# 2025 Update on the Chessie BIBI

Stream Health Workgroup Meeting

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# Stream Health Outcome(s)

## 2009 Chesapeake Bay Executive Order 13508

Improve the **health of streams** so that **70%** of sampled streams throughout the Chesapeake watershed are in **fair, good or excellent** condition as measured by an **Index of Biotic Integrity** by **2025.**

## 2014 Chesapeake Bay Agreement

Continually improve **stream health** and function throughout the watershed. Improve health and function of **10% of stream miles above the 2008 baseline** for the Chesapeake Bay watershed.

## Chesapeake Bay Agreement (rev. 2025)

Improve the **health** and the ecological integrity of at least an additional **4,340 (approx. 3%) nontidal stream miles** every **six years.**

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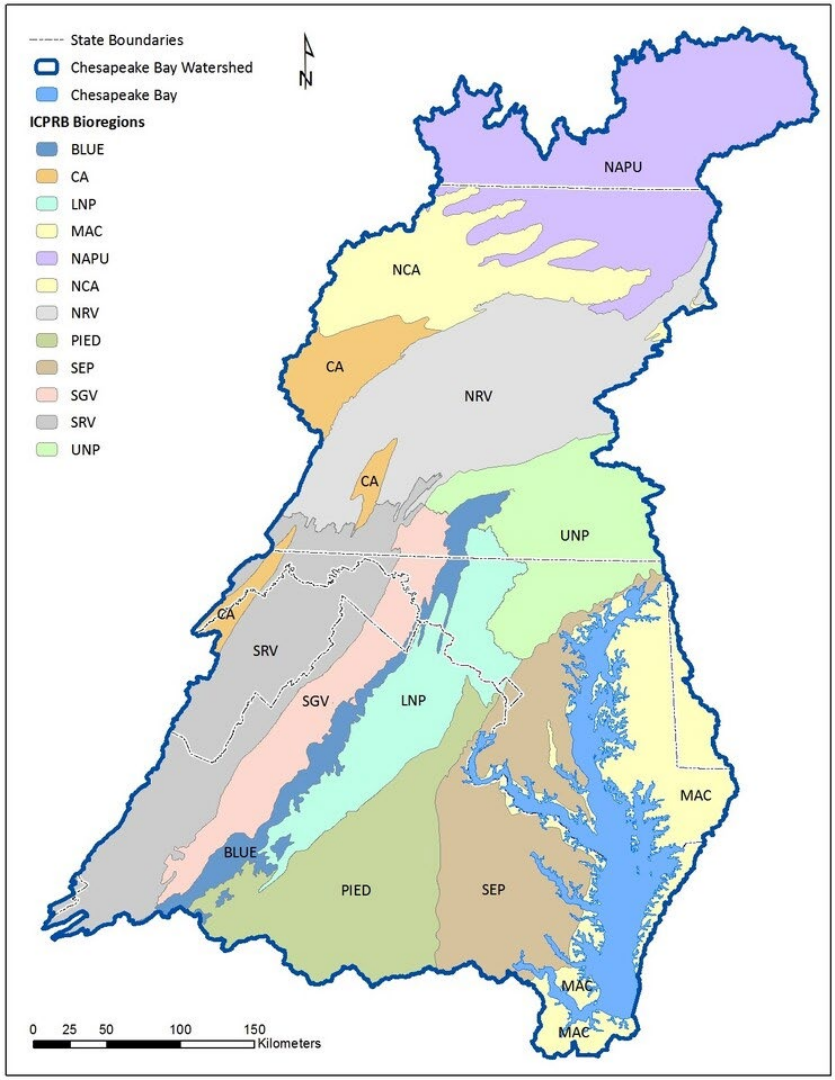
# Chessie BIBI

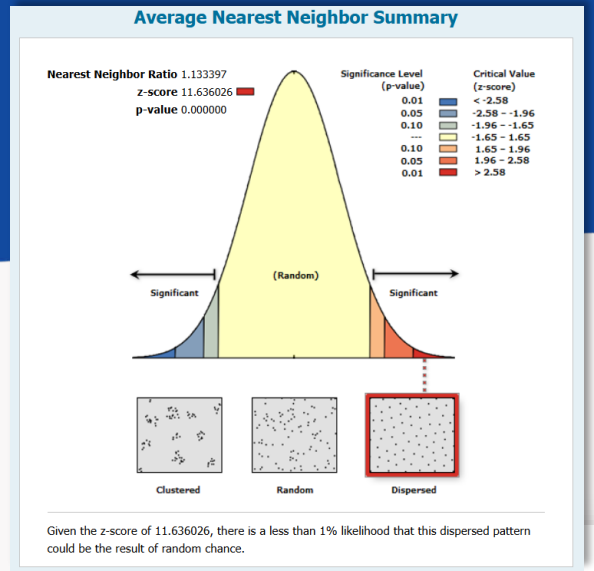
- **“Chesapeake Basin-wide Index of Biotic Integrity”**
- **Multi-metric, family-level** index of biological health calculated from **macroinvertebrate** taxonomic counts
- Applicable for **freshwater streams** and small **wadeable rivers** in Chesapeake Bay watershed
- Metrics tailored individually to **12 bioregions** that account for natural differences in benthic communities caused by differences in geology, elevation, climate, rainfall, and soils
- Index is **scored from 0-100** and binned into narrative ratings of **very poor, poor, fair, good, and excellent**



# 2024 Data Call

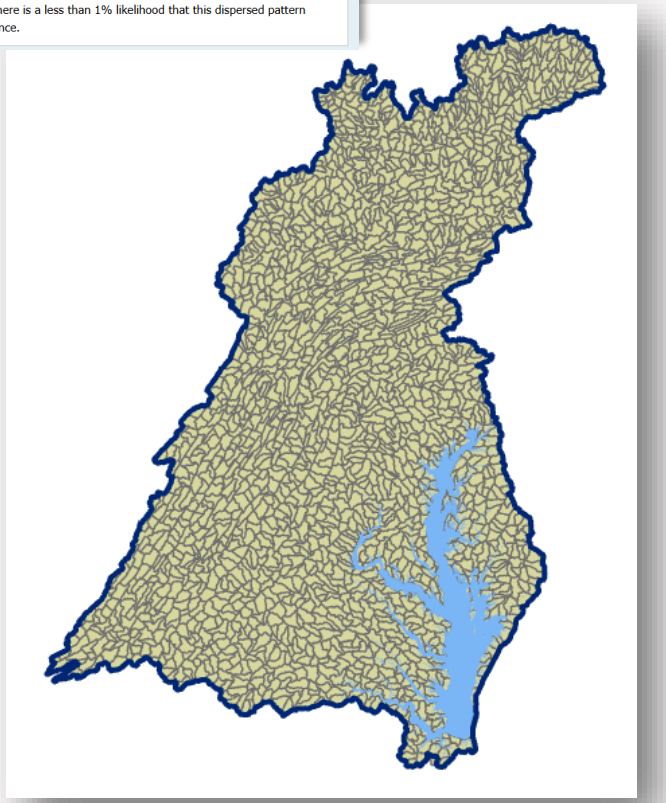
- ICPRB issues call for stream macroinvertebrate data and associated water quality and habitat variables every **6 years**
- Requests are to **state, federal, and local** agencies/programs and **citizen** groups in the Chesapeake Bay watershed
- Latest data call occurred in 2024 and requested data for **2018-2023**
- 2024 data call resulted in **13,113 new sampling events** from **18 data providers**

# Analysis Method




HUC12 polygons are used as a framework

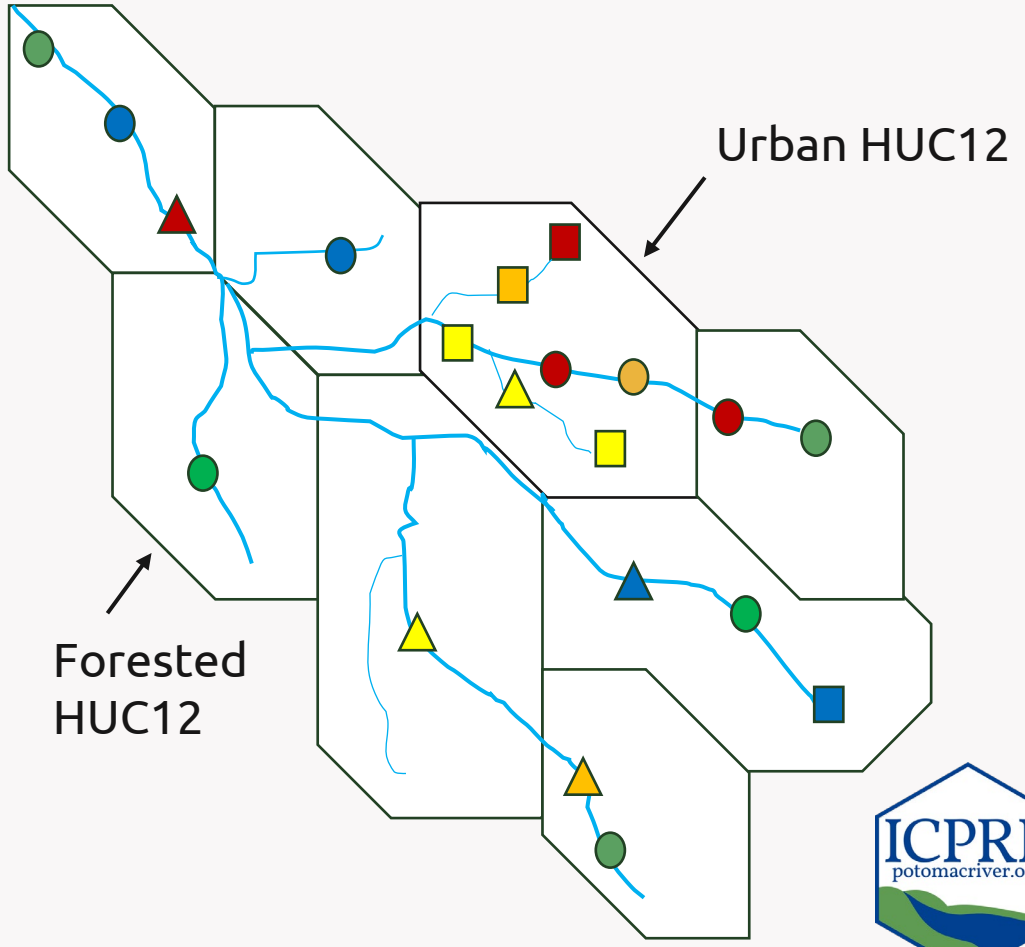
- HUC12 watersheds are similarly sized, and their centroids are very **evenly dispersed** ➔ a framework
- Sample sites are grouped and analyzed by **HUC12 polygons**
- **Sampled HUC12s** are also evenly or randomly dispersed.



**Program:** ArcGIS Pro, version 3.5.4
**Tool:** Average Nearest Neighbor (Spatial Statistics)

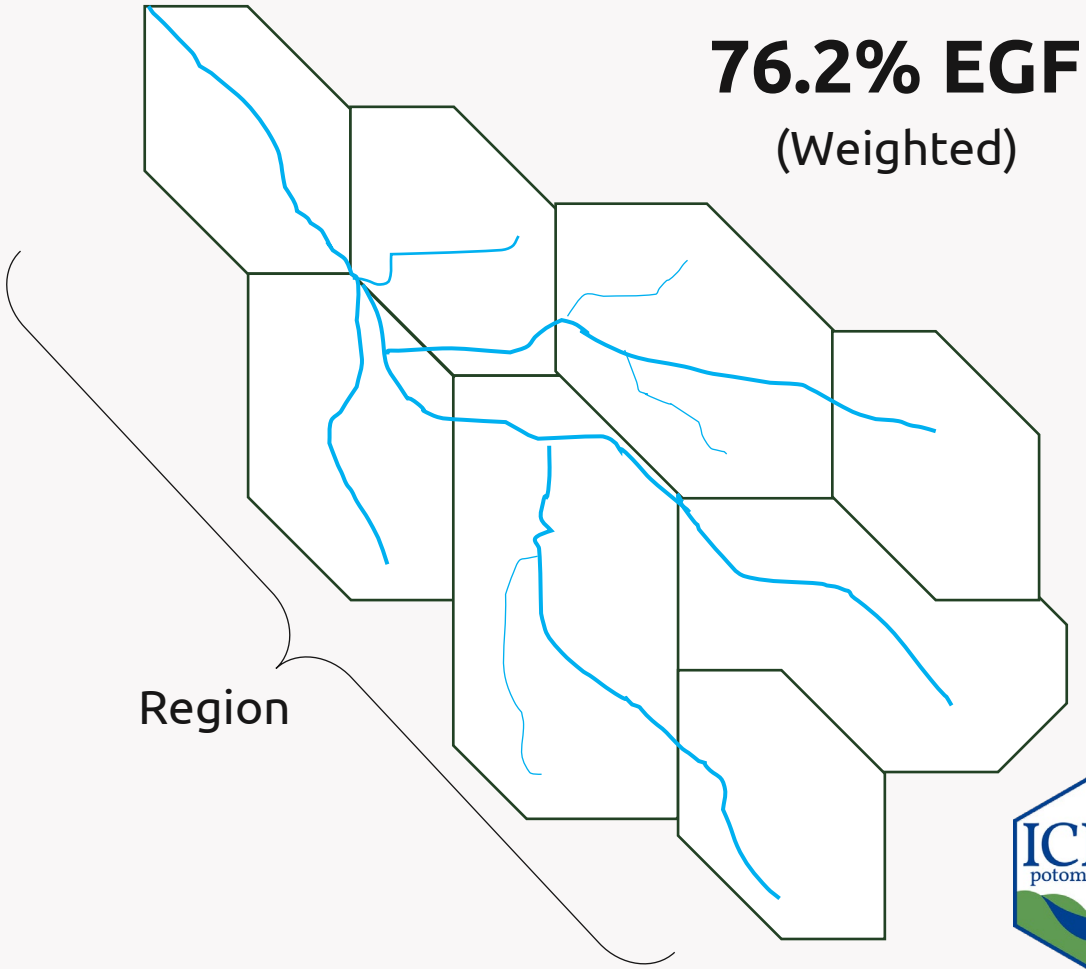
# Analysis Method

- Sites are **weighted** by equal proportions of their HUC12's total stream length
- This is to **remove bias** of HUC12s that are more heavily sampled than others
- For example, urban areas typically more frequently sampled than rural/forested areas
- It also preserves the diversity of ratings in HUC12 – something the mean does not do



# Analysis Method

- In this example, **unweighted** method of calculating stream health in a region results in **underestimating** the %healthy streams
- Unweighted estimate of %ExcellentGoodFair (%EGF) for the region is **65.0%**
- **Weighting removes bias caused by uneven sample between HUC12s**



# Results

Chessie BIBI scores and ratings recalculated for all previous samples and all new samples = **41,416 samples total** (1983-2024)

# %Healthy Streams in Chesapeake Bay Watershed

Stream Length-Weighted Results for Strahler Stream Order 1-5 (HR)

| INTERVAL | %EGF | Change |
|---|---|---|
| 2000-2005 | **56.4%** | |
| 2006-2011 (Baseline) | **60.7%** | **+4.3%** |
| 2012-2017 | **65.3%** | **+4.6%** |
| 2018-2023 | **66.7%** | **+1.4%** |
| Overall | | **+10.3%** |

- We have **not yet attained** the 2009 Executive Order **goal of 70% healthy** streams by 2025.
- We have **not attained the 10% improvement** above Baseline that is called for in the 2014 Bay Agreement.
- The proposed revision of the 2014 Agreement calls for a **3% improvement** in stream health **every six years**.
- It is conceivable we will meet all three goals in the next interval (2024 – 2030)

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# Comparing new and previous results

- Findings of current and earlier analyses **differ slightly**
  - Several **data entry errors** in early years identified and corrected – no effect on results
  - Method change in the analysis steps - less than 0.5% effect on results
  - **New data received is the primary cause** – estimates of % healthy streams dropped 1% - 2.5%

Sample Counts

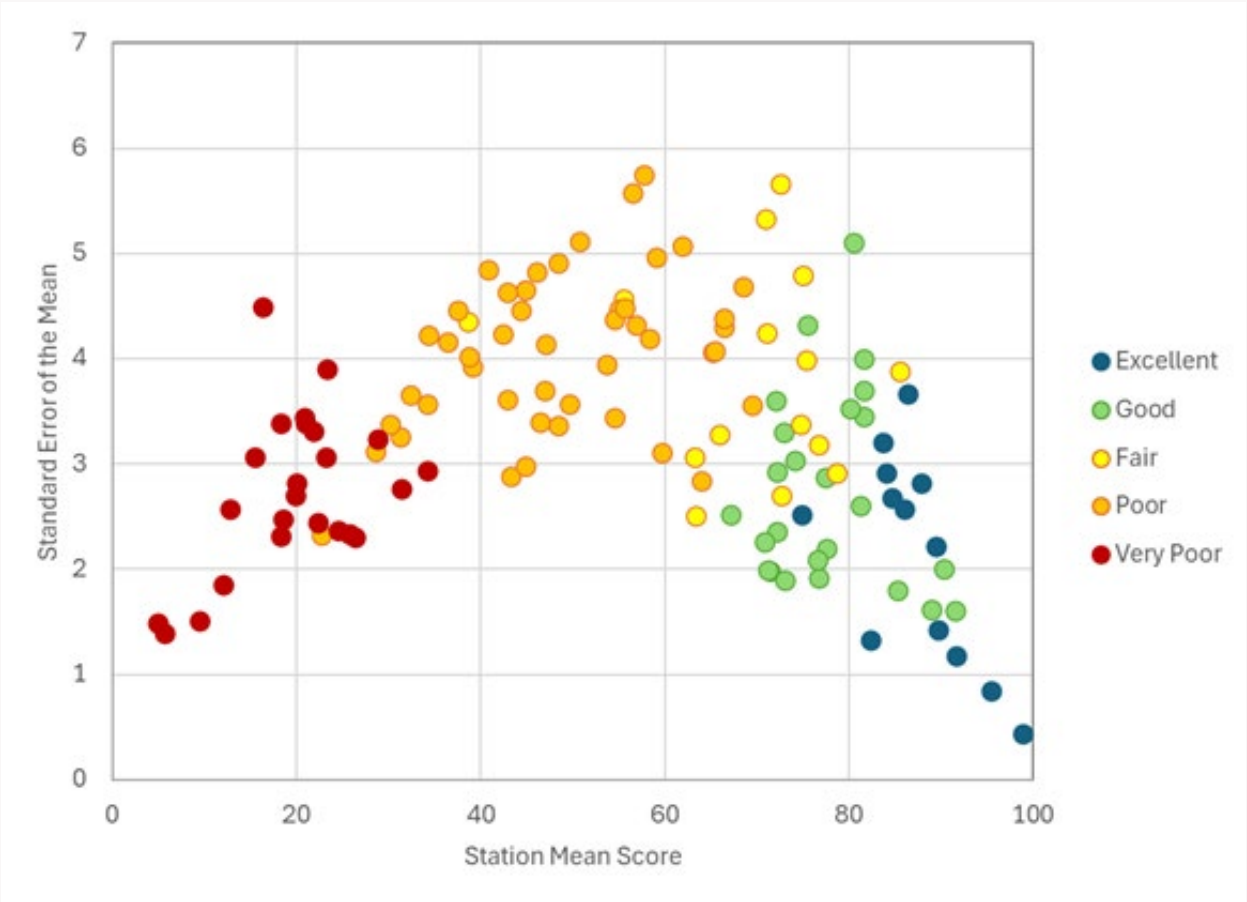
| Interval | 2025 Analysis | 2022 Analysis | Change |
|---|---|---|---|
| 2000-2005 | 7,029 | 7,035 | -6 |
| 2006-2011 | 8,273 | 8,016 | +257 |
| 2012-2017 | 6,170 | 4,713 | **+1,457** |
| 2018-2023 | 4,614 | ND | |

# Effect of Stahler Stream Order (SSO)

Comparison of the percentage of healthy streams (%EGF) in the Chesapeake watershed, by stream size. HR_SSO, high resolution Strahler Stream Order (1:24,000 )

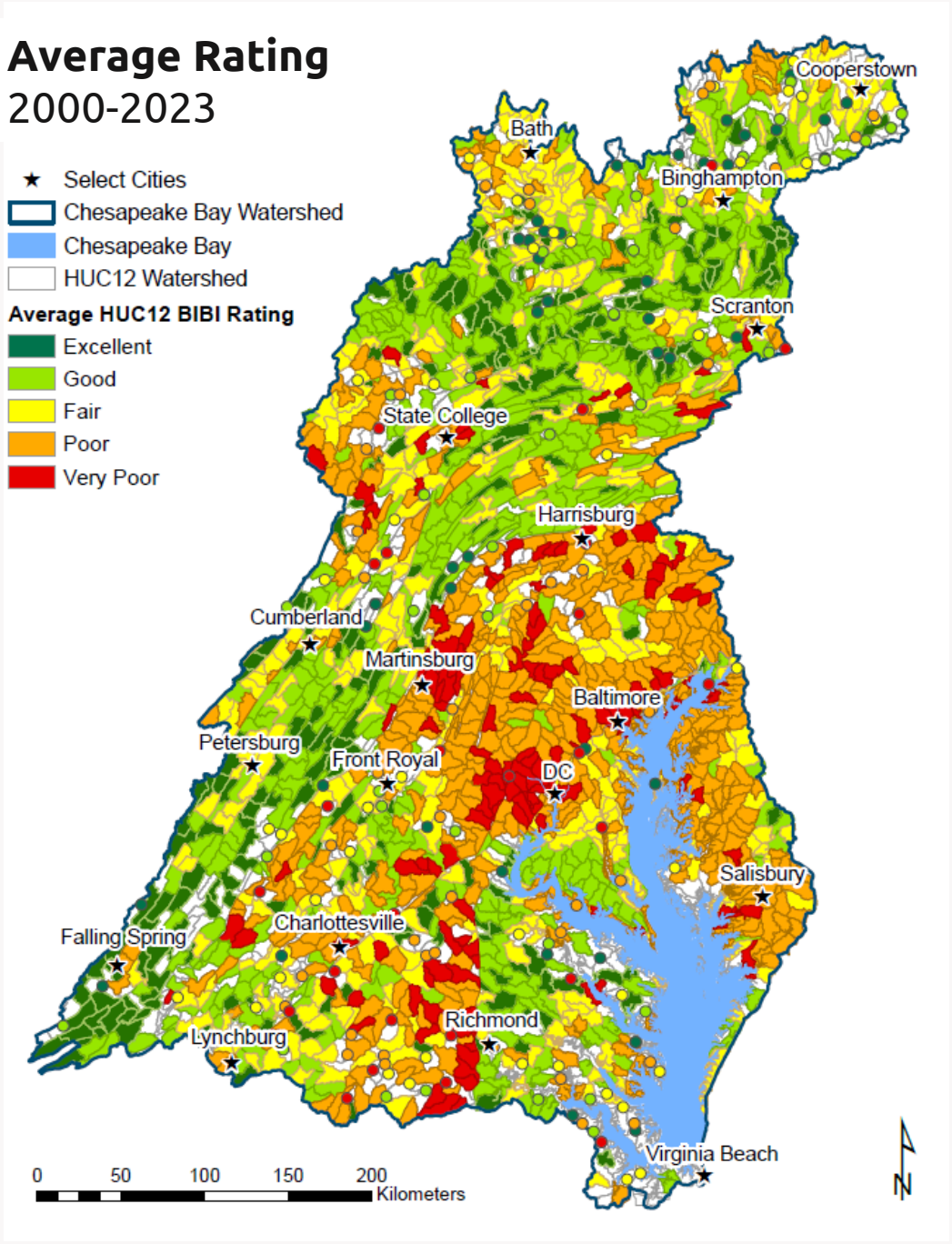
| Intervals | HR_SSO = 1-5 | 1 | 2 | 3 | 4 | 5 | 6-8 |
|---|---|---|---|---|---|---|---|
| 2000-2005 | **56.4%** | 44.3% | 50.1% | 51.3% | 57.4% | 60.0% | 60.2% |
| 2006-2011 | **60.7%** | 49.8% | 59.9% | 55.3% | 56.9% | 61.5% | 63.3% |
| 2012-2017 | **65.3%** | 58.6% | 63.0% | 63.2% | 56.4% | 68.9% | 69.5% |
| 2018-2023 | **66.7%** | 61.0% | 65.2% | 65.1% | 58.9% | 65.6% | 73.3% |

# Index Variability




Long-term monitoring stations

- Standard error around mean scores of 123 sites sampled 12+ times between 2000 – 2023
- Greater year-to-year variability at Fair and Poor sites makes it harder to detect change

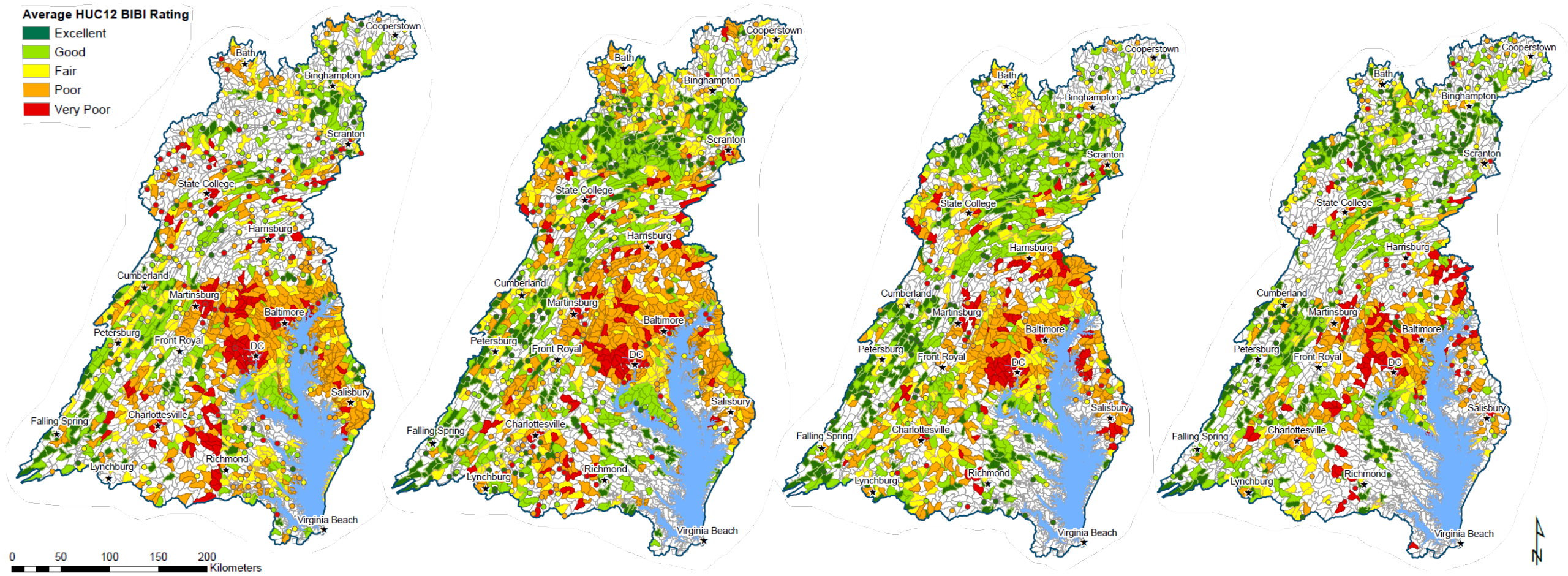



## Mapping:

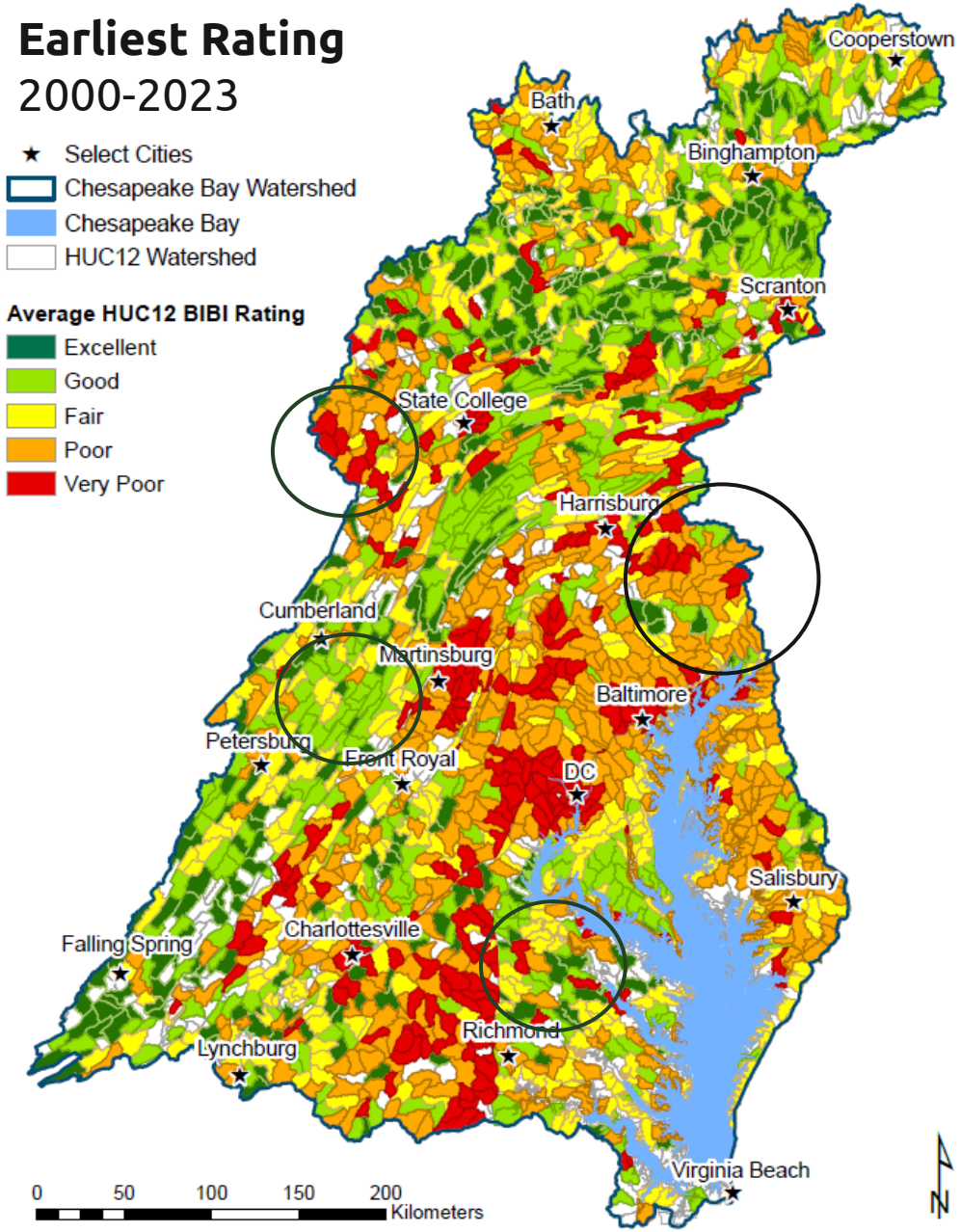
- Chessie BIBI ratings are mapped by HUC12 watershed
- HUC12s with 1 sample → point
- 2 or more samples → polygon colored in

Baseline

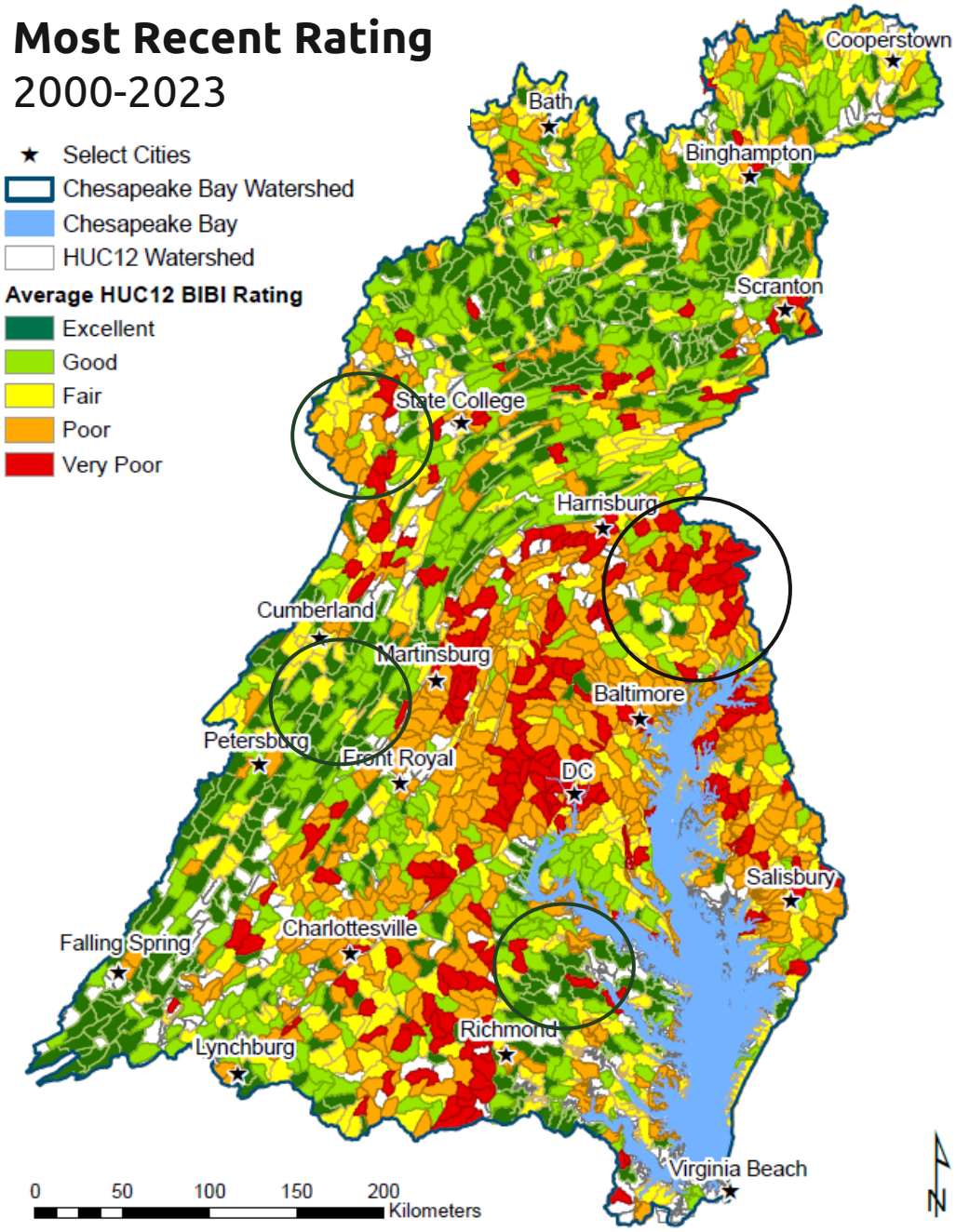
*2000-2005* *2006-2011* *2012-2017* *2018-2023*



## Earliest Rating
2000-2023

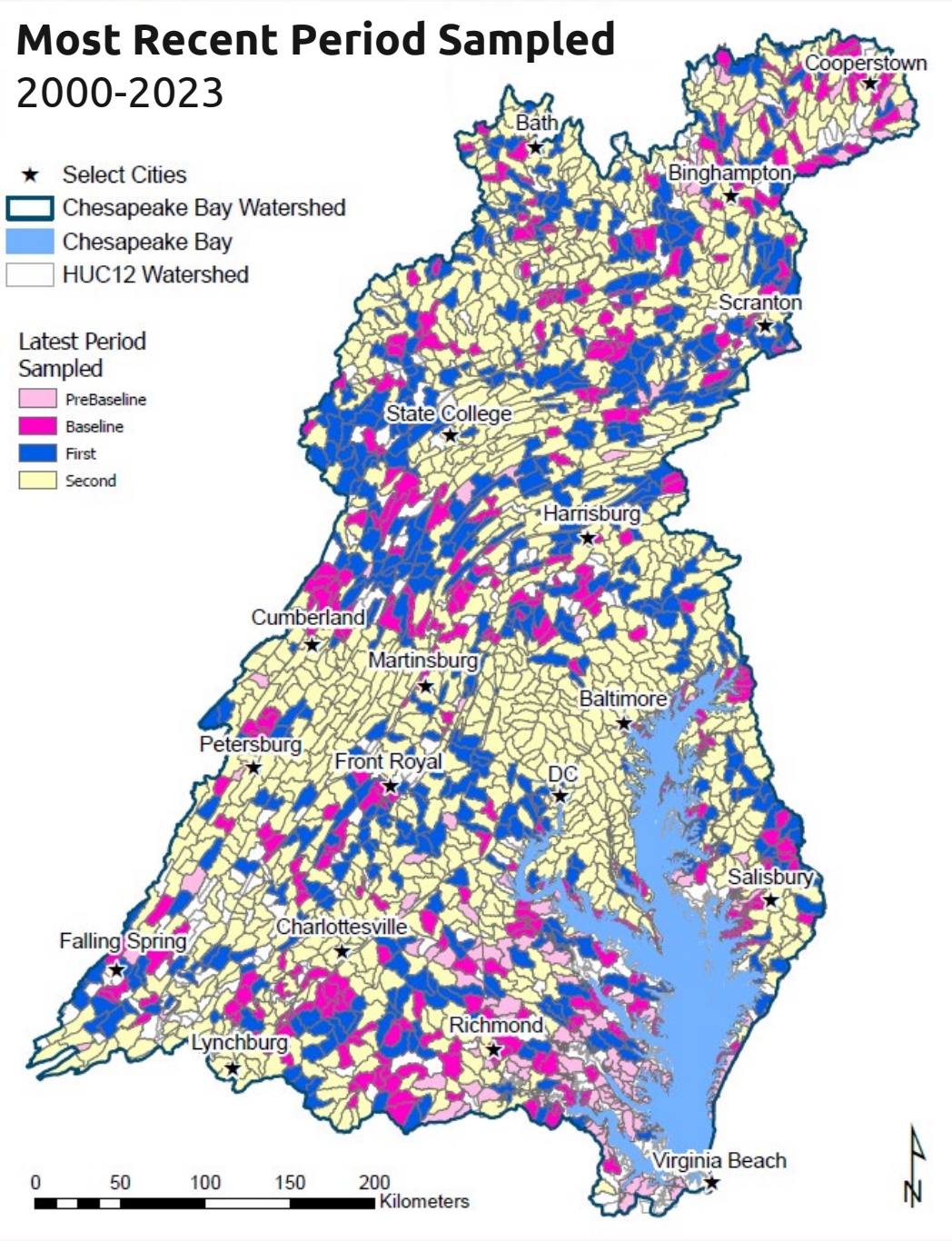



## Most Recent Rating
2000-2023

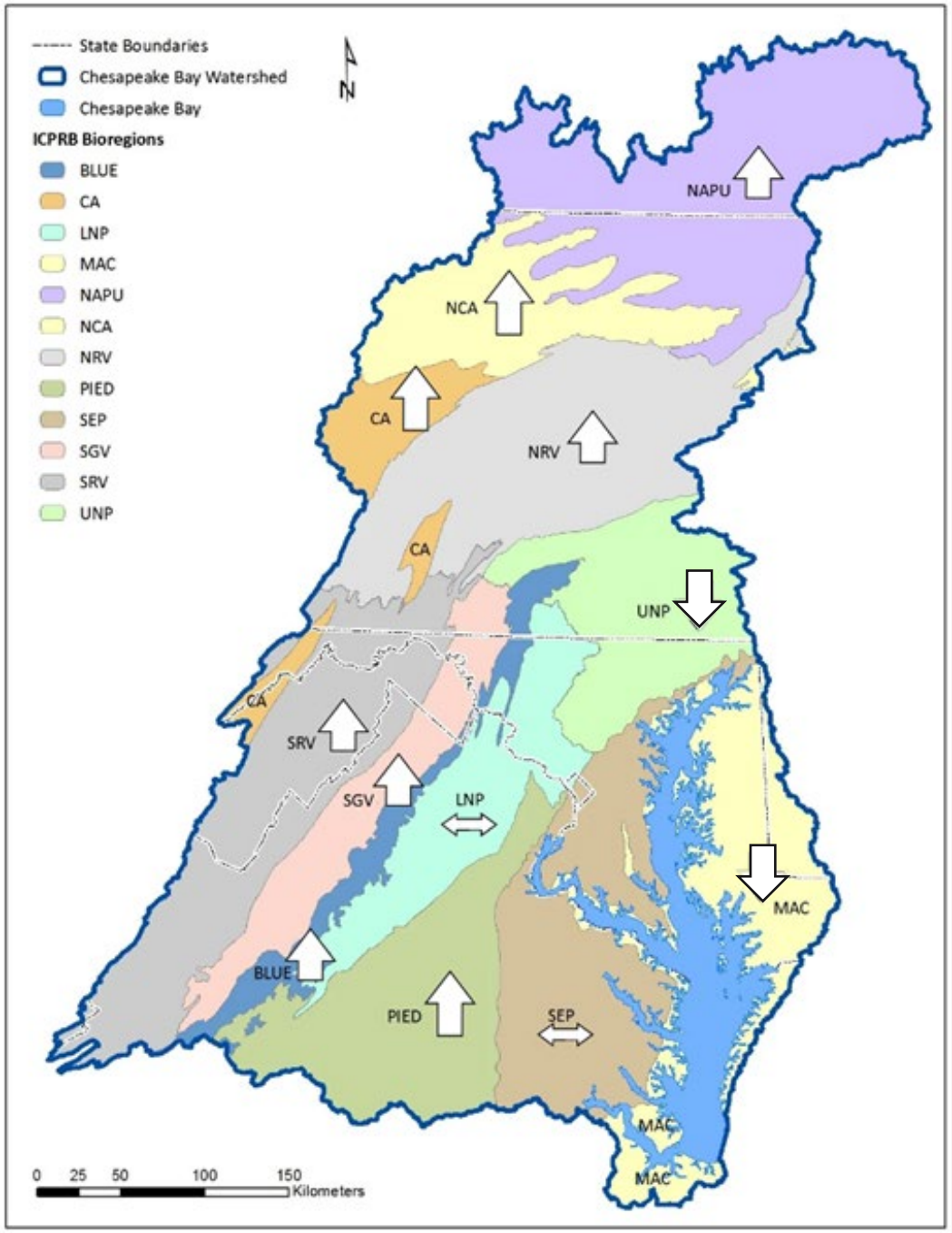


# Most Recent Period Sampled

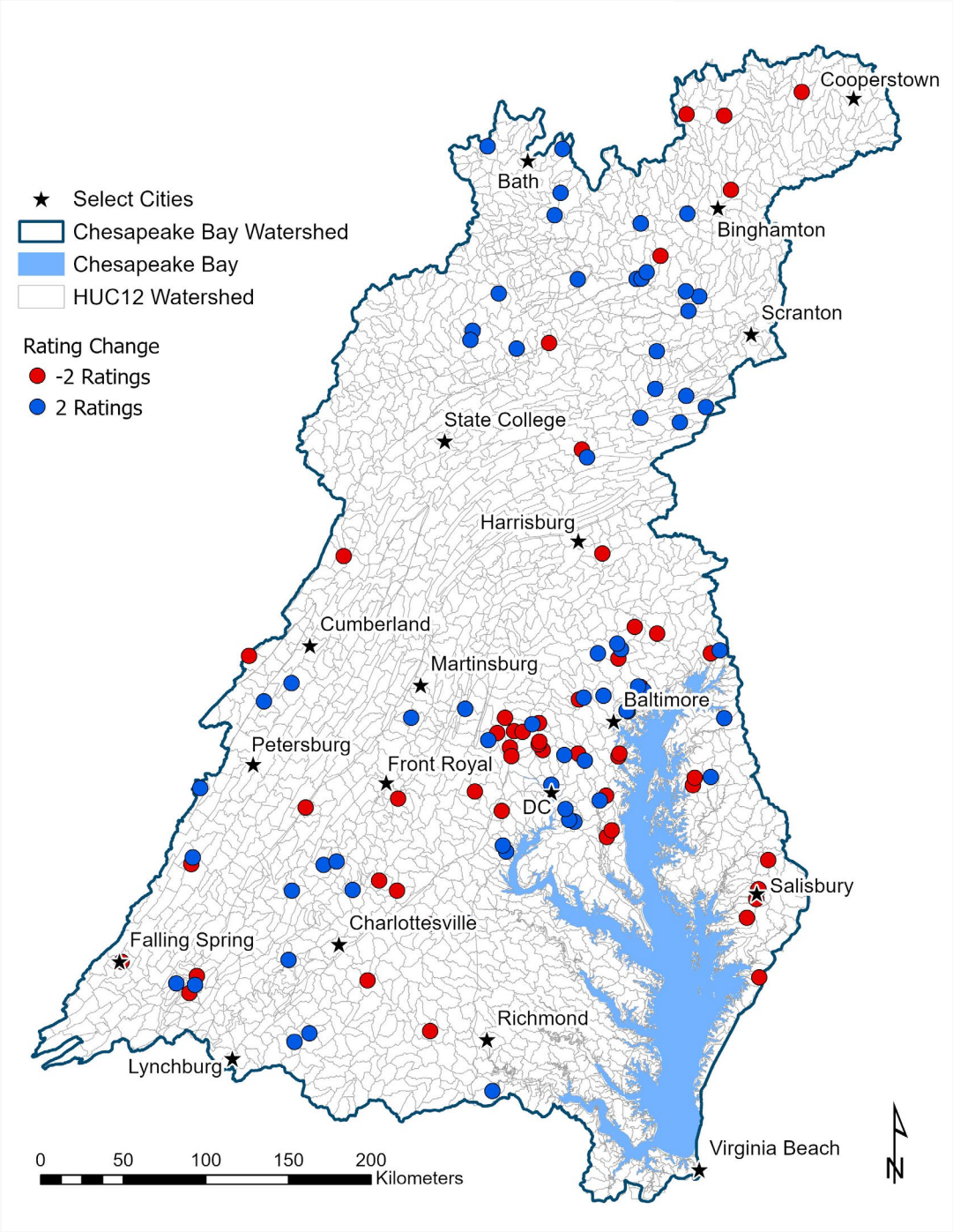
2000-2023



| Bioregion | Name | %EGF 2018-2023 | Trend |
|---|---|---|---|
| PIED | Piedmont | 55.6% | UP |
| CA | Central Appalachians | 70.0% | UP |
| NCA | North Central Appal. | 90.1% | UP |
| NRV | Northern Ridge&Valley | 73.6% | UP |
| BLUE | Blue Ridge | 74.3% | UP |
| NAPU | N. Appal. Plateau & Upland | 90.3% | UP |
| SRV | Southern Ridge&Valley | 93.9% | UP |
| SGV | Southern Great Valley | 28.4% | UP |
| SEP | Southeastern Plain | 53.8% | -- |
| LNP | Lower Northern Pied. | 21.3% | -- |
| MAC | MidAtlantic Coast | 31.0% | DN |
| UNP | Upper Northern Pied. | 21.2% | DN |



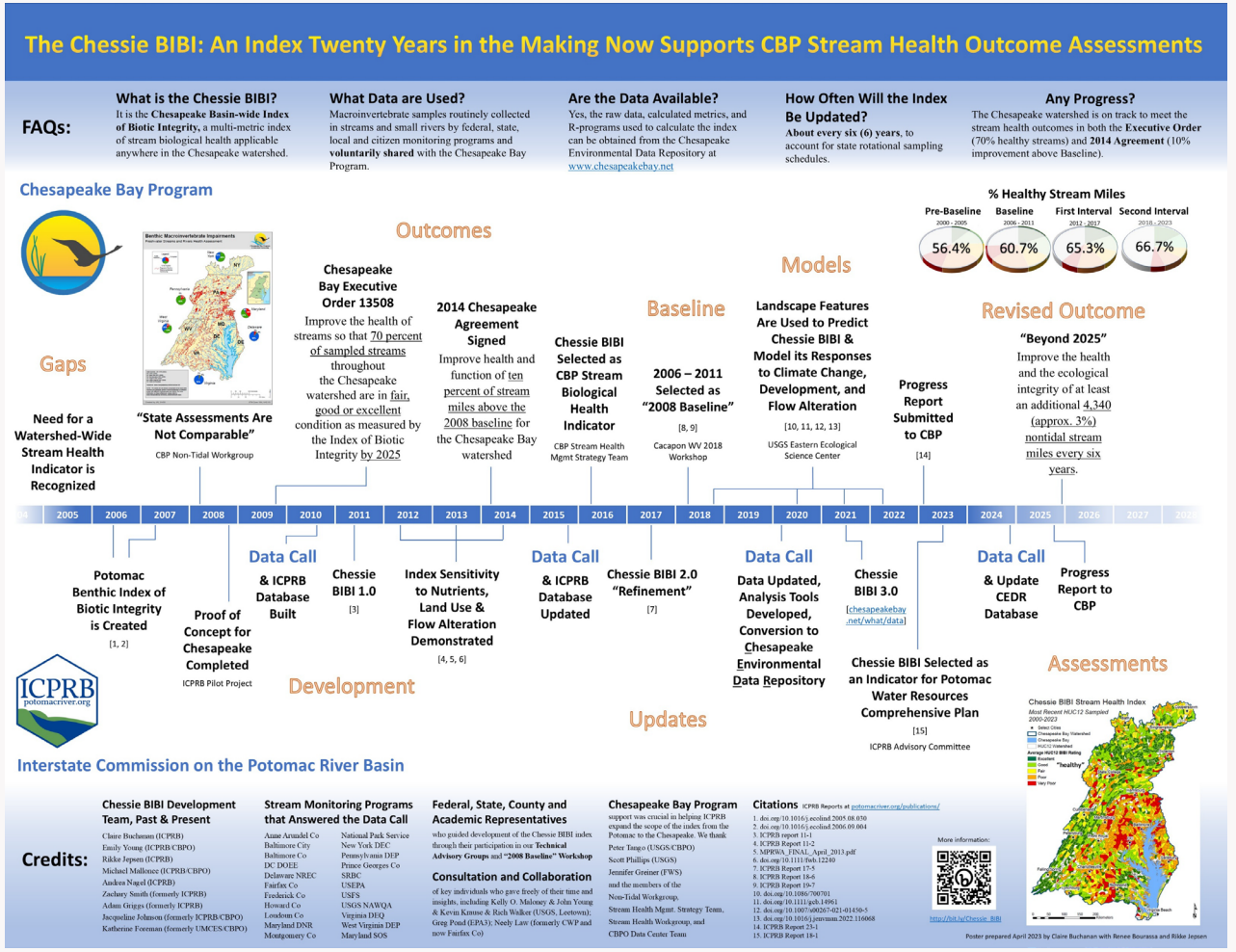
# Repeatedly-sampled stations with ±2 rating changes



# Future Work

- ✓ Finalize Progress Report (Dec 31 deadline)
- ✓ Finalize Method Document describing QA/QC, analysis, mapping, etc. (Dec 31 deadline)
- ✓ Update master taxa list and attribute tables
- ✓ Incorporate WQ and physical habitat data into CEDR
- ✓ Refine abiotic criteria for selecting Reference sites
- ✓ Upgrade index rating thresholds if needed
- ✓ Look for data to fill widening data gaps
- ✓ Next data call in 2030 for data from (2024-2029)!

## 2005 – 2025 TIMELINE



# *Thank you!*

18 years in the making
Many talented, dedicated people


**Index Development**

Claire Buchanan — *ICPRB*
Rikke Jepsen — *ICPRB*
Mike Mallonee — *ICPRB/CBPO*
Emily Young — *ICPRB/CBPO*
Zachary Smith — *New York DEC*
Andrea Nagel — *formerly ICPRB*
Katherine Foreman — *WSSC*
Adam Griggs — *formerly EPA HQ*
Jacqueline Johnson — *formerly NOAA*

**Data Collection/Sample Counting**

The field crews and managers of 24 monitoring programs in the Chesapeake Bay watershed

**Advisory Committees and Workshop Participants**

State and regional macroinvertebrate experts (2011, 2017, 2018)
*especially Greg Pond (EPA), Dustin Shull (PADEP), Scott Stranko (MDDNR), Jason Hill (VADEQ), A. J. Smith (NYDEC), Michael Whitman (WVDEP), Ellen Dickey (formerly DEREC), Ellyn Campbell (SRBC), Karen Blocksom (EPA), and Kelly Maloney (USGS)*

**Chesapeake Bay Program**

CBP Non-Tidal Workgroup and Stream Health Workgroup
*especially Peter Tango (USGS), Scott Phillips (formerly USGS), Neely Law (Fairfax Co.) and Jennifer Greiner (FWS)*

CBP Data Center staff
*especially Jacqueline Johnson and Mike Mallonee*

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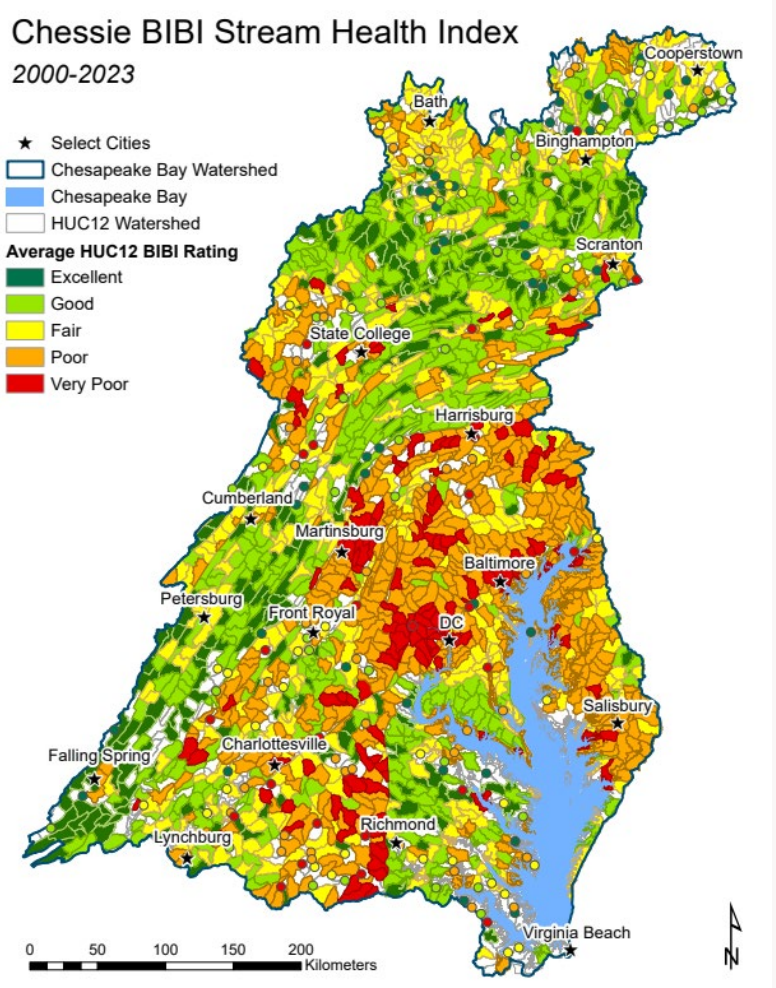
# Questions?

Contact: rjepsen@icprb.org

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*Protecting and preserving the Potomac through science and cooperation*