hypoxia Extent (Meters)' calculated using measured profiles (X axis) and the same quantity calculated using a hypothetical array of six sensors shown in (A). Different arrays were tested; the results are shown in Table 1.



Dynamic water column habitat
Seasonally and spatially





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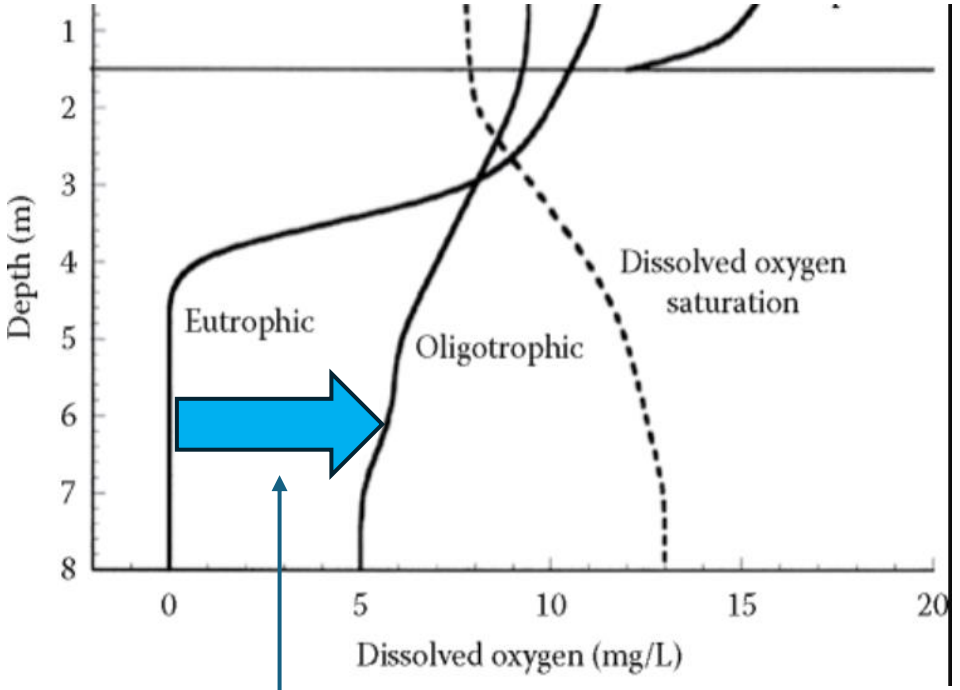
Key management target is for DO

- For *regulatory purposes*, we are needing habitat boundary resolution (Salinity and temperature)
- We need DO measured – it is the variable being managed for change over time.
- Depths of station data collections is an important consideration in field deployments and for the sampling design study.

Idealized oxygen distributions in enriched (eutrophic) and less enriched (oligotrophic) waters



Management aims to shift the distribution of dissolved oxygen with reduced nutrient loading to generate healthier habitats.

Wilson 2020: Evaluating the number of sensors for capturing hypoxia habitat boundary before hitting the field showed a fairly stable representation of CB4.3E DO profile with as few as 5 sensors.

Number of Sensors	Depths (meters)	R^2	% Variance	RMS Error (meters)
21	[1,2,3,…,19,20,21]	0.999	0.994	0.22
11	[1,3,5,7,…,17,19,21]	0.994	0.985	0.33
10	[1,5,7,9,…,17,19,21]	0.993	0.984	0.33
9	[1,6,9,11,13,15,17,19,21]	0.990	0.977	0.42
7	[1,6,9,12,15,18,21]	0.988	0.977	0.46
6	[1,7,11,15,18,21]	0.982	0.964	0.55
5	[1,7,12,17,21]	0.978	0.980	0.63

Table 1. Analysis of performance of various configurations of number and placement of vertical sensors

ON the question of vertical resolution - Not all arrays deployed need to serve the same purpose.

- Consideration that sensor distribution and what sensors are in play could be case dependent – not all arrays deployed have to serve all purposes simultaneously:
  - E.g., Regulatory habitat assessment support = at least 5 depths, DO+Sal+Temp, 3 years of data collection
    - Question to be determined – does 3 years = 3 full years? (I.e., 365 days of monitoring?) CAP WG.
  - E.g., Fisheries, Modeling = Sal + Temp + ??? And vertical resolution of ???
  - E.g., Research = ??? Sensors, ???? Depths???

Universe of segments for this study

- After discussions – needs some constraints considering the scope of the proposal.
- VADEQ submitted an updated priority list to consider with the work.
- Need to double back with our MDE friends but we have a place to start while doing that ☺.

Next steps

- Work with a limited number of scenarios on location options

- I think the community will benefit from seeing what happens in 1 segment when we mix and match monitoring inshore and offshore and see what it means to use the results when considering the value of adding or not adding sites and where.

Thank you ☺

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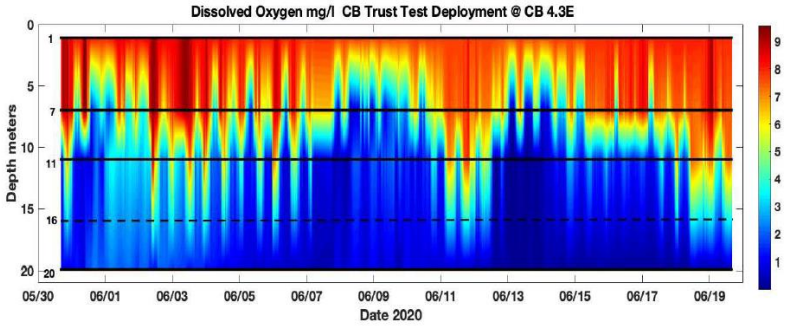

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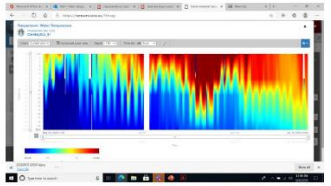

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