Synthesizing status and trend results for indicators of river and stream health in the Chesapeake Bay Watershed
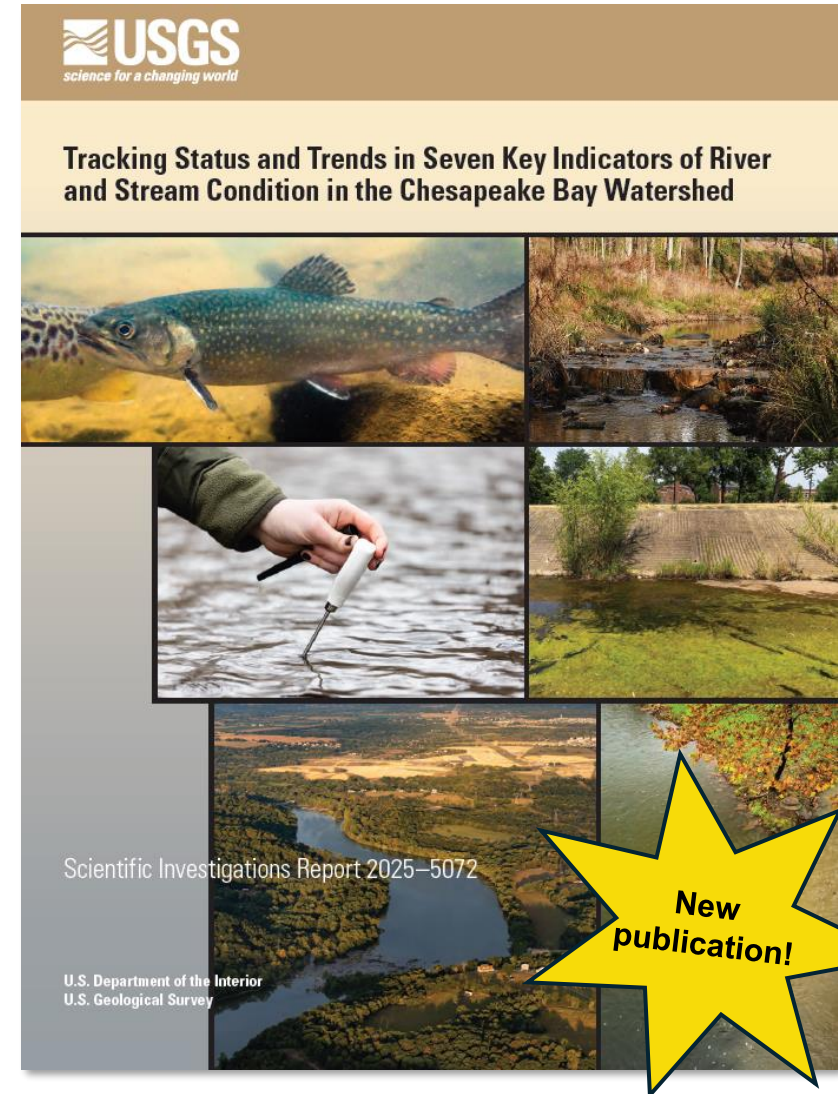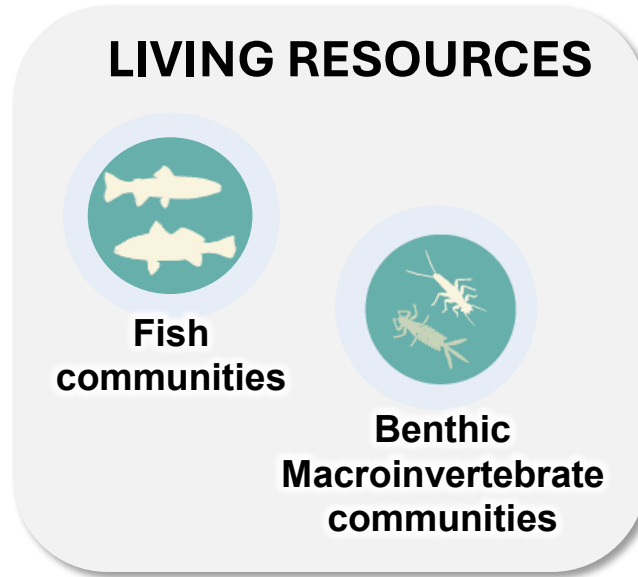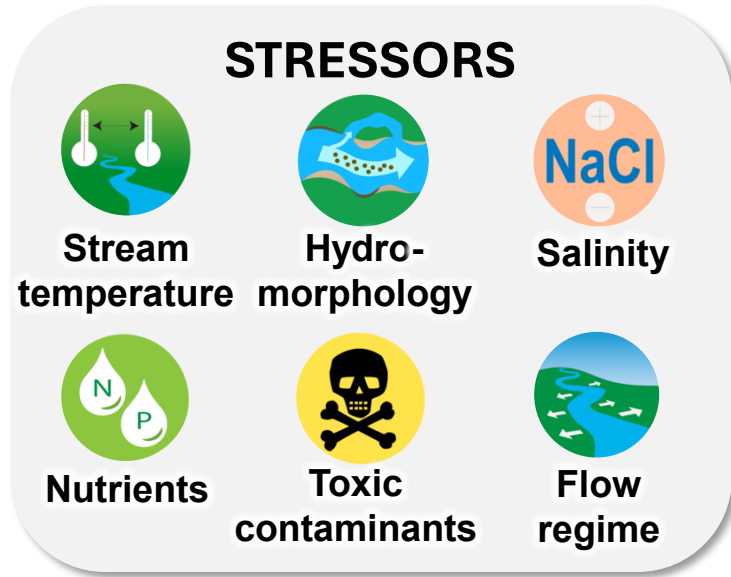

Lindsey Boyle, Rosemary Fanelli, Marissa Cassell, Zachary Clifton, Douglas Moyer

August 28, 2025

Chesapeake Bay Program Scientific Technical Assessment and Reporting (STAR) Team Meeting
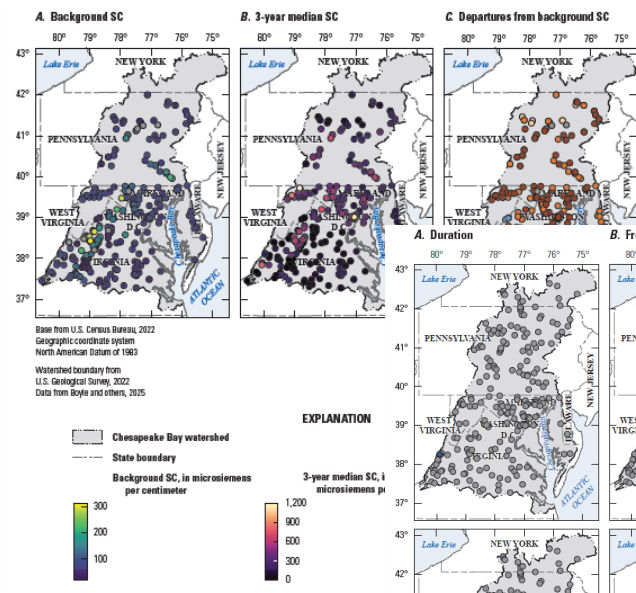
USGS Status & Trends publication

- Used USGS Non-Tidal Network as foundation for study design
- Added additional indicators describing stream health
- Compiled data inventories and harmonized datasets
- Selected approaches for computing status and trends
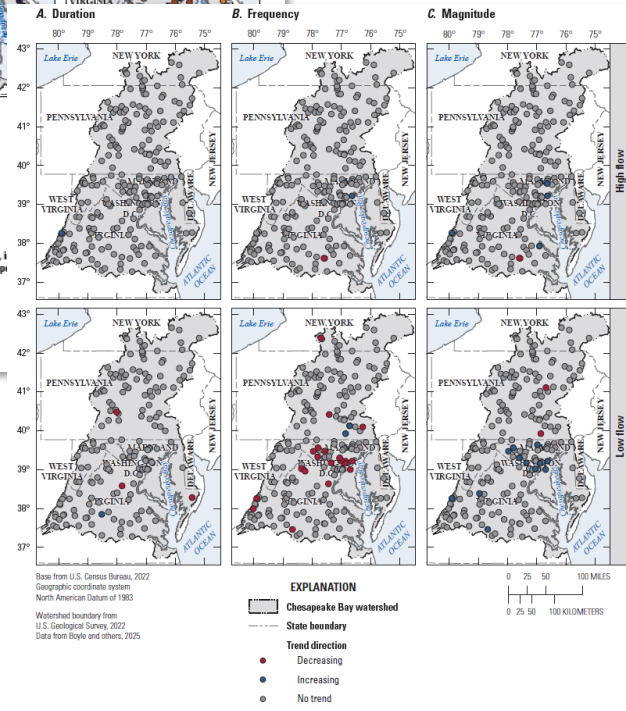- Reported general patterns across stream health indicators

STRESSORS

Stream temperature

Hydro-morphology

Salinity
NaCl

Nutrients
N P

Toxic contaminants

Flow regime

LIVING RESOURCES

Fish communities

Benthic Macroinvertebrate communities

Tracking Status and Trends in Seven Key Indicators of River and Stream Condition in the Chesapeake Bay Watershed

Scientific Investigations Report 2025–5072

U.S. Department of the Interior
U.S. Geological Survey

New publication!

Boyle, L.J., Austin, S.H., Cashman, M.J., Clifton, Z.J., Clune, J.W., Colgin, J.E., Elliott, K.E.M., Fanelli, R.M., Foss, E.P., Hitt, N.P., Hittle, E.A., Howe, C.M., Majcher, E.H., Maloney, K.O., Mason, C.A., Metes, M.J., Moyer, D.L., Needham, T.P., Rogers, K.M., Thompson, J.J., Yang, G., and Zimmerman, T.M., 2025, Tracking status and trends in seven key indicators of river and stream condition in the Chesapeake Bay watershed: U.S. Geological Survey Scientific Investigations Report 2025–5072, 104 p., https://doi.org/10.3133/sir20255072

USGS Status & Trends publication

Salinity status

Flow trends

## Anthropogenic land use as potential driver of stream health

Indicator	Metric	Relationship at significance value of p≤0.05		
		Developed	Agriculture	Forest
Nutrients and sediment	Suspended sediment concentration, mg/L	None	None	Negative
	Total nitrogen concentration, mg/L	None	Positive	Negative
	Total phosphorus concentration, mg/L	Positive	Positive	Negative
Temperature	Temperature, °C	Positive	None	Negative
Salinity	3-year median annual SC value, µS/cm	Positive	Positive	Negative
Streamflow	Low-flow magnitude, (ft³/s)/mi²	Positive	Positive	Negative
	Low-flow frequency	Positive	None	None
	Low-flow duration, days	None	None	None
	High-flow magnitude, (ft³/s)/mi²	None	Negative	Positive
	High-flow frequency	Positive	Negative	Negative
	High-flow duration, days	Negative	Negative	Positive
Hydromorphology	Bank stability	Negative	None	Positive
	Bank vegetative protection	Negative	None	Positive
	Channel alteration	None	None	None
	Embeddedness	Negative	None	Positive
	Epifaunal substrate	Negative	None	Positive
	Channel streamflow status	Negative	None	Positive
	Frequency of riffles	None	None	None
	Sediment deposition	Negative	Negative	Positive
	Velocity and depth combinations	None	Positive	None
Biological assemblages	Chessie BIBI	Negative	None	Positive
	Percentage EPT-H	Negative	None	Positive
	MMI	None	None	None
	Percentage nontolerant individuals	None	Negative	None

Boyle, L.J., Austin, S.H., Cashman, M.J., Clifton, Z.J., Clune, J.W., Colgin, J.E., Elliott, K.E.M., Fanelli, R.M., Foss, E.P., Hitt, N.P., Hittle, E.A., Howe, C.M., Majcher, E.H., Maloney, K.O., Mason, C.A., Metes, M.J., Moyer, D.L., Needham, T.P., Rogers, K.M., Thompson, J.J., Yang, G., and Zimmerman, T.M., 2025, Tracking status and trends in seven key indicators of river and stream condition in the Chesapeake Bay watershed: U.S. Geological Survey Scientific Investigations Report 2025–5072, 104 p., https://doi.org/10.3133/sir20255072
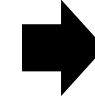
Next steps: Exploring common drivers

Compute indicator metrics
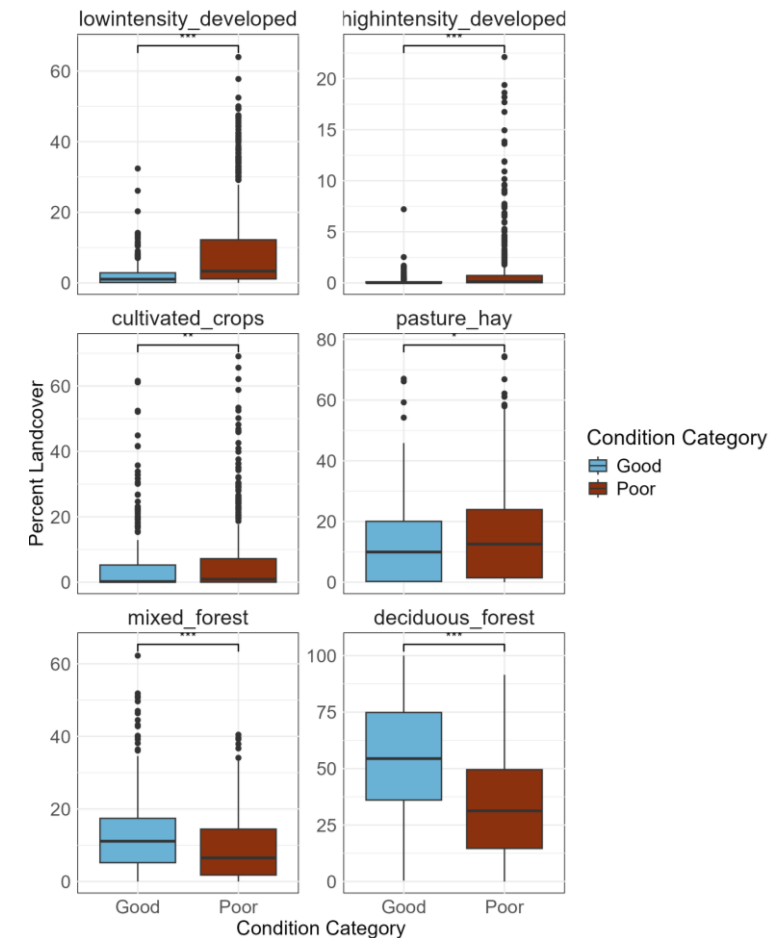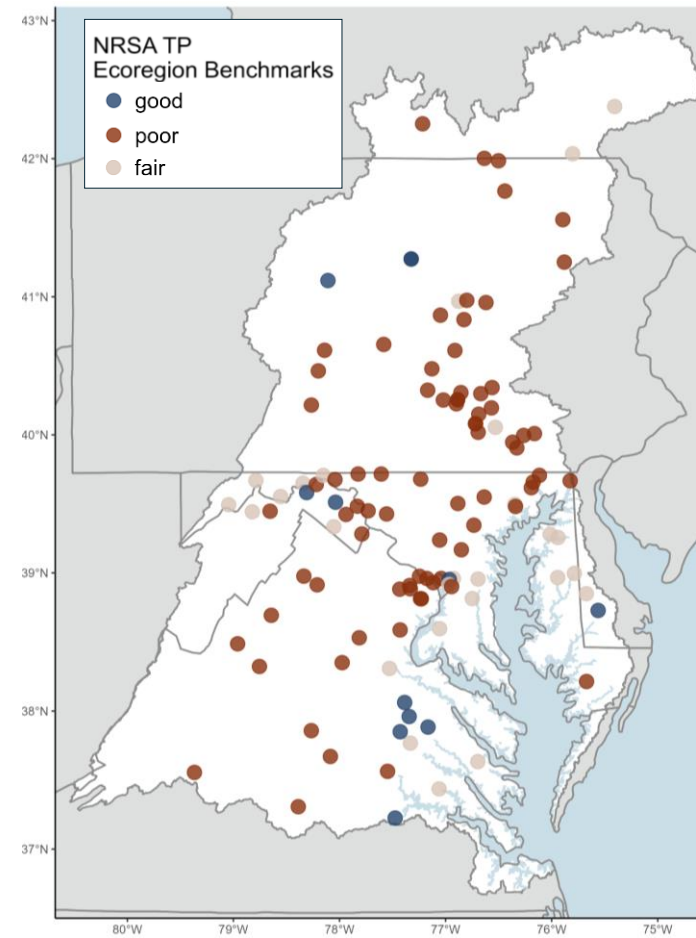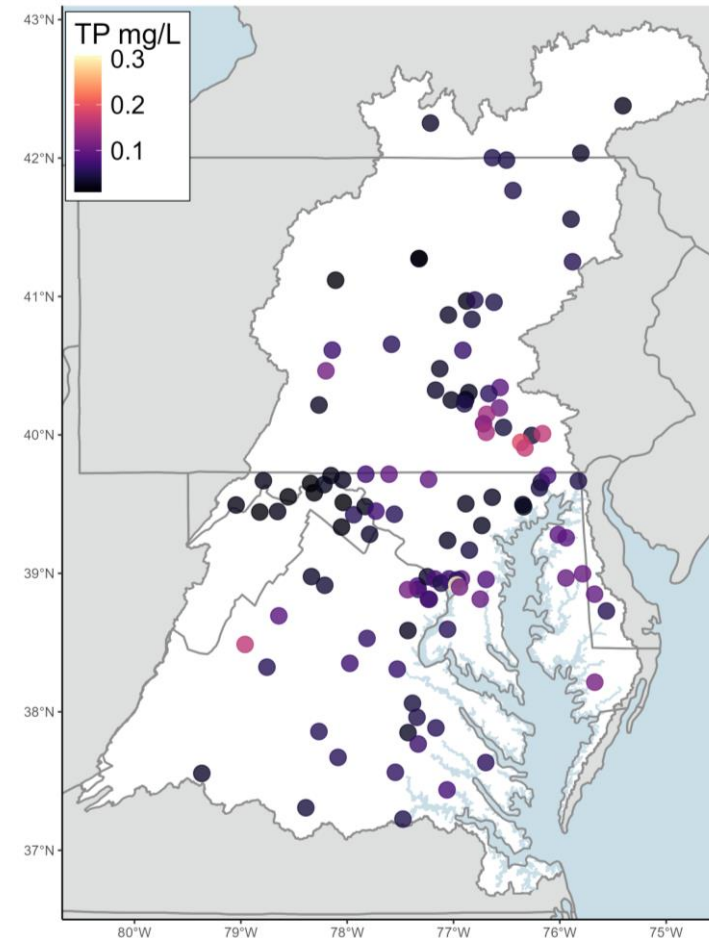*Nutrients: median total phosphorus concentration*
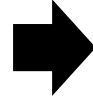
Assess site conditions
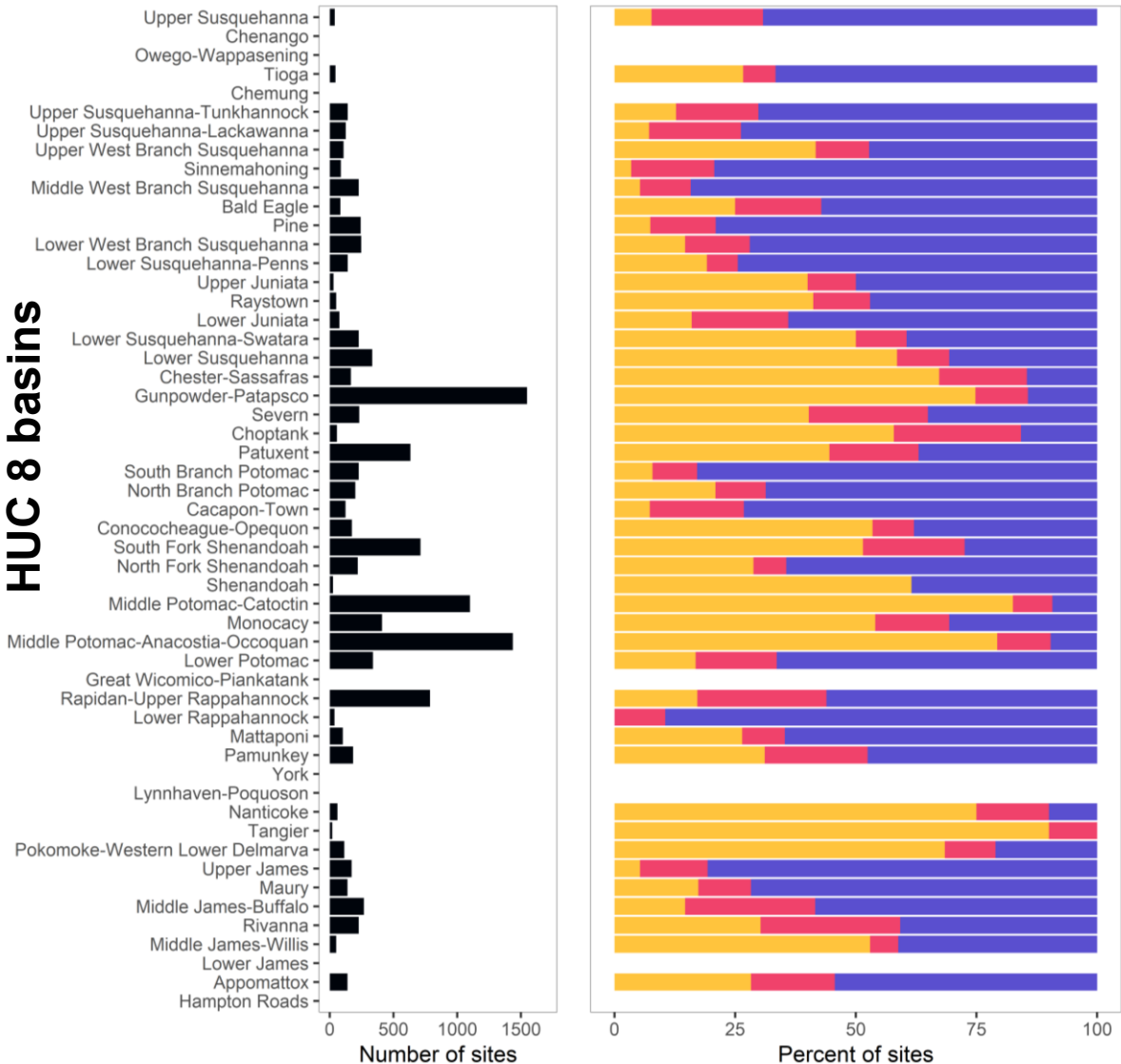*Compare metric values to ecological benchmarks to rank sites*

Explore common drivers
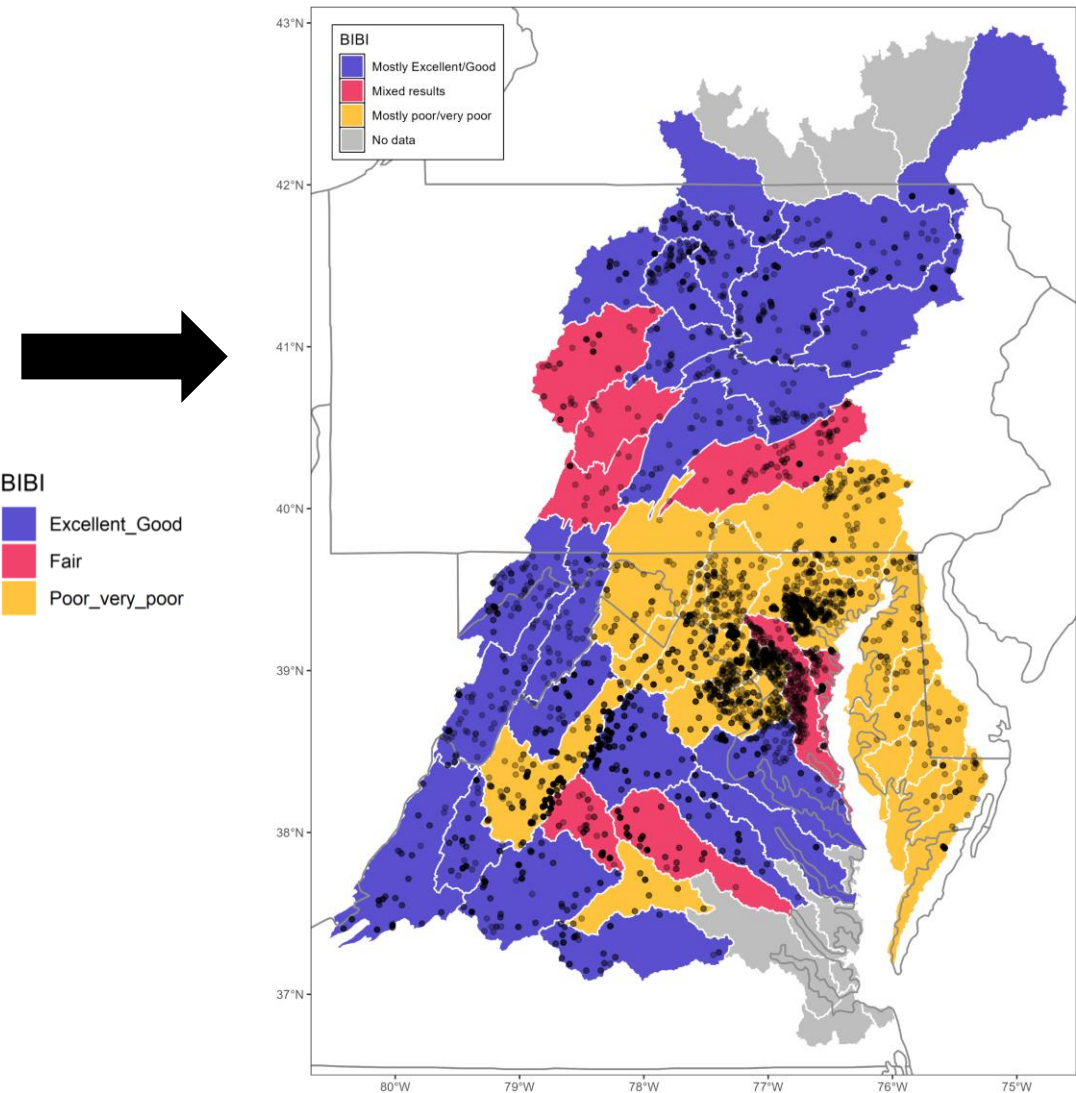*Compare watershed characteristics across multiple stream health indicators in sites with good or poor condition*

Next steps: HUC-scale synthesis
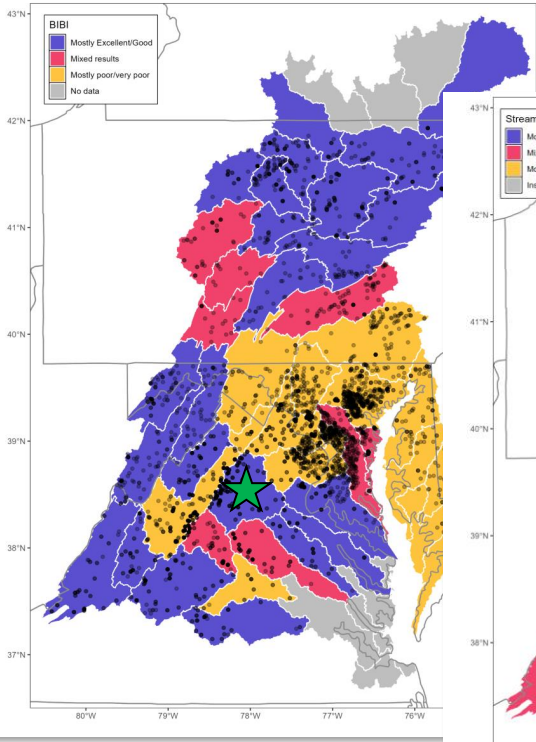

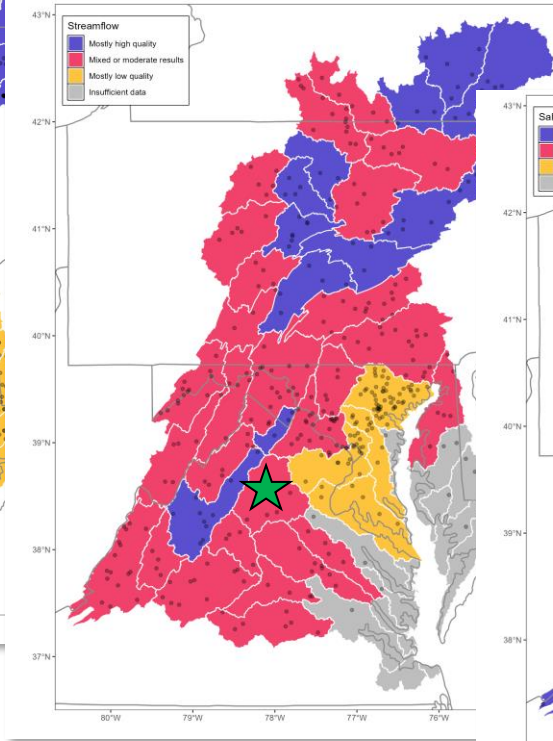**Benthic macroinvertebrate IBI results**

Benthic IBI patterns across HUC 8 basins

Next steps: HUC-scale synthesis

Benthic IBI

Streamflow

Salinity

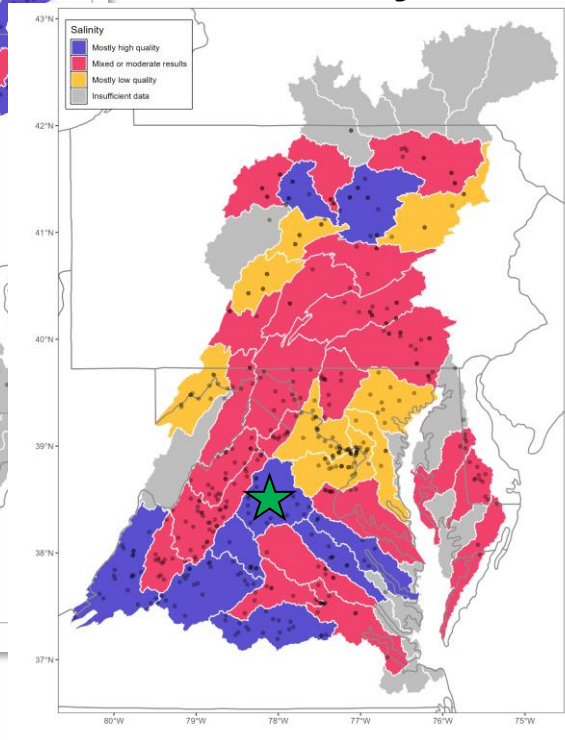Report on **number of sites in HUC** with indicator data, the **percentage of sites** with high/low-quality conditions, and **data gaps**
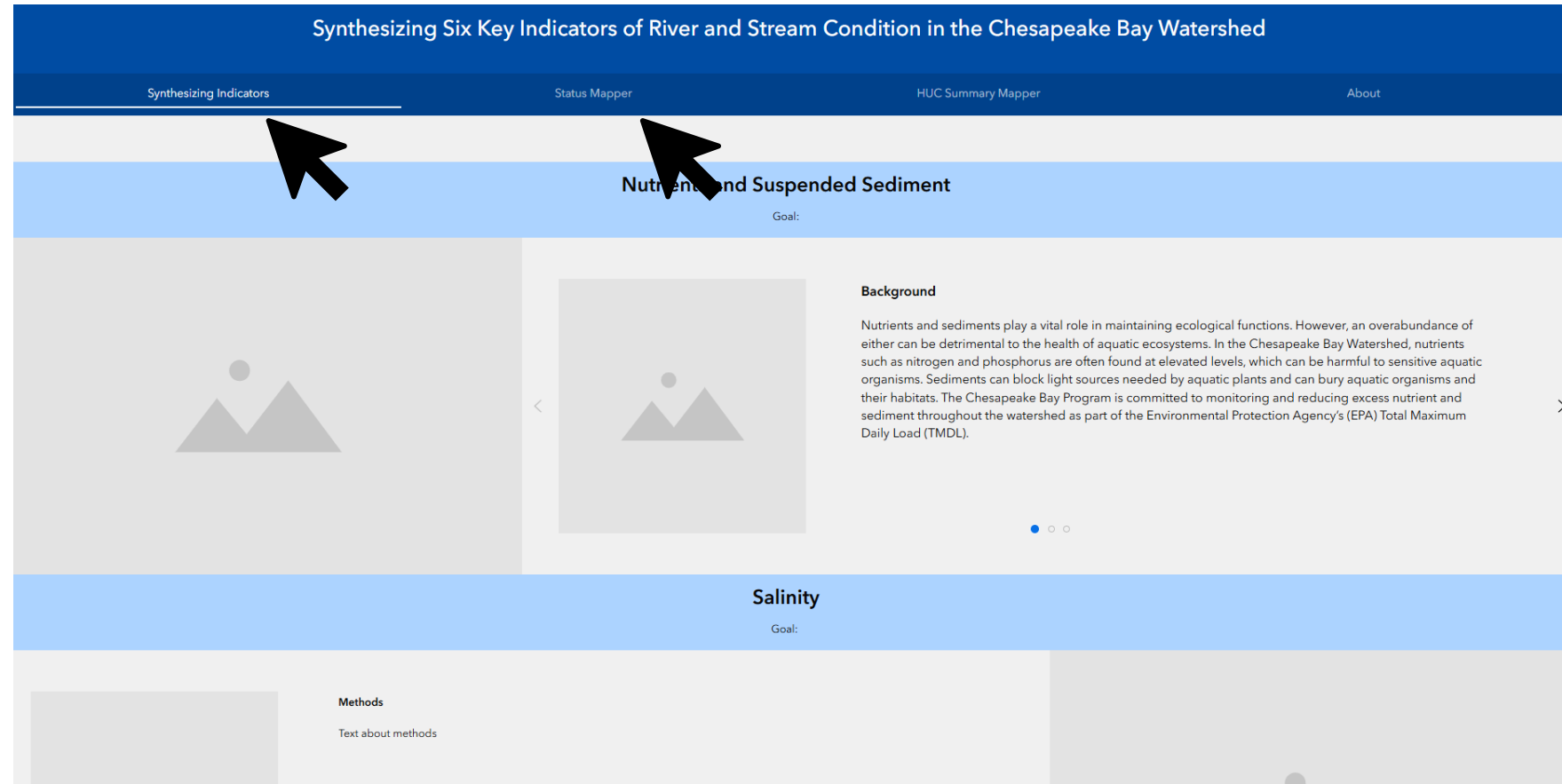
Stream Health report for Rapidan-Upper Rappahannock

- **Biology:** Most sites (83%) had BIBI scores in Excellent/Good or Fair categories
- **Habitat:** Almost half of the sites (49%) had low levels of embeddedness
- **Salinity:** Most sites (89%) had salinity levels at or around background
- **Flow:** All sites had moderately elevated flashiness
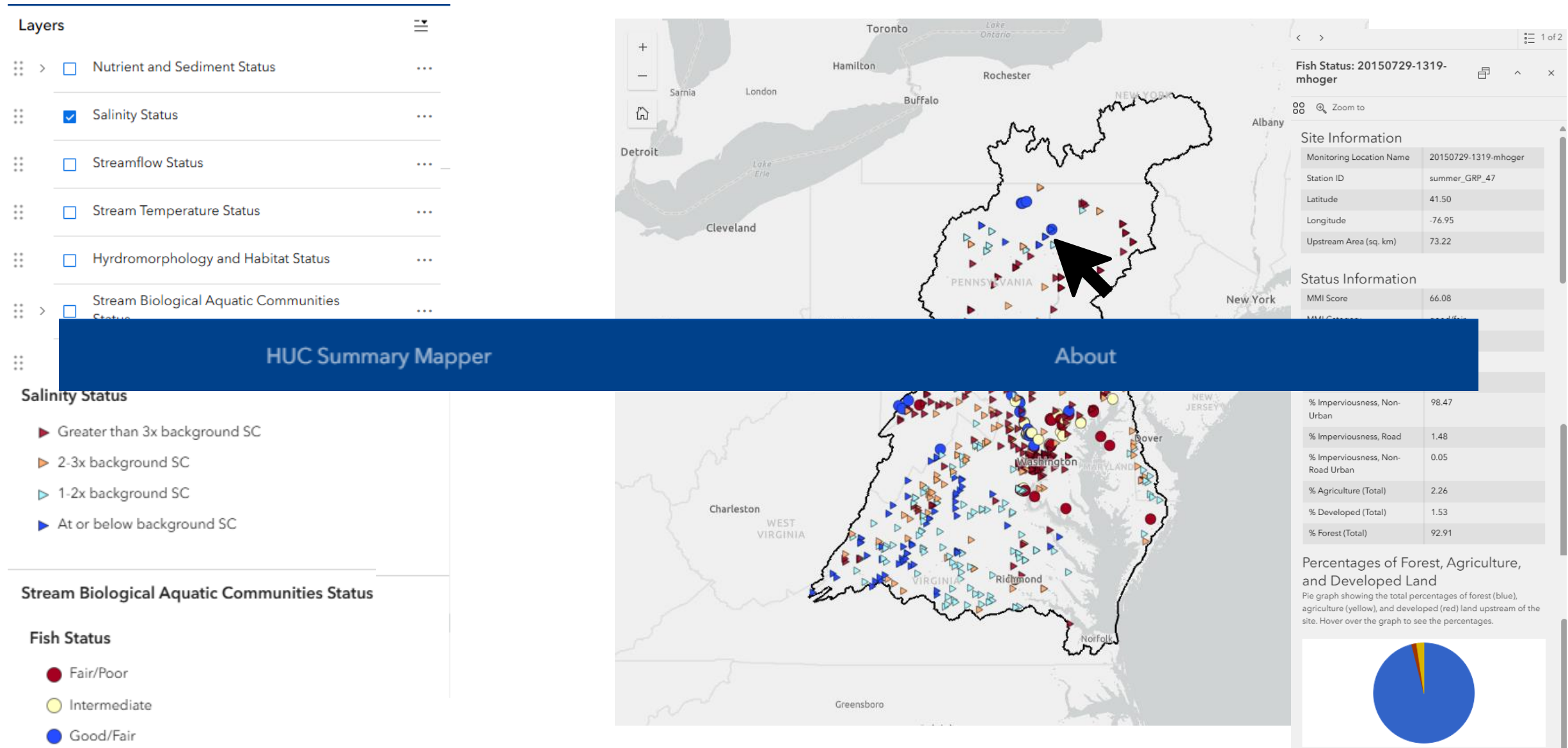- **Nutrients:** Not enough information (n < 3 sites)

Next Steps: Data Visualization

- Tool for collaborators to view:

  - Background information

  - Methods

  - Site Specific Status Results

  - HUC Status Results

  - HUC Summary Information

  - Resources and References

Next Steps: Data Visualization