Short and long-term station-specific Secchi Depth trends

STAC Advancing Monitoring Approaches Workshop
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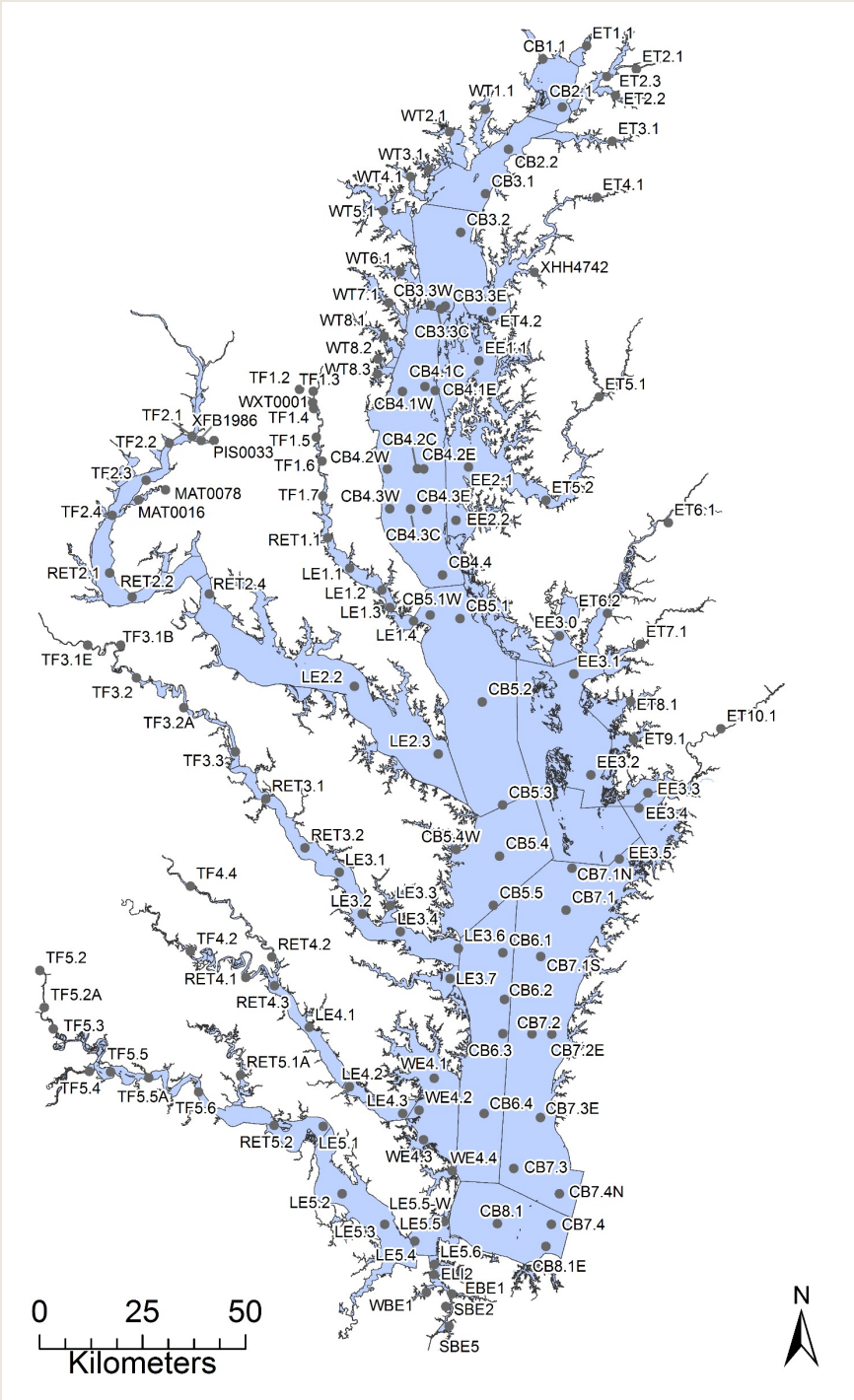
Results generated in collaboration with: Renee Karrh (MDDNR), Mike Lane (ODU), Cindy Johnson (VADEQ), Elgin Perry (consultant), Jon Harcum (Tetra Tech) and ITAT team

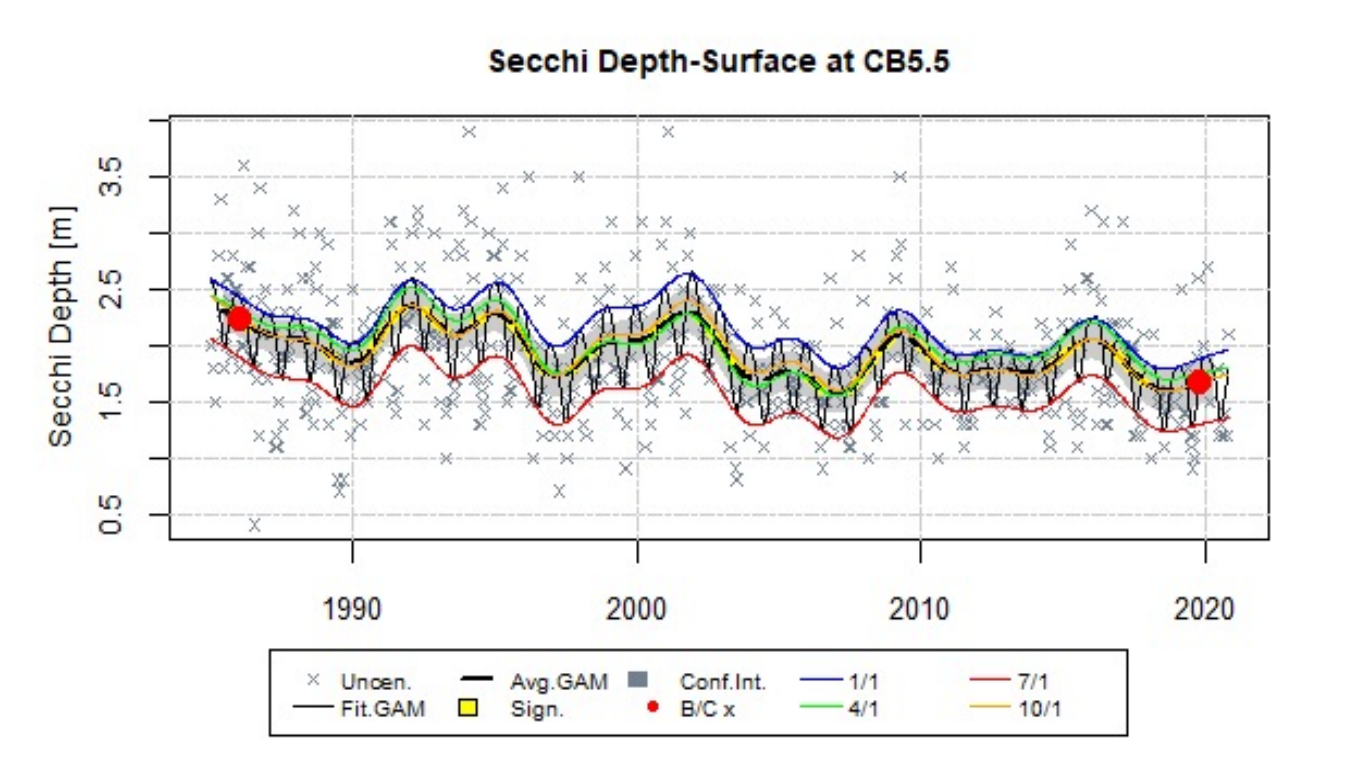
Annual Tidal Trend Analysis

- Focus on long-term fixed stations
  - *150+ stations (mostly mid-channel)*
  - *Data collection 1-2x/month since 1985*
  - *Multiple samples collected with depth: Surface & bottom + more depending on station & parameter*
- Annual cycle in collaboration with MD, VA (and soon DC) analysts and ITAT team to analyze data and compute trends for:
  - *Annual Secchi depth*
  - *Spring & summer, surface & bottom: Chlorophyll a*
  - *Annual surface & bottom TN, TP, DIN, PO4, TSS, water temp, salinity*
  - *Summer surface & bottom DO*



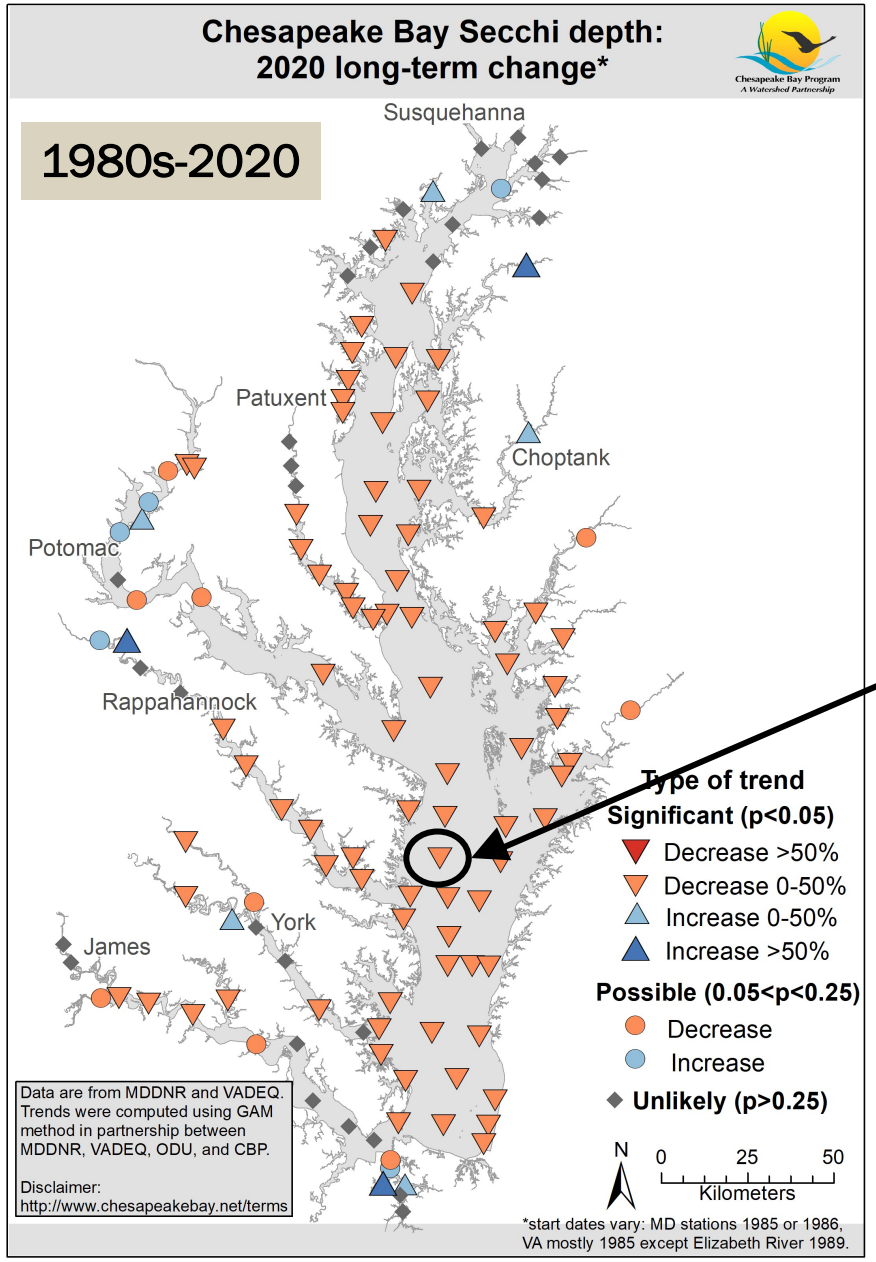
Annual Observed Secchi Depth

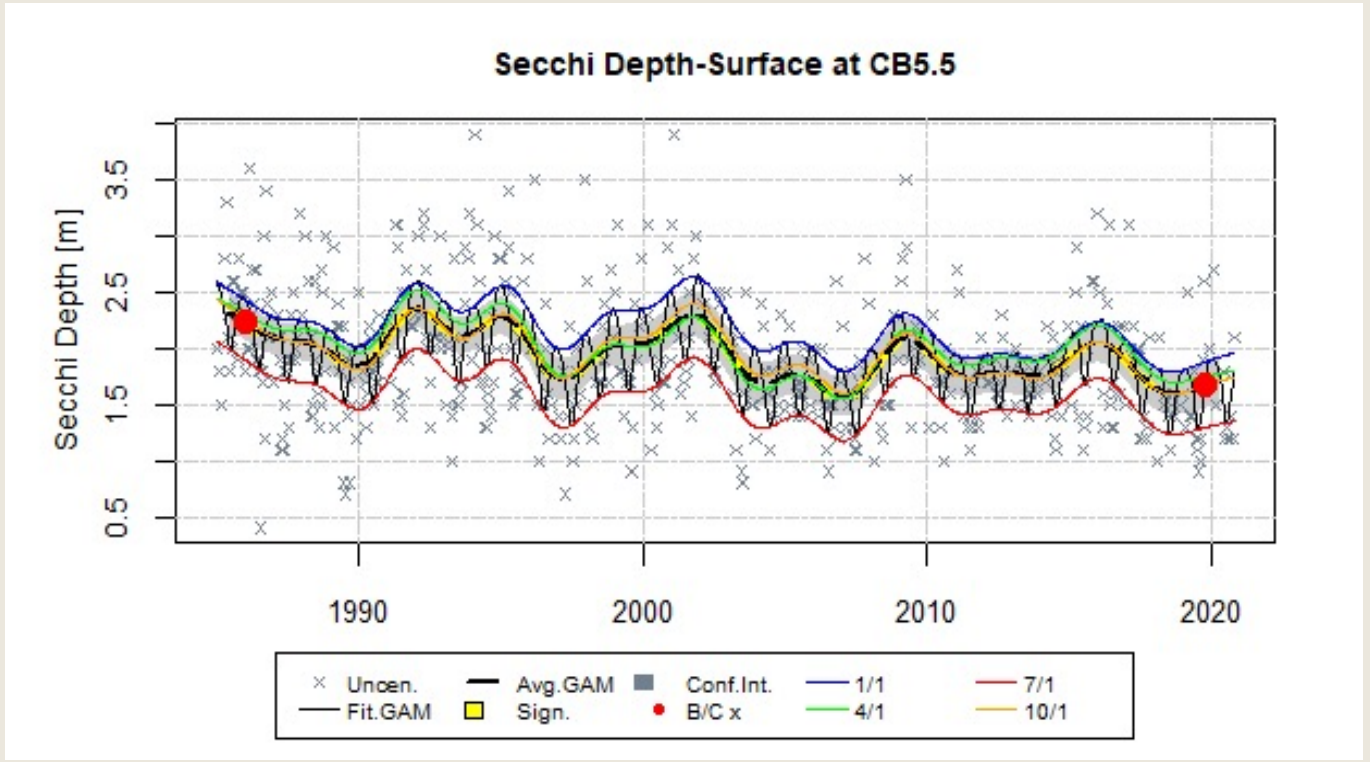
- Statistical Generalized Additive Model (GAM) fit to all Secchi measurements at each station
  - *Captures non-linear patterns in the data*
  - *Can be used with data that is not spaced regularly*
  - *Generates observed and flow-adjusted patterns over time*
- Results extracted from the full models to summarize change across different times



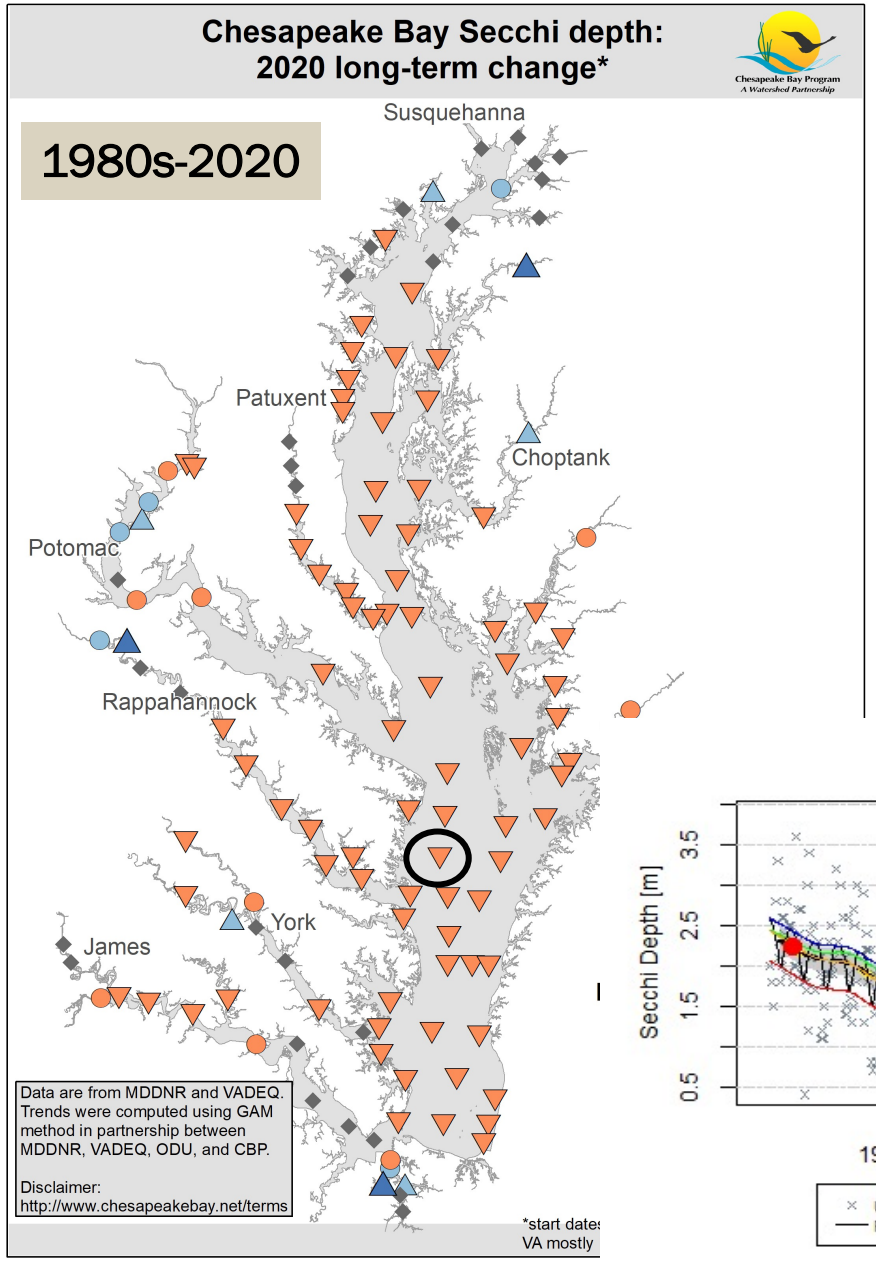
Murphy et al. 2019. Environ. Modelling Software 118: 1-13. https://doi.org/10.1016/j.envsoft.2019.03.027.

Annual Observed Secchi Depth

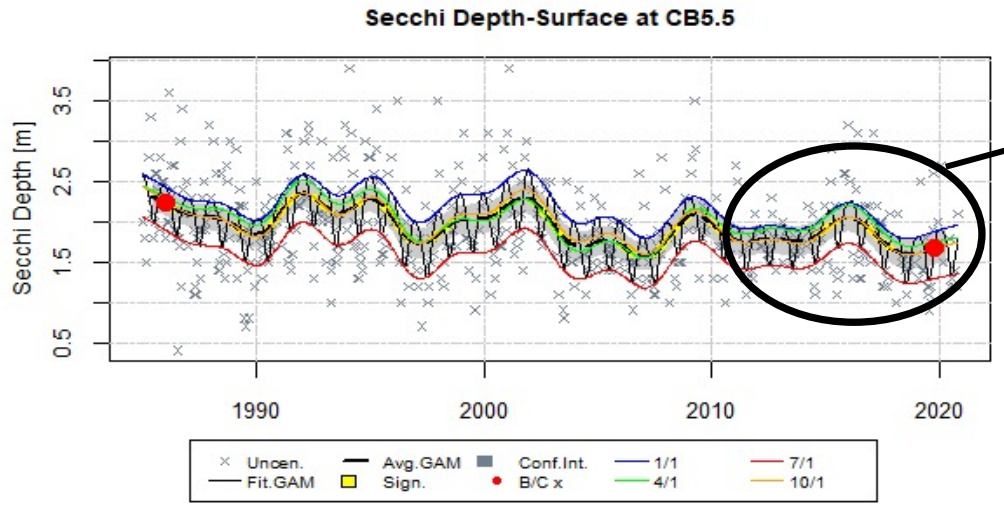


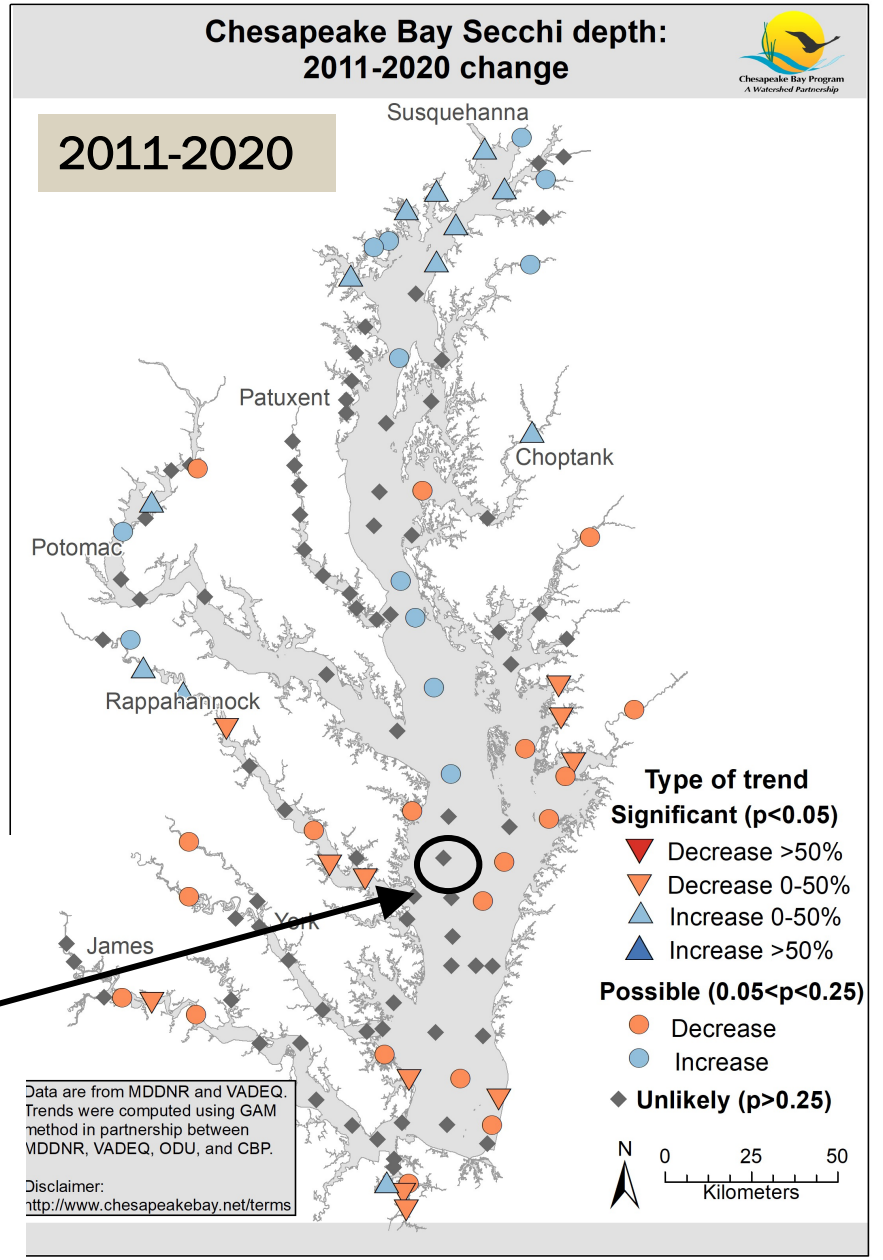


Annual Observed Secchi Depth

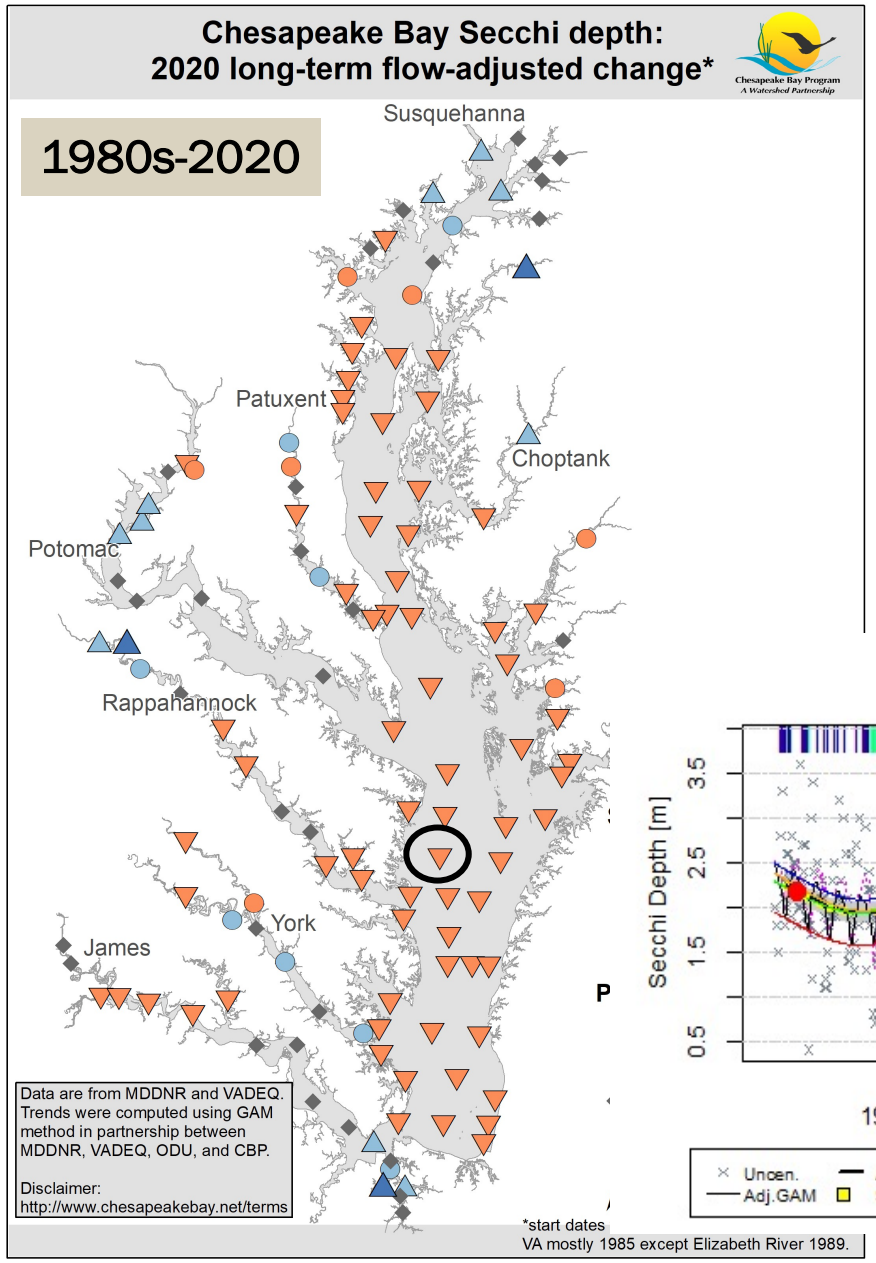


Patterns vary, but this example shows a long-term degradation, and short-term plateau

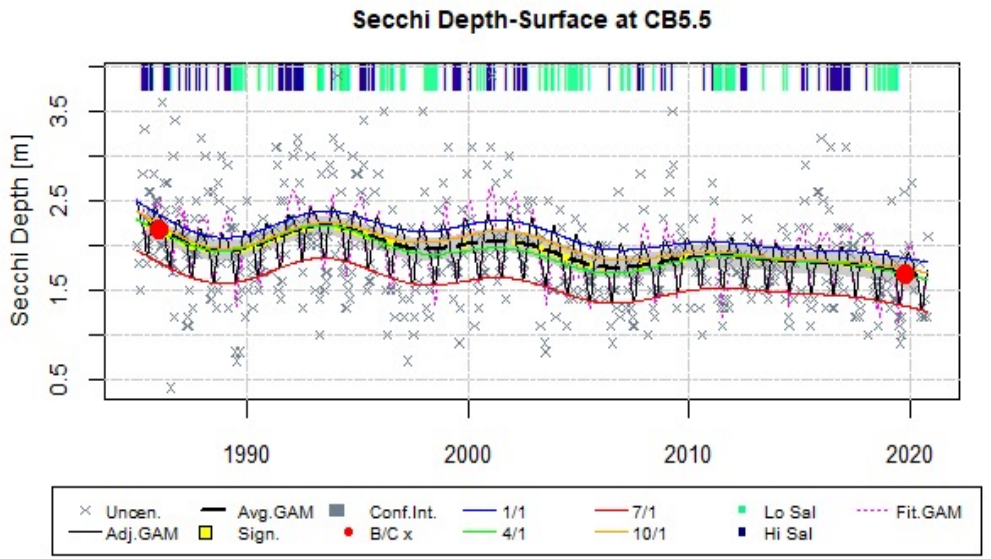


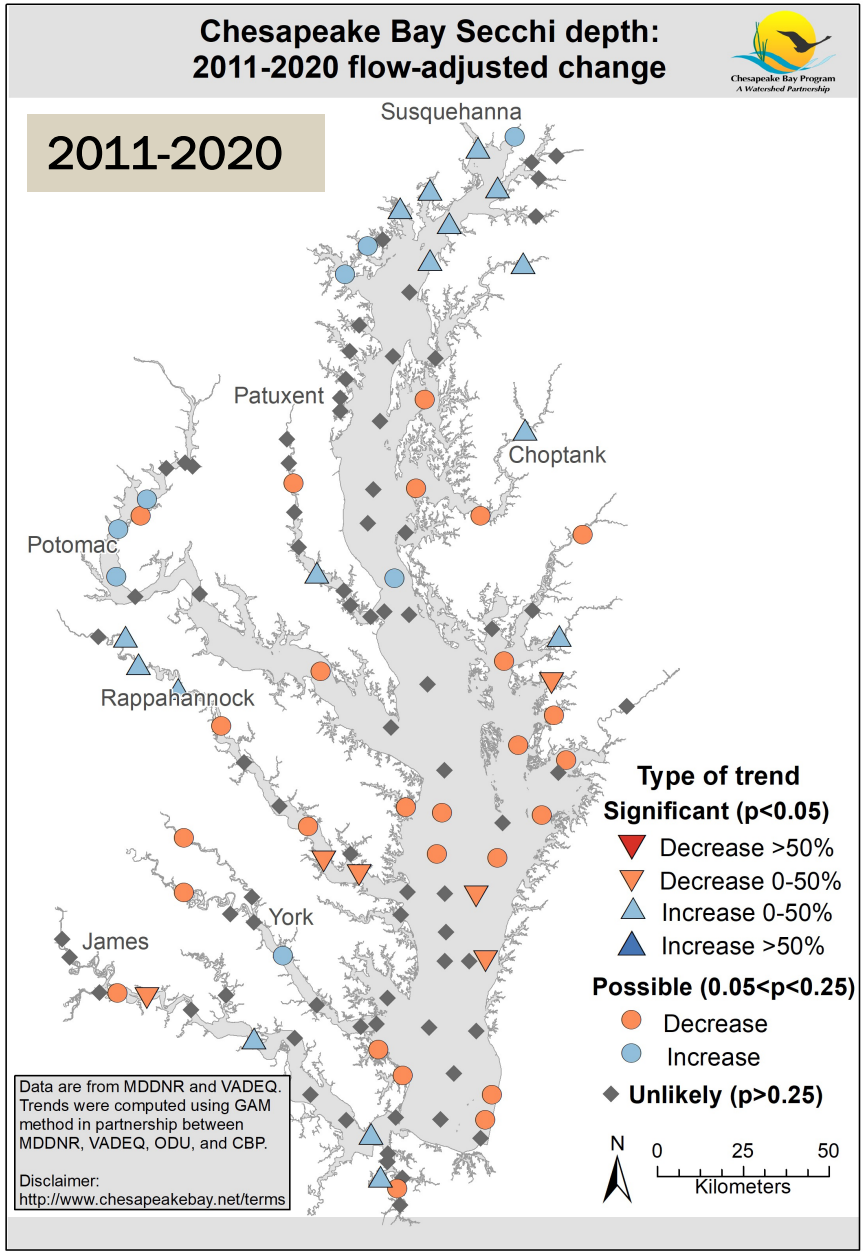


Annual Flow-adjusted Secchi Depth



- Flow-adjusted show results “if flow had been average”
- Not too much difference from observed for secchi (this year at least)





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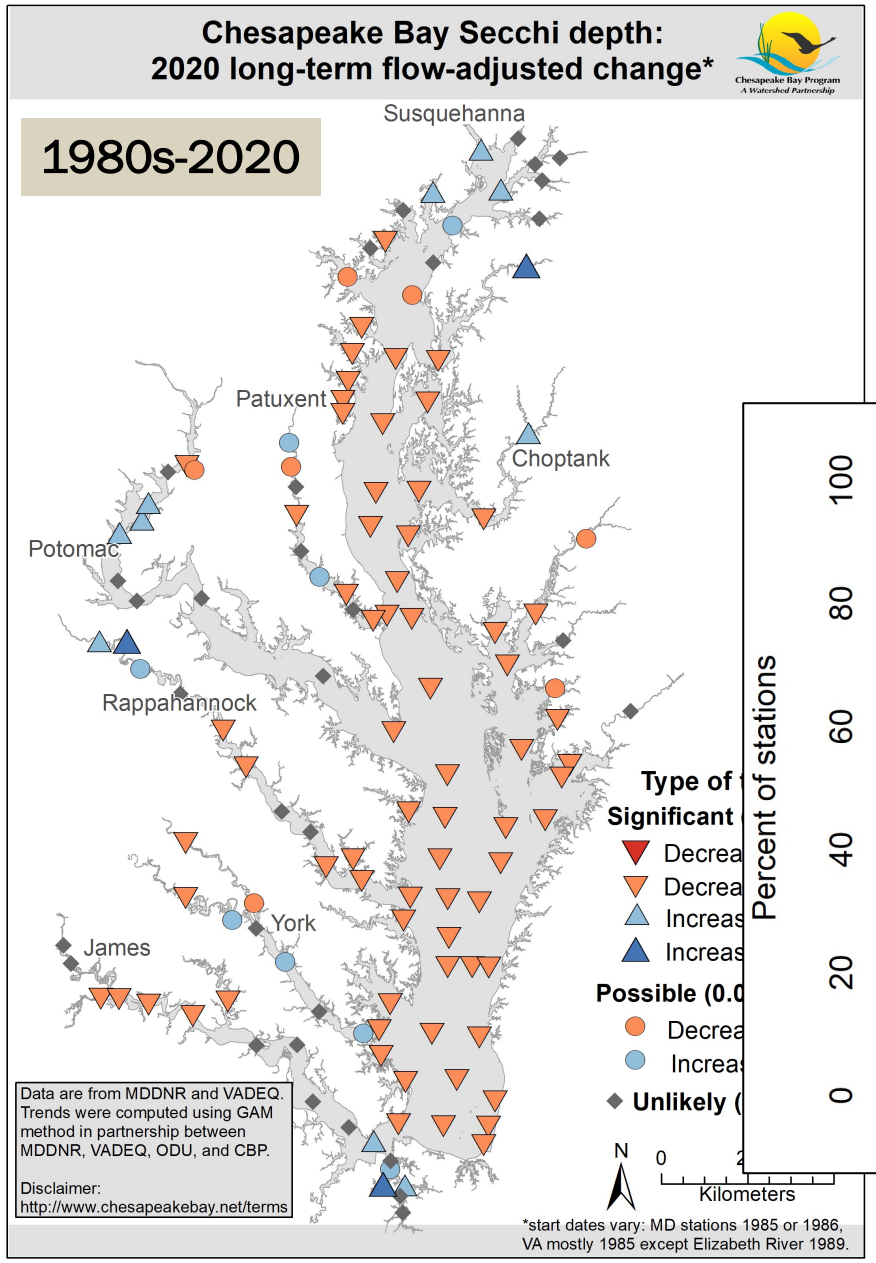
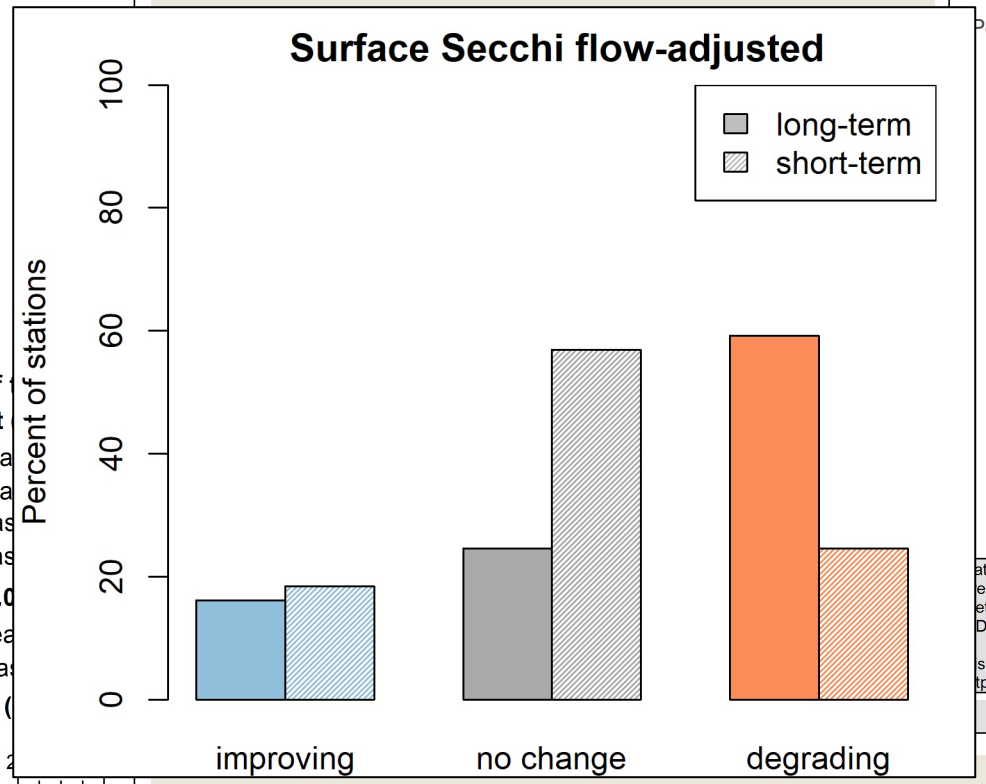
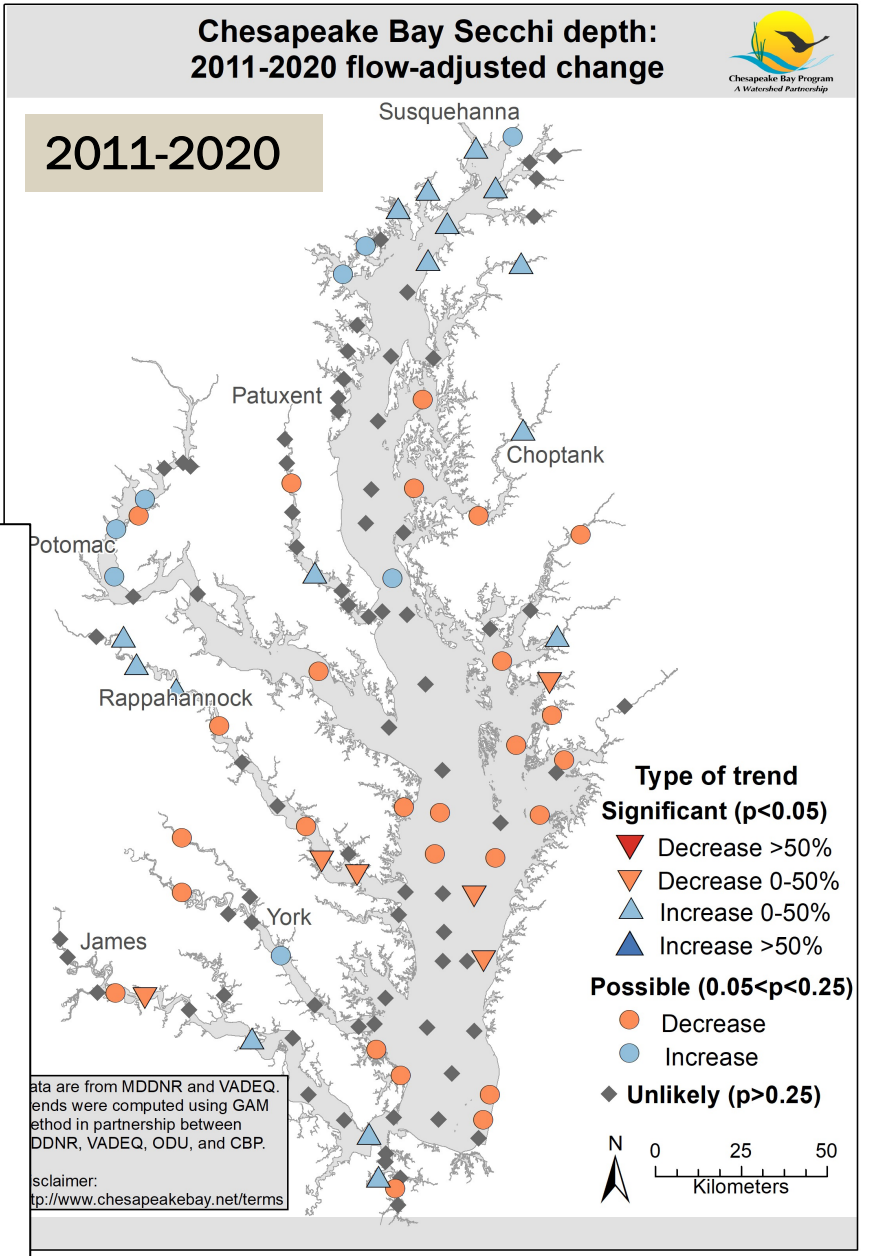


- We also aggregate all stations into a bar graph



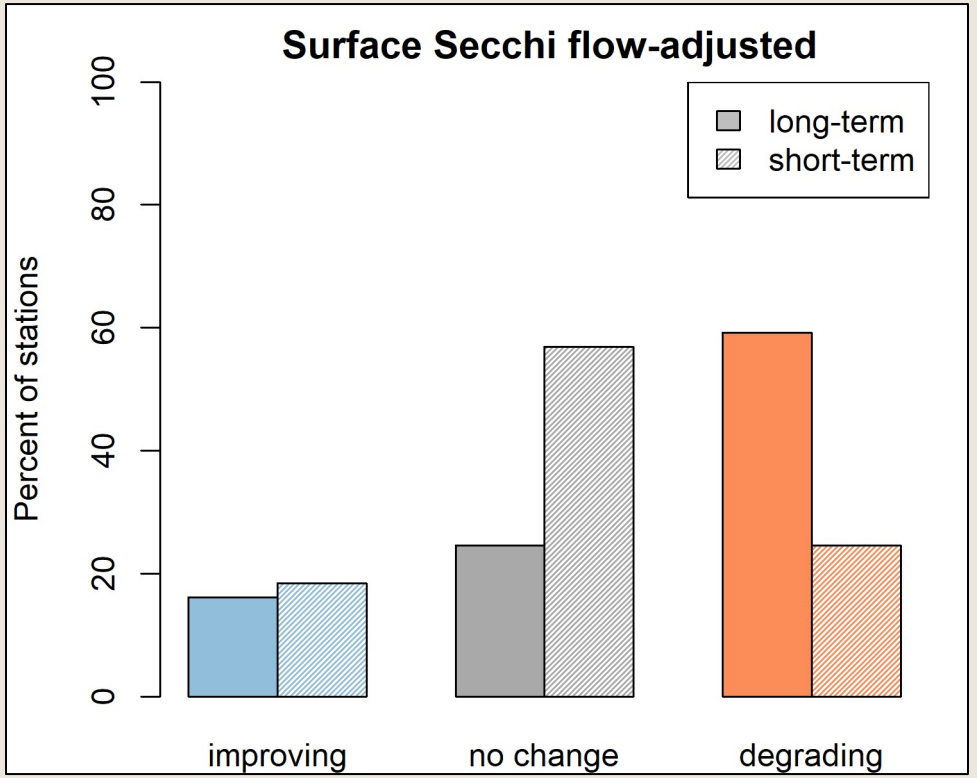


Summary: 2020 Secchi Depth Trends

- Annual maps summarize our very detailed GAM analysis of the monitoring data to give bay-wide picture

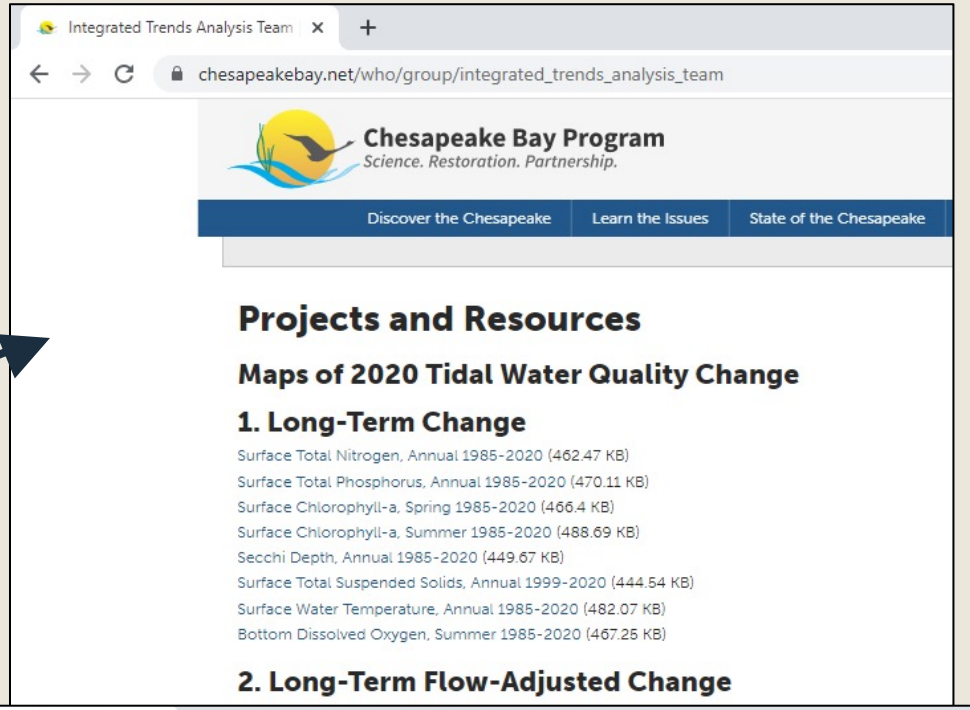
- We also found these bar graphs help with a big-picture summary as well

  → *e.g., can see how the majority of the stations have long-term degrading Secchi, but over the short-term, that swapped to be mostly "no change" for the majority of the stations*

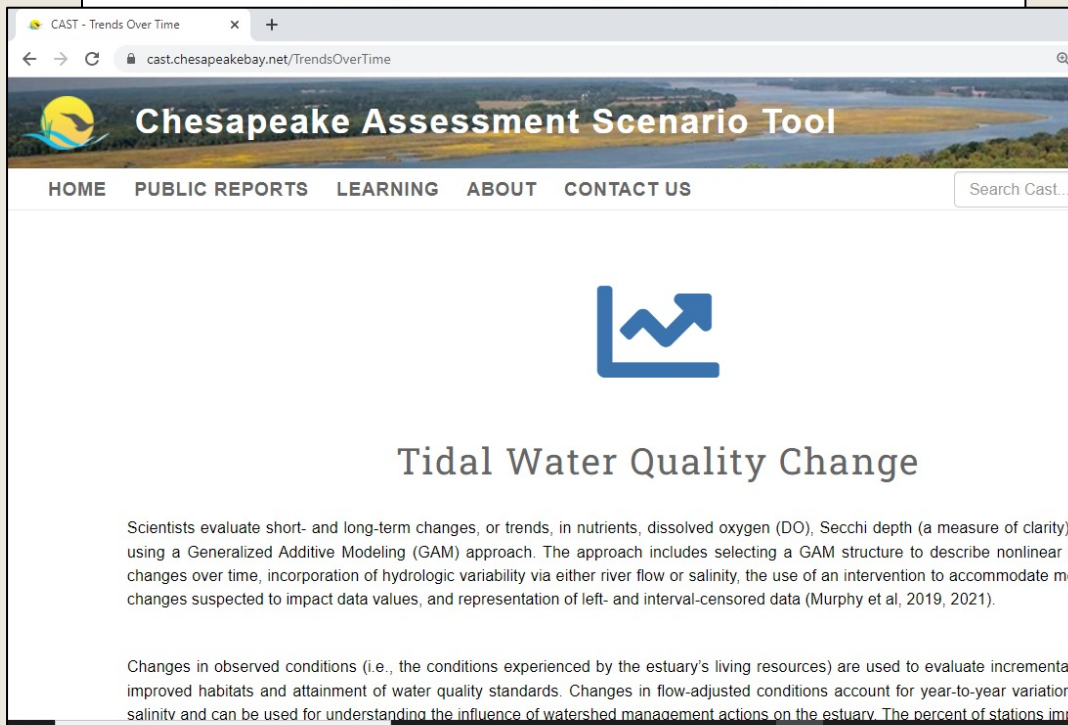


Accessing Tidal Trends

- ITAT webpage
  - *2020 maps are available for all parameters.*
  - *https://www.chesapeakebay.net/who/group/integrated_trends_analysis_team*



- Baytrendsmap via CAST
  - *Summary file, table, and interactive website to explore the trends.*
  - *https://cast.chesapeakebay.net/TrendsOverTime*



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