Natural Processes

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Natural Processes

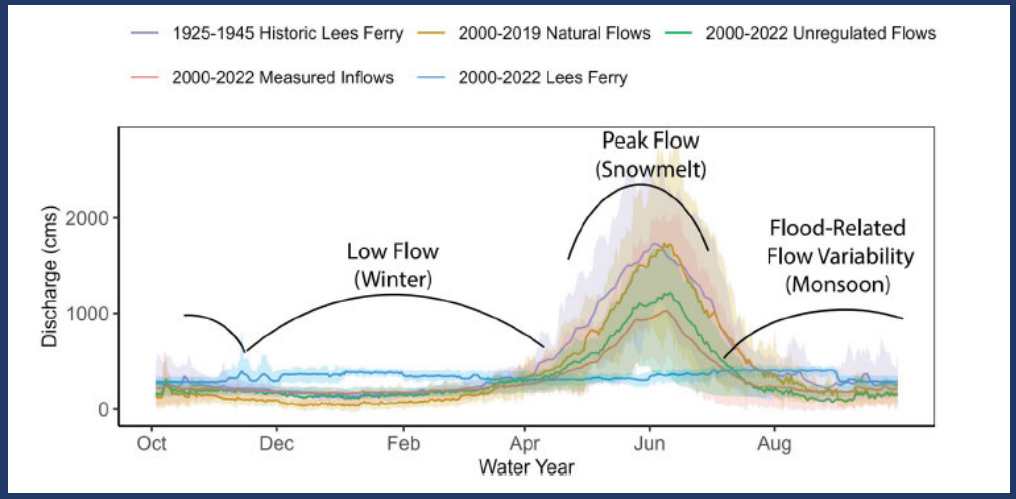
Restore, to the extent practicable, ecological patterns and processes within their range of natural variability, including the natural abundance, diversity, and genetic and ecological integrity of the plant and animal species native to those ecosystems.

Here, we focus on elements of these natural processes that

1) are primary drivers of ecological patterns in the CRe or are indicators of biological response to primary drivers
2) are influenced by management actions
3) are not already included in other LTEMP goals.

2.1 Deviation from Natural Flow
2.2 Subdaily Stage Fluctuation
2.3 Springtime Primary Production in Marble and Grand Canyon
2.4 Percent Mayflies, Stoneflies, & Caddisflies (EPT) in Light Traps

Metric 2.1- Deviation from Natural Flow

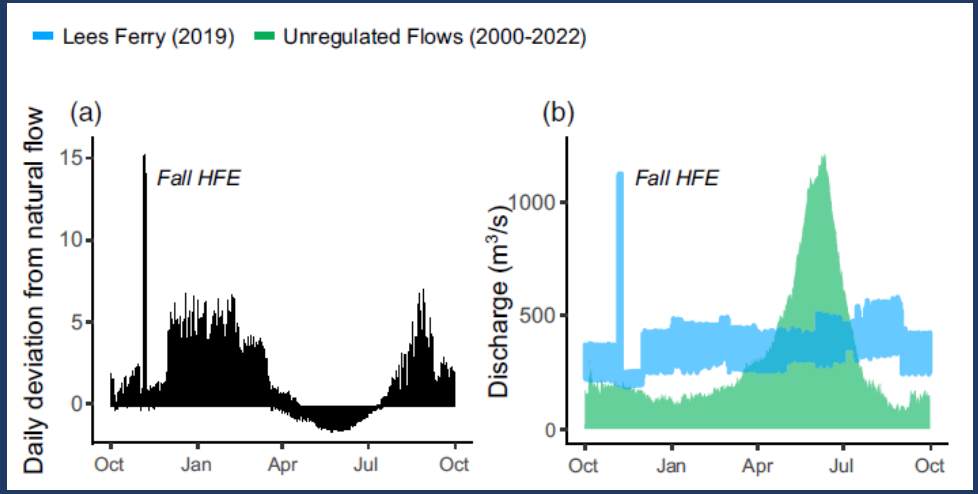


Palmquist, Deemer et al. 2024 River Research & Applications

Flow metric is calculated like a z-score, quantifying standard deviations from the natural unregulated flow baseline.

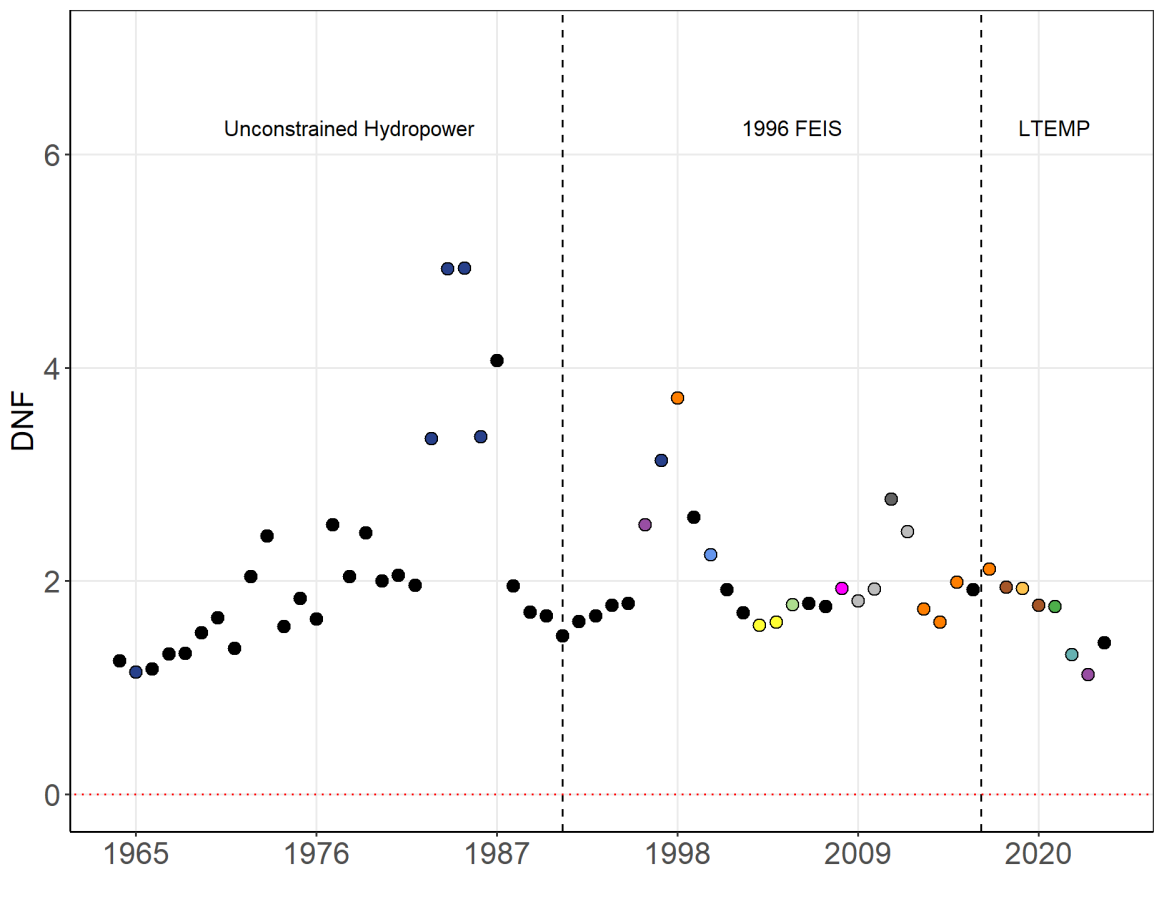
A value >2 would only occur naturally about 5% of the time.

Functional flow submetrics identify seasons with greater or less deviation.



Adapted from Palmquist, Deemer et al. 2024 River Research & Applications

Metric 2.1- Deviation from Natural Flow



Preliminary Information- Subject to Revision. Not for Citation or Distribution

In 2024:

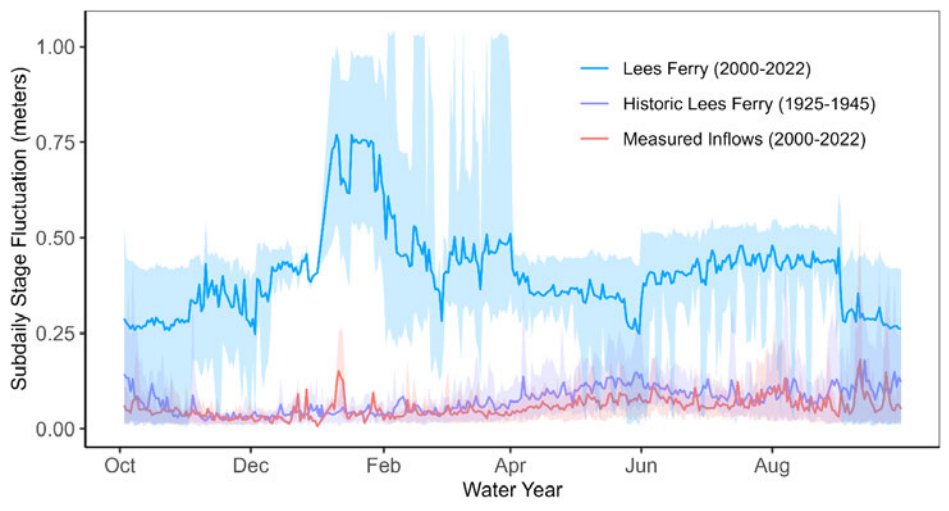
DNF metric was 1.43, which represents the third lowest DNF metric score of the LTEMP period.

Spring peak flow submetric was -1.74

Monsoon submetric was 1.48

Low flow submetric was 2.12

Metric 2.2- Subdaily Stage Fluctuation



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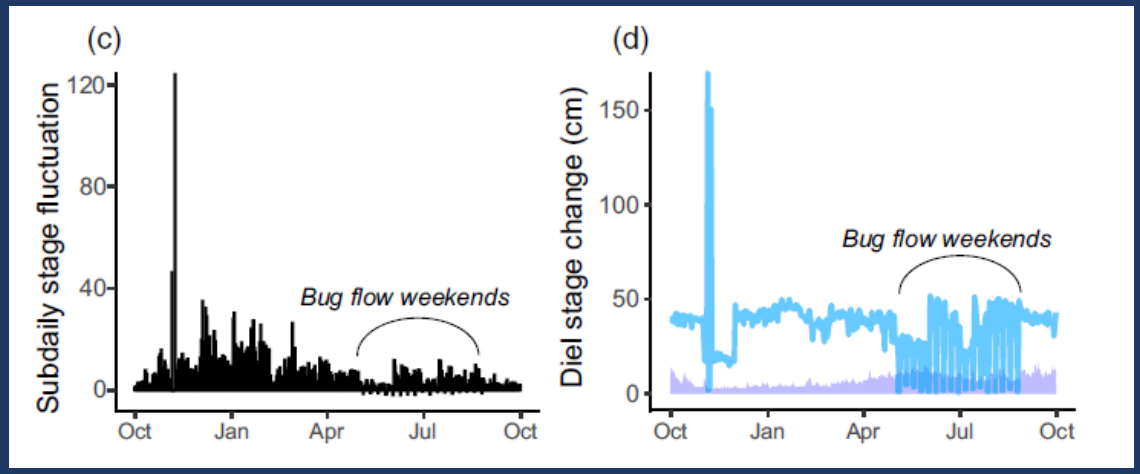
Similar z-score approach for the subdaily stage fluctuation metric, but this time historic fluctuations at Lees Ferry are used as a baseline.

Photo Credit: Matt Kaplinski



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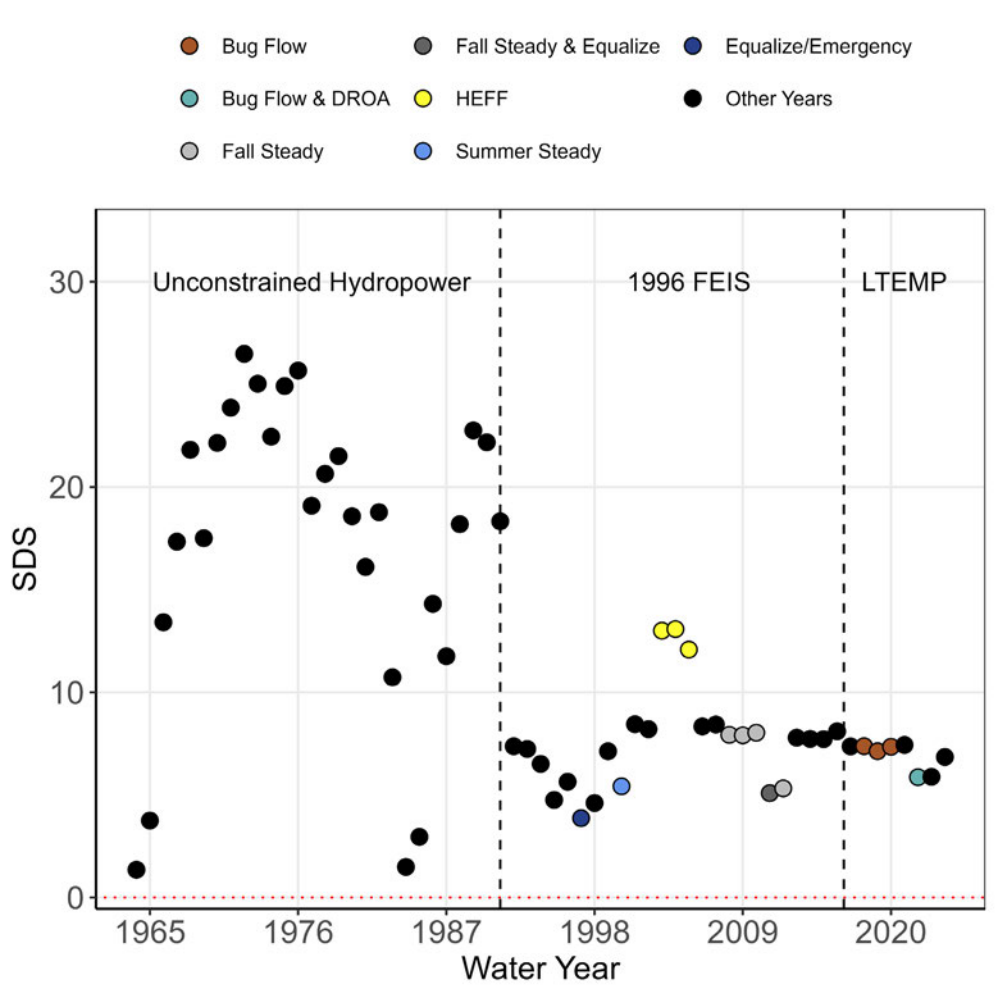
Metric 2.2- Subdaily Stage Fluctuation



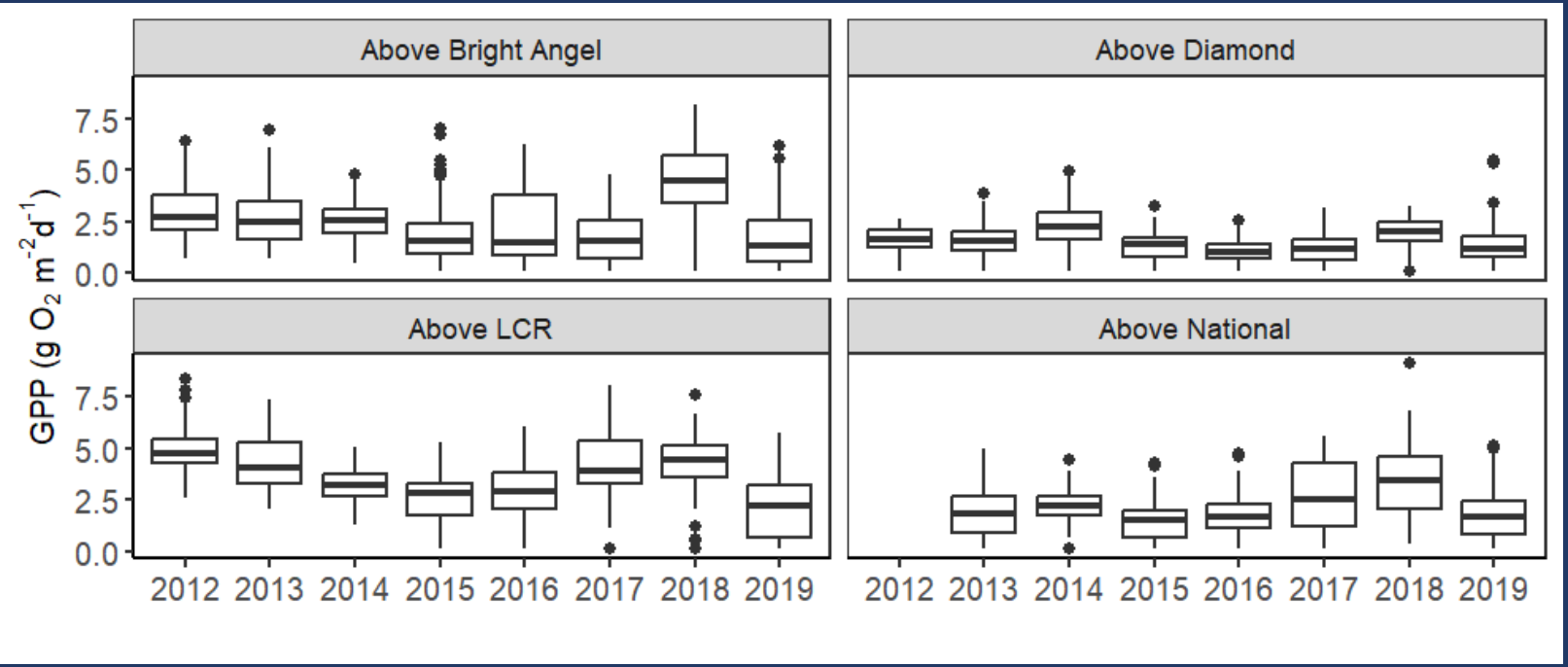
In 2024:

The SDS metric was 6.85, falling in the lower 25% of the historic distribution.

Consistent with previous years, the SDS metric was the highest (i.e., >6 standard deviations from natural condition) of any of the flow metrics that were analyzed.

Metric 2.3- Springtime Primary Production in Marble and Grand Canyon

- Gross primary production (GPP) is a proxy for aquatic food availability
- Developing a versioned data release for GPP estimates



Data from: Deemer et al. 2022 ScienceBase Data Release: https://doi.org/10.5066/P9ZS6YLV

Metric 2.4- Percent EPT

Describes ability of a river to support aquatic life

<u>In 2024:</u>
EPT metric was highest in the 13-yr record.

Driven by low midges and relatively high caddisflies

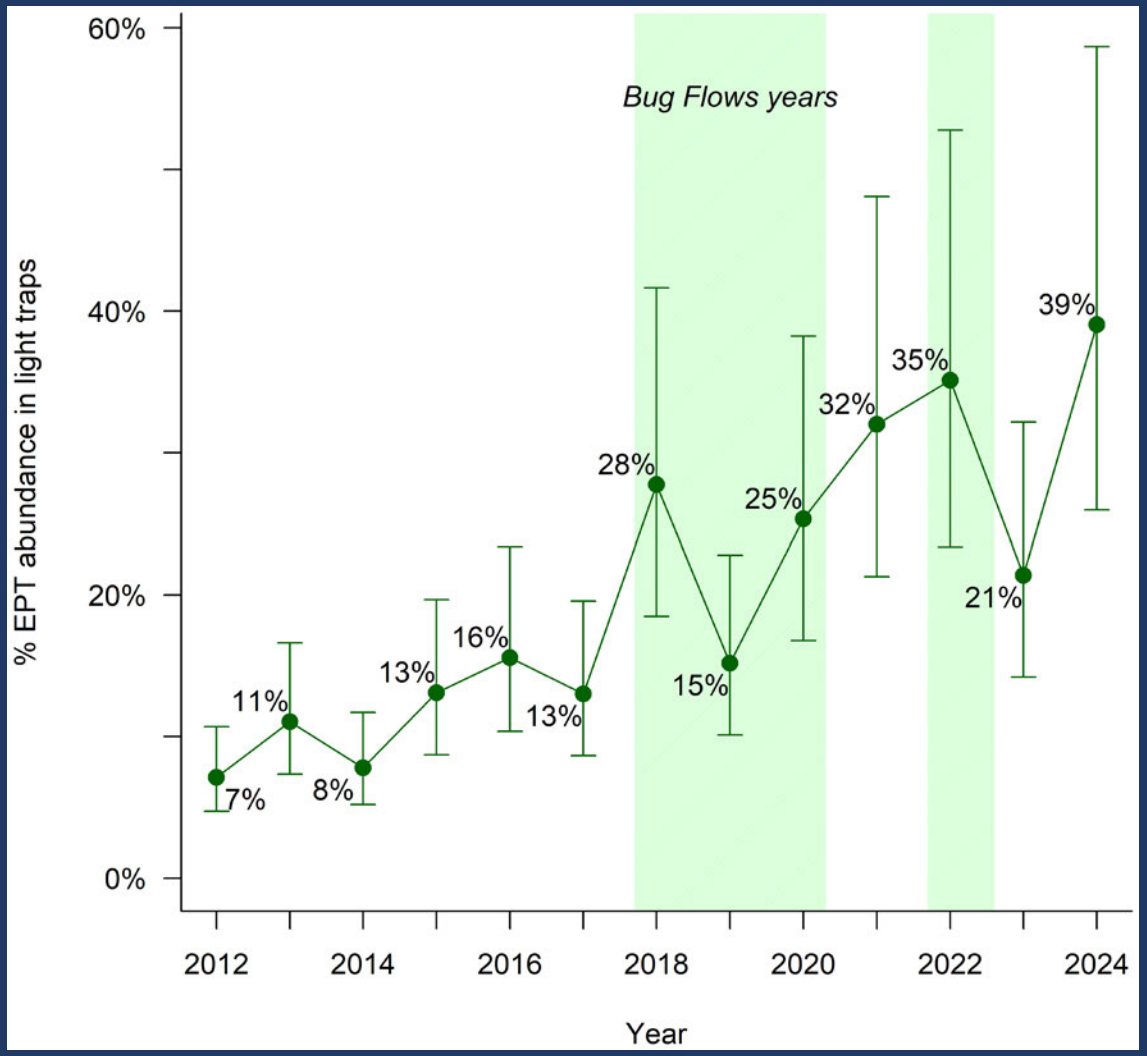



Photo credit: E. Palmquist

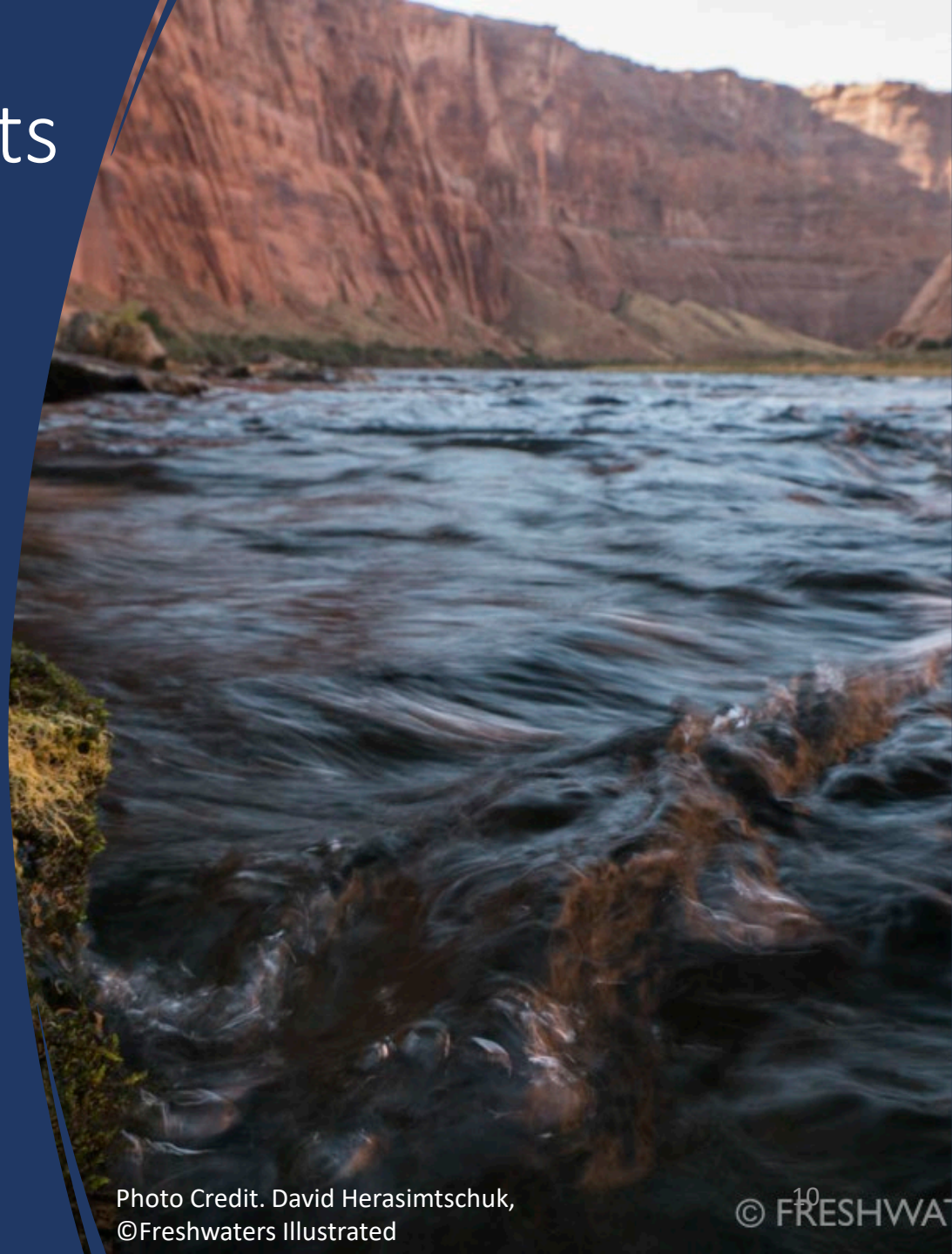
Caveats & Next Steps...

- Choosing metrics is inherently value laden given they correspond to a human-defined management goal
- For example, opinions on how human activities are (or are not) considered as part of natural processes guide the way metrics are defined here.
- Some unresolved ideas pertaining to natural processes include
  - Measuring human impacts on terrestrial landscape processes
  - Alternate measures of ecosystem productivity (e.g., related to land-based carbon inputs)
  - Including (or not) a water temperature metric

USGS science for a changing world

Acknowledgements

- Lindsay Hansen for GPP Estimation
- Joel Unema for help with Lees Ferry rating curve
- Lucas Bair, Paul Grams, Helen Fairley, Joel Sankey, Charles Yackulic: co-authors on natural flow metrics paper
- Funding from the GCDAMP



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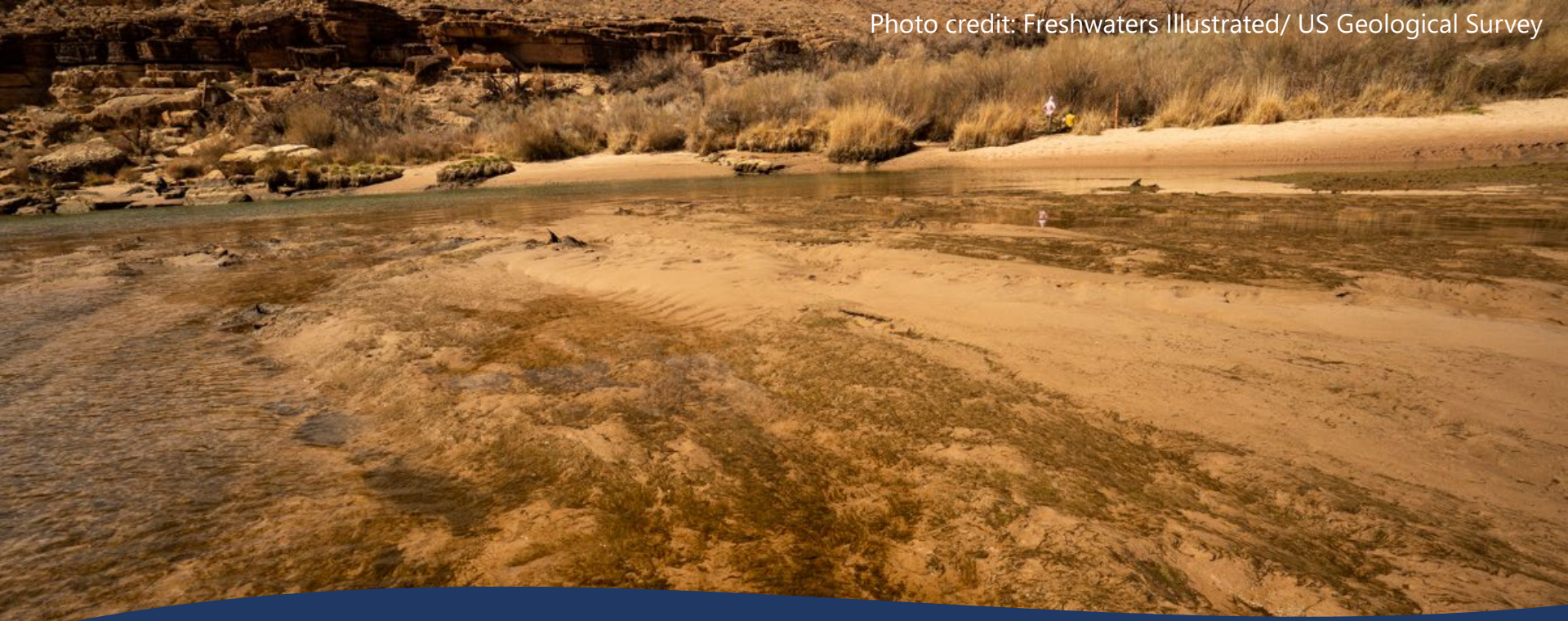
Photo credit: Freshwaters Illustrated/ US Geological Survey

Questions?

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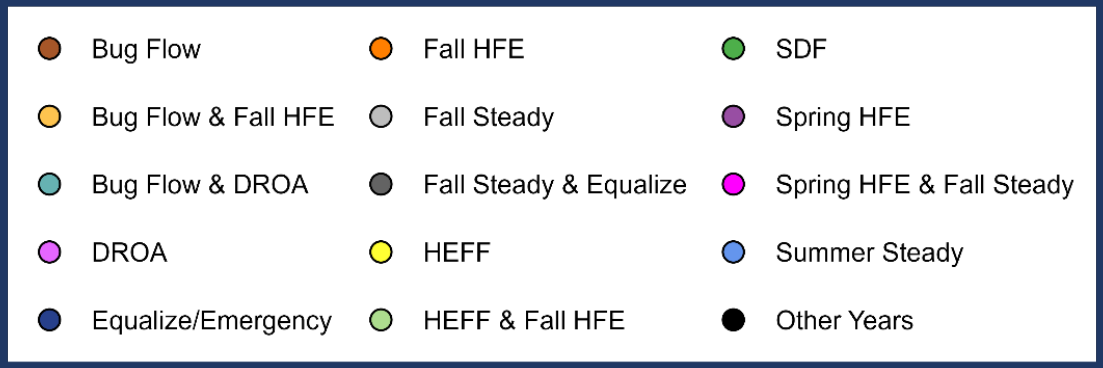
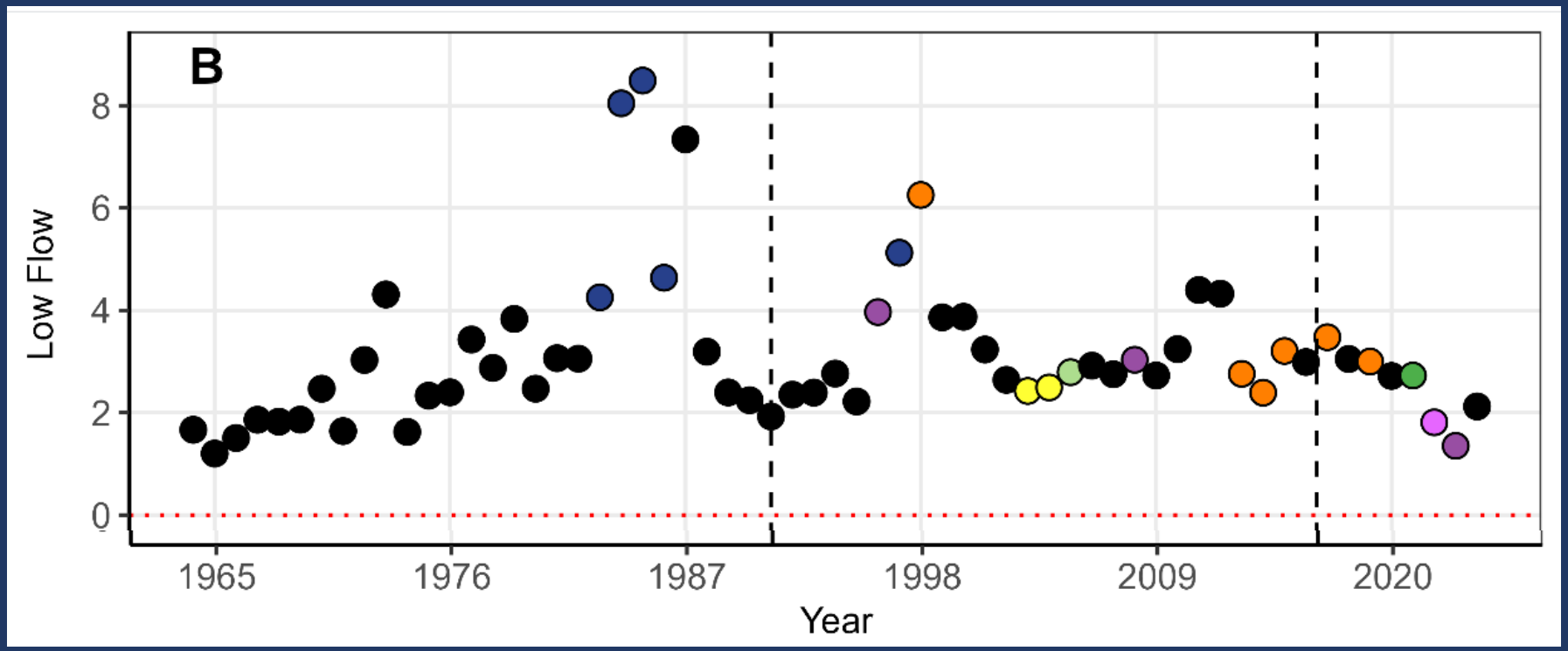
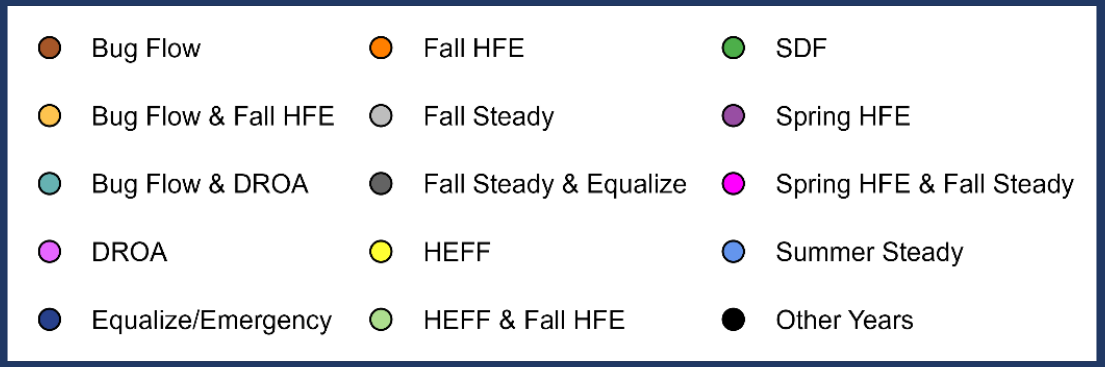
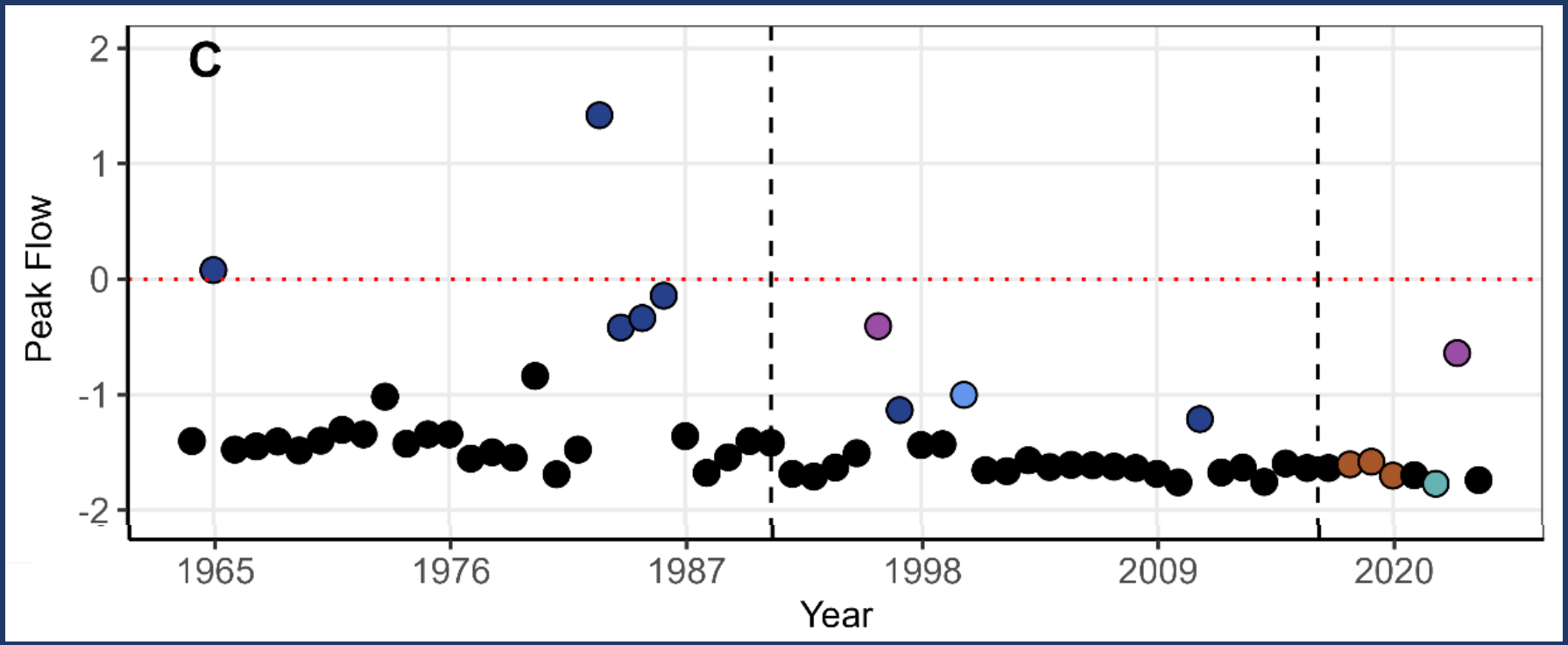
Low Flow Metric



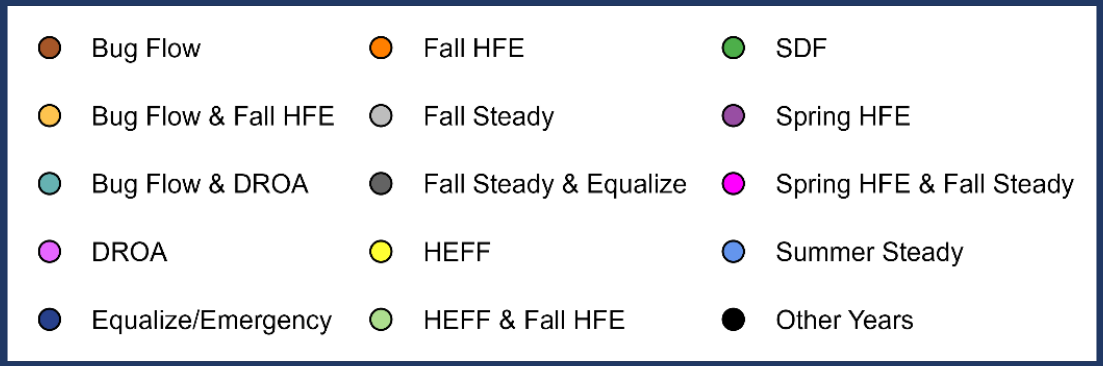


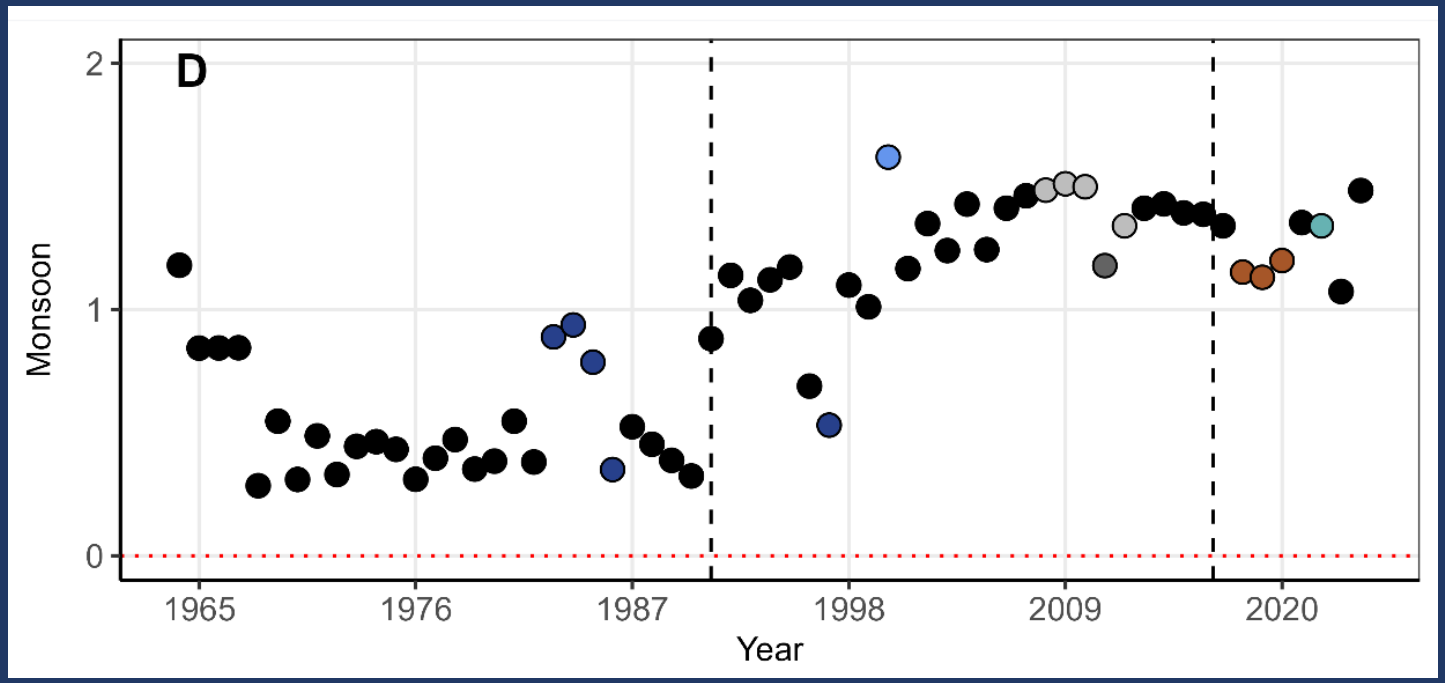
Peak Flow Metric



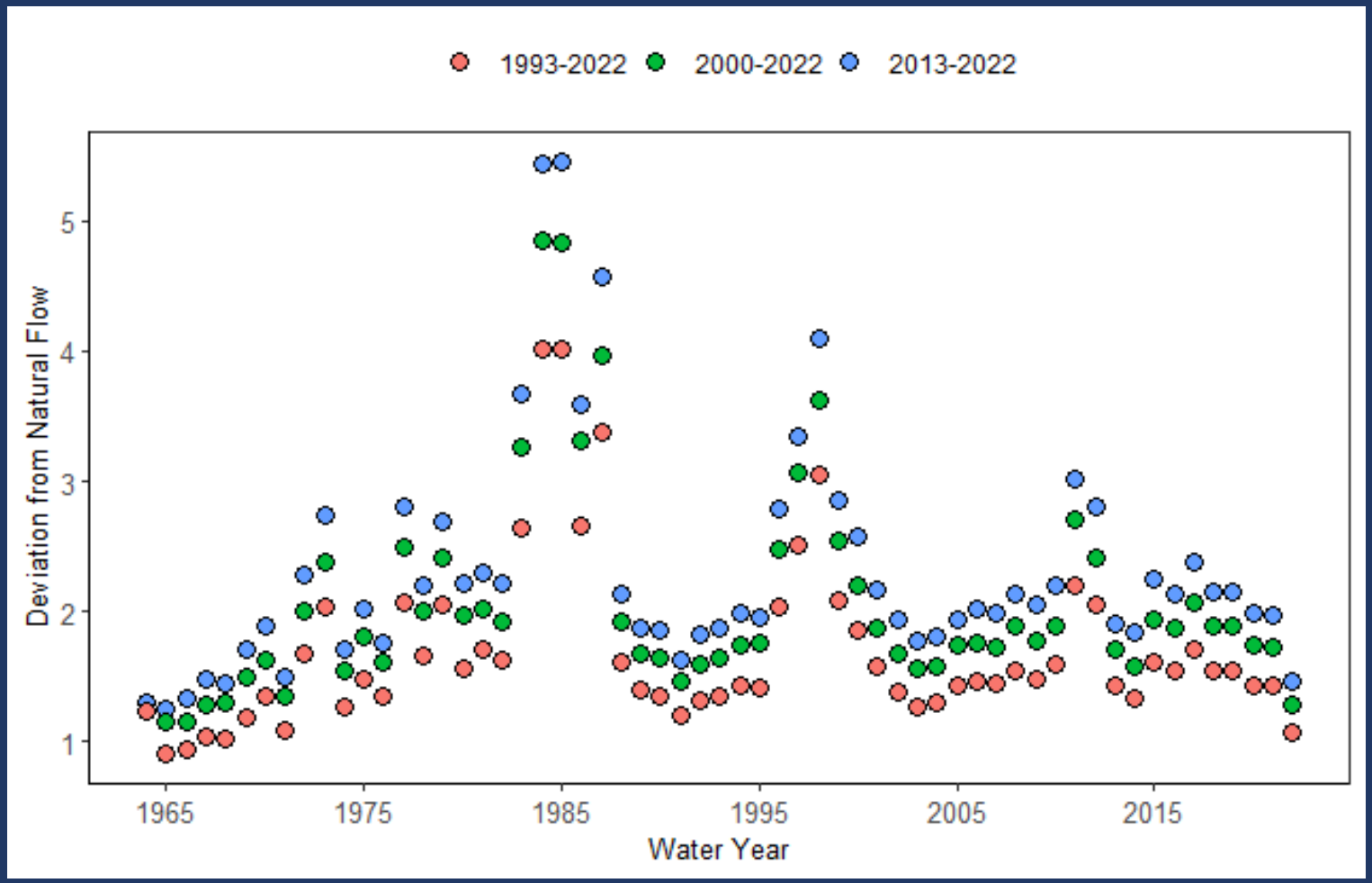


Monsoon Variability Metric





Different baseline lengths give similar results



Different baseline sources give similar results