DISENTANGLING METEOROLOGICAL, TERRESTRIAL, AND NEARSHORE AQUATIC DRIVERS OF BEACH WATER QUALITY BY COMBINING STATISTICAL AND PHYSICALLY-BASED MODELS

Eva L. Kramer[1,2], Alicia Ritzenthaler[1,2], Lauren M. Fry[1,2], Eric J. Anderson[2], Andrew D. Gronewold[2]

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Watershed Modeling, 2014 Water Microbiology Conference
May 7, 2014

Great Lakes RESTORATION

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CILER
Cooperative Institute for Limnology and Ecosystems Research
University of Michigan

GLERL
Great Lakes Environmental Research Laboratory

NOAA
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
U.S. DEPARTMENT OF COMMERCE

Outline

- Project Overview

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- Monitoring Results

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- Impact of Drivers

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- Conclusions

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- 3 focus areas:

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  - Harmful Algal Blooms (HABs)
  - Water Quality
  - Beach Water Quality

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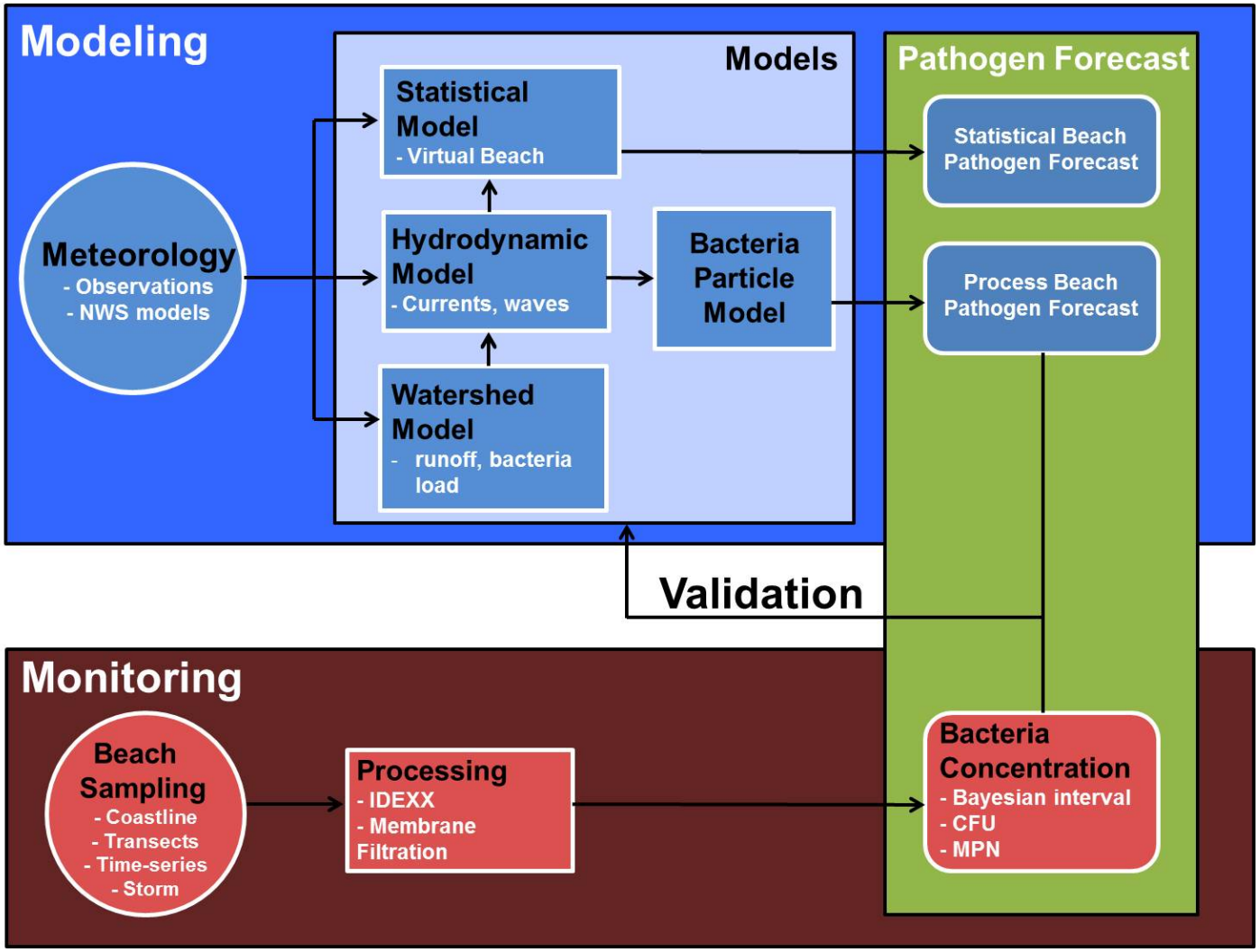

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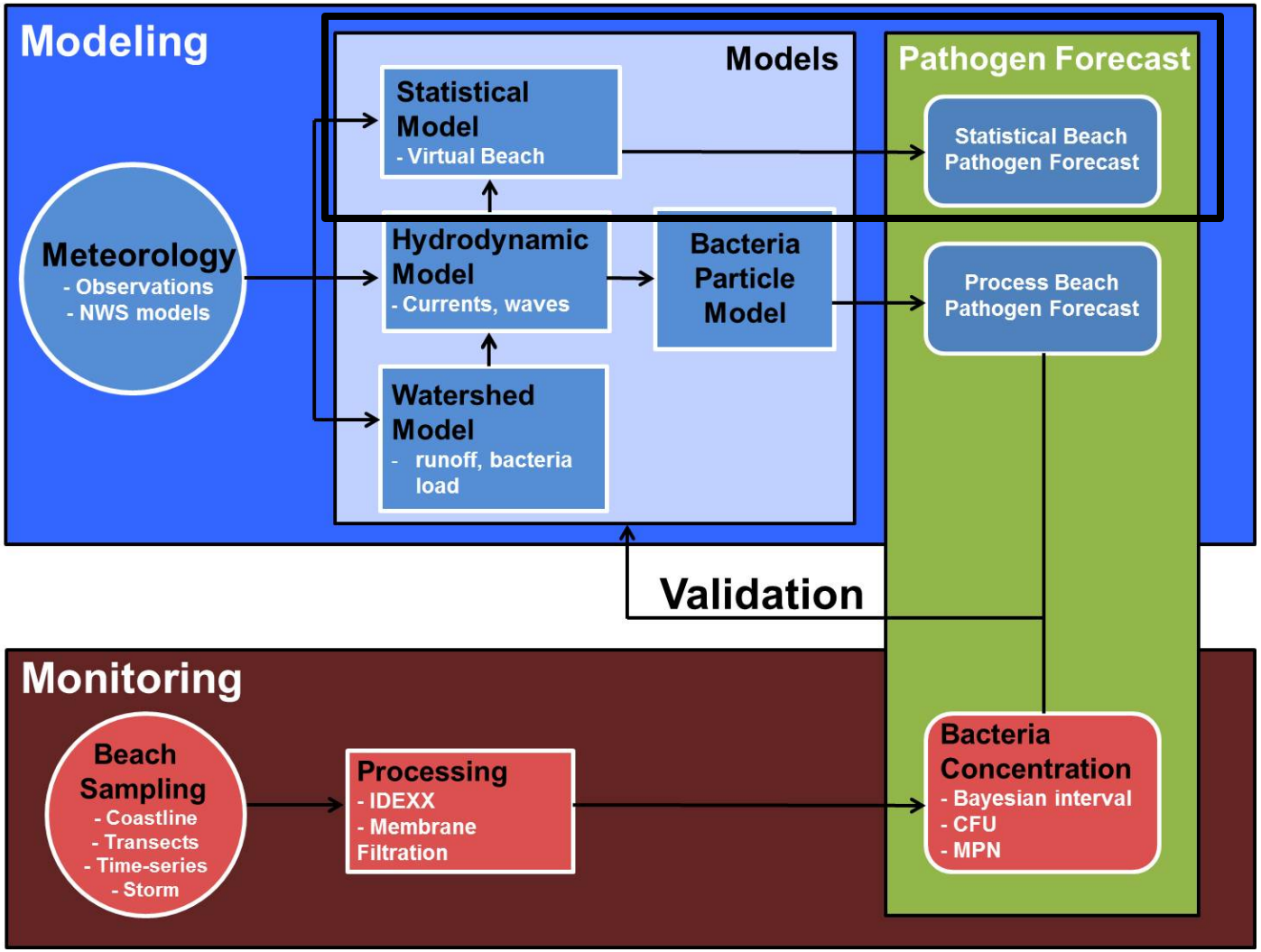

D. Rockwell *et al*, "Beach Water Quality Decision Support System", NOAA Tech. Memo. GLERL-156. 2013.

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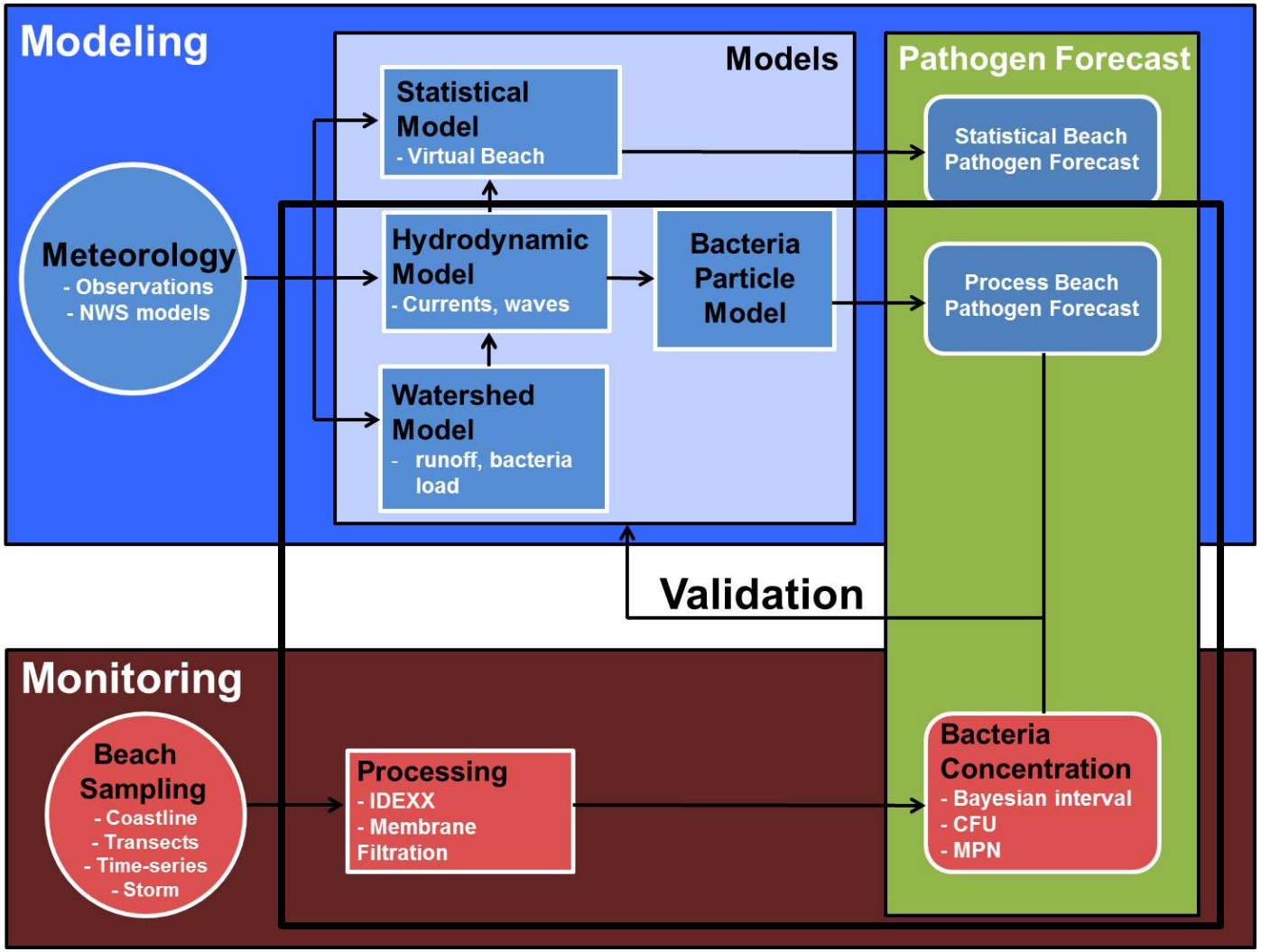

E. Anderson *et al*, "Real-time hydraulic and hydrodynamic model of the St. Clair River, Lake St. Clair, Detroit River system". 2010.

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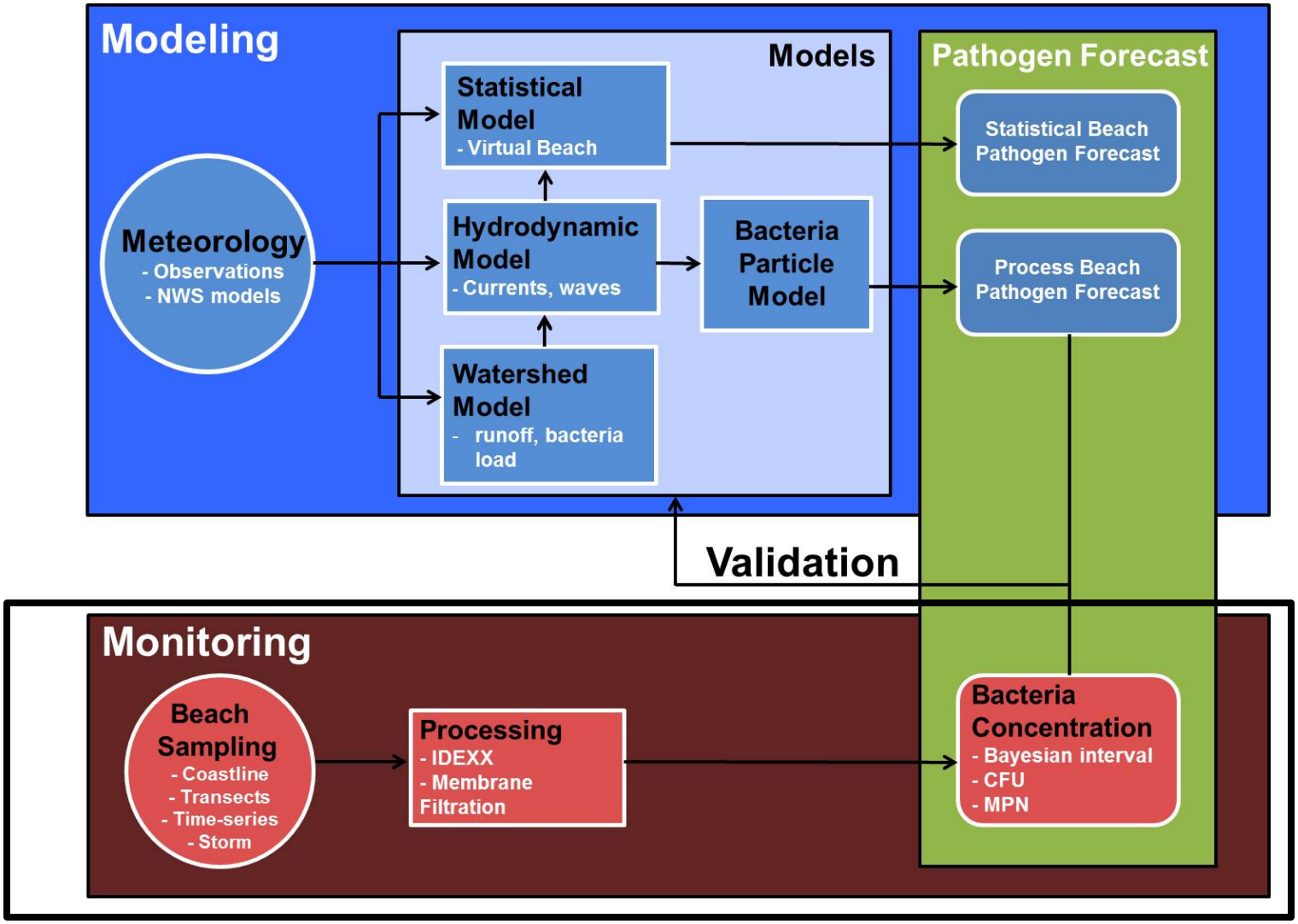

Project Goals

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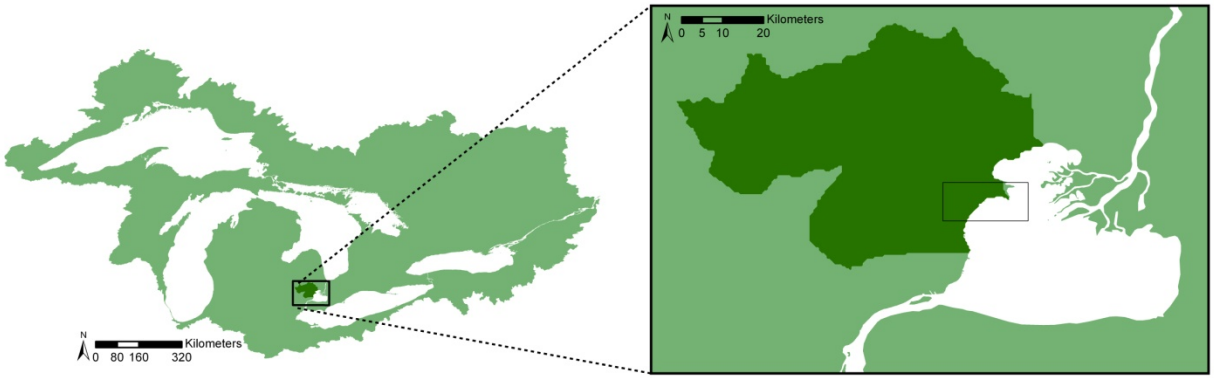
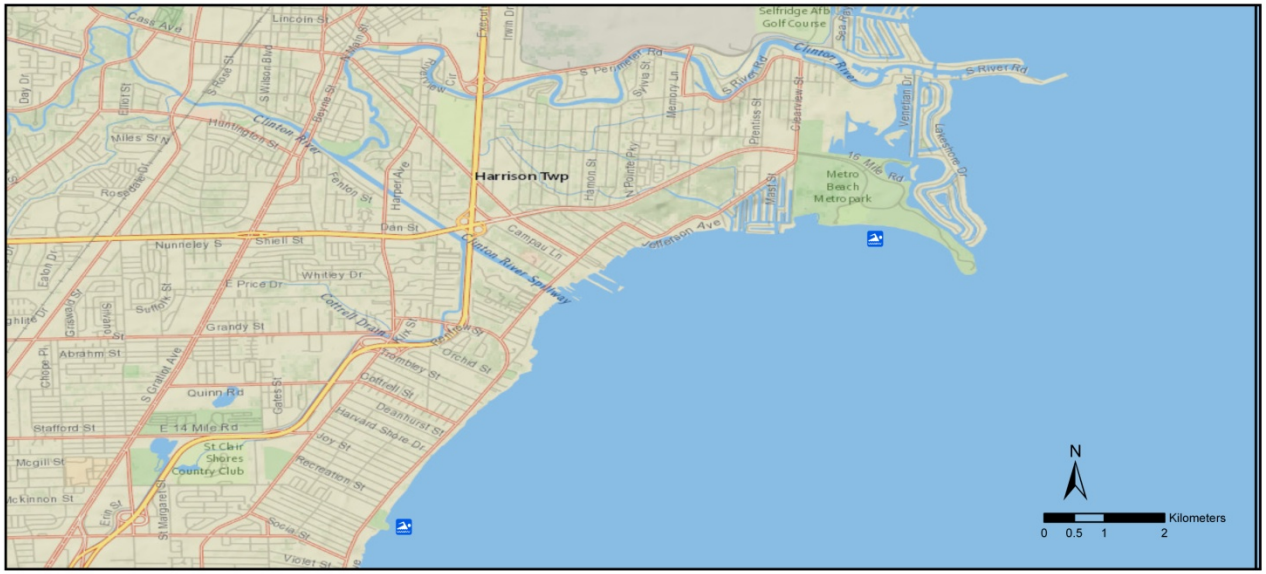
Project Area

Clinton River watershed and Lake St. Clair near-shore zone





Monitoring Program

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- Supports calibration and validation of models

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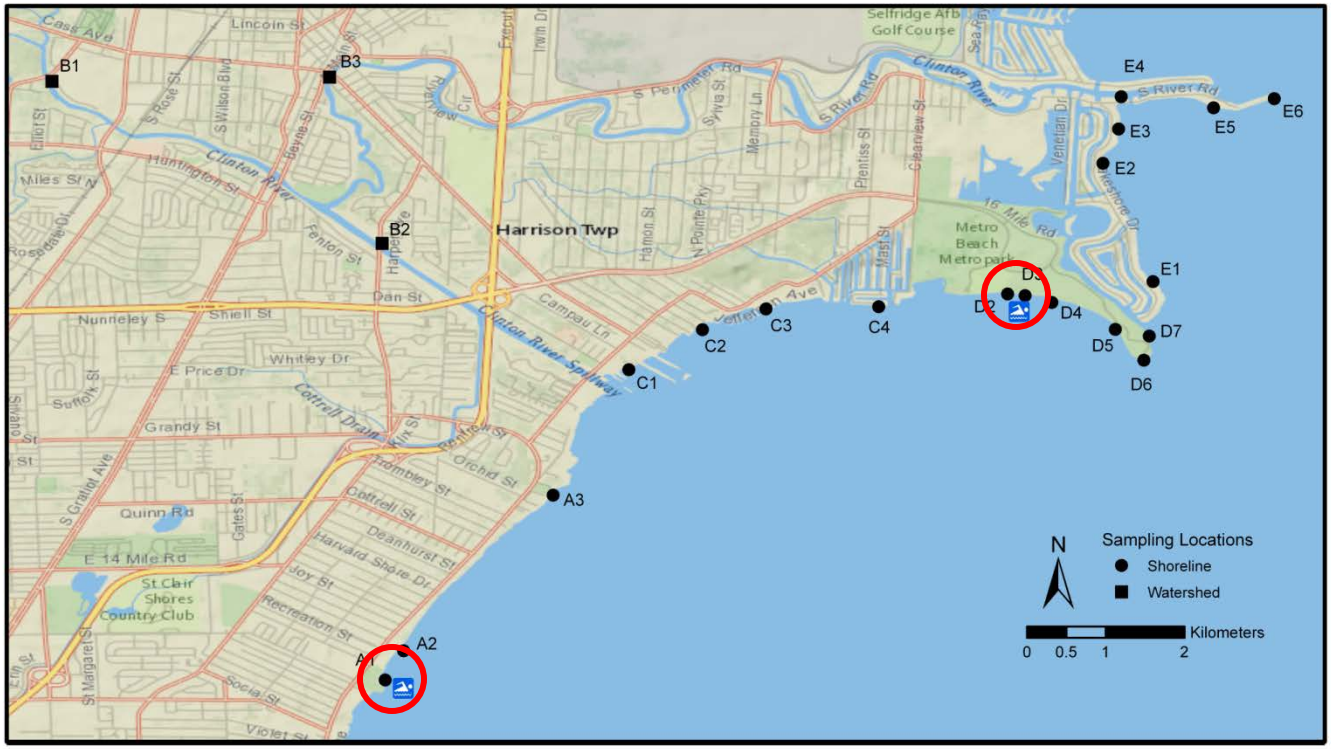
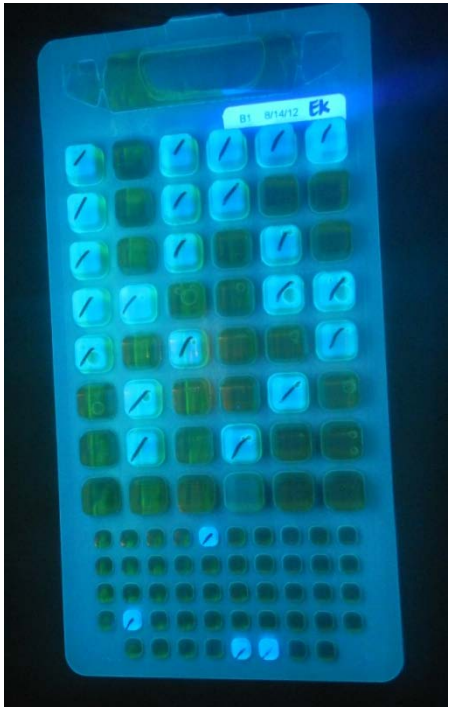


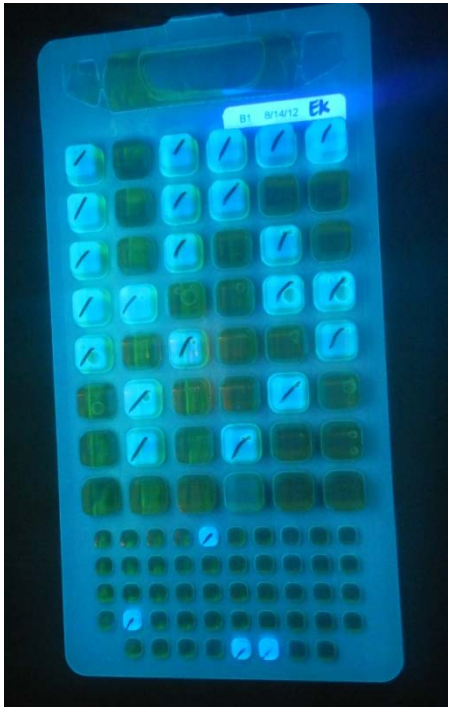
Monitoring Program

- Weekly sampling during bathing season (2012-2013)
  - Less frequent sampling in Apr, Sept-Dec

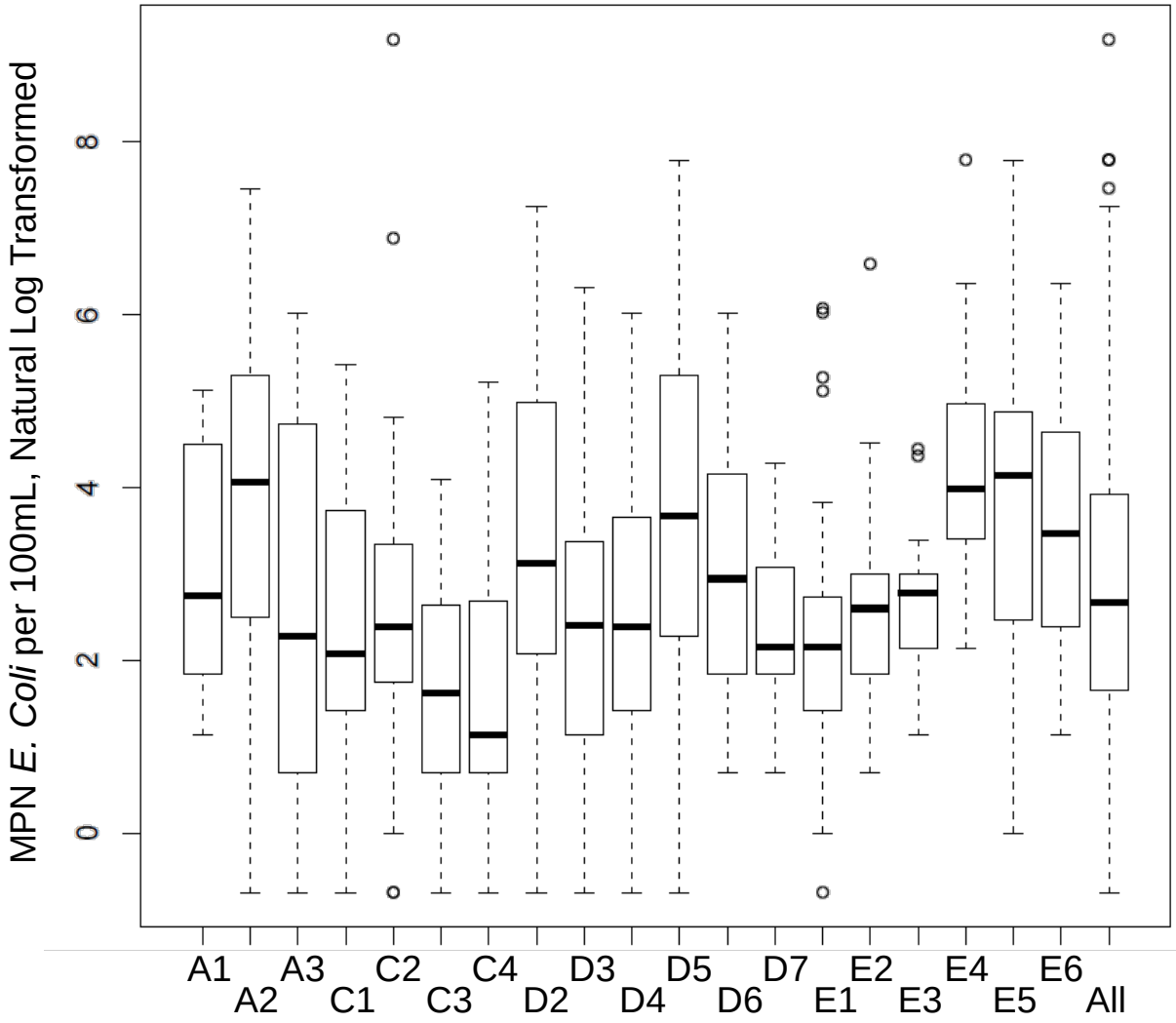


Monitoring Program

- Weekly sampling during bathing season (2012-2013)
  - Less frequent sampling in Apr, Sept-Dec
- Analyzed using IDEXX Colilert
  - Range: 1-2419.6 MPN/100mL
  - 10x dilutions analyzed following storms
  - Least dilute valid result used for data analysis



Spatial Variability



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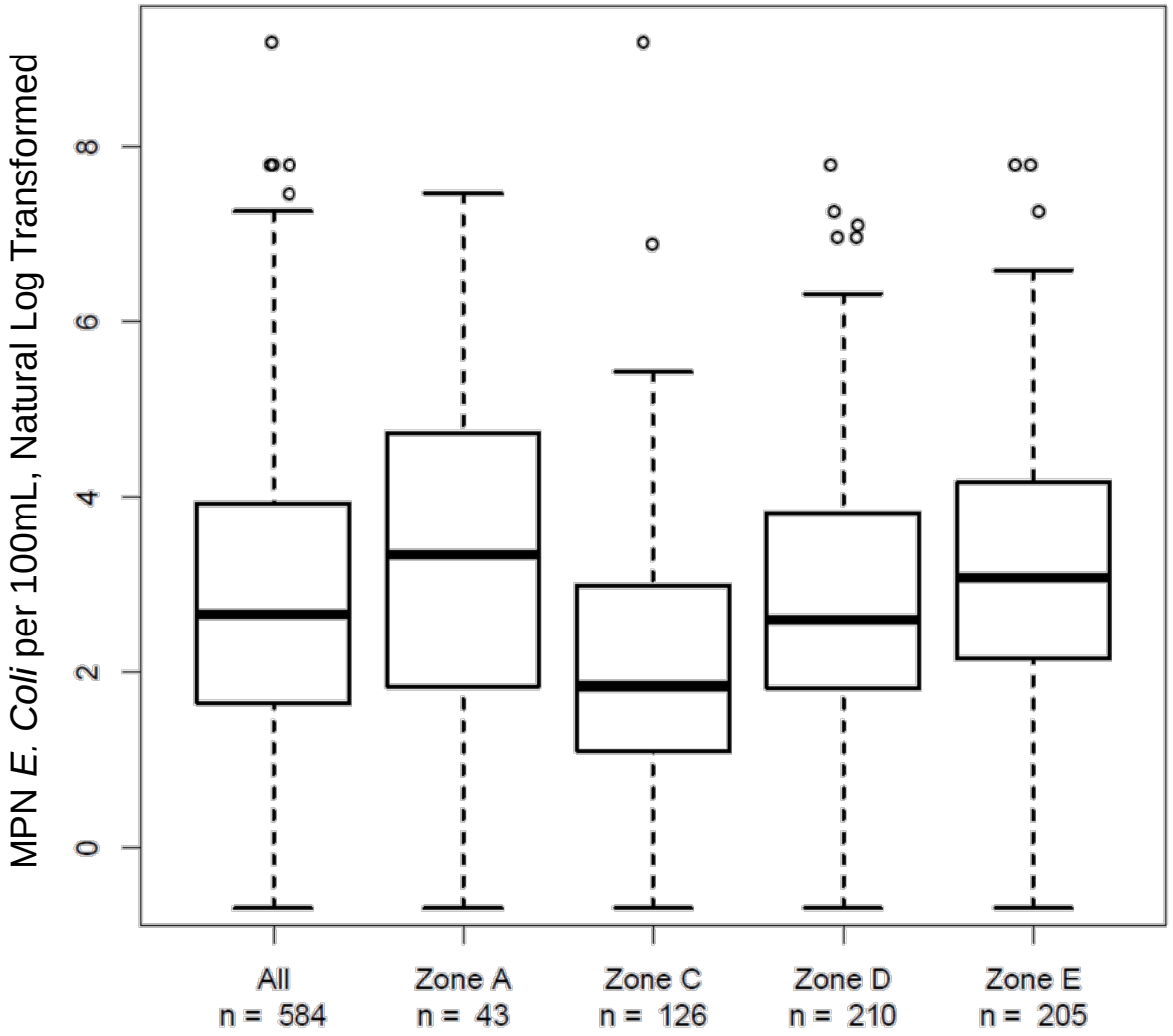

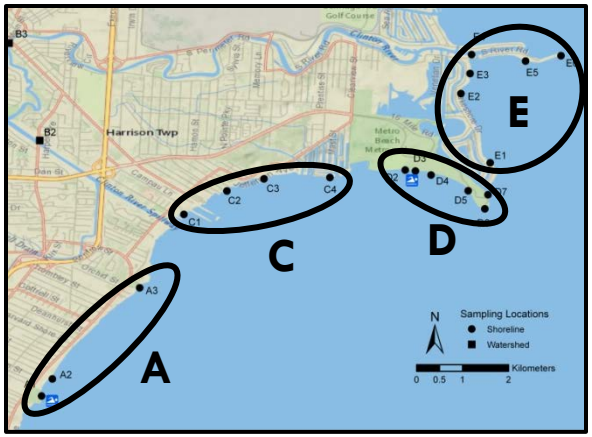

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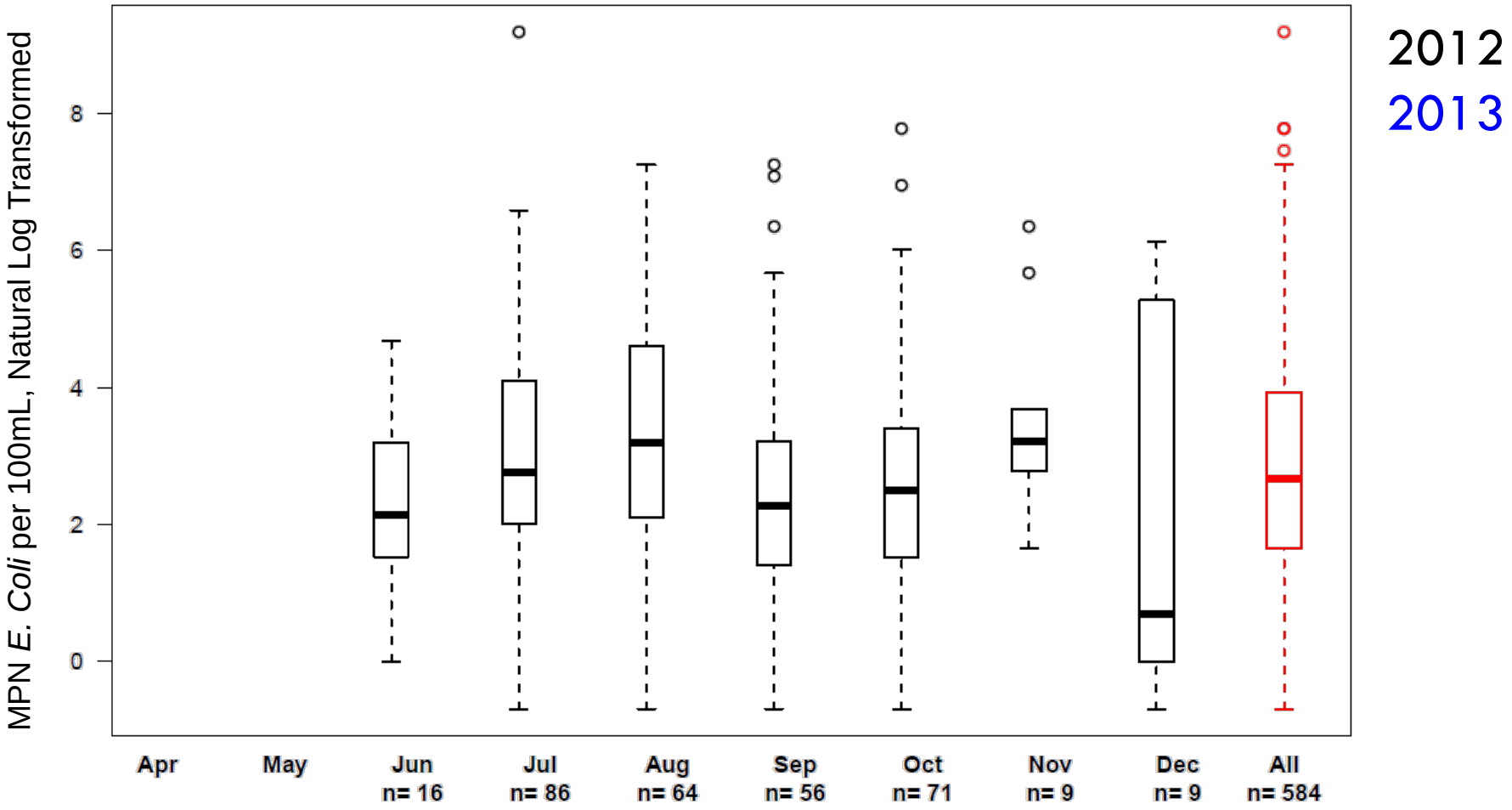

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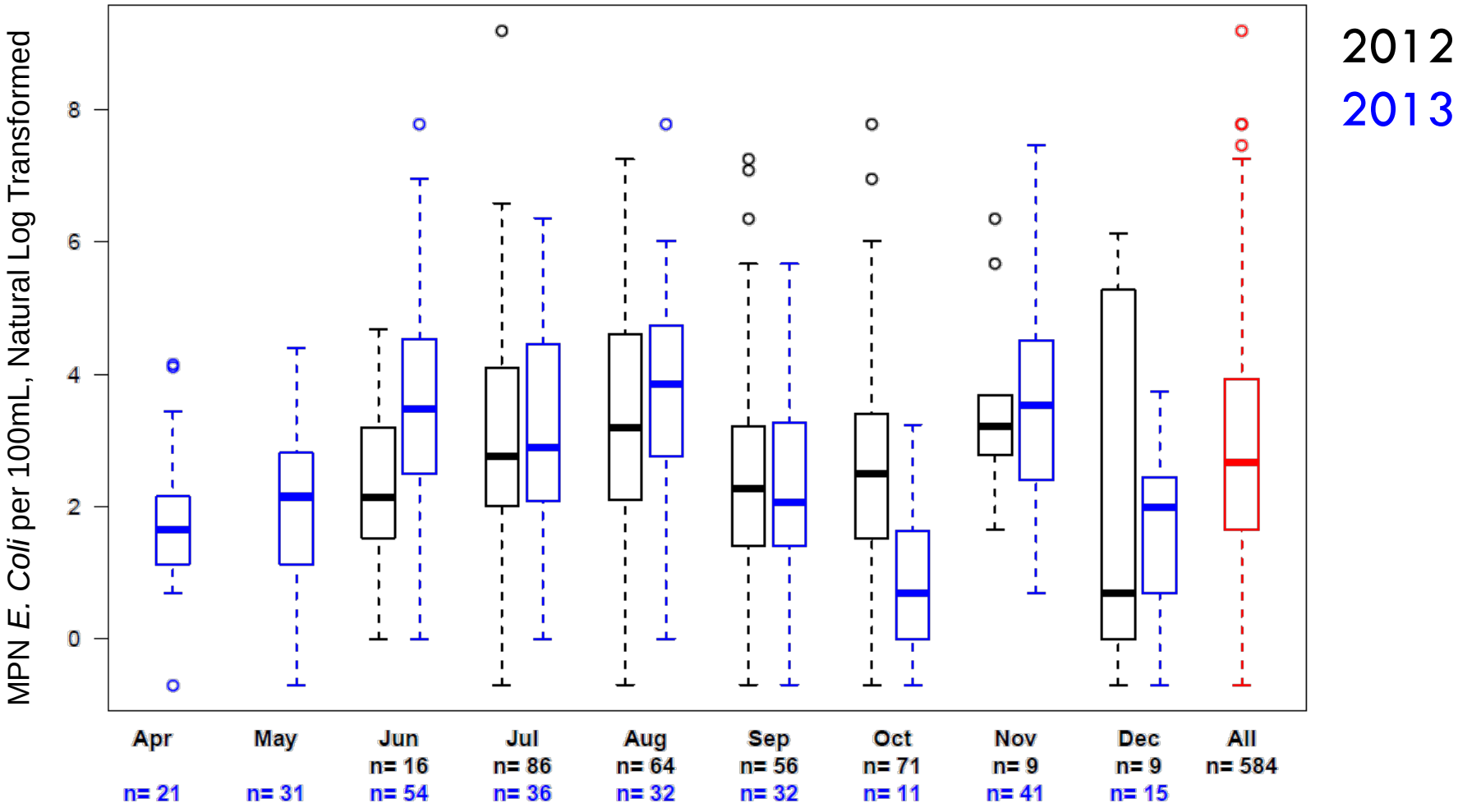
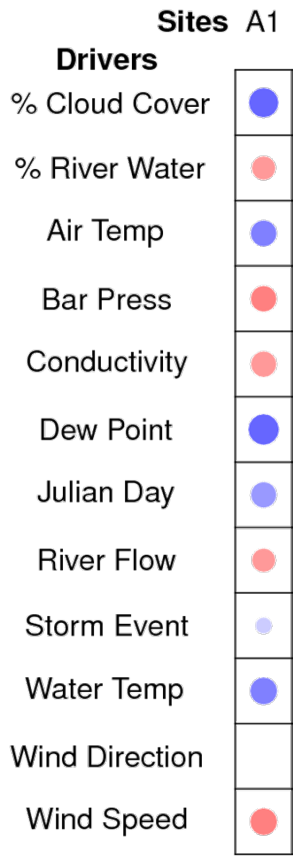
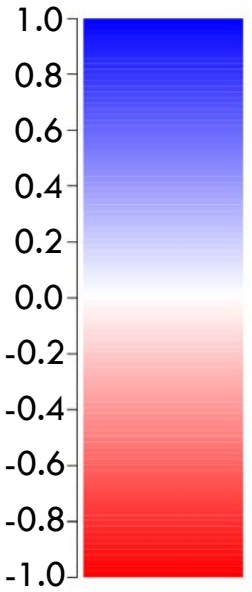


Impact of Drivers





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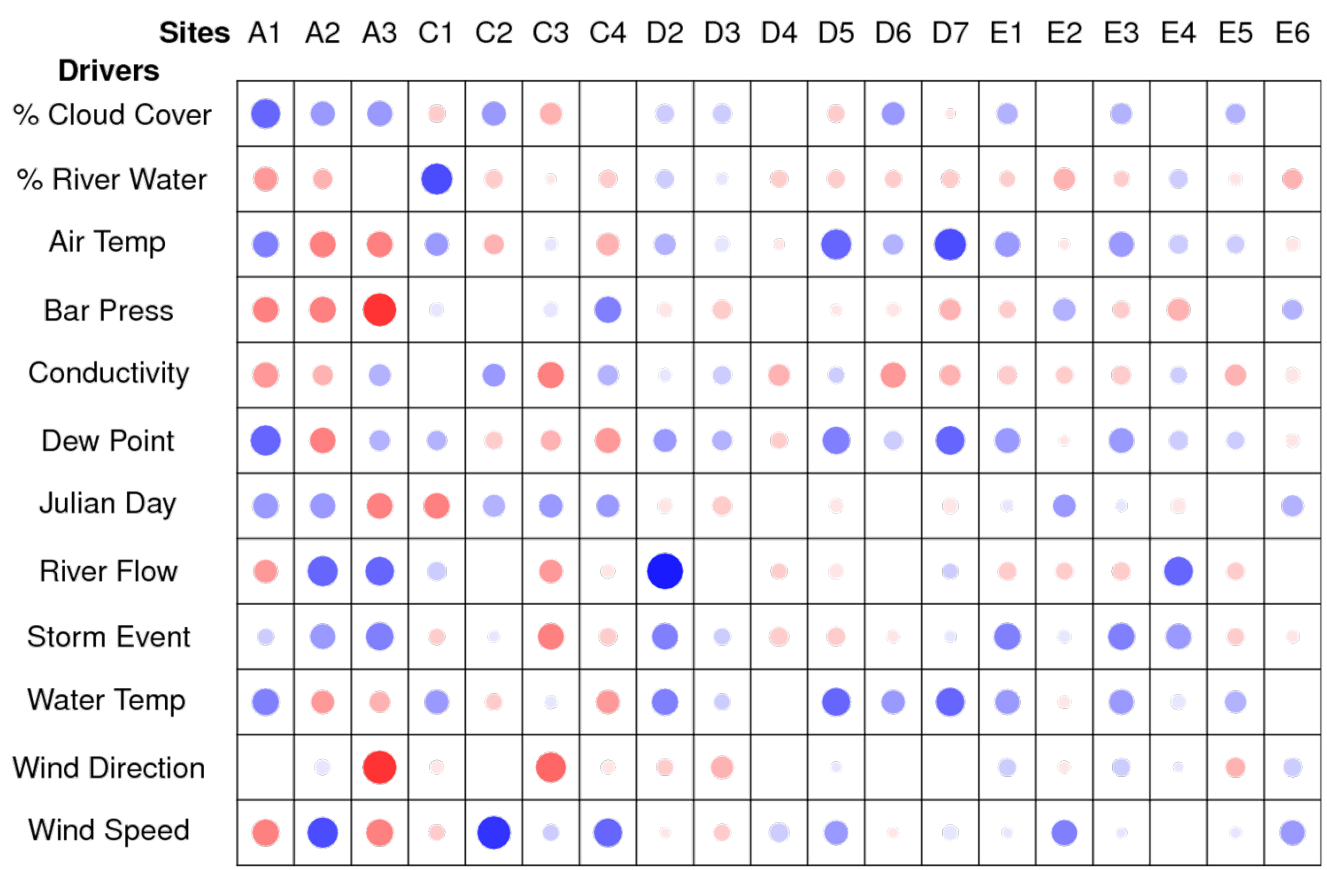

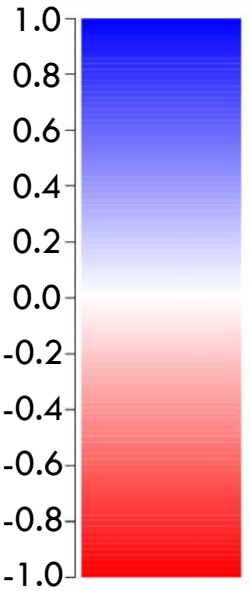

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Example: *Is the beach open?*

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Month

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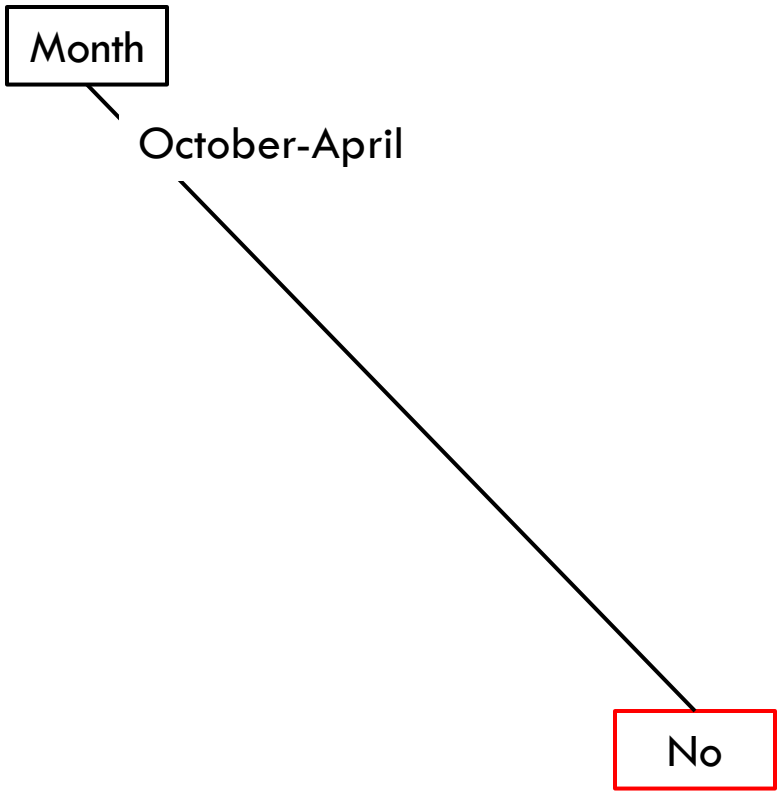

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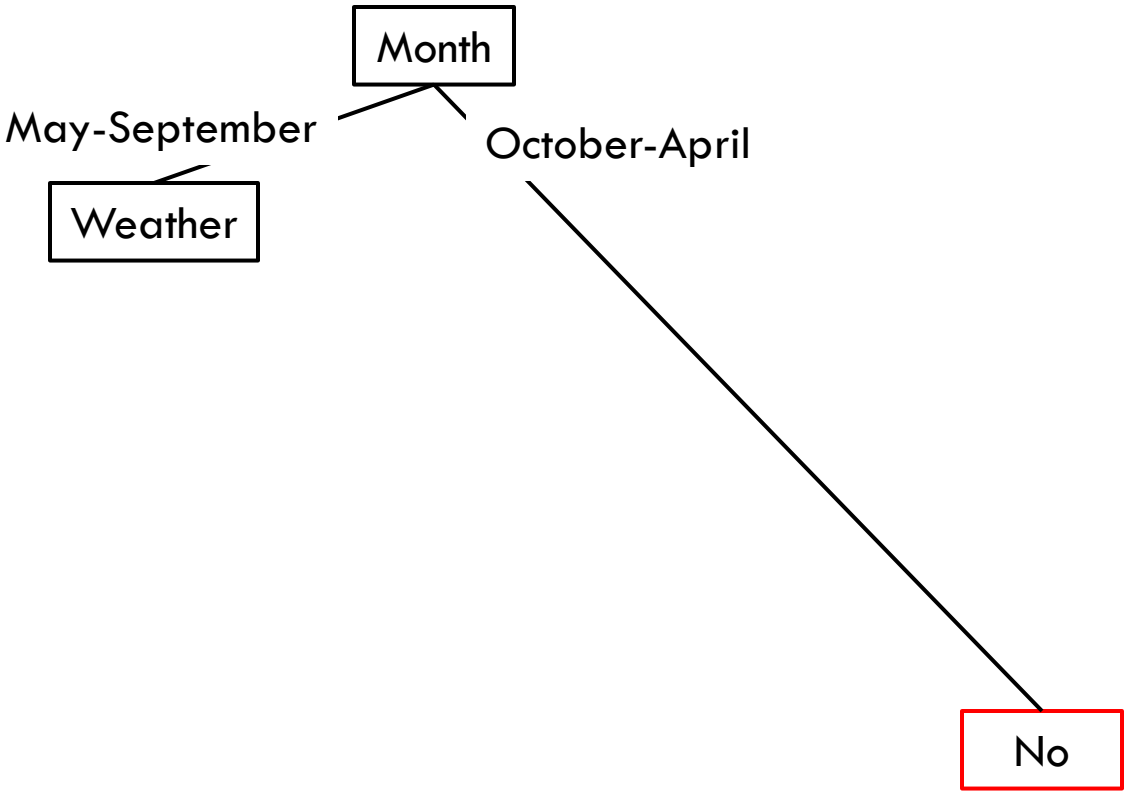

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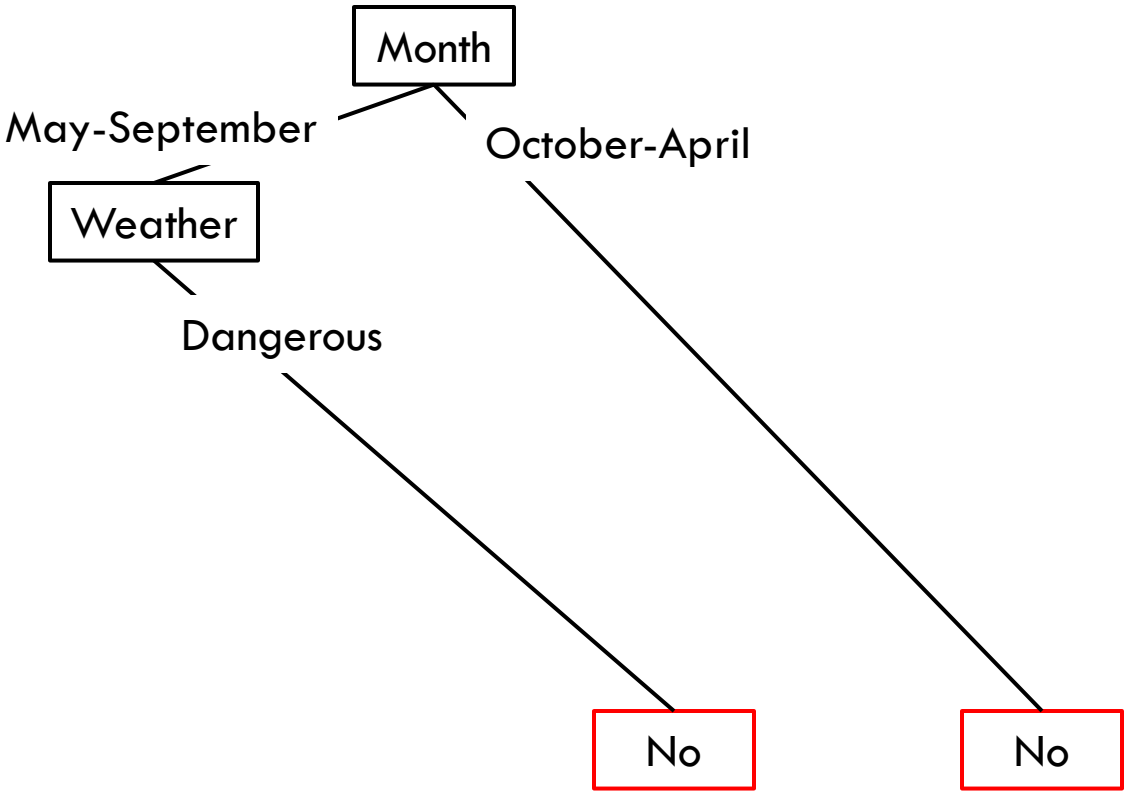

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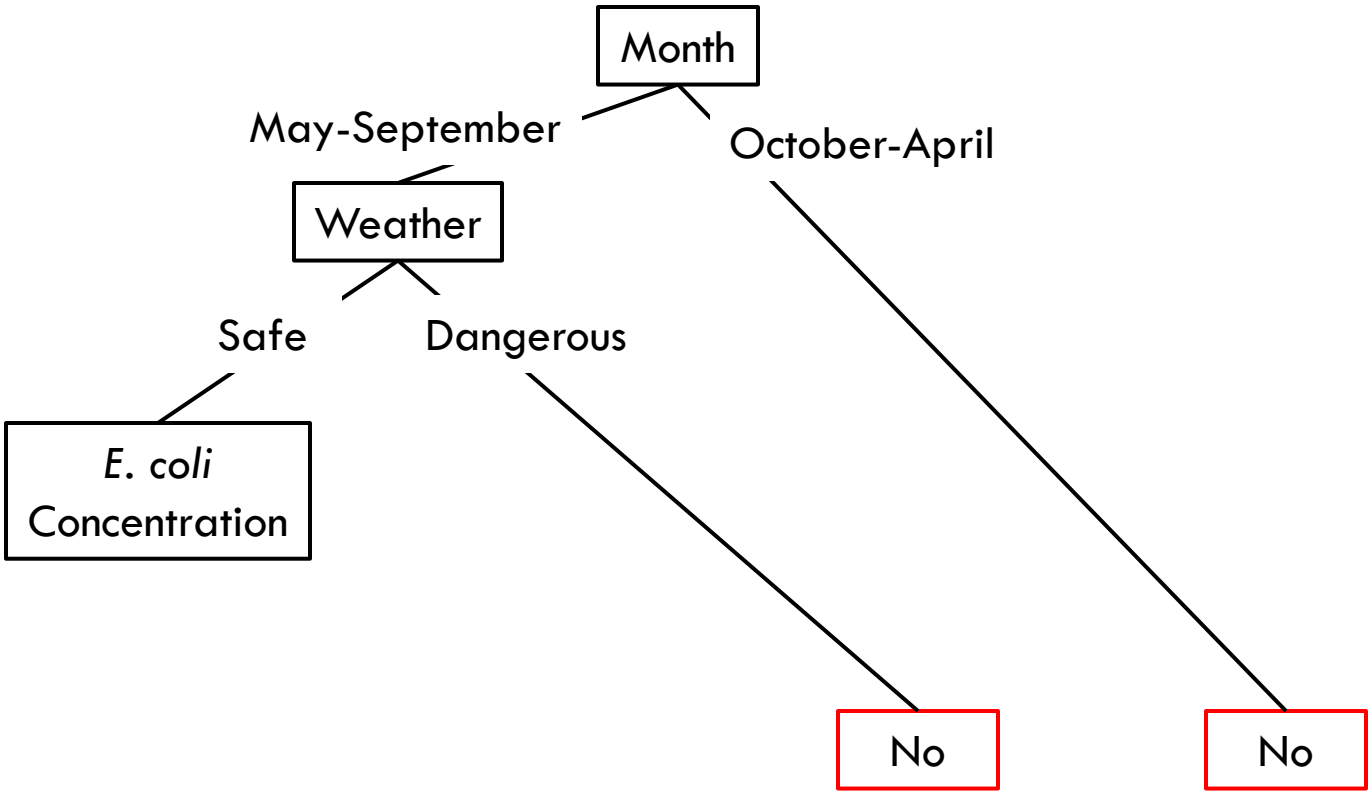

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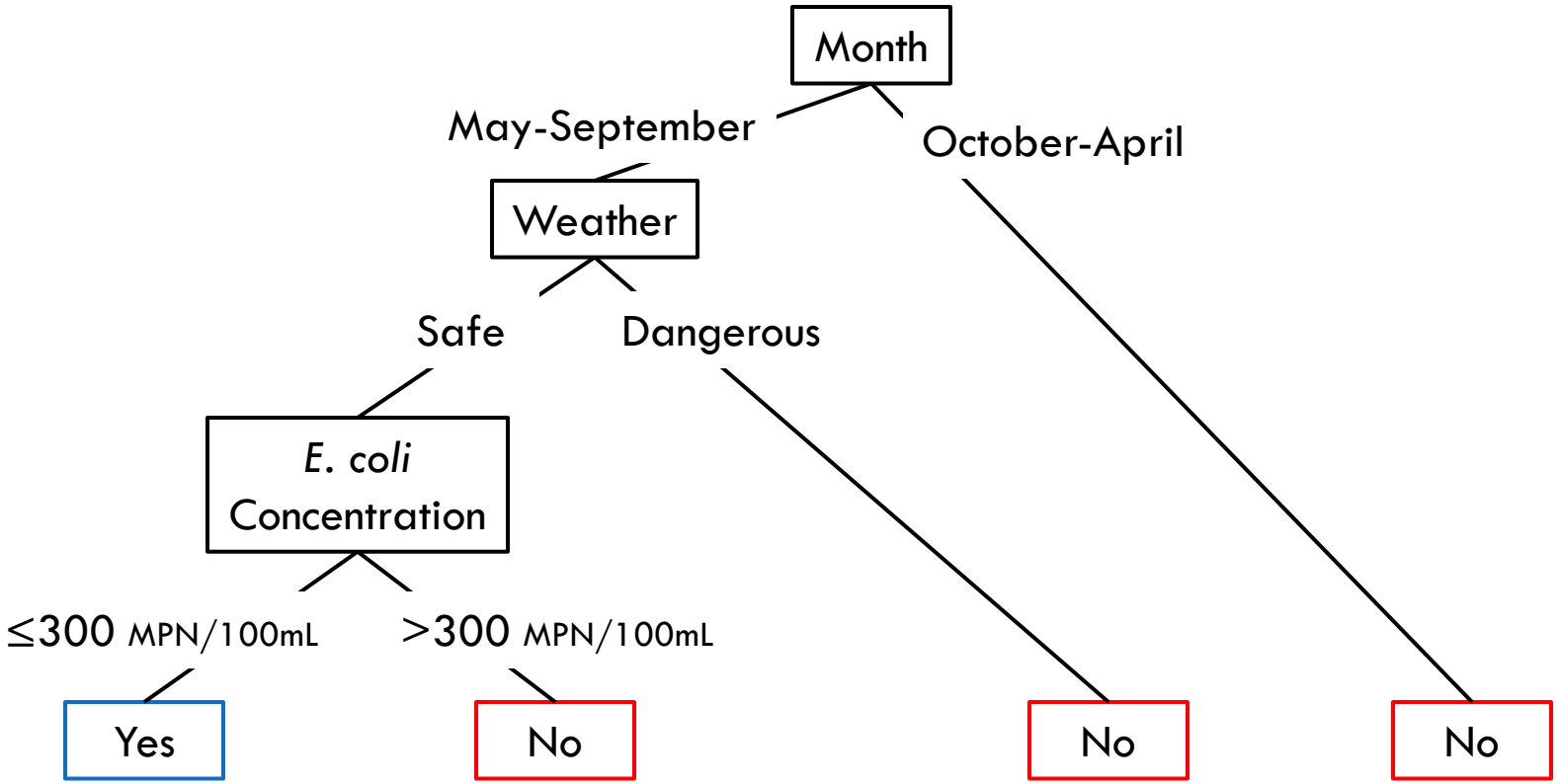

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$p < 0.001$

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{A2, D2, D5, E4, E5, E6}

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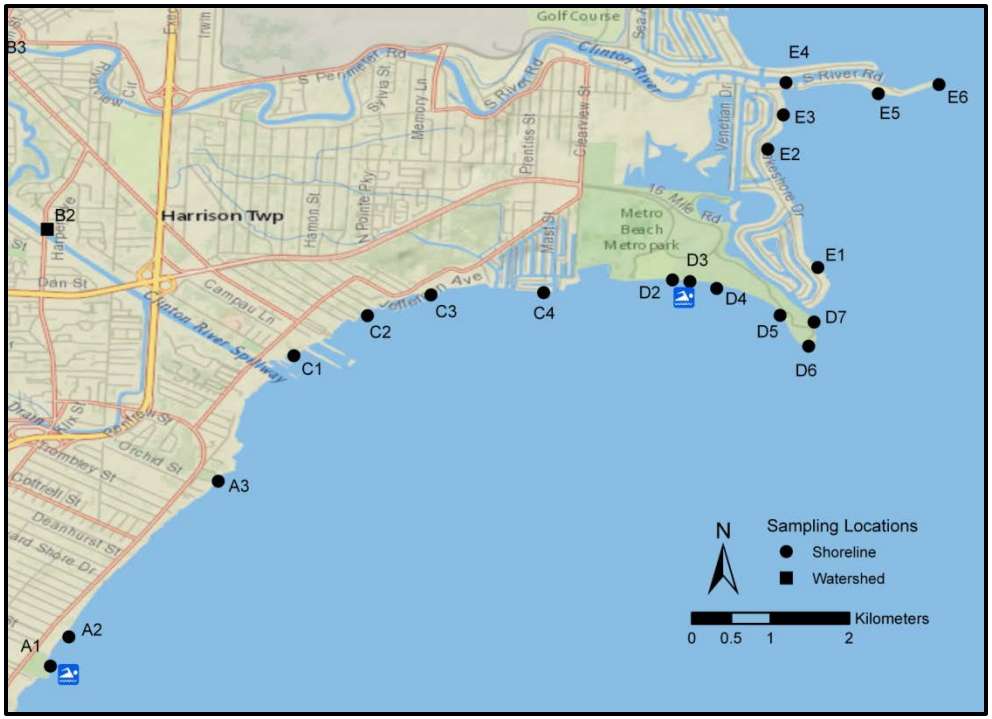

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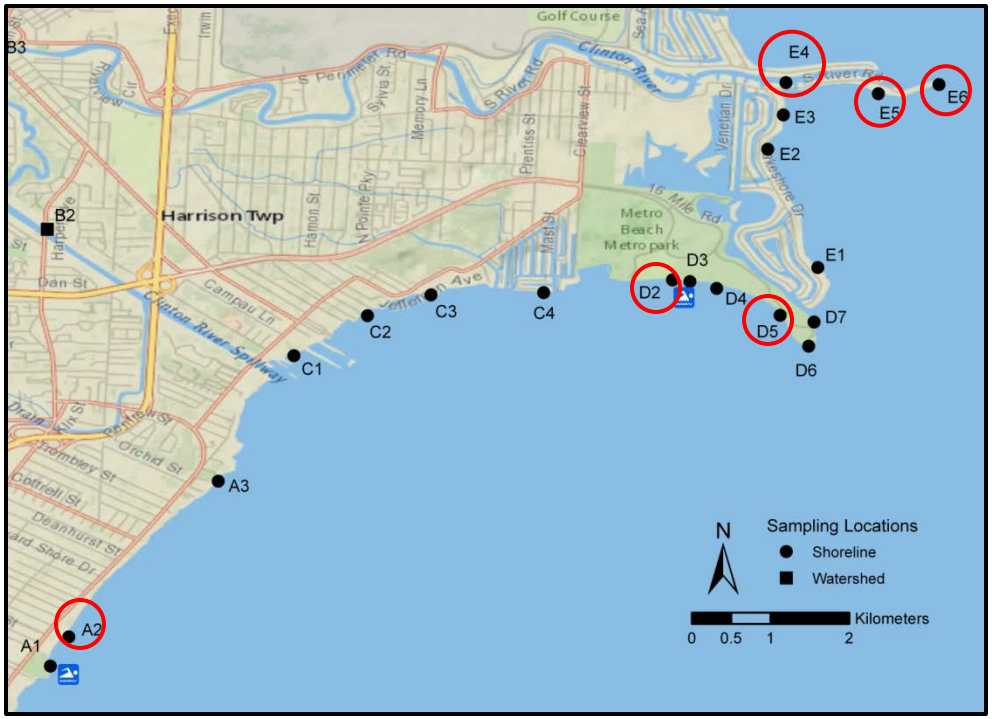

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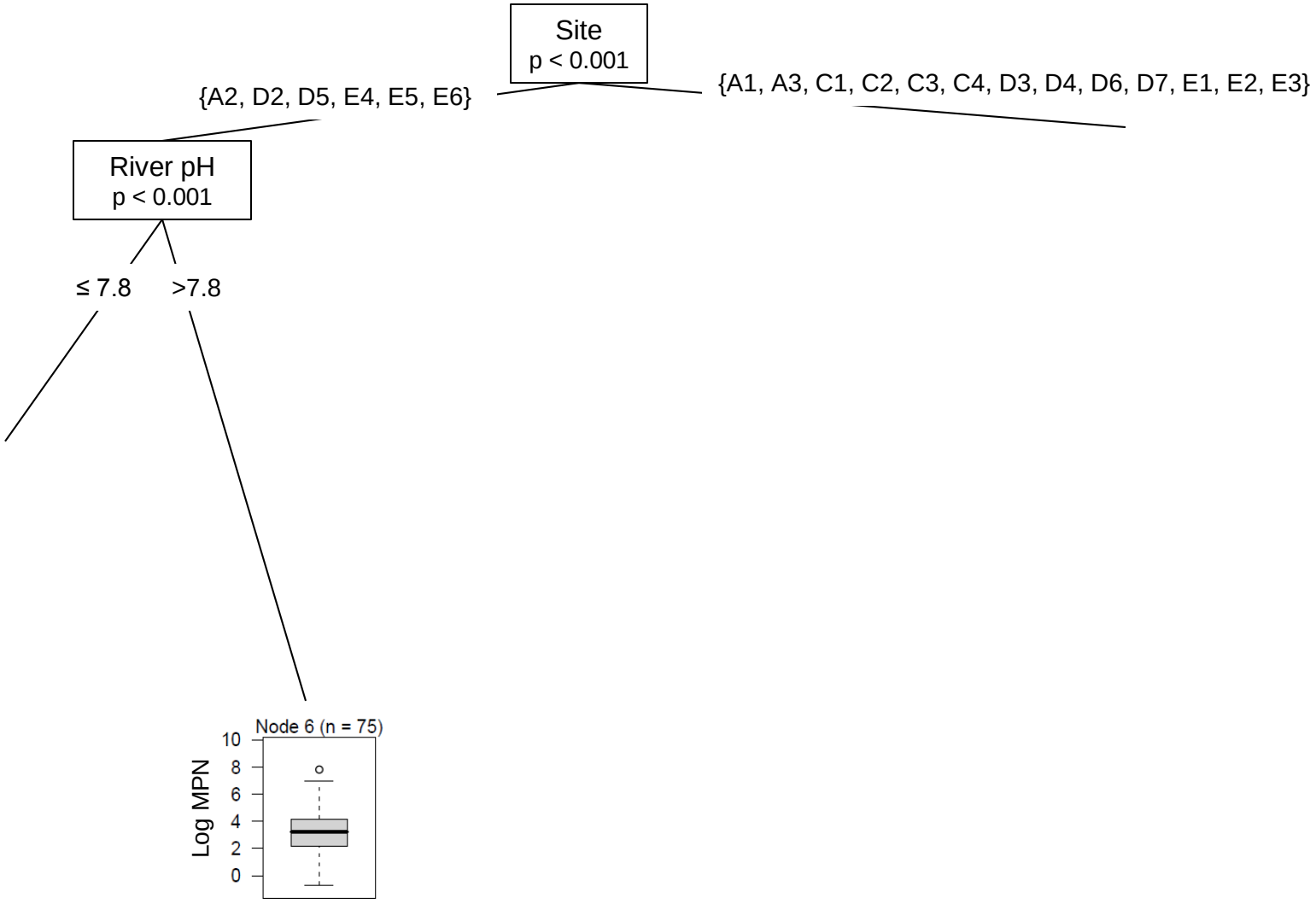

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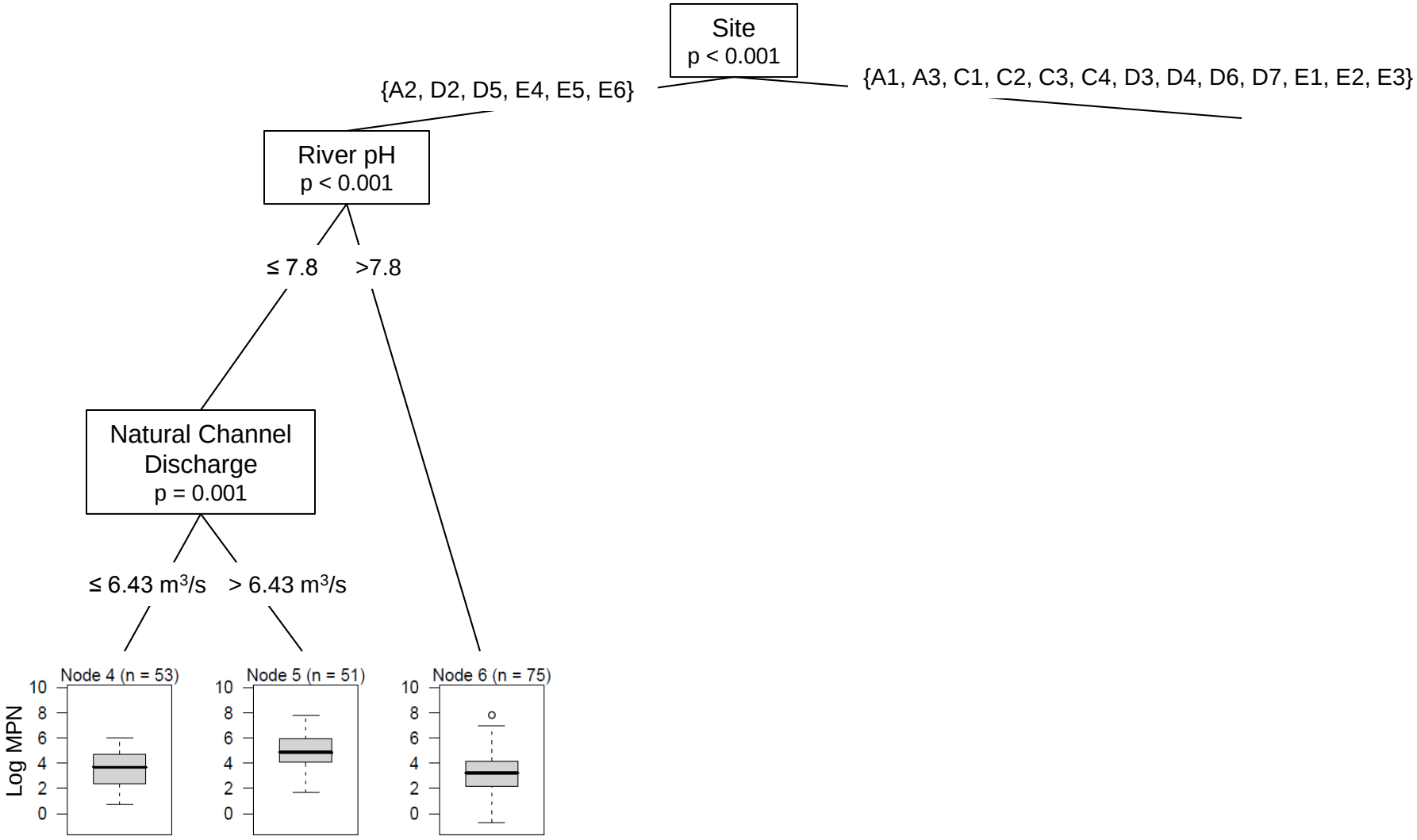

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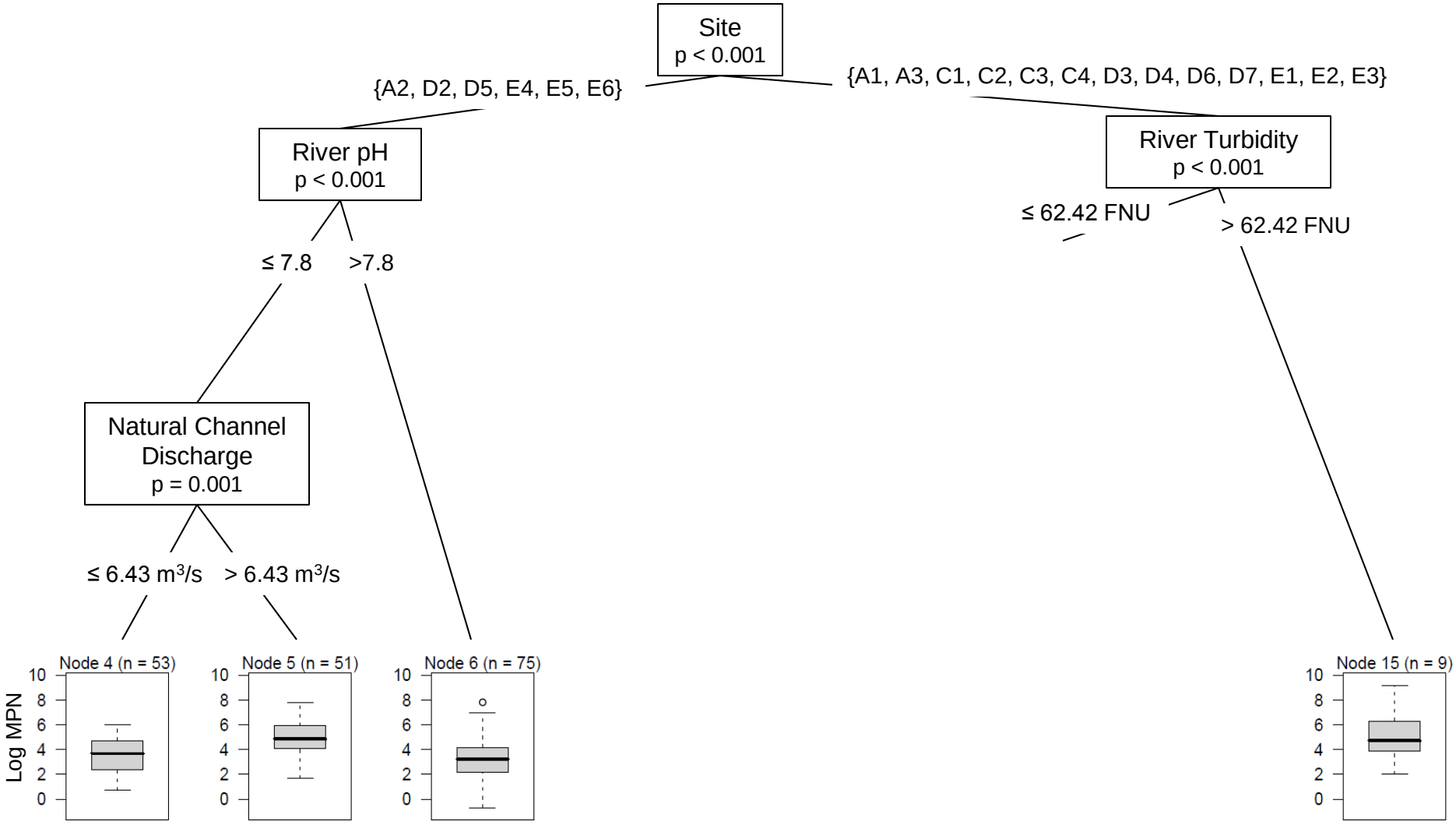

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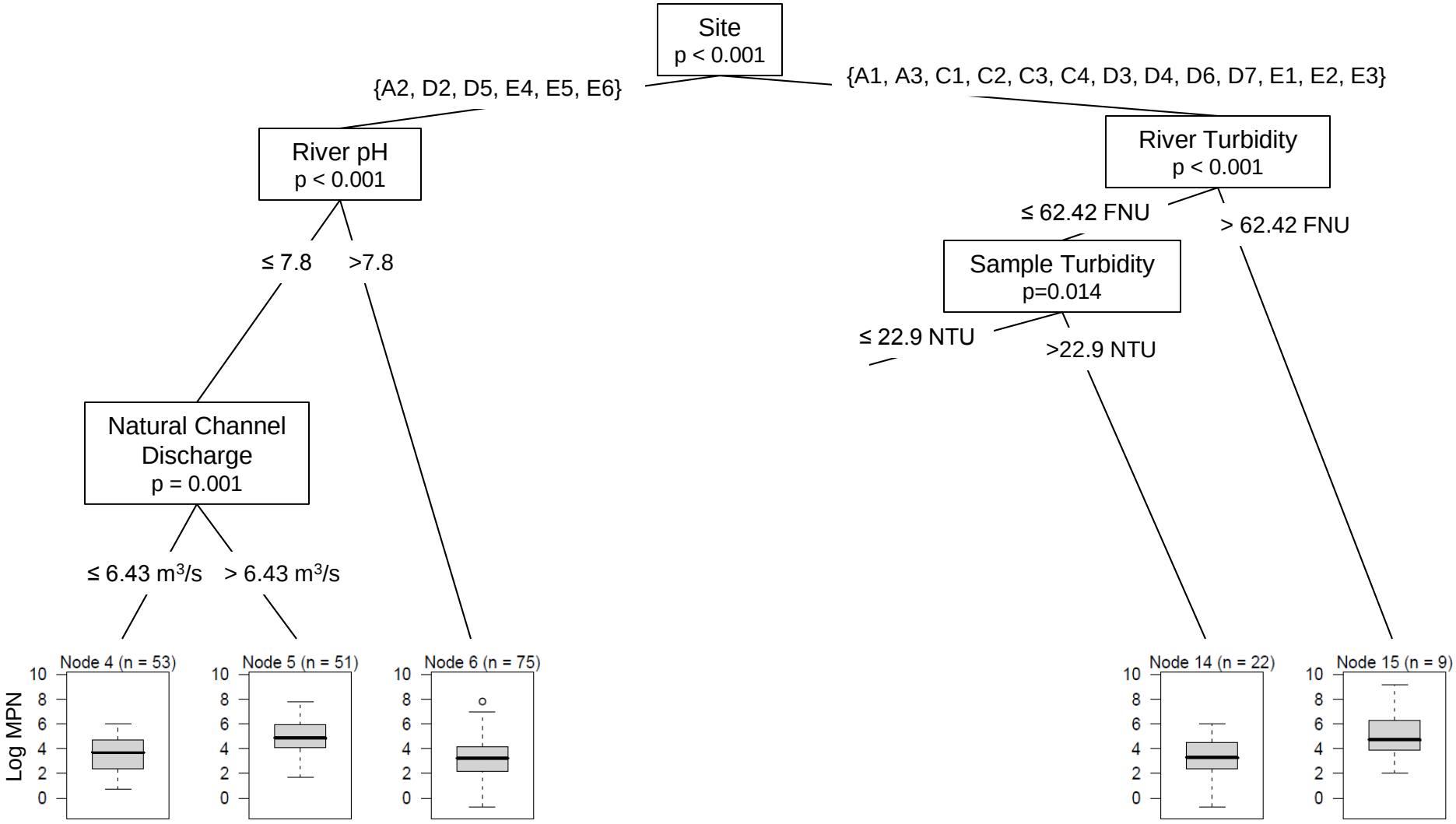

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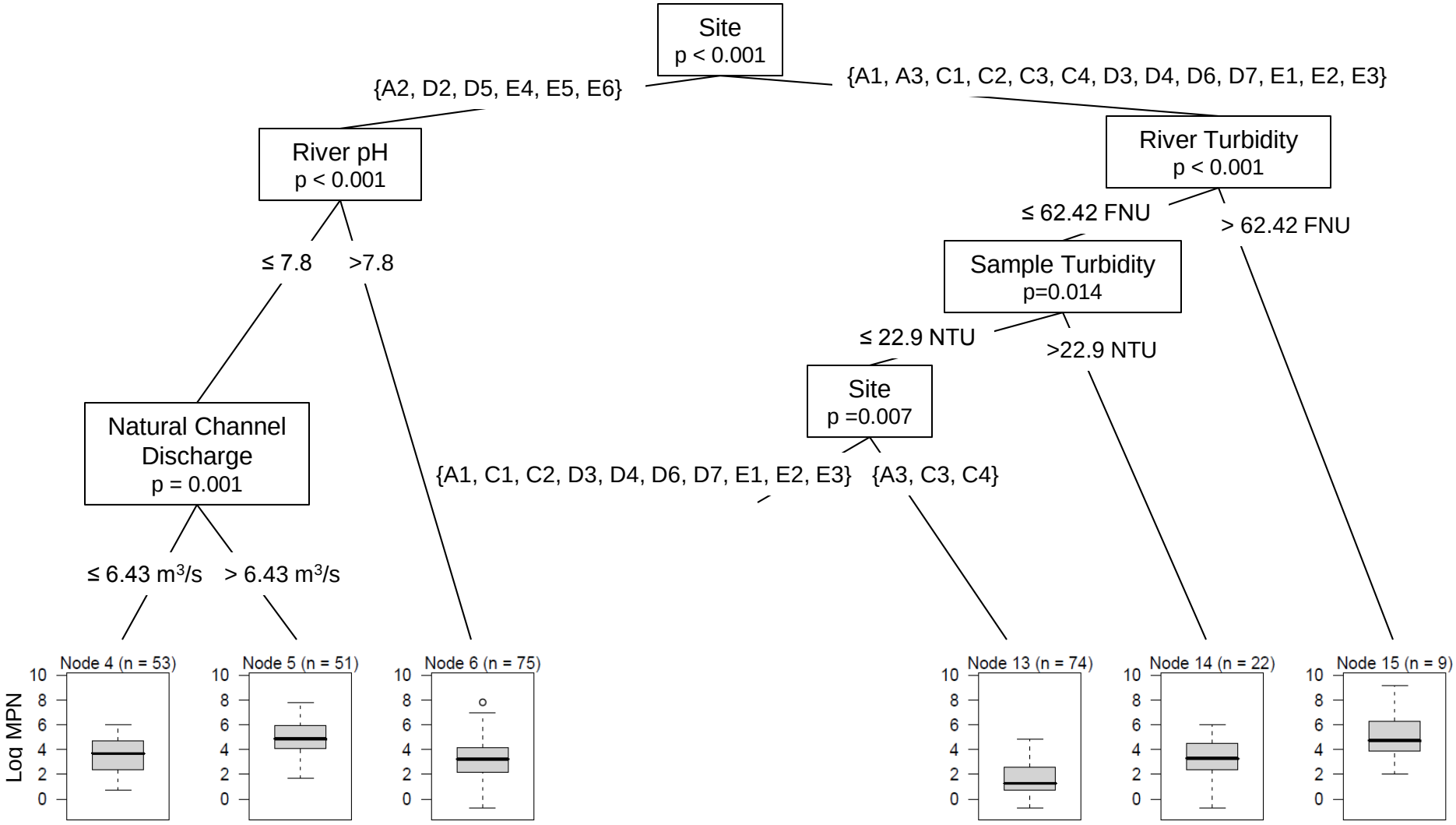

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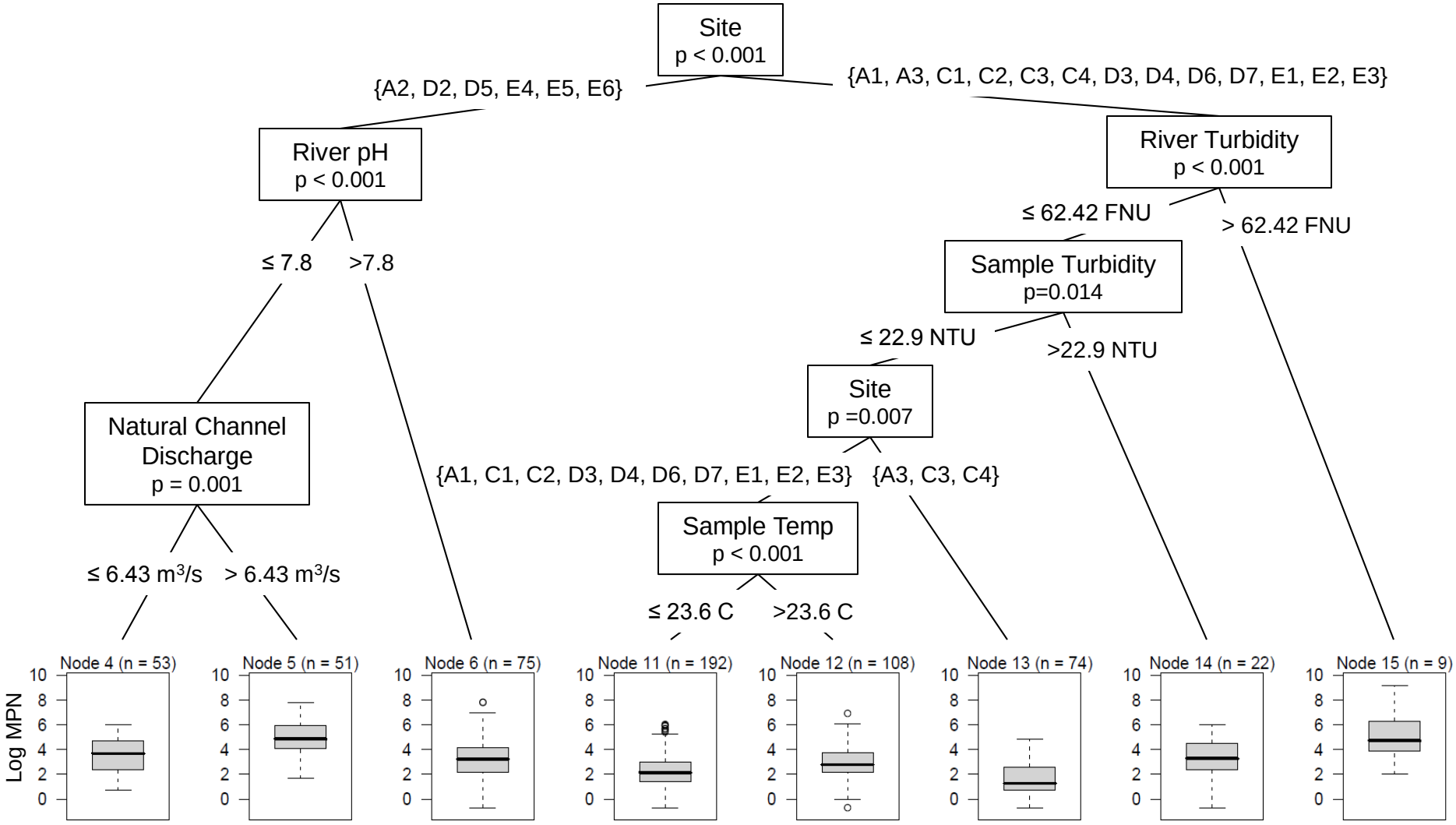

Conclusions

- Distributions of *E. coli* vary greatly through time, space
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- Up next:
  - Continue analysis of drivers
  - Measure temporal variability at finer scales
  - Incorporate uncertainty into analysis

QUESTIONS?

For more information on our project:
http://www.glerl.noaa.gov/res/Centers/HumanHealth/nearshoreFIB/

…or scan the QR code:

Email contact: eveuh@umich.edu

Thanks for listening!

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List of Drivers Used

- Site
- Sample Temperature
- Sample Conductivity
- Sample Turbidity
- Storm Event

- River Turbidity
- River Temperature
- River Discharge
- River Conductivity
- River Velocity
- River pH
- River DO
- Modeled Discharge in Natural Channel
- Modeled Discharge in Spillway
- River water concentration

- % Cloud Cover
- Air Temperature
- Barometric Pressure
- Dew Point
- Wind Direction
- Wind Speed

- Julian Day
- Shoreline Type
- Distance from Natural Channel Mouth

Monitoring Results

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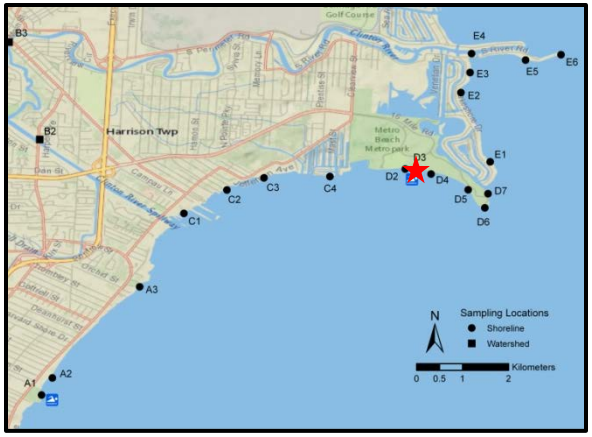

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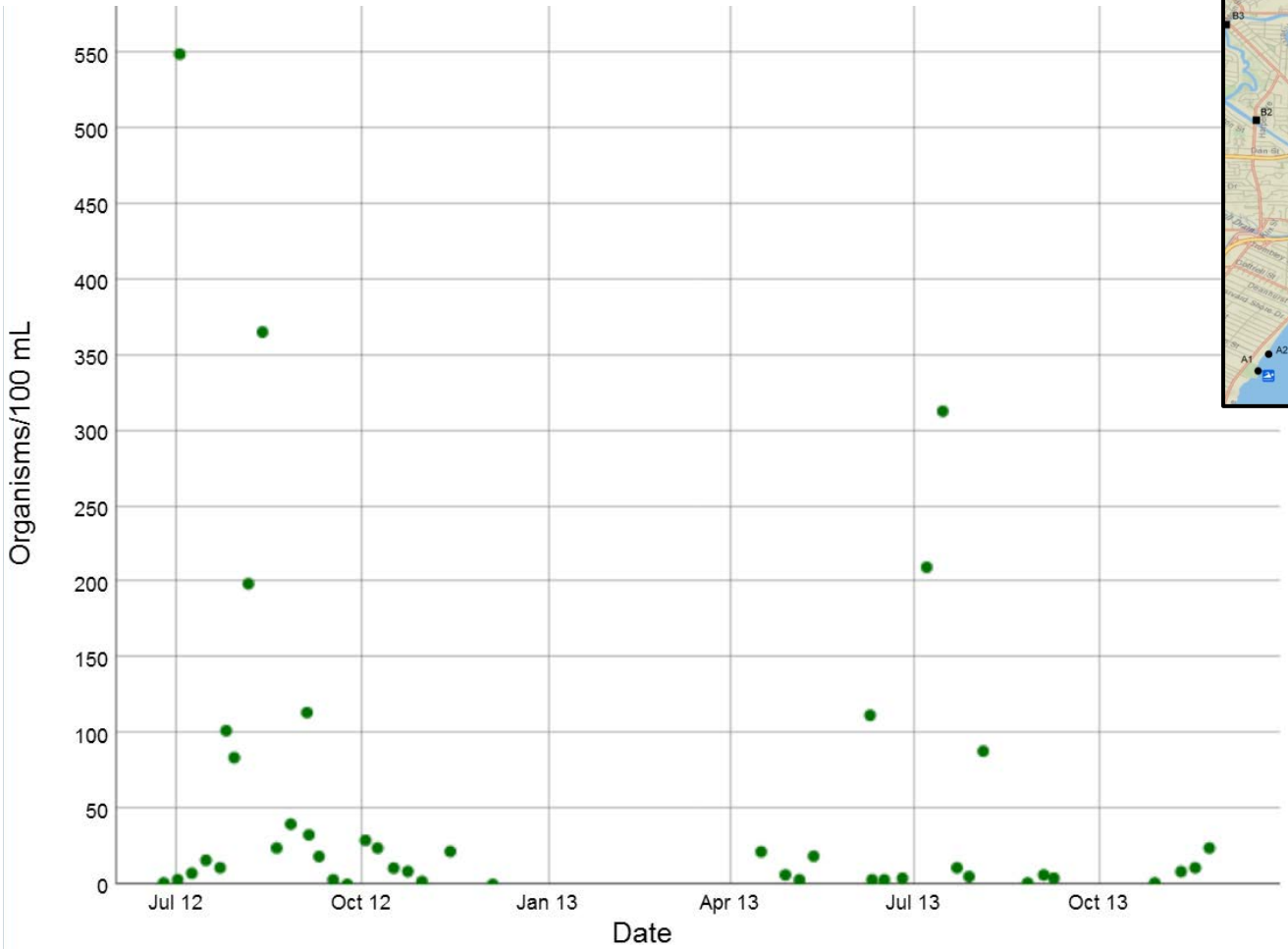

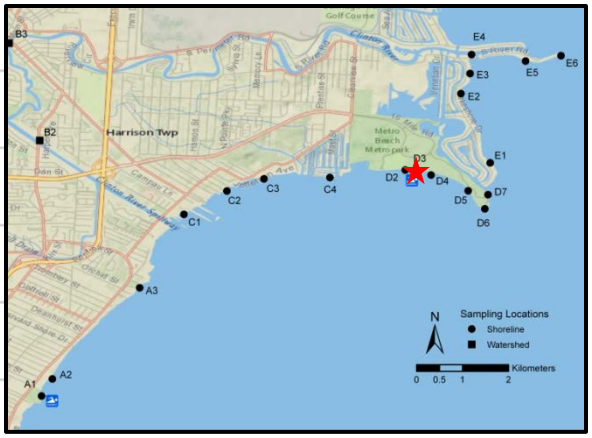

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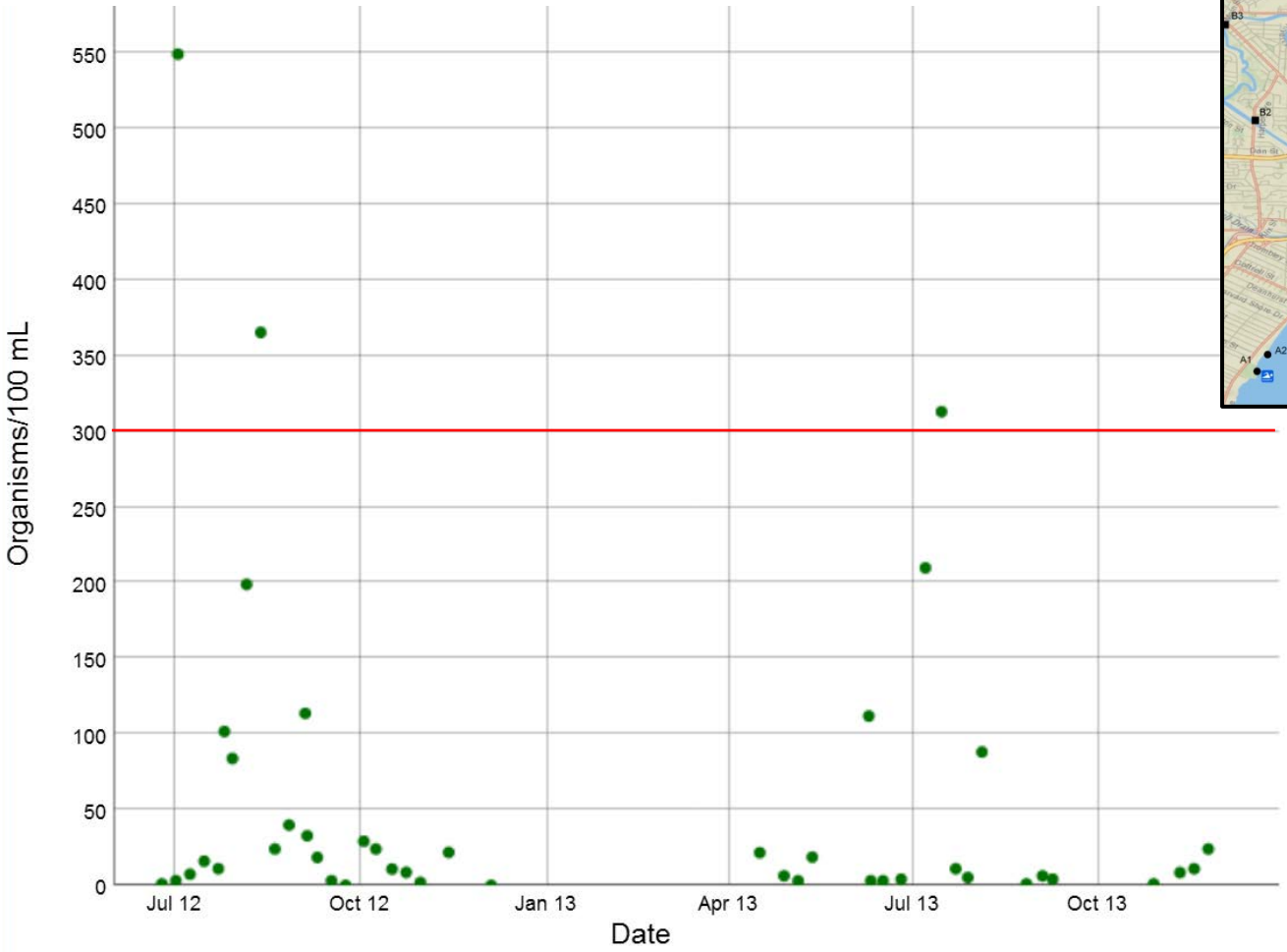

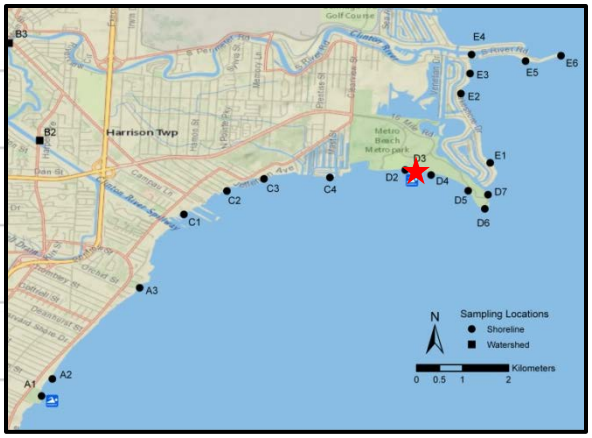

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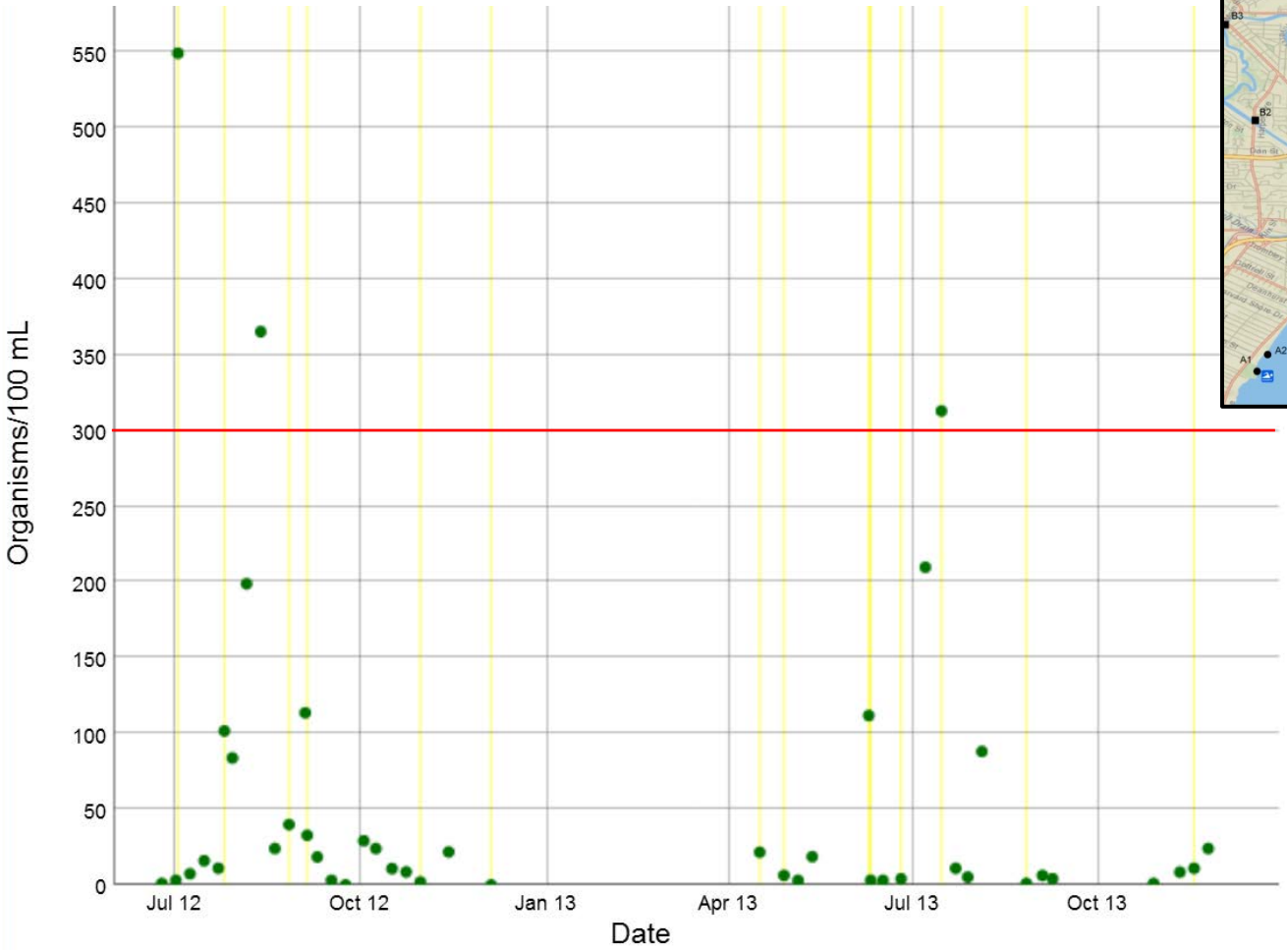
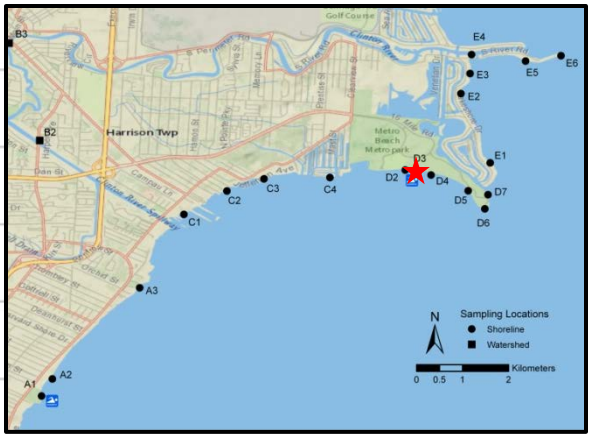
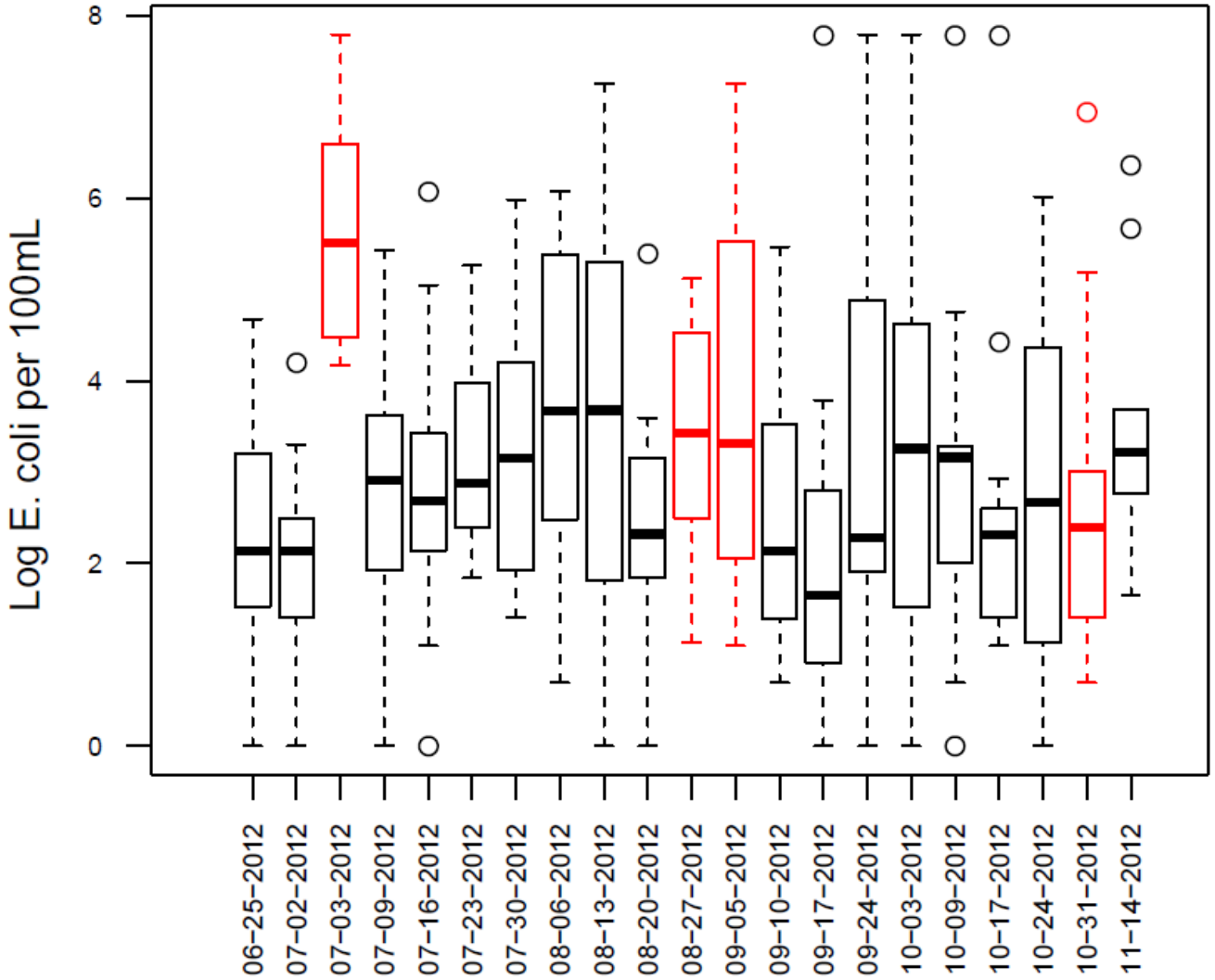




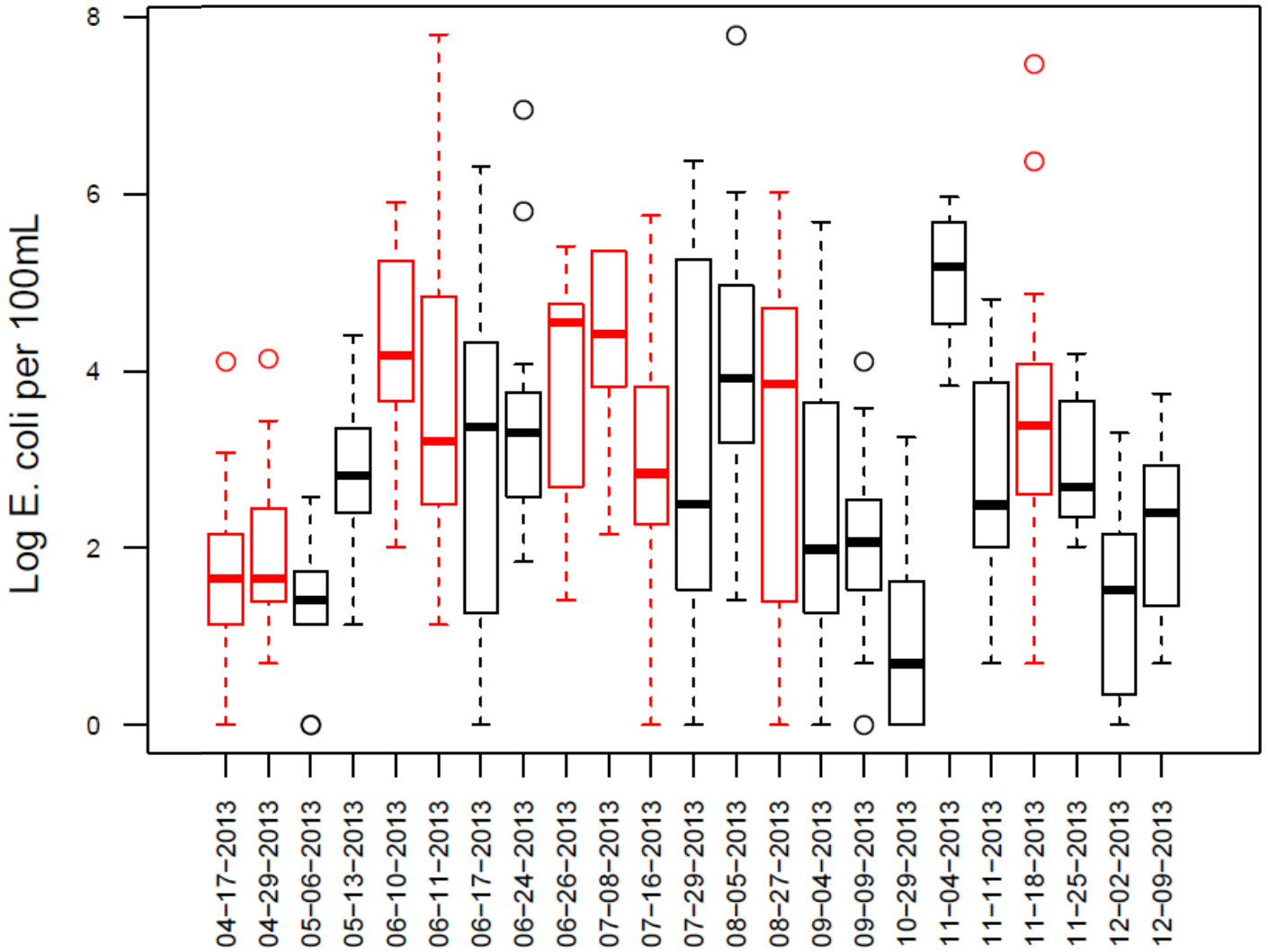
Temporal Variability



Routine Dates

Storm Dates

Temporal Variability



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