

Web-based 4D Visualization of Water Quality and Habitat Status and Change in Chesapeake Bay

Zhaoying “Angie” Wei (zwei@chesapeakebay.net)

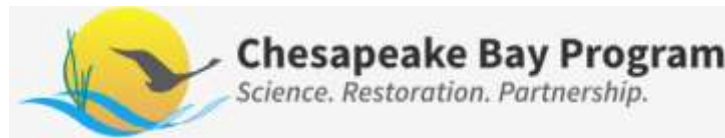
John Wolf (jwolf@chesapeakebay.net)

Emily Trentacoste

Qian Zhang

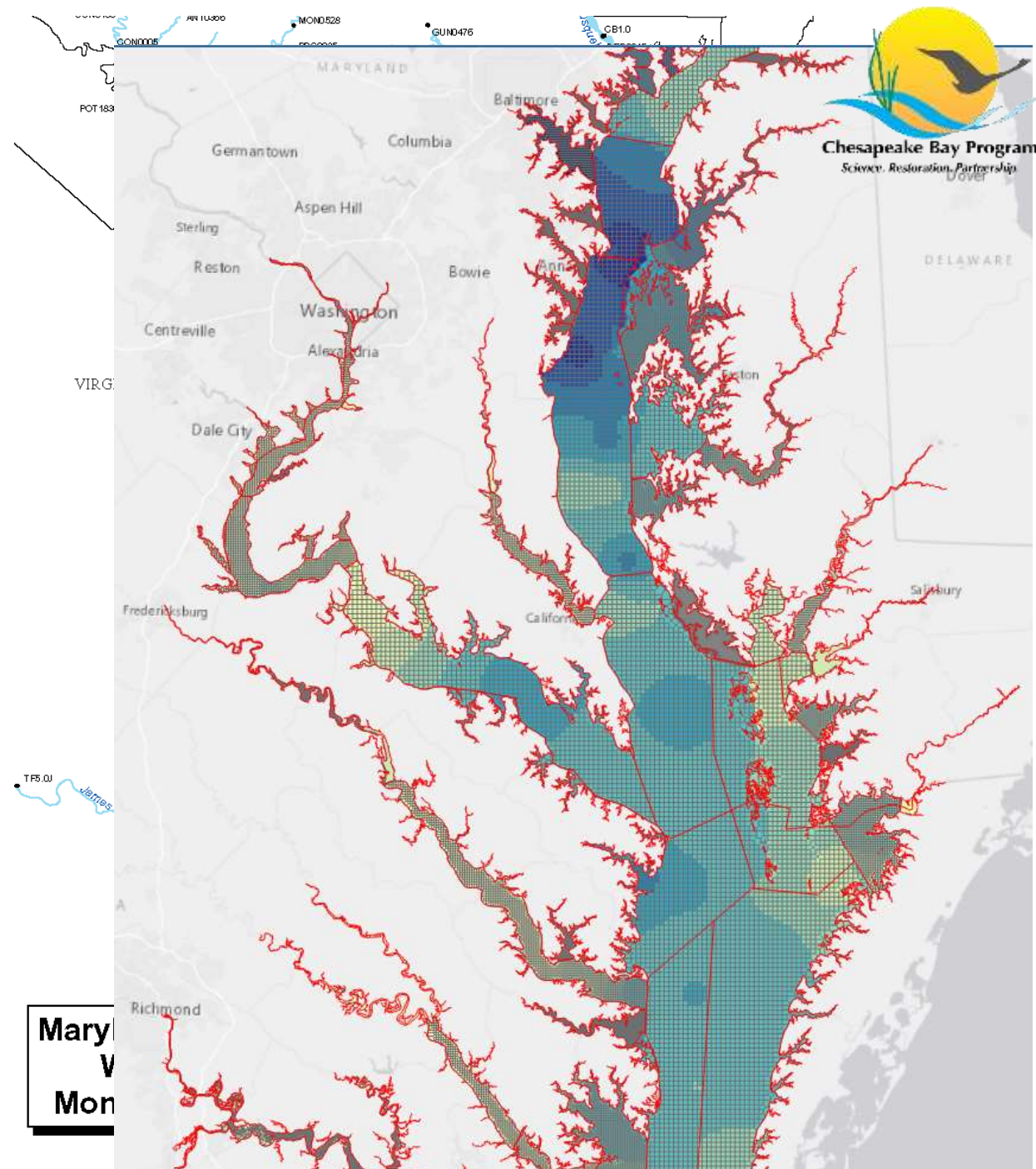
Peter Tango

Richard Tian



Data - Chesapeake Bay Interpolator

- Version: developed by NOAA in 2006
- Cell based interpolator (VOL3D)
 - use water quality concentrations measured at monitoring stations in monthly cruises as input
 - interpolation output for the entire Bay
- Cell size 1km x 1km horizontal, 1m vertical from surface to bottom
 - shallow 50m x 50m



Method



.EST file

- Measurements: DO, Salinity, Temperature
- Temporal: 33 years monthly (1985 – 2017)

Interpolator output



python



ArcPy

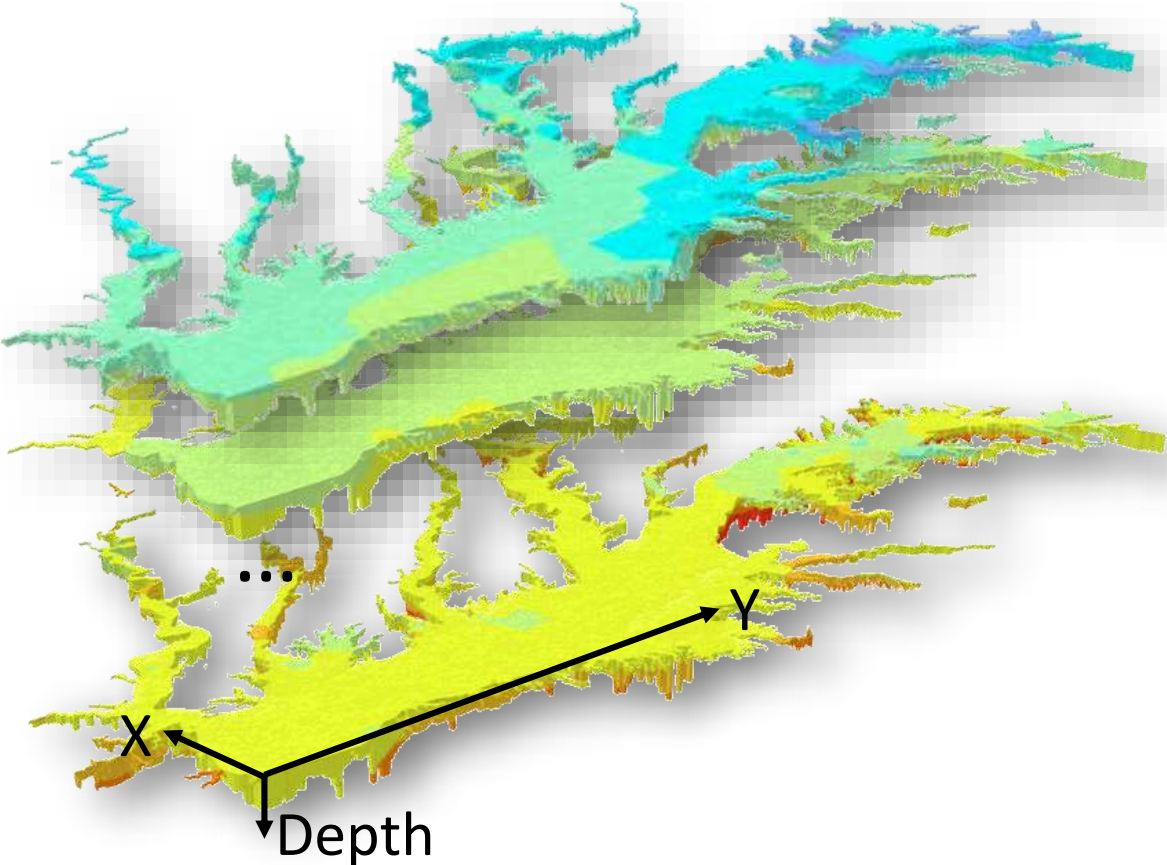
.CSV file

3D Scene layer package

Depth

X	Y	Segment	DO_Depth1	DO_Depth2	...
X	Y	Segment	DO_Depth1	DO_Depth2	...
X	Y	Segment	DO_Depth1	DO_Depth2	...

Time



Water Quality Conditions



Method



Dissolved
Oxygen

Salinity

Temperature

**Habitat Requirements for
Chesapeake Bay Living Resources
(1991, EPA)**

Dissolved Oxygen > 5.0
Temp 10 - 27 (J) 20 - 22 (A)
Salinity 0 - 16 (J)



Dissolved Oxygen > 3.0
Temp 5 - 39
Salinity 0 - 30 (A)



Species Occurrence

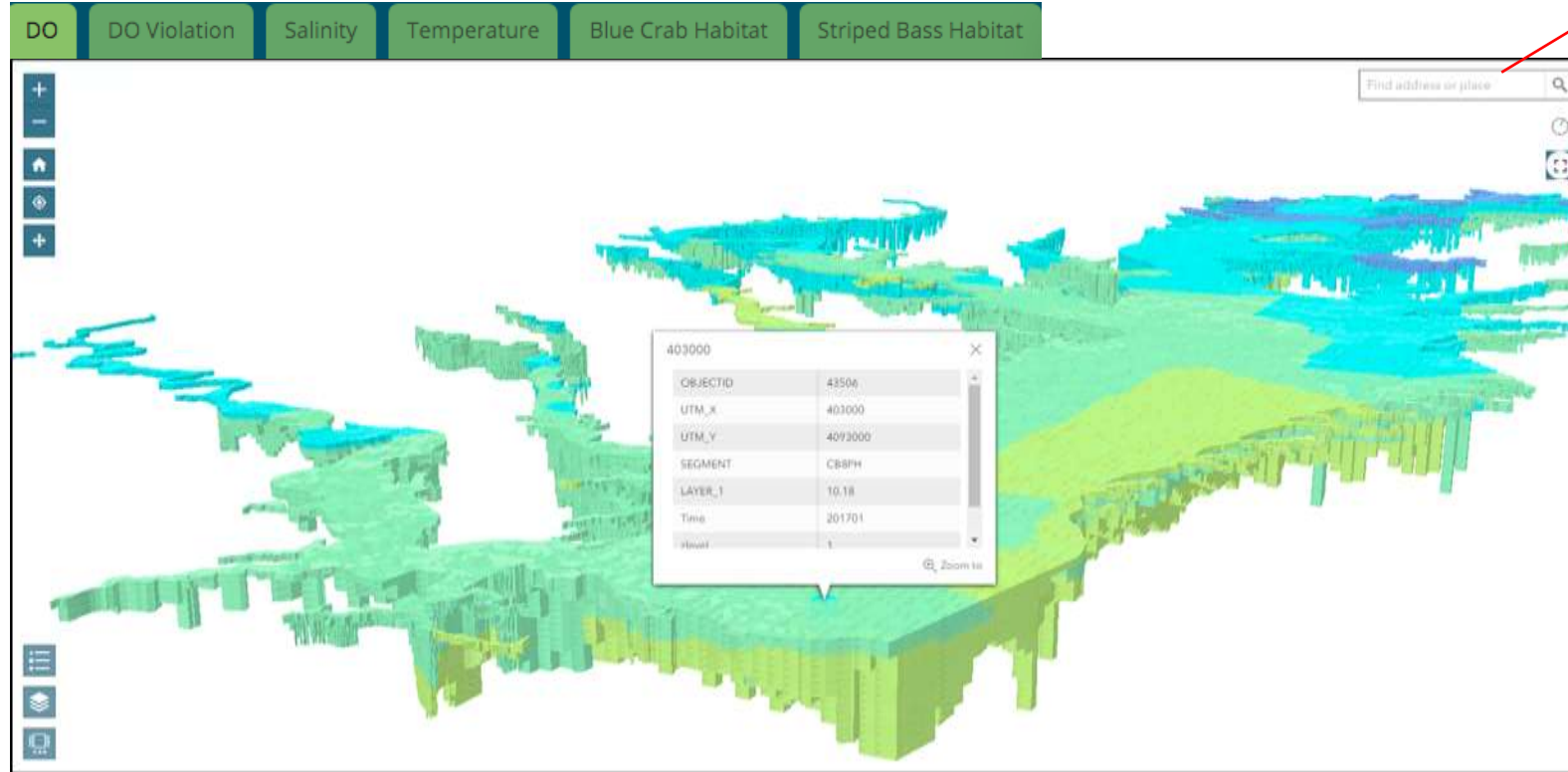
Striped Bass
Morone saxatilis

Blue Crab
Callinectes sapidus

X	Y	Segment	Habitat Depth1	Habitat Depth2	...

X	Y	Segment	Habitat Depth1	Habitat Depth2	...

Result – Web-based application <https://bit.ly/2IoRqbm>



Search and zoom to your interested location



Explore from different angles using Navigate button



Switch on and off layers of different depth

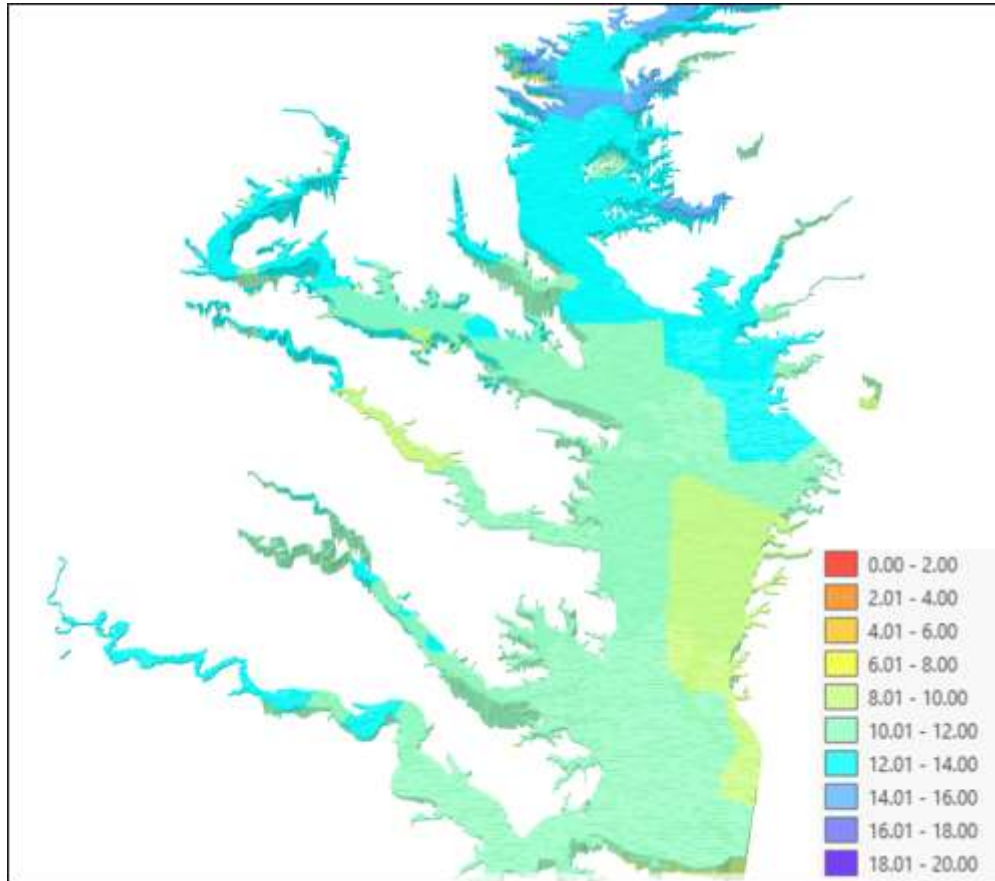


Loop through data of each month using Slides button

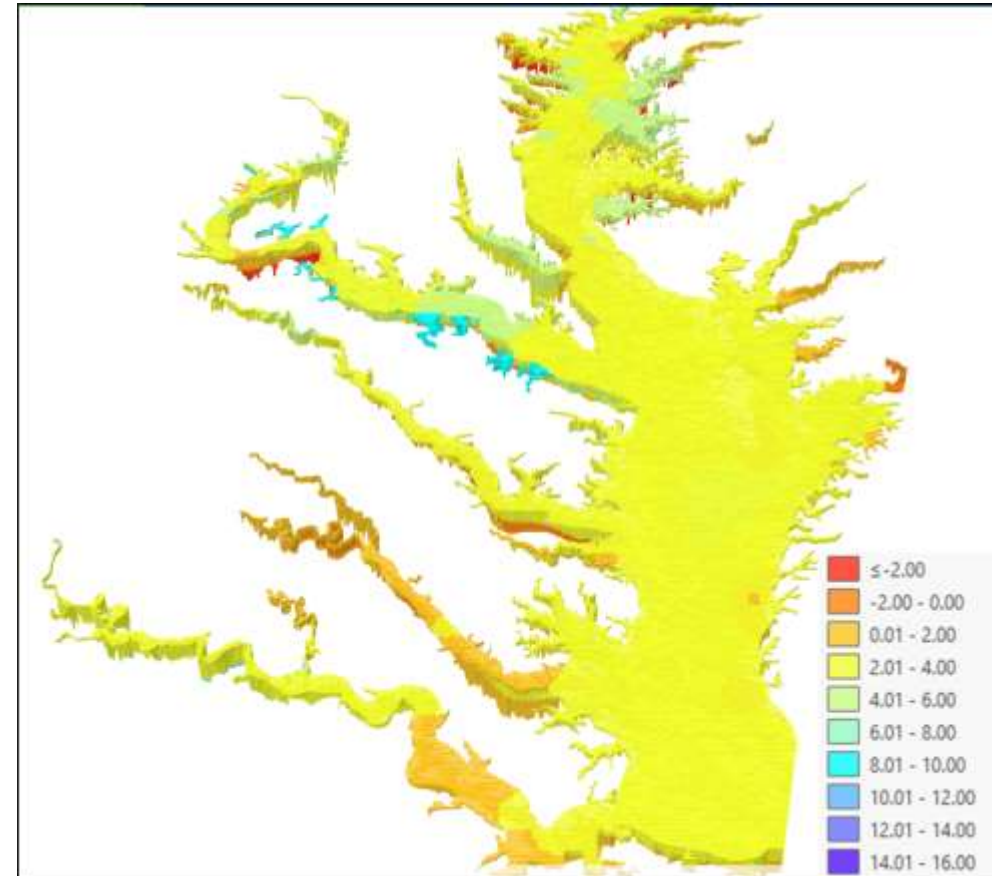
Click on individual cell to view details in pop-up

Result – Web-based application <https://bit.ly/2IoRqbm>

Monthly Dissolved Oxygen (mg/L)



Magnitude of Violation in Dissolved Oxygen (mg/L)



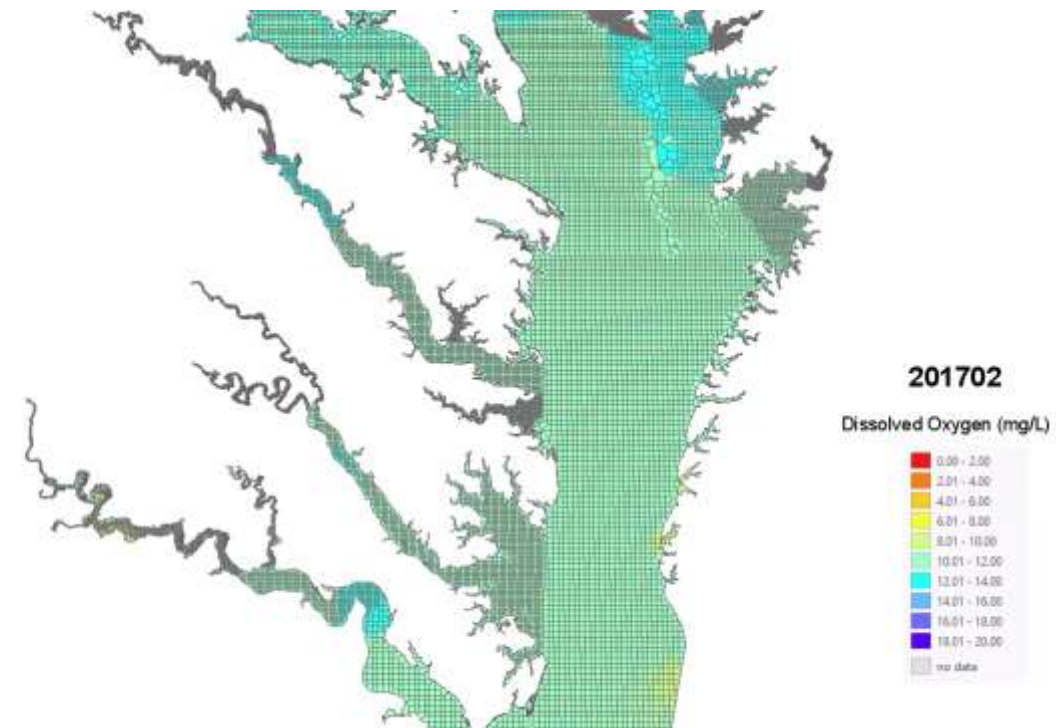
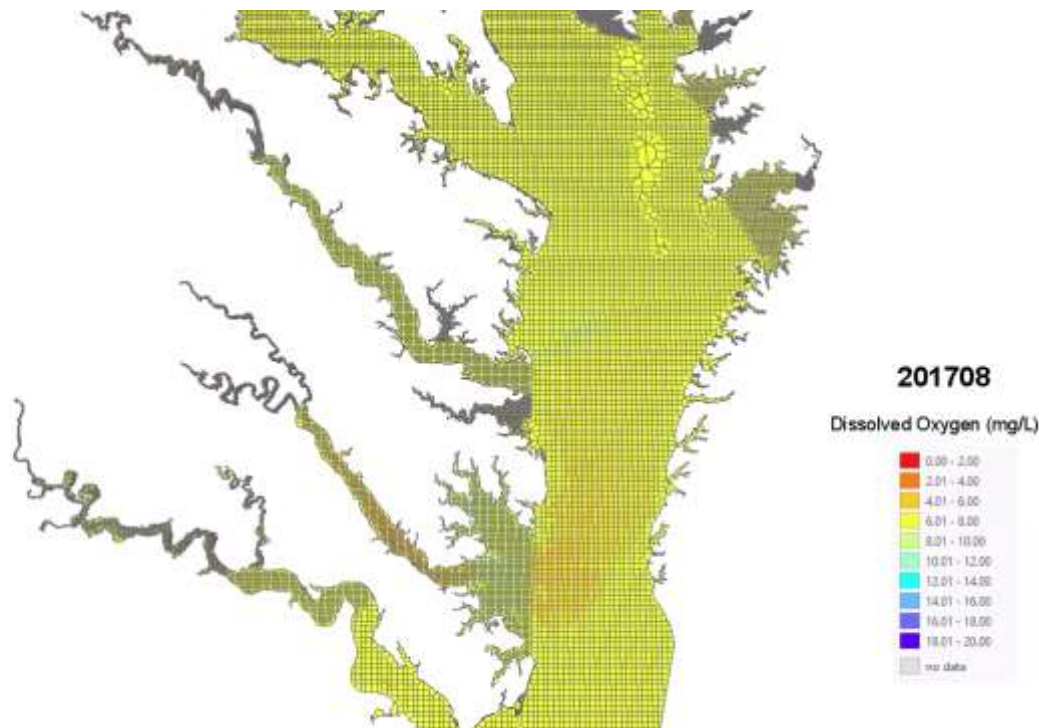
Open Water: 5

Deep Water: 3

Deep Channel: 1

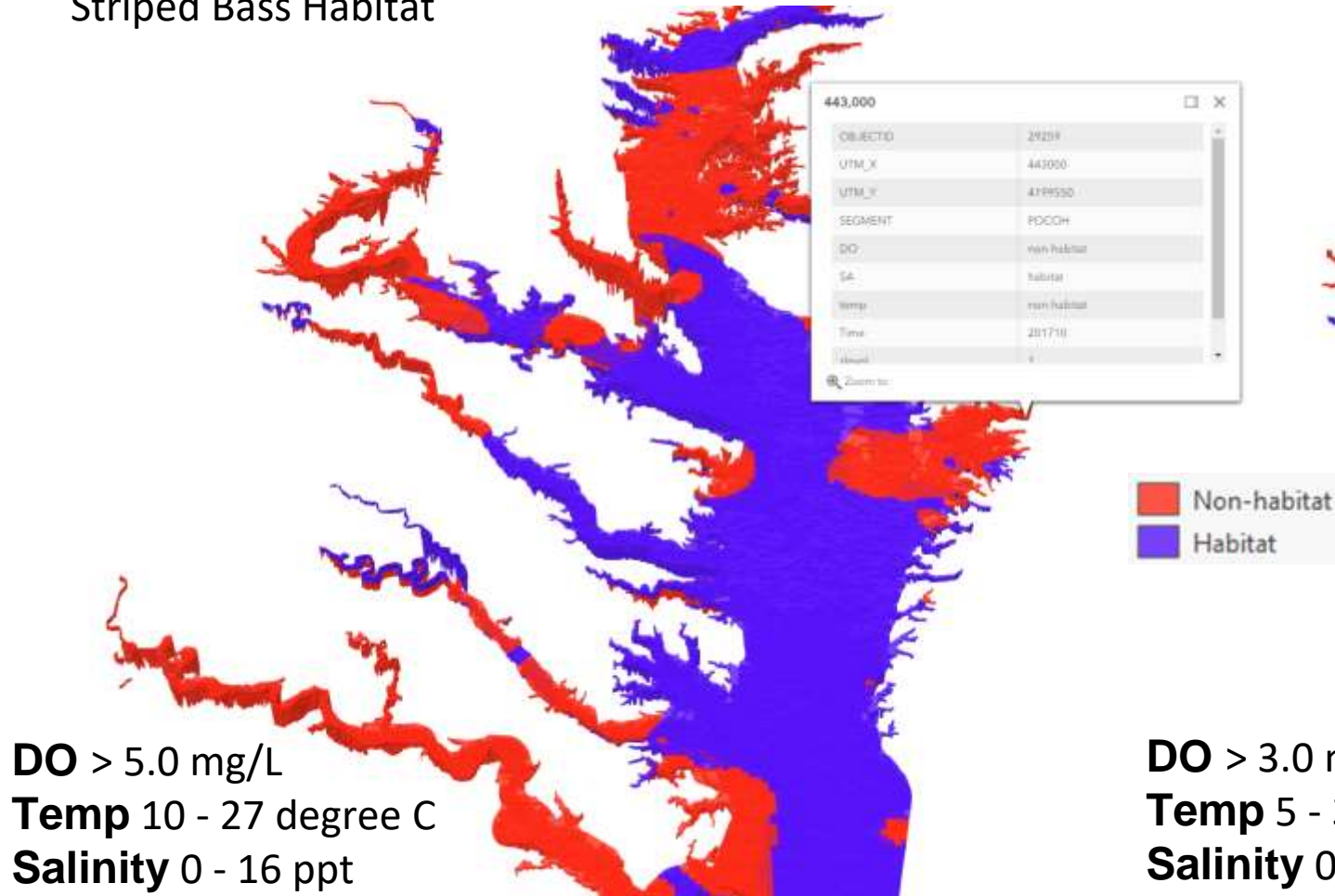
Result - Animation

- Dissolved Oxygen 2017 summer vs winter

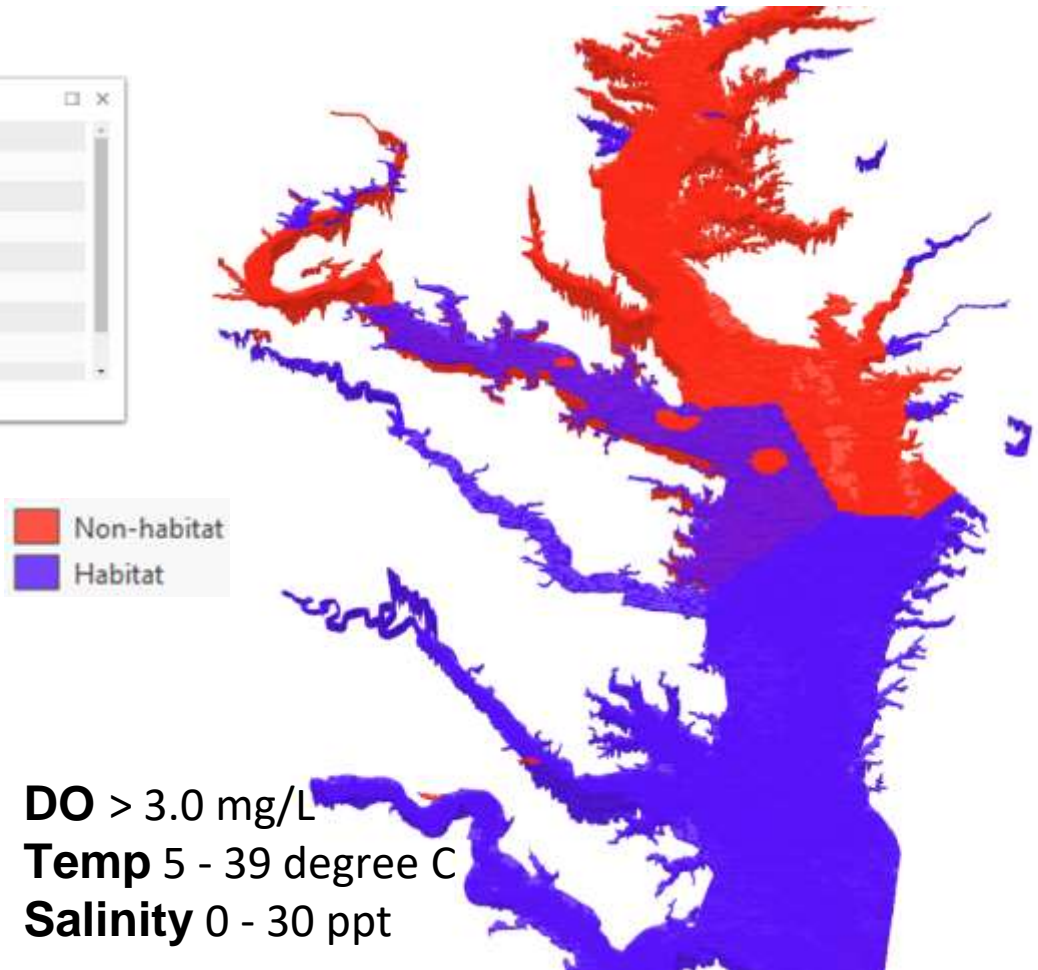


Result – Web-based application <https://bit.ly/2IoRqbm>

Striped Bass Habitat

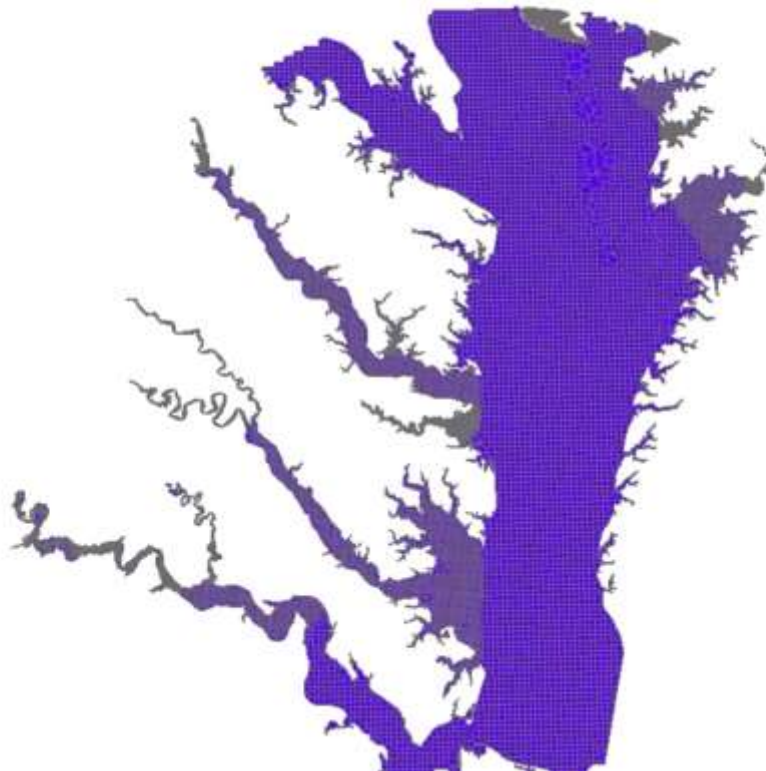


Blue Crab Habitat



Result - Animation

- living resource habitat requirements



Blue crab 201708

Dissolved Oxygen > 3.0 mg/L

Temp 5 - 39 degree C

Salinity 0 - 30 ppt (A)



Summary

- A cell-based 4D illustration of bay-wide water quality
- Analysis in dissolved oxygen violations
- Habitat status assessment for multiple target species

Next step

- Explore how this visualization can help answer more scientific questions.
- Customized applications. Combine statistical analysis function
- Integration with more living resource habitat requirements

Shoreline Condition - Percentage Armored Shoreline in Chesapeake Bay

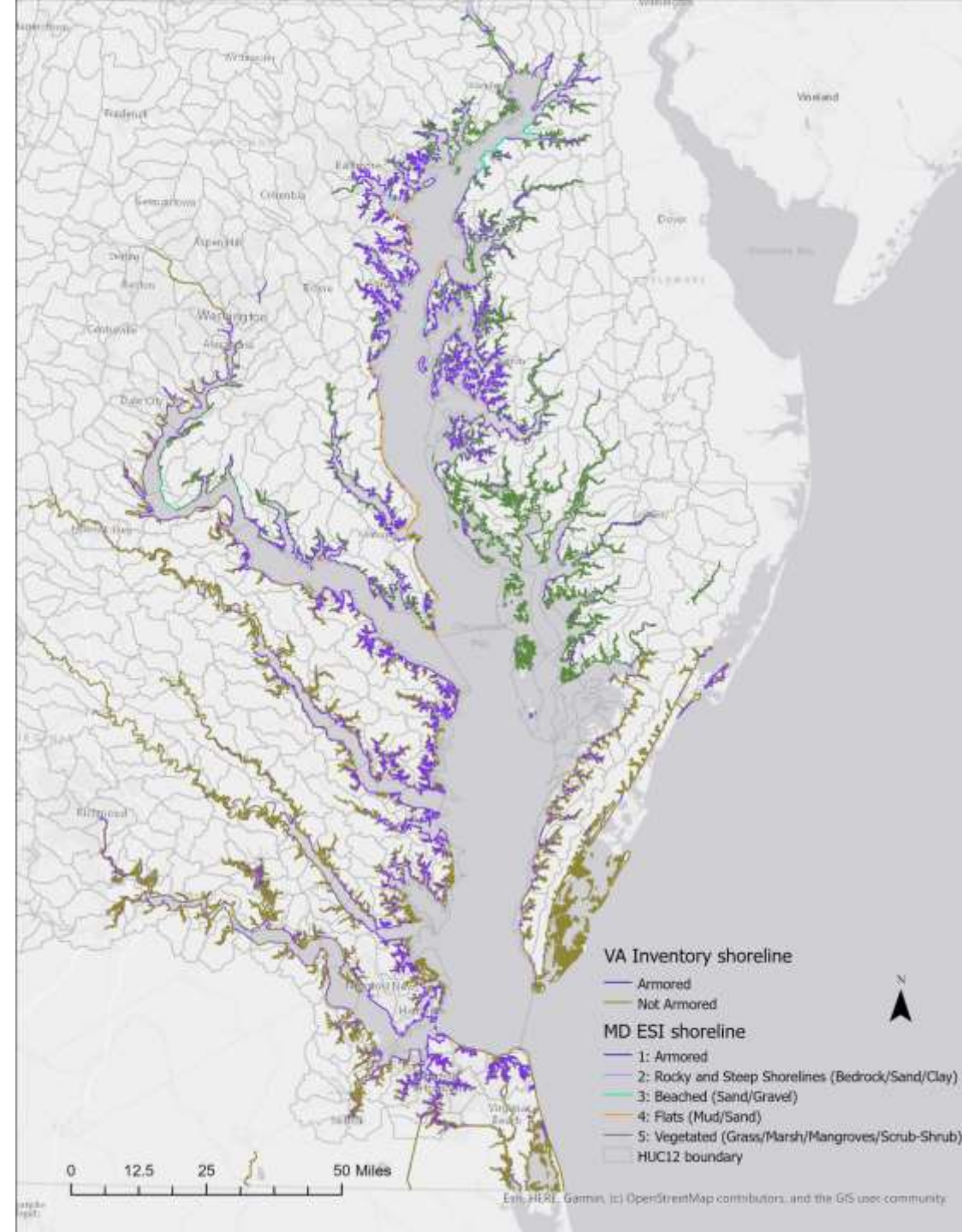
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John Wolf



Shoreline Data

- VA – VIMS Shoreline Inventory Data 2018
 - Armoring: Bulkhead, Debris, Dilapidated bulkhead, Marina, Riprap, Unconventional, Wharf
 - Excluded structure: Breakwater, Groinfield, Marsh Toe Revetment, Jetty
- MD – NOAA Environmental Sensitivity Index (ESI) Data 2016
 - Armored shoreline

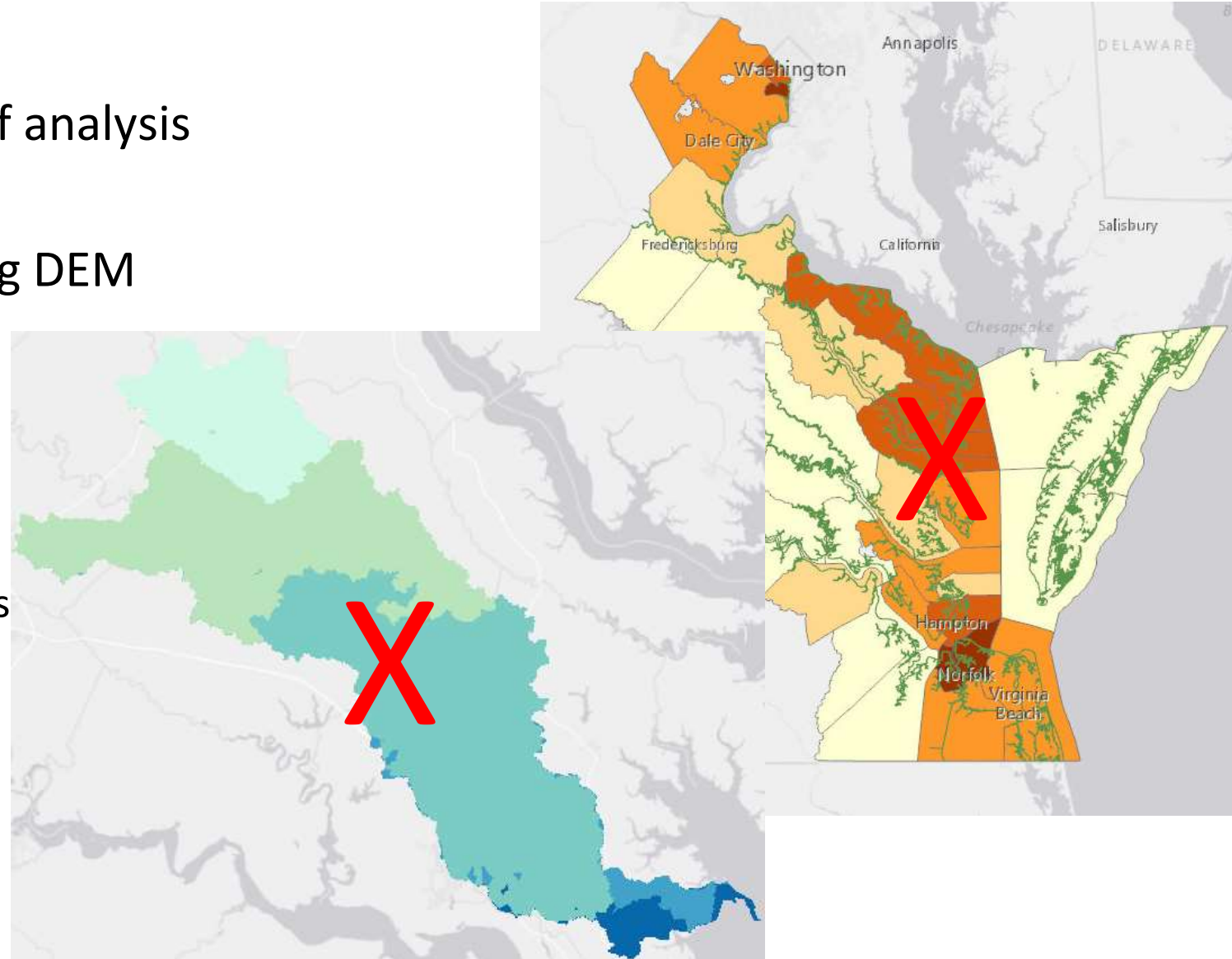
	MD	VA
Total Length (mi)	6,531.747	10,728.827
Armored Length (mi)	1,117.266	973.894
%Armored	17.11%	9.08%



Subwatershed scale

Discussion: Appropriate scale of analysis

- County: too coarse
 - Generate subwatersheds using DEM
 - elevation not vary a lot bay-wide
 - **HUC 12 polygons**
 - Others
 - Use distance, e.g. 1km by 1km
 - Subwatersheds for particular species
- e.g. Troy Tuckey's presentation



Percentage Armored Shoreline by HUC12

