Microbial Water Quality at Reference Beaches In Southern California:
An Example Approach for ASBS

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Background For Bacteria

- Many beaches suffer from bacterial contamination
  - 99 beaches in So Cal subject to TMDLs
- Not all bacteria come from human sources
- How clean is clean?
- Comparison to reference beaches

Study Questions

- What percent of samples from reference beaches exceed water quality thresholds?
  - Wet weather, winter dry, summer dry
- What is the level of bacteria along reference beaches with varying watershed factors?

Design Issues

- What constitutes a reference site?
- What factors influence discharge and receiving water characteristics?
- What and where to measure?
Reference Site Selection Criteria

- Open beach with freshwater input
- Watershed size within range of listed beaches
- Undeveloped (>95% open)
- Wet weather access (ability to rate flow)
- Sample in wave wash
  - Fecal indicator bacteria, salinity
- Sample in discharge
  - Flow, fecal indicator bacteria, and salinity
  - Human virus
San Onofre Ck

Storm Characterization Factors

- Goal is to capture a range of potential factors
- Three conditions (summer, winter, wet)
- Four days per storm (day of + three)
- Three sized sheds (large, med, small)
- Two types of seasons (early, late)
- Two types of storm events (large, small)

Effect of Weather Condition

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<th>4</th>
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AB411 Single Sample Thresholds
- Total > 10,000 /100 mL
- Fecal (E. coli) > 400 /100 mL
- Enterococcus > 104 /100 mL
- Total:Fecal ratio < 10 when Total > 1,000
- Any = cumulative of all thresholds

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Exceedances (%)
Effect of Time Since Rainfall

Effect of Watershed Size

Effect of Seasonality

Effect of Storm Size
Effect of Breaching

![Effect of Breaching Graph]

Relationship Between Discharge and Receiving Water

![Relationship Graph]

Effect of Lagoons In Wet Weather

![Effect of Lagoons Graph]

Effect Of Lagoon In Dry Weather

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<thead>
<tr>
<th></th>
<th>Lagoon Breached</th>
<th>Lagoon Not Breached</th>
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<tr>
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<td>Avg.# Birds</td>
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Summary of Results

- Winter wet weather has greater frequency of exceedence than winter or summer dry weather
- Frequency of exceedence generally declines over the 3 days following rainfall
- Early season storms have greater exceedence frequencies than late season storms
  - Greater number of indicators exceed in early season

Summary of Results

- Big storms have greater frequency of exceedence than small storms
  - Function of breaching the sand berm
- Storm discharges effect wave wash concentrations