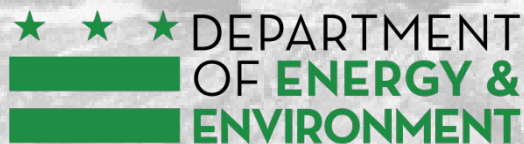


# Metrics for Success: Pre- & Post-Restoration Monitoring for Urban Streams

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Presented By  
Matt English



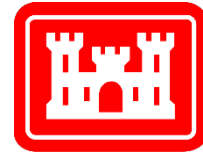
GOVERNMENT OF THE  
DISTRICT OF COLUMBIA  
MURIEL BOWSER, MAYOR

TAG THIS PRESENTATION @DOEE\_DC

# Why Do We Monitor Restoration?

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1. Construction Activity Requirement
  - Army Corps Permits
  - State Water Quality Certification
  - Stream & Wetland Permits
2. Funding Partner Requirement
3. Regulatory Goal Requirement
  - Total Maximum Daily Load (TMDL)
  - MS4 Permit
4. To show other stakeholders it worked
  - Public
  - Scientific Community



**US Army Corps  
of Engineers®**



**Chesapeake Bay Program**  
*Science. Restoration. Partnership.*

# Where can we detect change?

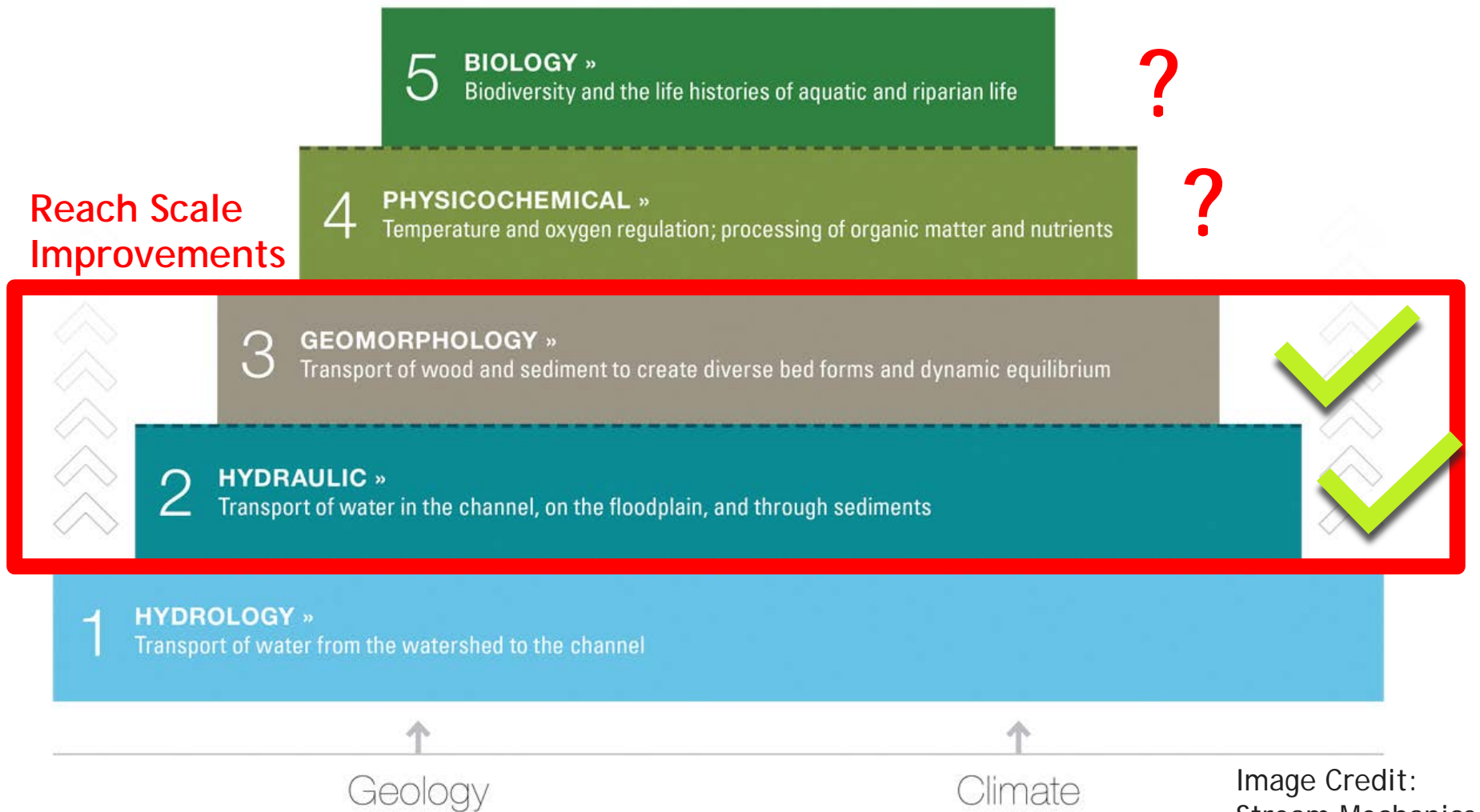


Image Credit:  
Stream Mechanics

# How can we detect change?

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**DISCLAIMER: I am not a researcher or statistician!**



Natural resource data has variability

Ideally sampling program is planned to detect to expected

- Sample Size Calculators not budgets

Not all sampling designs are equal

- |                                      |      |
|--------------------------------------|------|
| • Just After                         | OK   |
| • Before and After                   | Good |
| • Before After Control Impact (BACI) | Best |

Will my sampling design detect the change?

# Geomorphic/Physical Monitoring

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Direct change to system

Less variable = Fewer data required

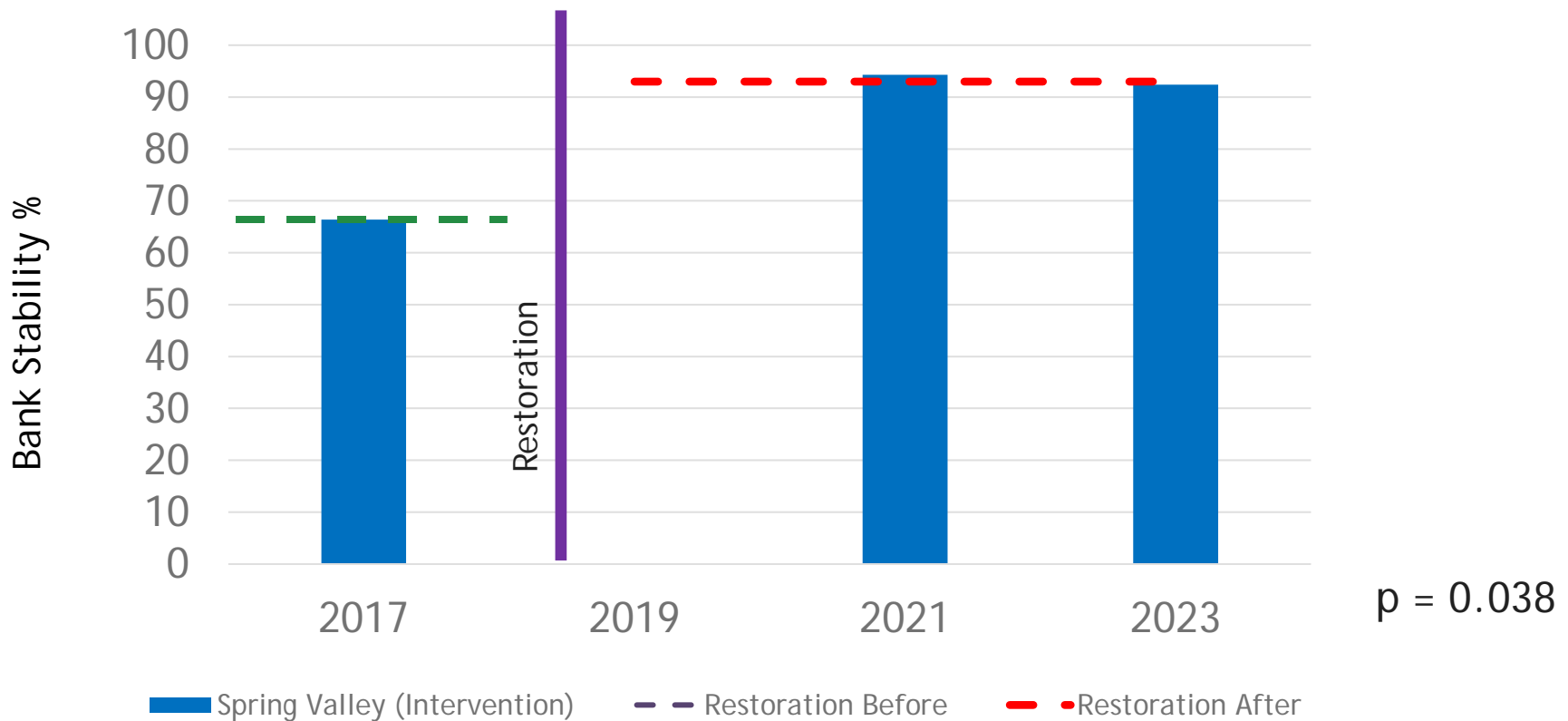
Example Parameters

1. Bank Stability
2. Bank Erosion
3. Bank Height

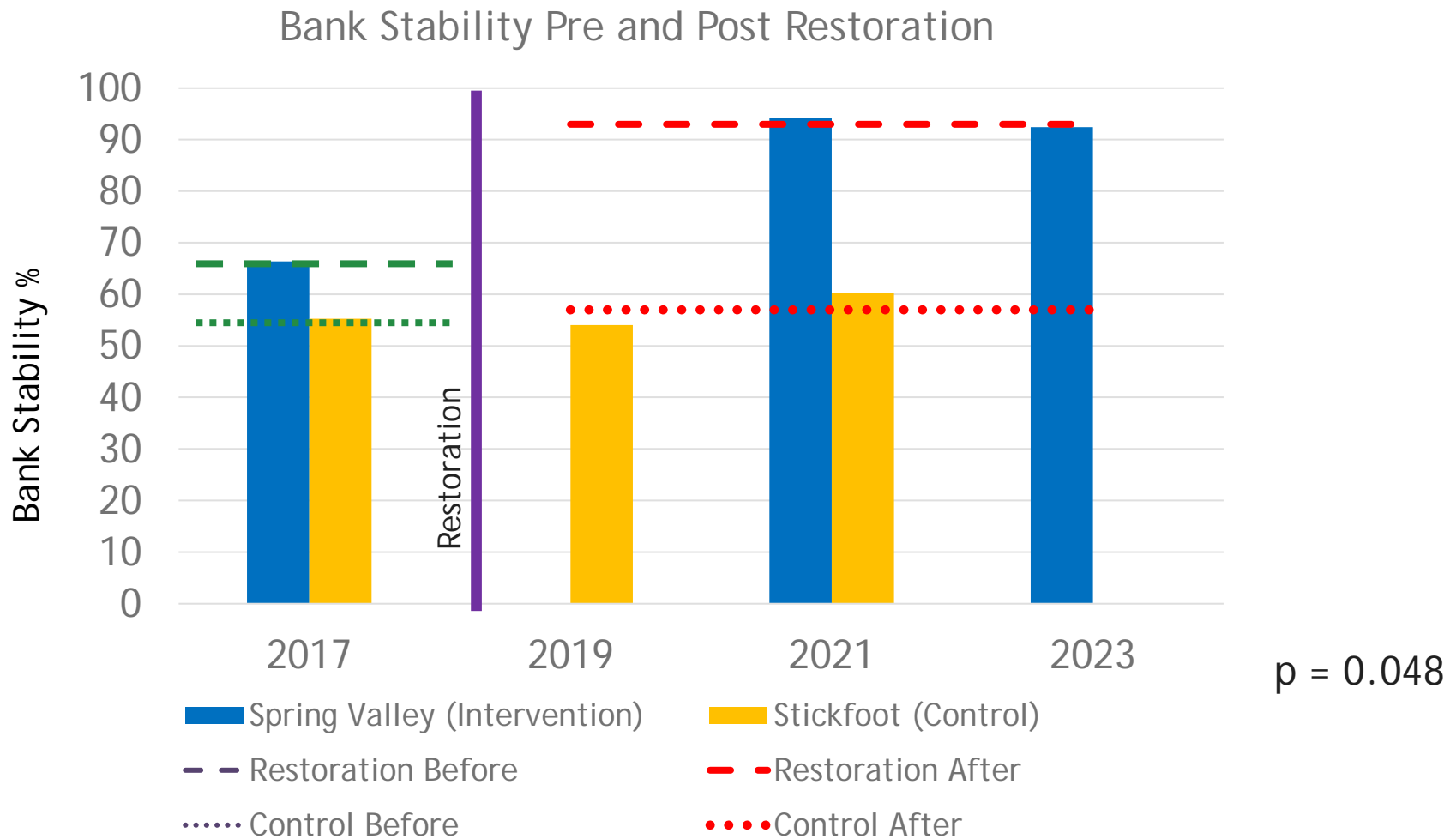


# Geomorphic/Physical Monitoring

## Bank Stability Pre and Post Restoration



# Geomorphic/Physical Monitoring



# Physiochemical Parameter Monitoring

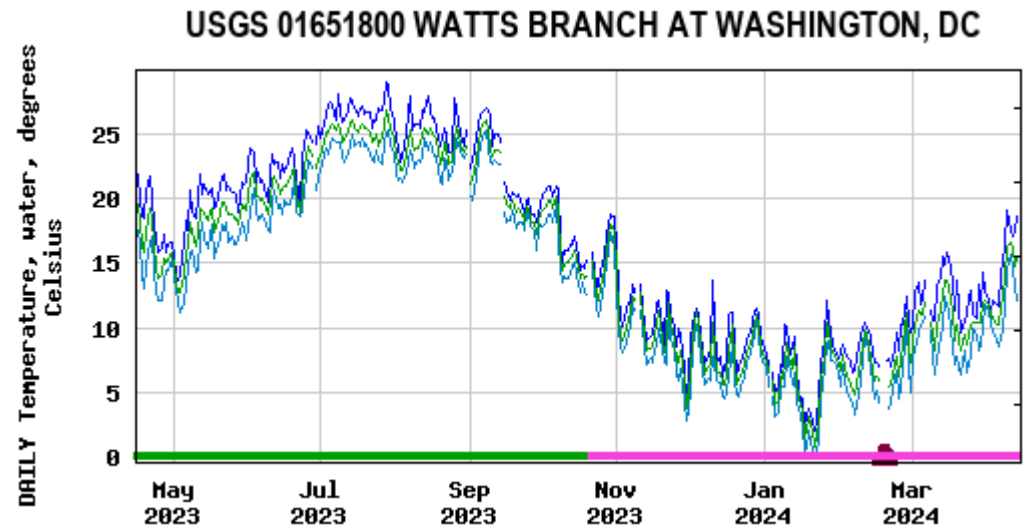
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Not a direct result from our work

More variability in data = More data required

## Example Parameters

1. DO
2. pH
3. Temperature
4. Nutrients
5. Turbidity/Sediment





# Physicochemical Parameter Monitoring

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Quarterly Sampling - Just using August Data  
15-minute Temperature Data (June through Sept)  
USGS Data as control

Temperature Data Type	Number of Data Points	P value	Change Detected?
Quarterly Sampling BACI	10	0.15	No
Monthly Mean BACI	35	0.12	No
Daily Mean BACI	1087	<0.0001	Yes!

Load data is often very far from true value until high-frequency

# Biological Community Monitoring

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## Concerns

Biology is at the TOP of the Pyramid

May still be limited by water quality

Biological communities are variable

IBIs are a complex aggregate indicator



## Suggestions:

Look at individual metrics - not aggregate

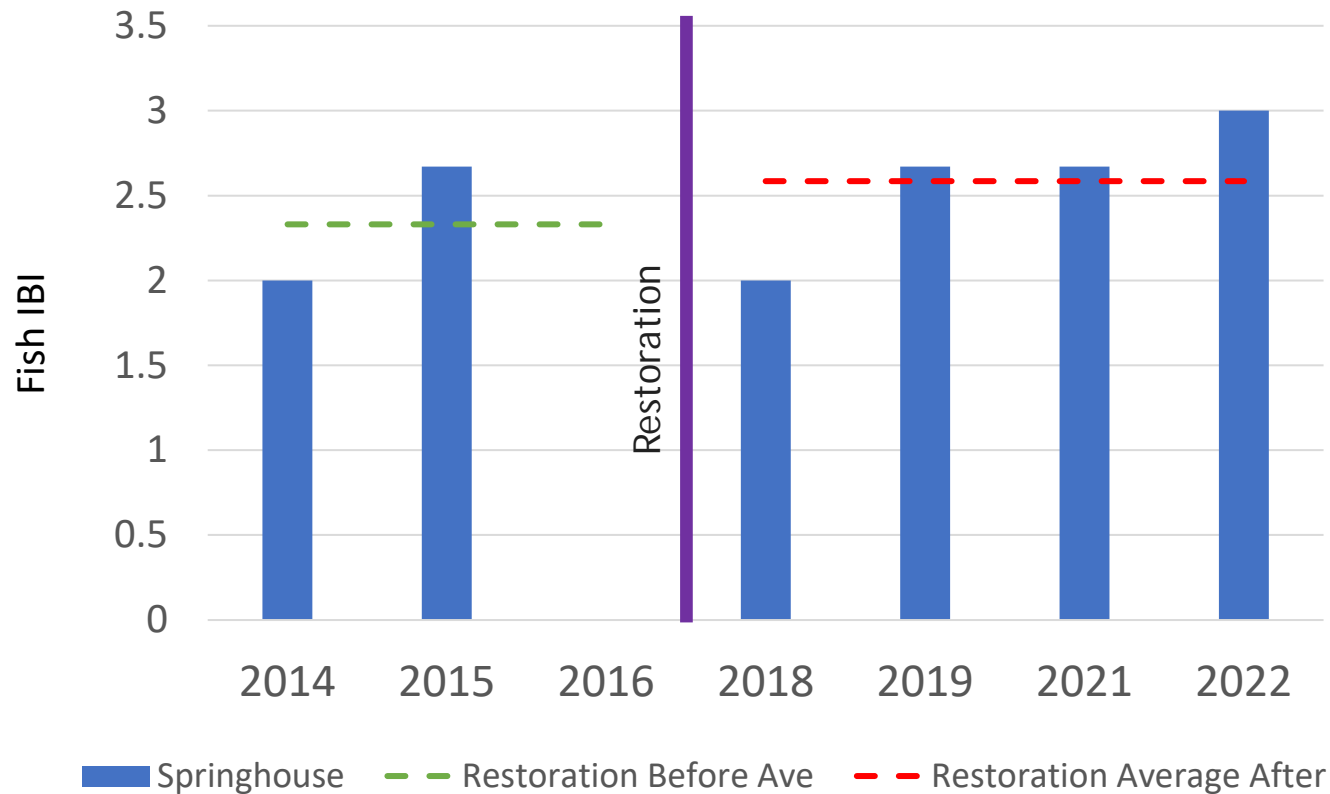
Choose the right communities

- Macroinvertebrates
- Fish
- Herpetofauna



# Biological Community Monitoring

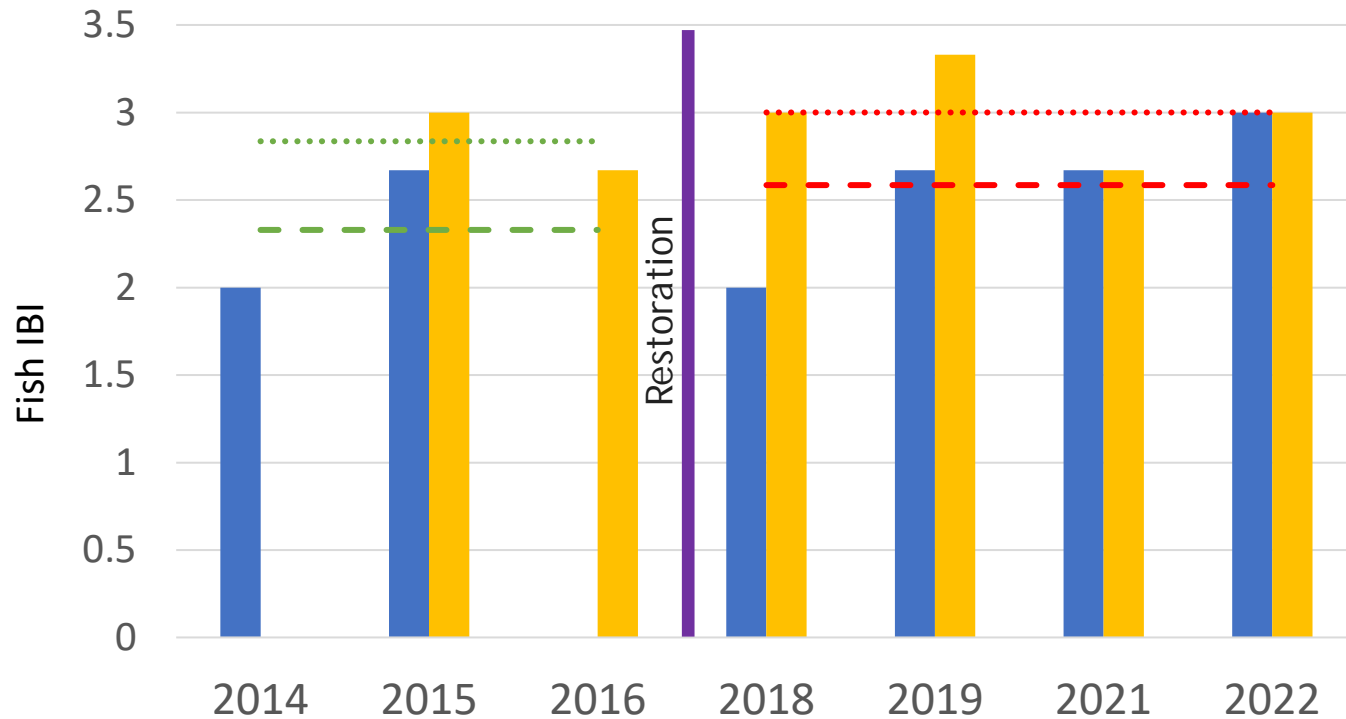
## Fish IBI for Pre and Post Restoration



$p = 0.54$

# Biological Community Monitoring

## Fish IBI for Restoration and Control Site



$p = 0.87$

Springhouse

Hickey Run

Restoration Before Ave

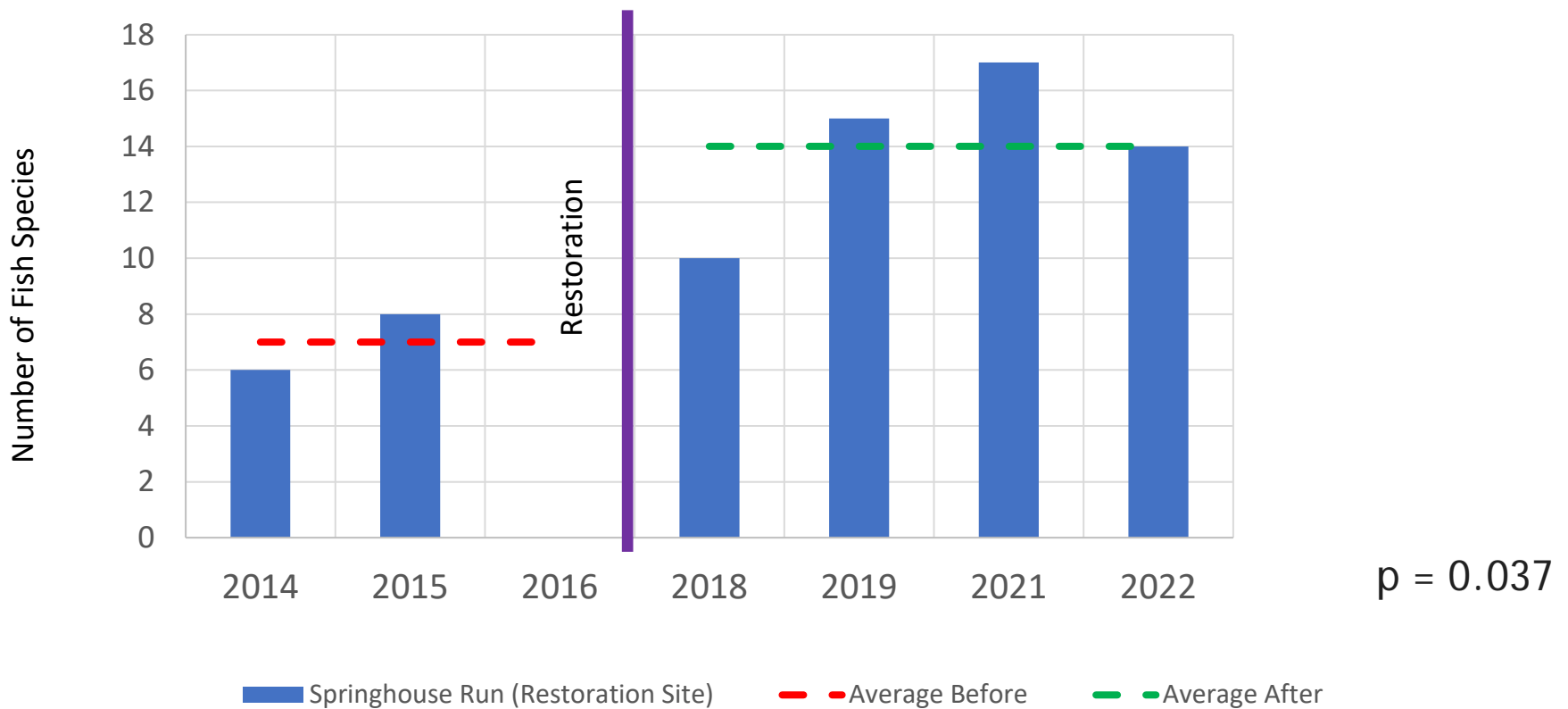
Restoration Average After

Control Average Before

Control Average After

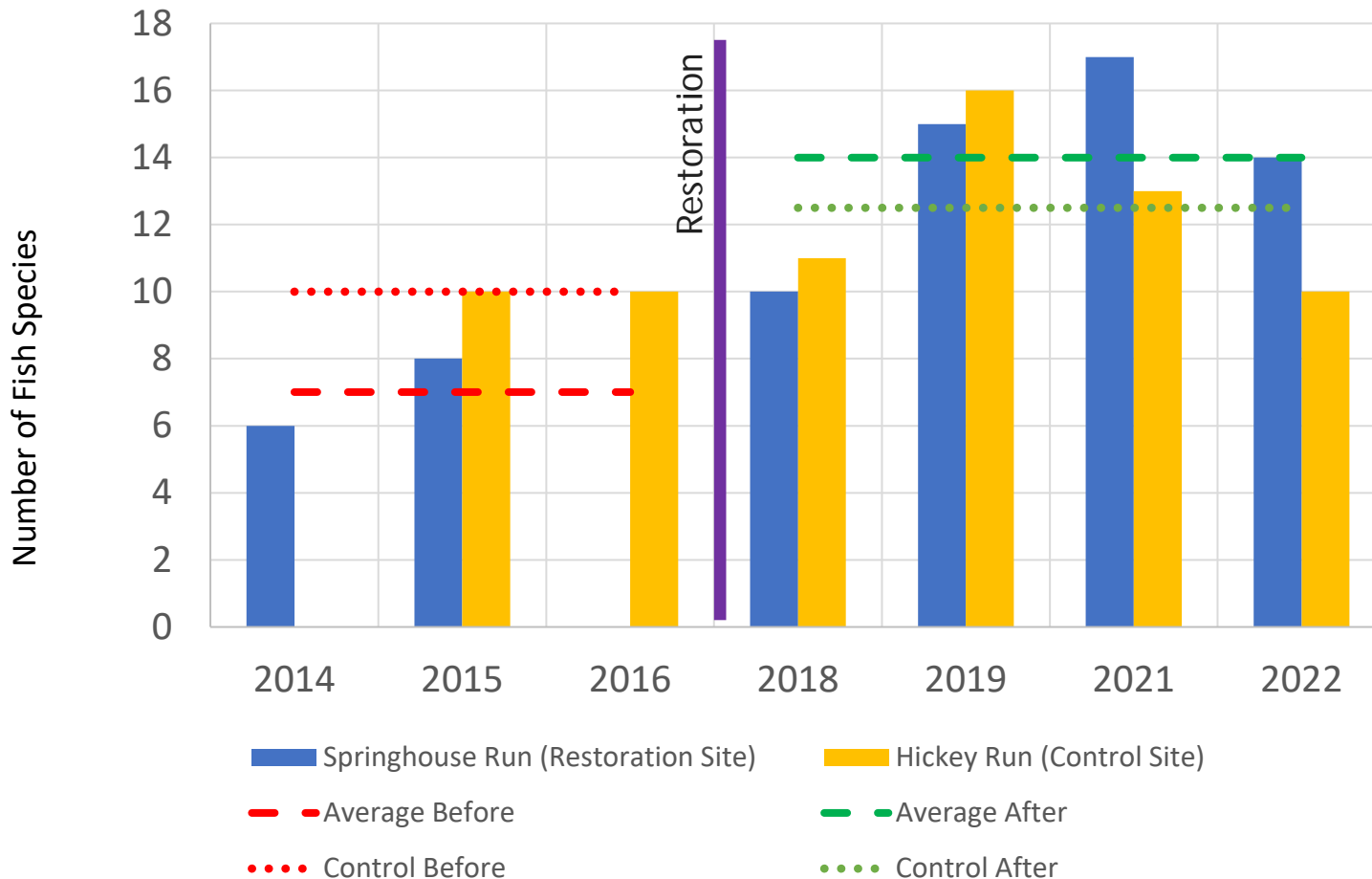
# Biological Community Monitoring

## Number of Fish Species Pre and Post Restoration



# Biological Community Monitoring

## Number of Fish Species Pre and Post Restoration



$p = 0.17$

# Improving Over Time

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1. Select the data for the story
  2. Be consistent over time
    - Sampling
    - Data storage
  3. Start monitoring early and keep going after required
  4. Target sampling frequency to detect change
  5. Establish Controls/Semi-controls
  6. Make friends with a researcher who works for free
- OR
- Set expectations with what you will be able to detect

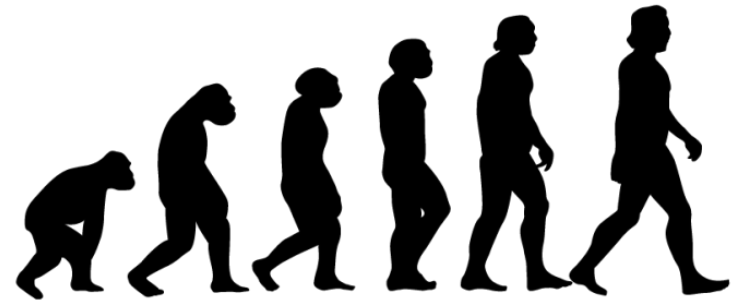


Image Credit: Washington University Of St. Louis

# Special Thanks

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Hannah Wauchope - The University of Edinburgh

Mark Southerland and Nancy Roth - Tetra Tech

Gerald Haywood and Josh Burch - DOEE

Phong Trieu and Aubin Maynard - MWCOG



# Questions?

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