

Biological Stressor Identification (BSID) for Chesapeake Watershed

Stream Health Workgroup Meeting

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State Water Quality Assessments

States Draft Integrated Reports

- Submitted to EPA every two years
- Describes condition of surface water quality (305b)
- Identifies impaired waters (303d)



Impaired Waters

... waters failing to meet Water Quality Standards of a state's **Designated Uses**

- Human health, recreation...
- **Aquatic Life Use (ALU)**
("...biological integrity")



TMDL Planning & Implementation



Biological Stressor Identification (BSID)



State BSIDs

Examples of BSID components

Impairment Causes (Stressors)

Numeric criteria in Water Quality Standards

Screening thresholds for stream habitat & water quality

Toxicity testing

Species composition

Pollution Sources

Atmospheric deposition vs AMD

Eutrophication methods for small streams

Screening thresholds for Land Use/Land Cover

Links to some documents

[New York](#)

[Pennsylvania](#)

[West Virginia](#)

[Maryland](#)

[District of Columbia](#)

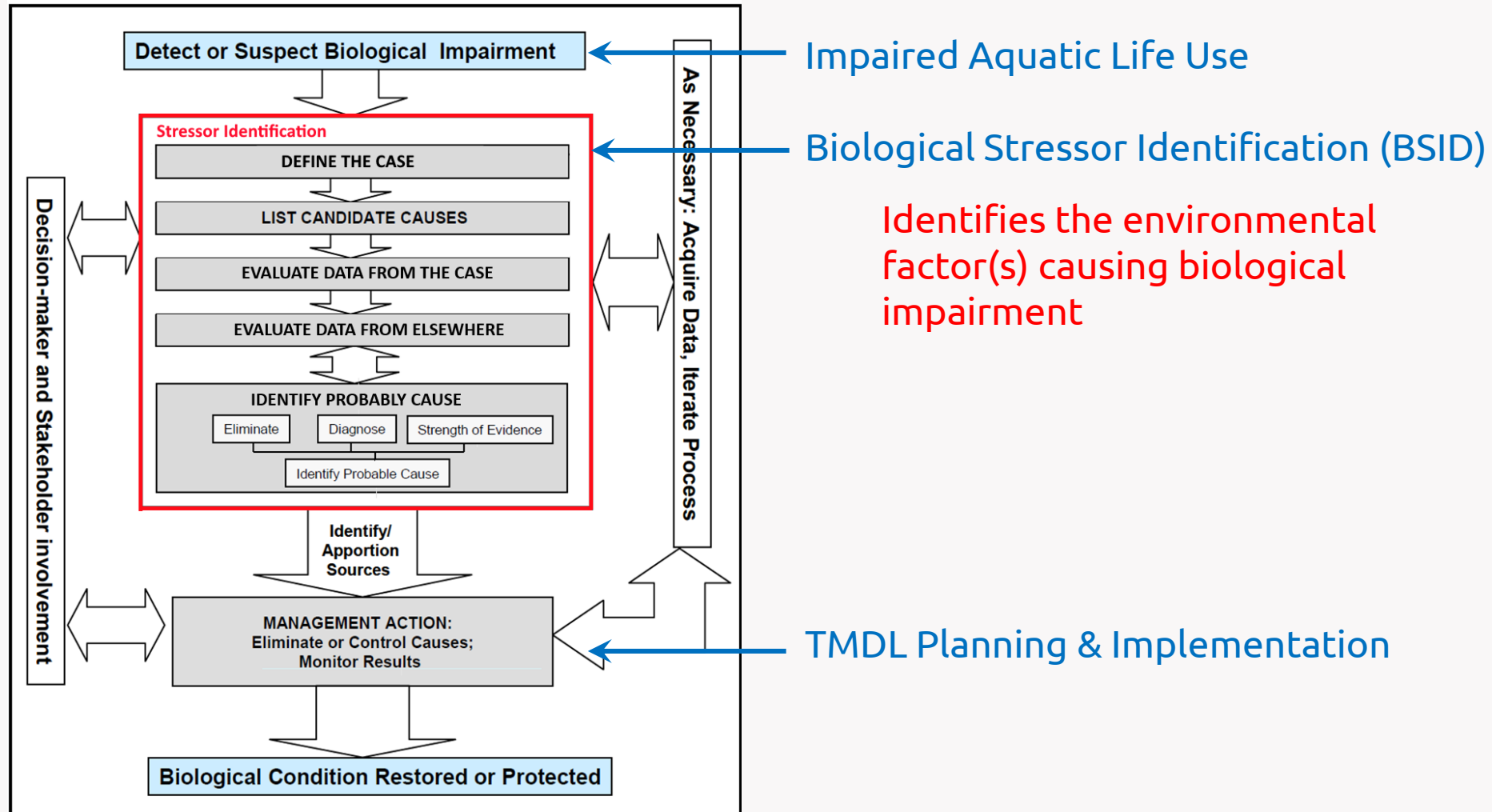
[Delaware](#)

[Virginia](#)

Chesapeake Bay states have or are developing individual BSID methods that parallel to varying degrees the EPA's **CADDIS** approach to BSIDs



EPA's Causal Analysis/Diagnosis Decision Information System (CADDIS)



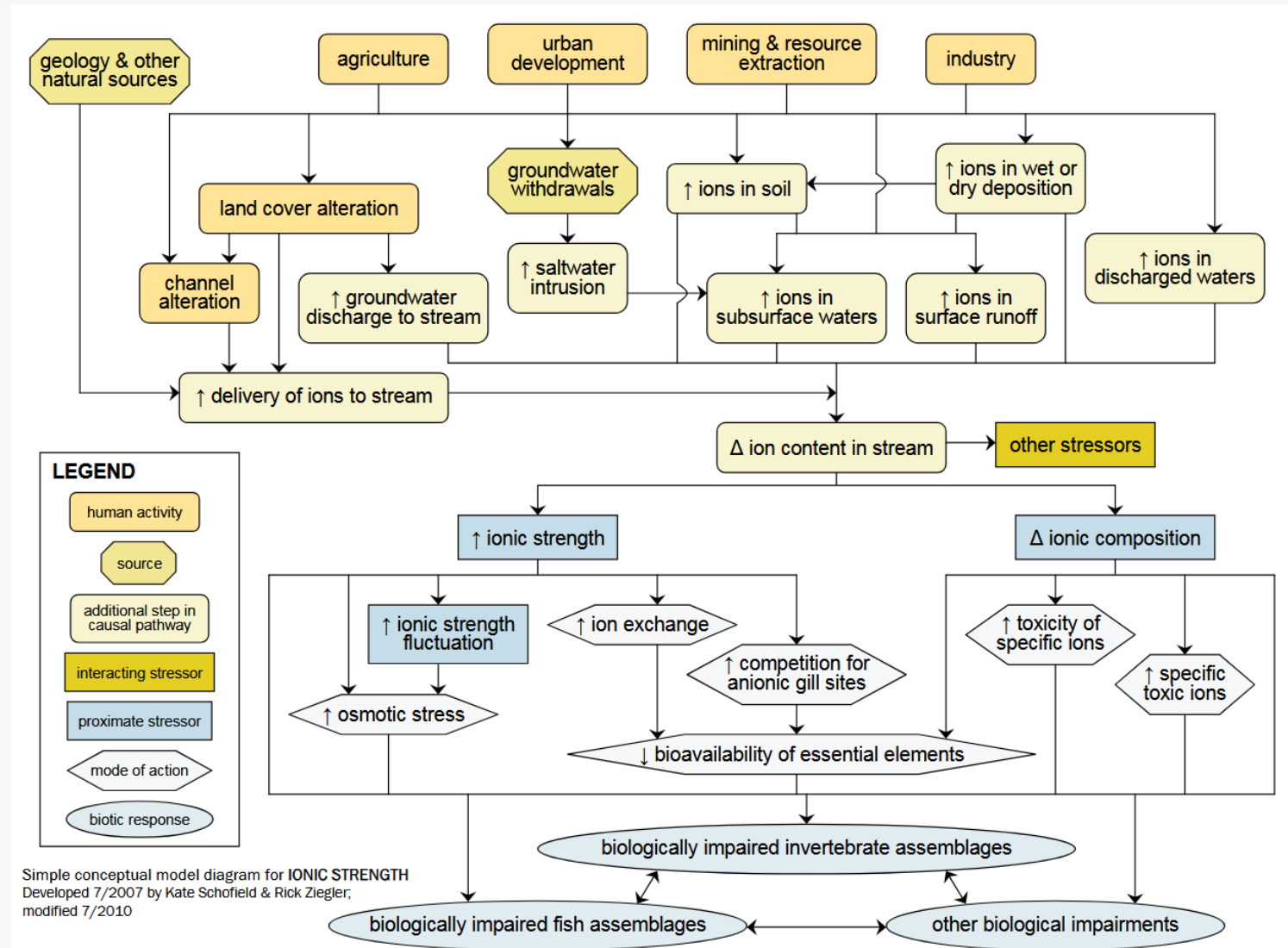
<https://www.epa.gov/caddis>

Example: EPA Conceptual Diagram for Ionic Strength

Pollution sources and causal pathways

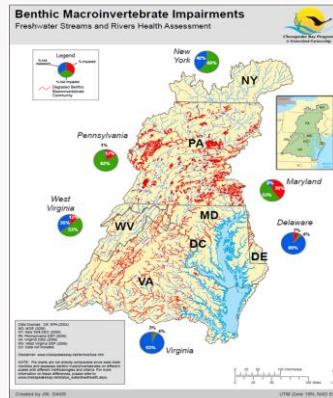
Stressors and their mode of action

Biological impairment



“...Improve Stream Health and Function...” (Stream Health Outcome)

“State Biological (ALU)
Assessments are
Not Comparable”
Non-Tidal Stream Workgroup, 2008



Different Stressor ID Thresholds
used to Identify Candidate
Stressors, Evaluate/Rank Stressors

Needed Interstate Coordination
for Stream Restoration
Planning and Permitting

..prompted...

Chessie BIBI Indicator
2008, 2011, 2017, 2022 reports

Chesapeake BSID?

Restoration Workshops
2004, 2014, 2023
Permitting Surveys
2015, 2023

Ongoing Efforts to ID Stressors Watershed-Wide

USGS & GIT-Funded Projects

- Phase 1: most significant **stressors** impacting stream health in Chesapeake watershed ([Fanelli et al. 2022](#))
- Phase 2: management actions to reduce impacts of **stressors** (Center for Watershed Protection [Report](#))
- Phase 3: select suite of non-biological **metrics** (flow, sedimentation, water quality, etc.) that complement Chessie BIBI
 - 3A Identify potential stream **geometry and flow** metrics; desktop Hydromorphology Assessment Tool (Tetra Tech and EPR [Report](#))
 - 3B Identify potential stream **water quality** metrics (ongoing)
 - 3C In-depth analysis of selected metrics; communication materials (future project)

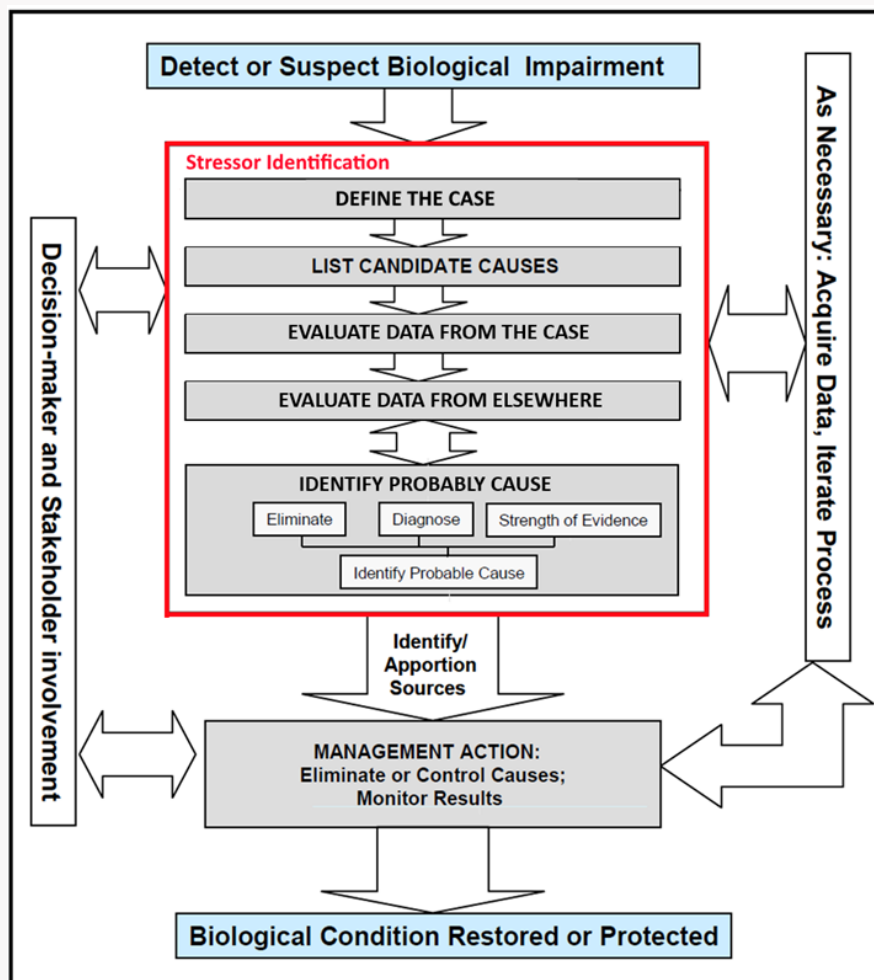


USGS Chesapeake-Focused Studies

- [Stressor-driven changes in freshwater biological indicators inform spatial management strategies using expert knowledge, observational data, and hierarchical models](#) (Emmons et al, 2025)
- [Physical habitat is more than a sediment issue: A multi-dimensional habitat assessment indicates new approaches for river management](#) (Cashman et al., 2024)
- [Linking altered flow regimes to biological condition: an example using benthic macroinvertebrates in small streams of the Chesapeake Bay watershed](#) (Maloney et al., 2021)
- [Disentangling the potential effects of land-use and climate change on stream conditions](#) (Maloney et al., 2019)
- [Predicting biological conditions for small headwater streams in the Chesapeake Bay watershed](#) (Maloney et al., 2018)

SHWG Efforts Could Line Up with a CADDIS Approach

CADDIS Approach



SHWG Efforts To-Date

→ Chessie BIBI

→ GIT Projects/USGS studies
- Available data & GIS layers,
non-biological metrics,
candidate causes/sources

→ **MISSING STEPS**

→ State Coordination,
CBP Restoration Planning
& Targeting

PROPOSAL

Use CADDIS or CADDIS-Like Approach to Complete a Chesapeake Watershed-Wide BSID

- Identify state BSID methods that can be expanded to a Chesapeake watershed scale and inform CBP restoration efforts
- Agree on consistent (ecoregion-specific?) screening thresholds for stream water quality and habitat parameters
- Develop a stressor identification and evaluation process to rank stressors at degraded streams across the Chesapeake watershed

CBP Uses:

- Report progress in reducing stressors of stream biology
- Better target and inform diverse restoration efforts
- Better integrate with other CBP GIT restoration efforts (e.g., fish passage, riparian buffer, watershed LULC)

State Uses:

- Additional BSID information & resources
- Coordinate TMDL development & implementation in interstate waters

SHWG Phase 1
Fanelli et al. (2022)

“EPA’s **CADDIS** could be a good starting point for unifying key terms and conceptual frameworks for stressor identification and could reduce the likelihood of attributing biological impairment to a proxy or co-occurring stressor.”



Please provide an overview of your jurisdiction's BSID procedures.

How does your state BSID compare to the CADDIS approach?

Are there components of your BSID that could potentially be used
for a Chesapeake-wide BSID?