Evaluation of Coliphage as a Beach Water Quality Indicator

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Presentation to the SCCWRP Commission

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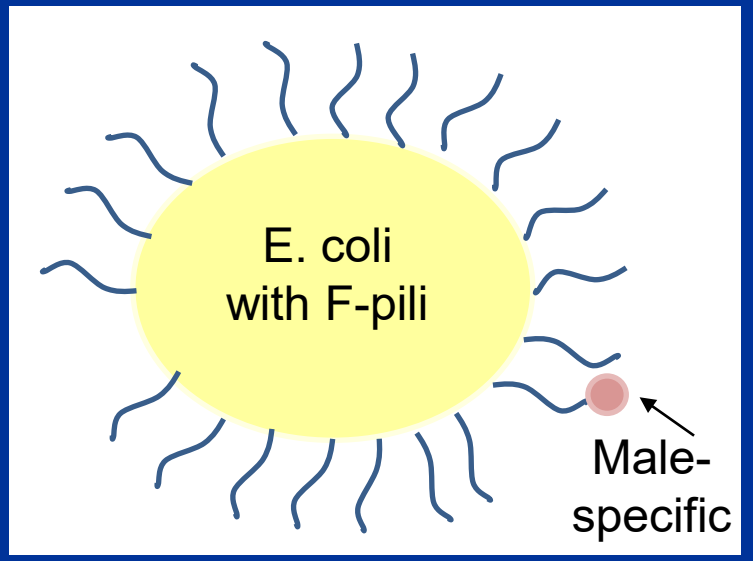
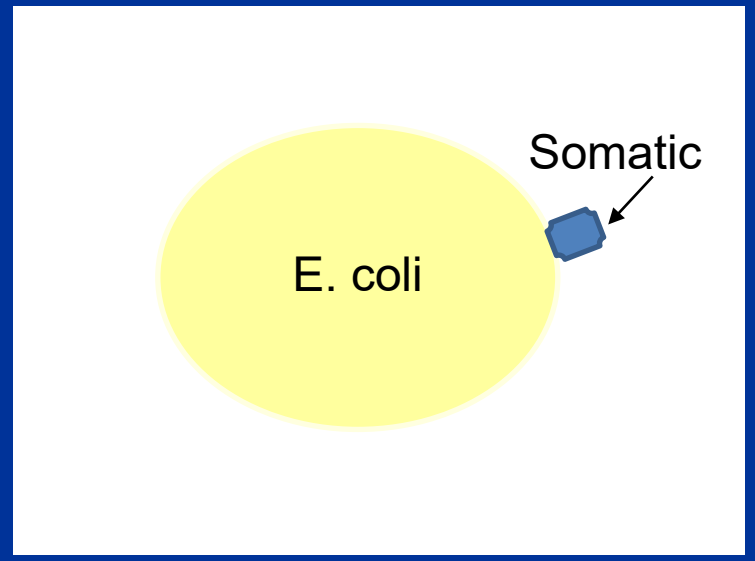
COLIPHAGE

- **Viruses that infect *E. coli***
  - Two main types – Somatic and Male-specific
- **Consistently present in high numbers in human sewage**
- **Easy to enumerate**
- **Non-pathogenic to humans**





WHY MEASURE COLIPHAGE?

- **Viruses are often the cause of swimming-associated illnesses in human-impacted waters**

- **Need an indicator that mimics human viruses**
  - Viruses can survive treatment
  - Different fate and transport in the environment

- **Coliphage is already approved for other applications**
  - EPA Groundwater Rule
  - FDA Shellfish bed monitoring

COLIPHAGE - CURRENT STATUS

- **April, 2015 - EPA published Review of *Coliphages as Possible Viral Indicators for Fecal Contamination for Ambient Water Quality***

- **April, 2016 - Coliphages a focus at EPA Recreational Water Conference**

- **April, 2018 - EPA published Method for Enumeration of Coliphage in Recreational Waters**
  - Method 1642: Male-Specific (F+) and Somatic Coliphage in Recreational Waters and Wastewater by Ultrafiltration (UF and Single Agar Layer (SAL) Procedure

- **Currently working to establish risk-based thresholds for recreational waters**

STATEMENT OF THE PROBLEM

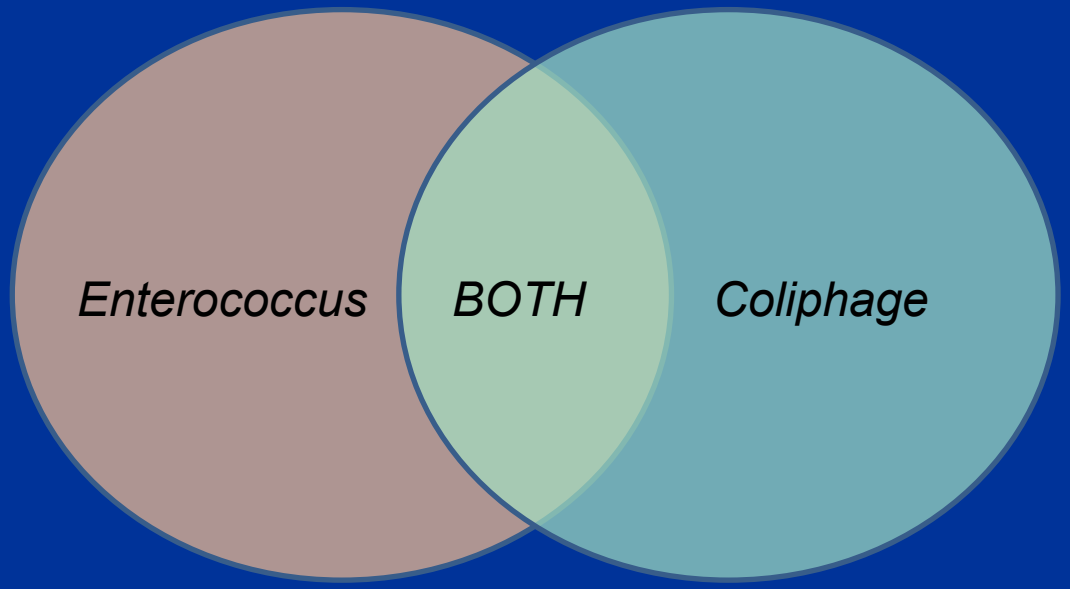
- **Need to know if local laboratories can reliably perform the method**
  - What level of expertise is required?
  - How much additional time is required for sample processing if method adopted?

- **Method has not been tested at California beaches**
  - How do coliphage measurements compare to *Enterococcus?*
  - Will we get more frequent hits?

GOALS OF THE STUDY

- **Determine "ease of use" of the new coliphage method**

- **Determine relationship between coliphage and *Enterococcus* at our beaches**



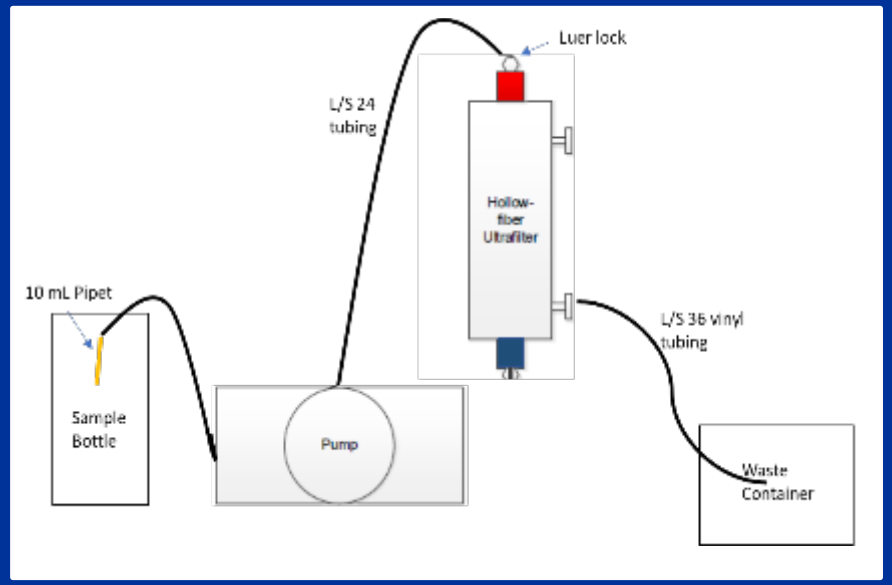
APPROACH

- **Phase 1: Train participating labs in Method 1642**
- **Phase 2: Intercalibration exercise to ensure consistency between labs**
- **Phase 3: Beach Water Testing**
  - Initiated August 2019

PARTICIPATING LABS

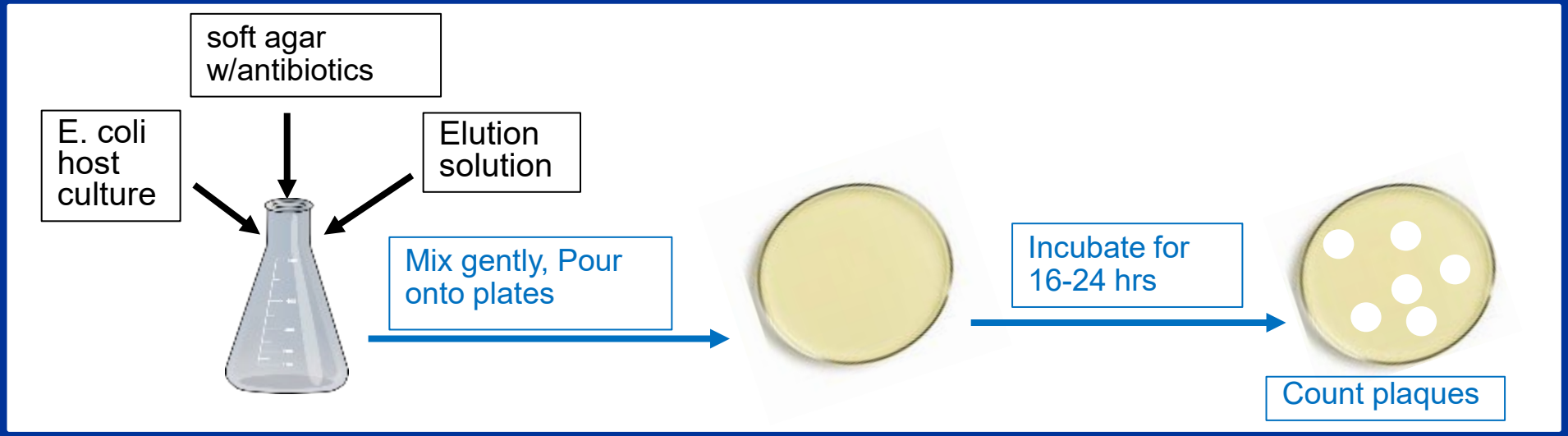
- Orange County Sanitation District
- Orange County Public Health Lab
- City of Los Angeles
- Los Angeles County Sanitation District
- City of San Diego
- County of Ventura (Cal State Channel Islands)

COLIPHAGE- METHOD 1642



- **Ultrafiltration**
  - 2L per sample for both MSC and Somatic
  - Hollow-fiber ultrafilter
- **Elution from ultrafilter**

Single Agar Layer Assay

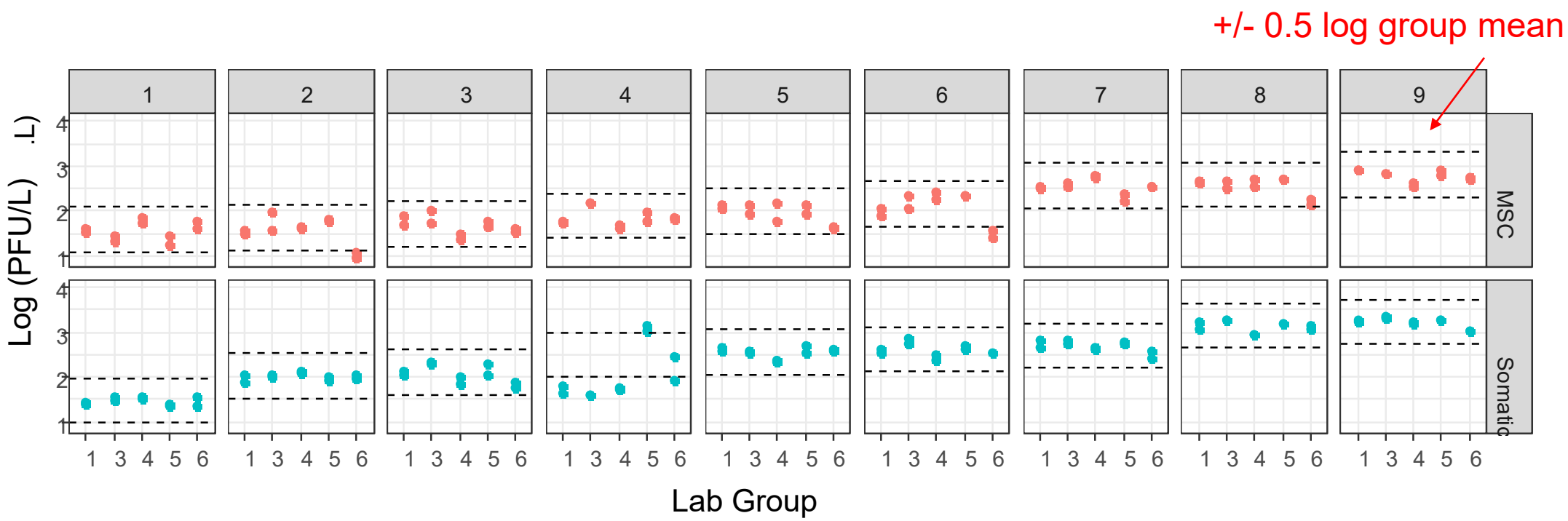


EVALUATING LAB PERFORMANCE

- **EPA Method Validation Criteria**
  - Percent coliphage recovered from spiked samples
  - Relative percent difference between duplicates

- **Repeatability**
  - Across labs
  - Within labs

MEASURED COLIPHAGE LEVELS FROM SPIKED WATER SAMPLES



BEACH WATER TESTING

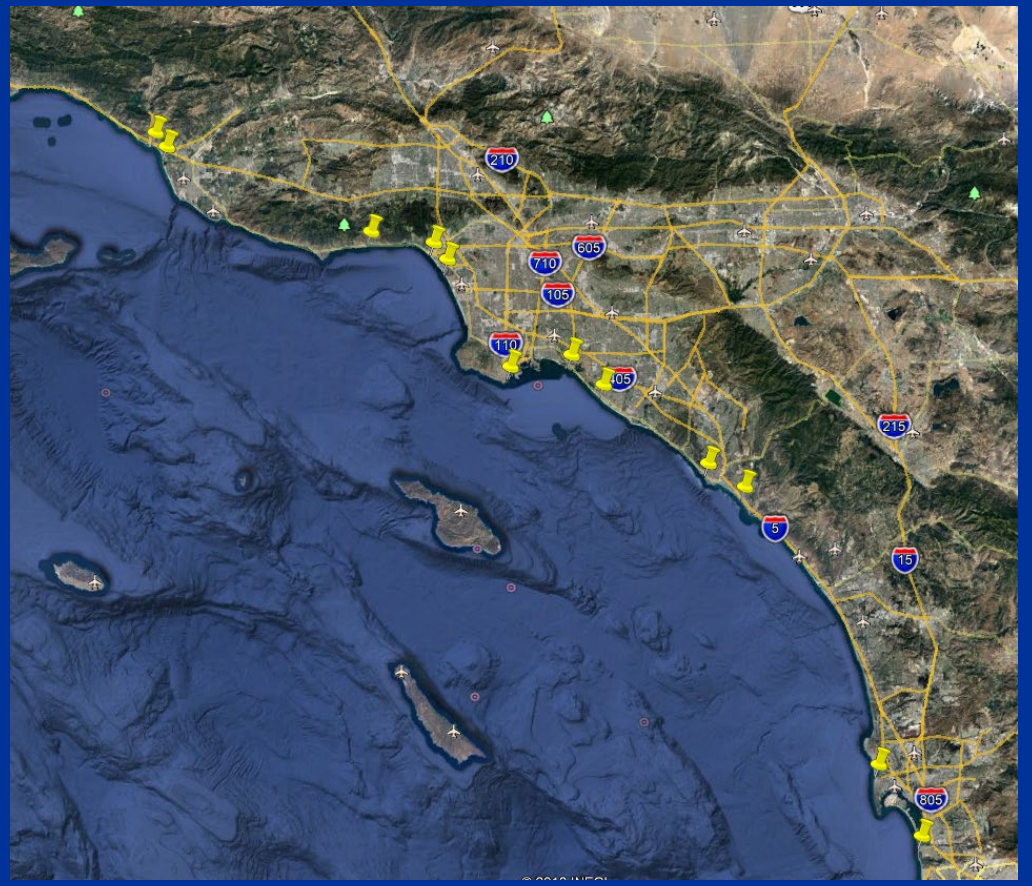
- **12 sites**
  - Samples collected during routine monitoring

- **Wet and Dry weather**
  - 30 samples each site and season

- **Side - by - side measurements of coliphage and *Enterococcus***

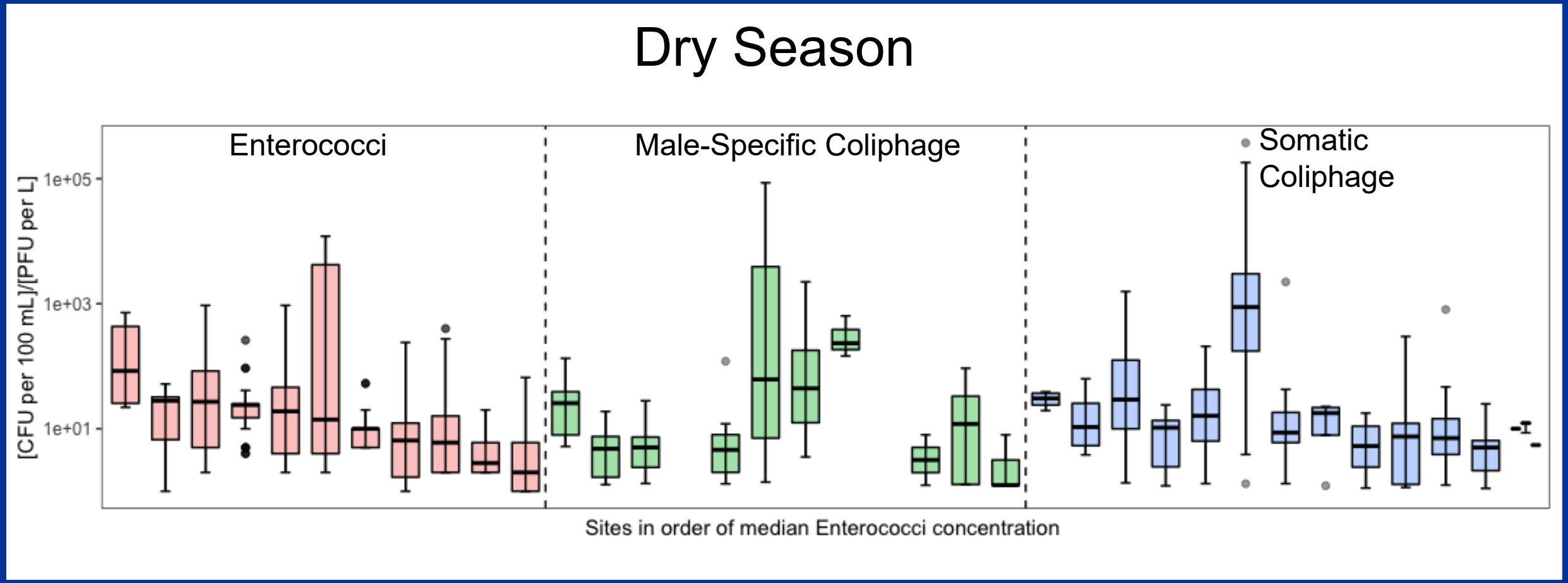
BIGHT 18' COLIPHAGE SAMPLING SITES

Monitoring Agency	Location
City of San Diego	Imperial Beach
City of San Diego	Dog Beach
OCSD	Huntington Bch Stn. 0
OCSD	Huntington Bch Stn. 3
LACSD	Inner Cabrillo
LACSD	Marina Del Rey
City of Los Angeles	Surfrider Beach
City of Los Angeles	Santa Monica Pier
OCPHL	Salt Creek
OCPHL	San Clement Pier
County of Ventura	Surfer's Point at Seaside
County of Ventura	Surfer's Knoll Beach



COLIPHAGE LEVELS VARIED BY SITE AND SEASON

PRELIMINARY RESULTS



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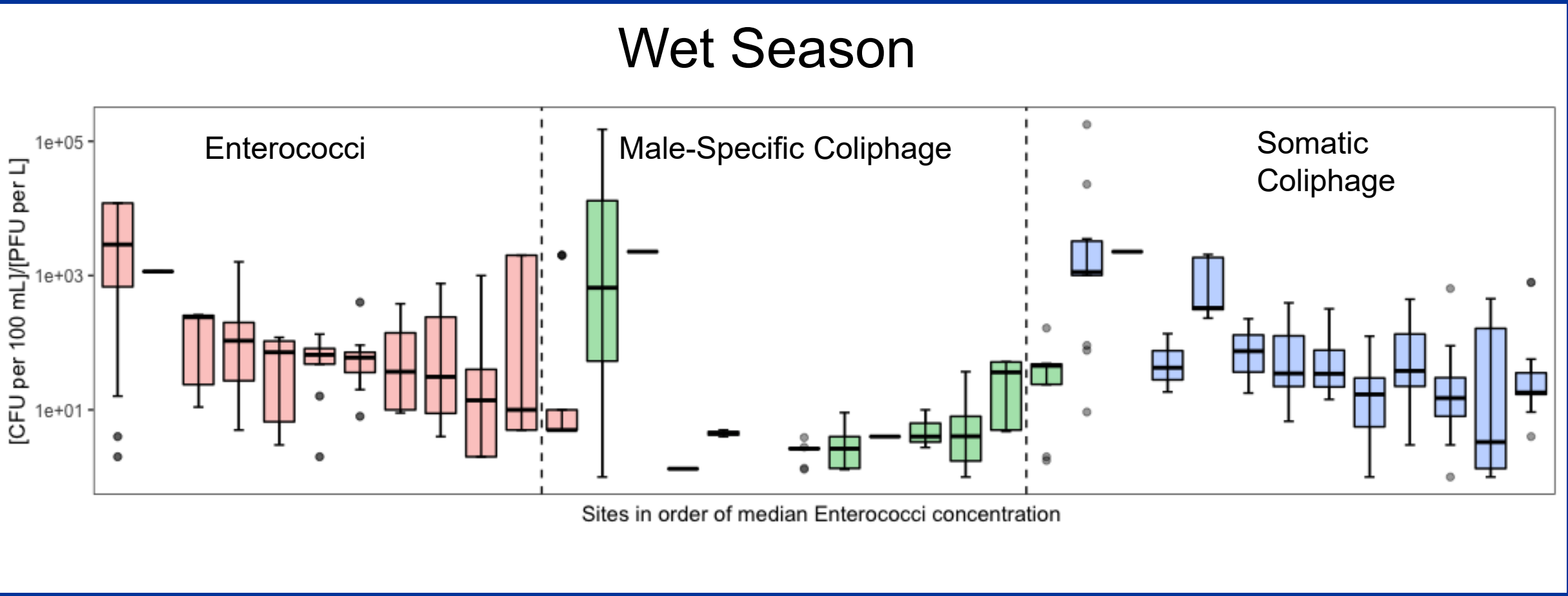

ENTEROCOCCI AND COLIPHAGE LEVELS WERE CORRELATED

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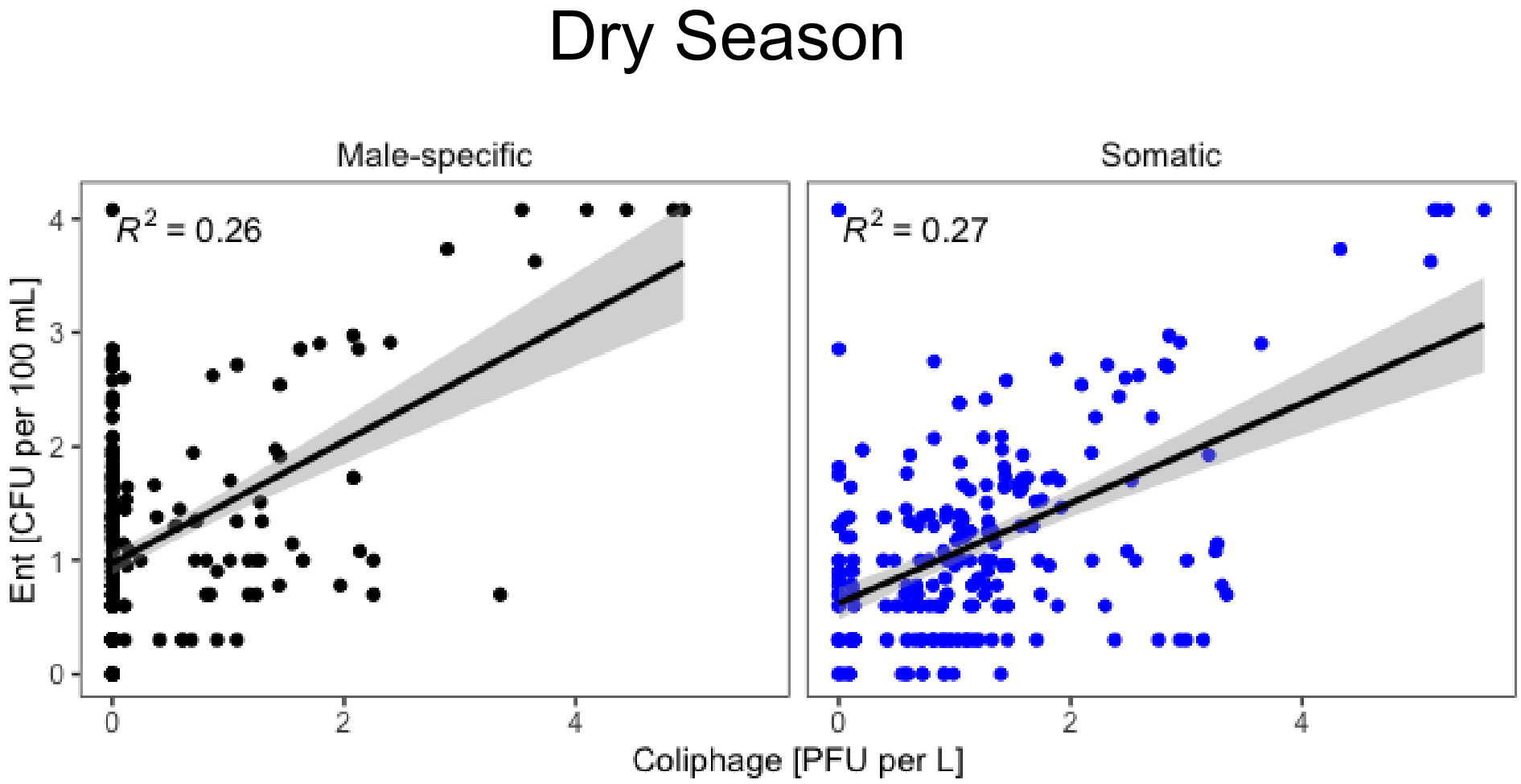

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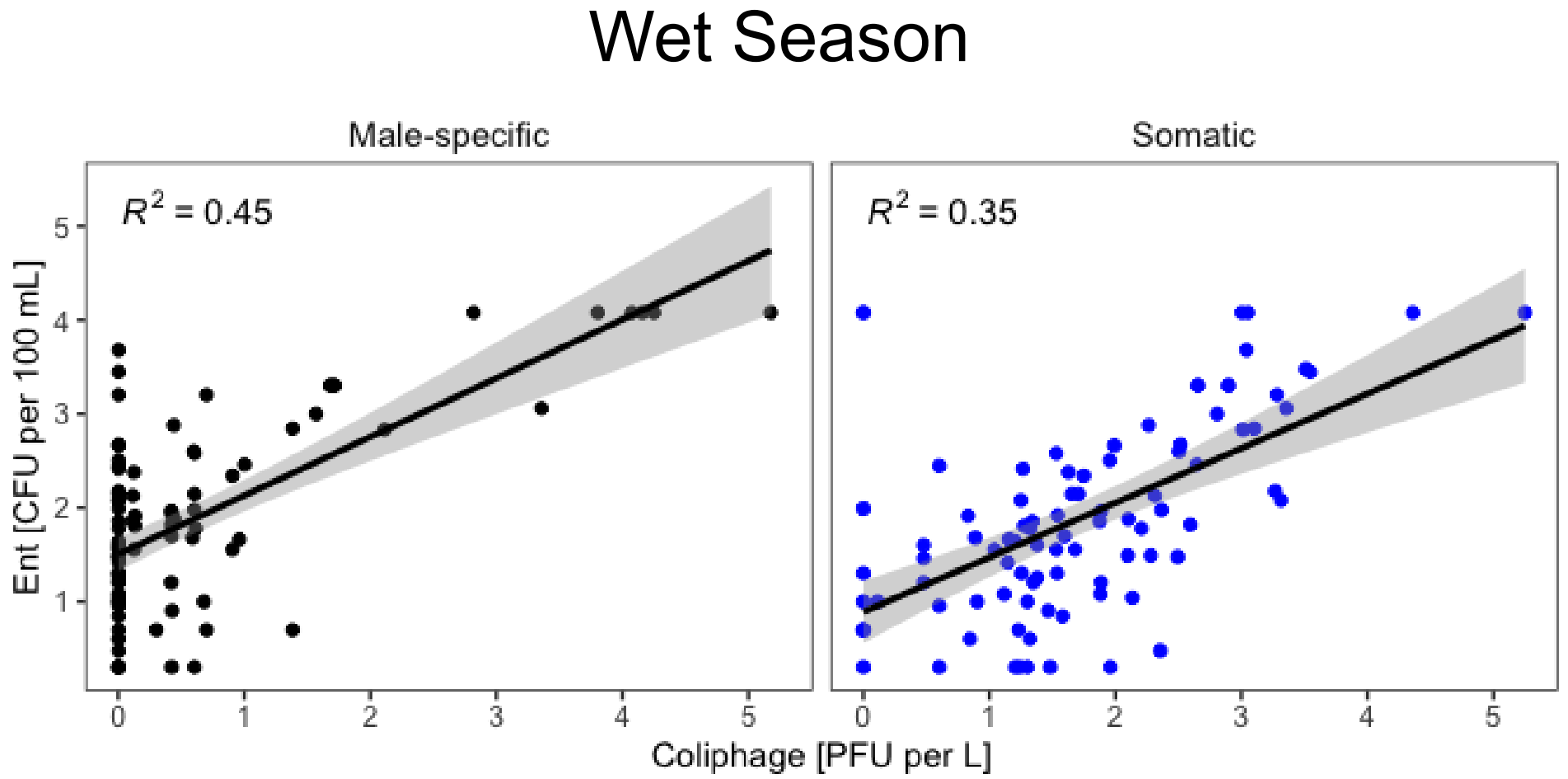


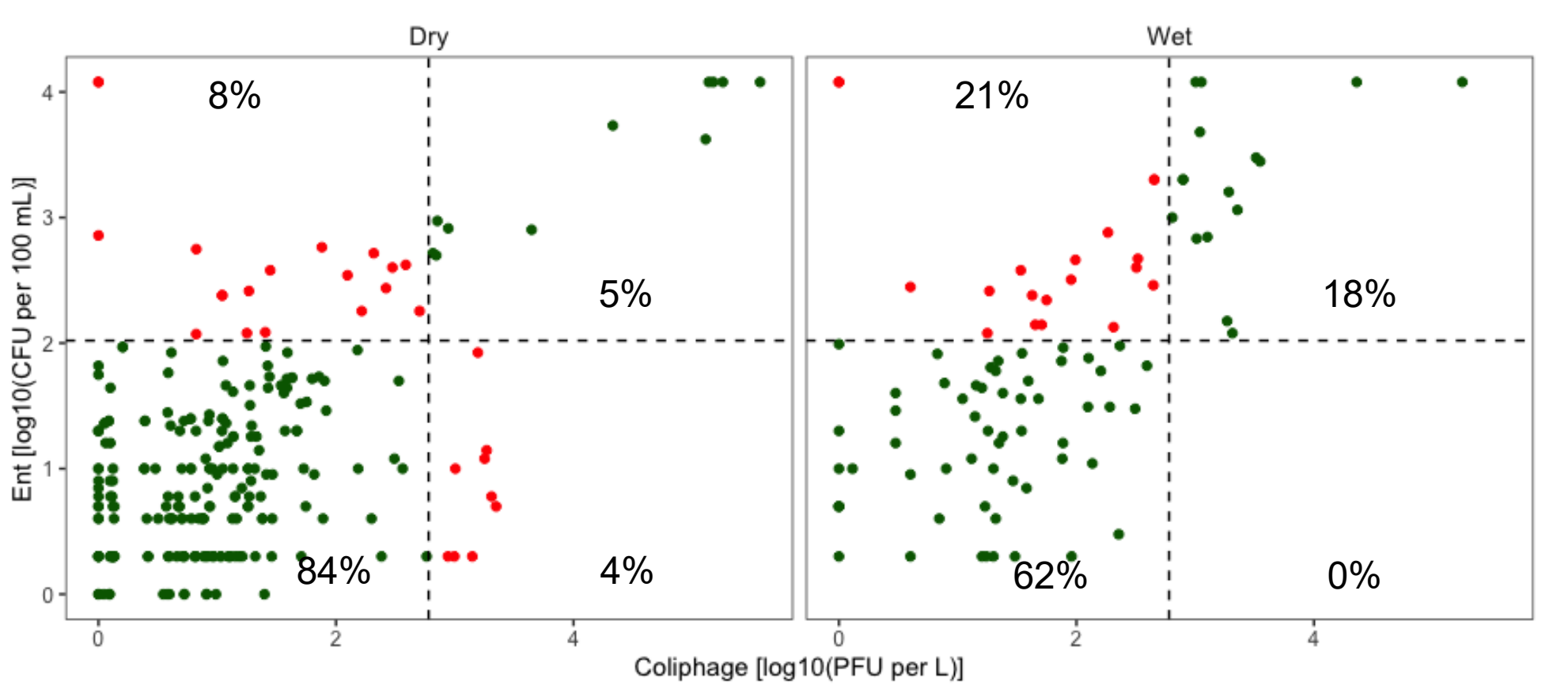
WERE COLIPHAGE LEVELS MEASURED PROBLEMATIC?

- **Currently, no EPA threshold**

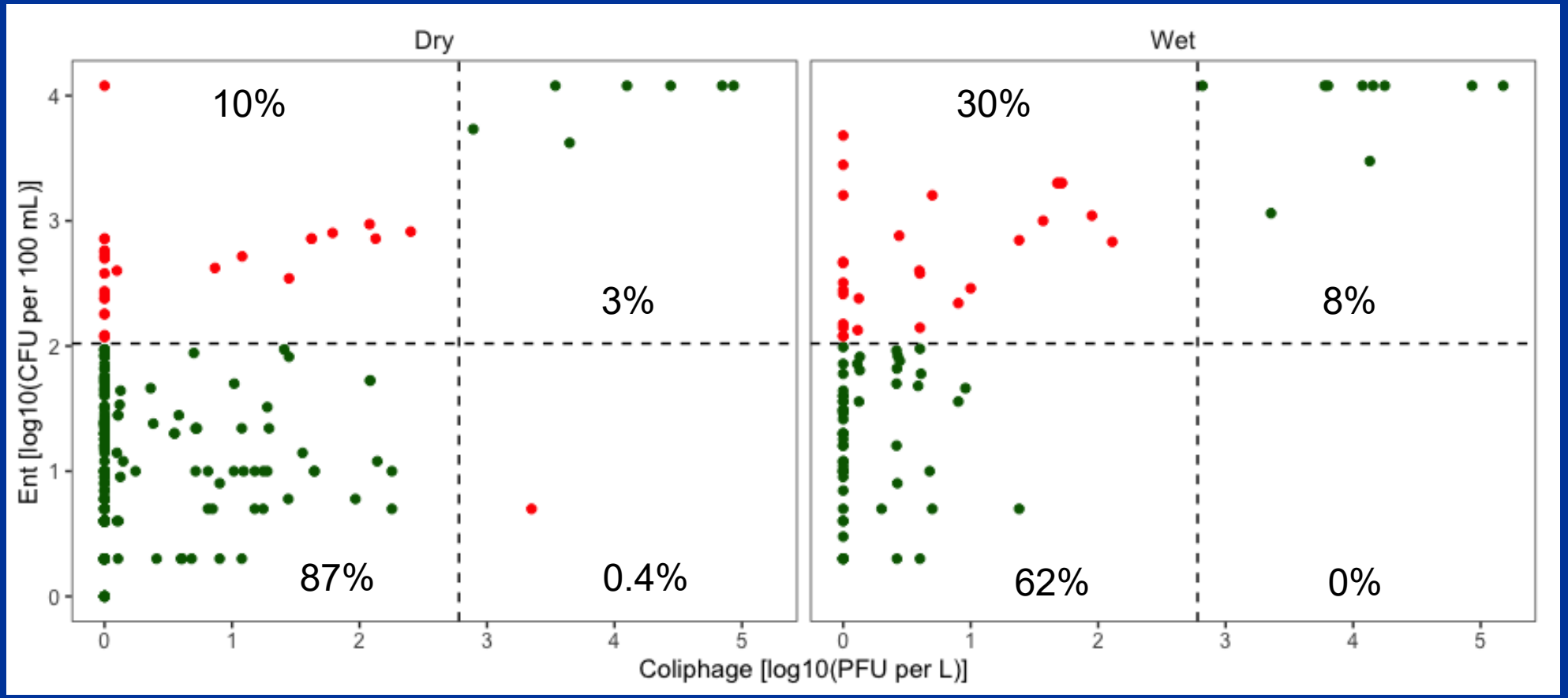
- **A recently published risk model suggested thresholds for both somatic and male-specific coliphage in surface waters**

  - Somatic: 60 PFU/100 mL
  - Male-specific: 30 PFU/100 mL

SOMATIC COLIPHAGE
PRELIMINARY RESULTS



MALE-SPECIFIC COLIPHAGE
PRELIMINARY RESULTS



WHAT'S NEXT

- **Dry weather sampling will conclude September 30**
- **Bight Microbiology Committee meeting this month to make a decision on whether to proceed with wet weather sampling**
- **EPA will soon be making decisions about how and where to implement coliphage**
  - SCCWRP will be providing our data to help guide this process