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

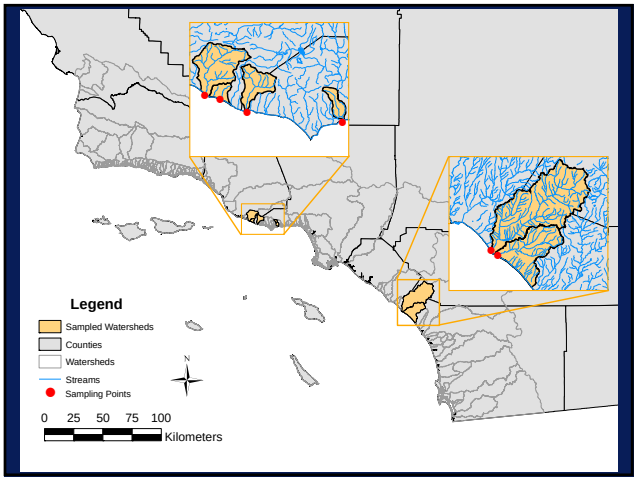
- What percent of samples from reference beaches exceed water quality thresholds?
  - Wet weather, winter dry, summer dry
- What is the level of bacteria along reference beaches with varying watershed factors?

Design Issues

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

Reference Site Selection Criteria

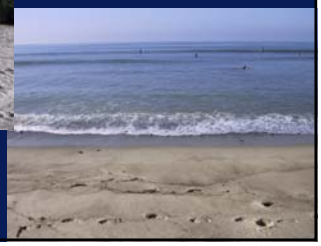
- Open beach with freshwater input
- Watershed size within range of listed beaches
- Undeveloped (>95% open)
- Wet weather access (ability to rate flow)
- Sample in wave wash
  - Fecal indicator bacteria, salinity
- Sample in discharge
  - Flow, fecal indicator bacteria, and salinity
  - Human virus



Deer Ck

Solstice Cnyn

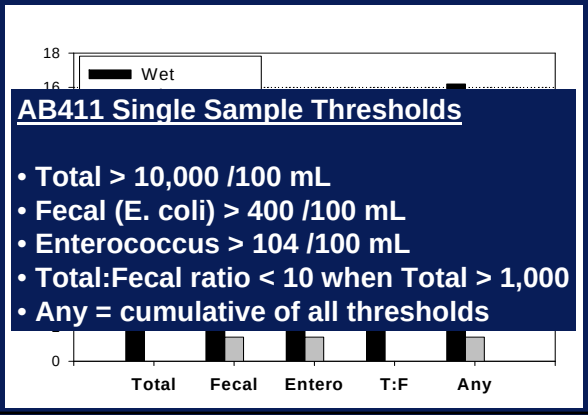
San Onofre Ck



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)

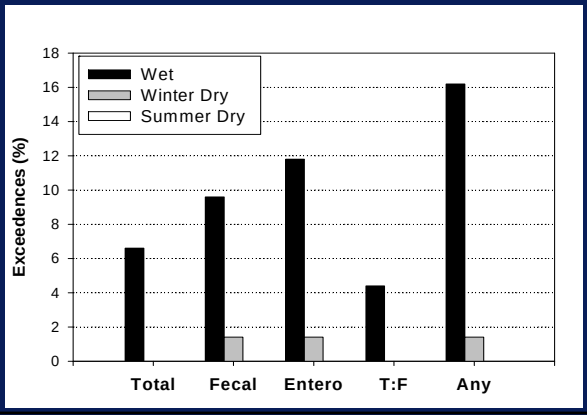
Effect of Weather Condition



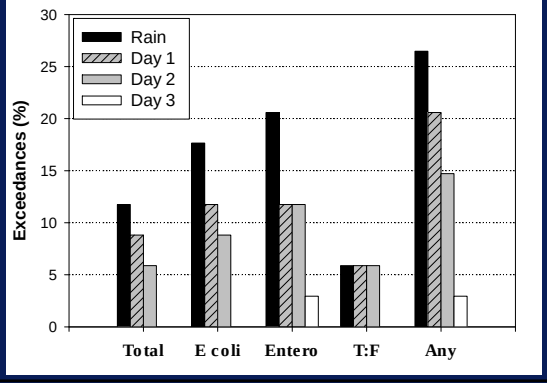
AB411 Single Sample Thresholds

- 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

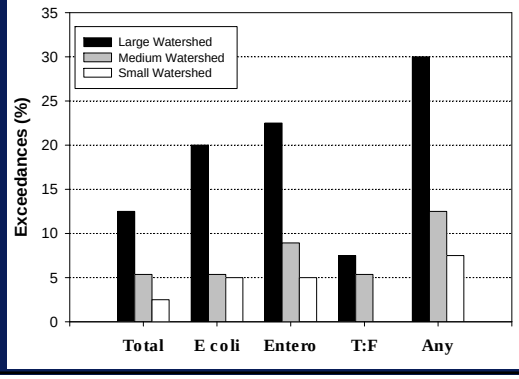
Effect of Weather Condition



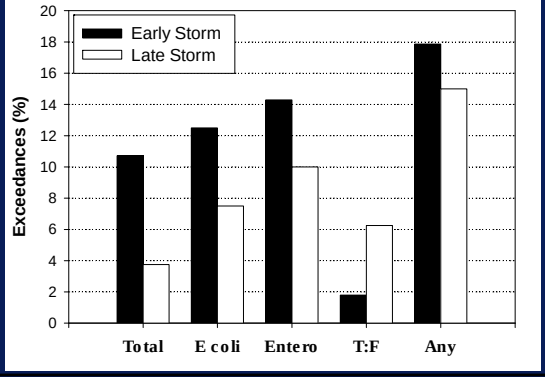
Effect of Time Since Rainfall



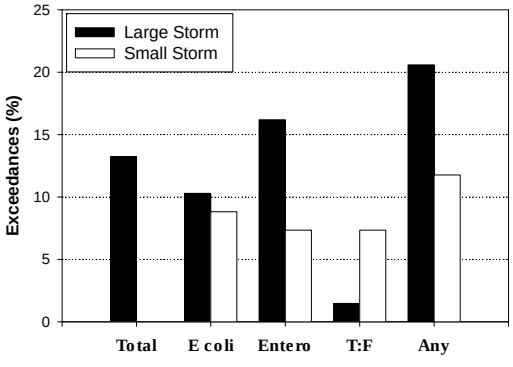
Effect of Watershed Size



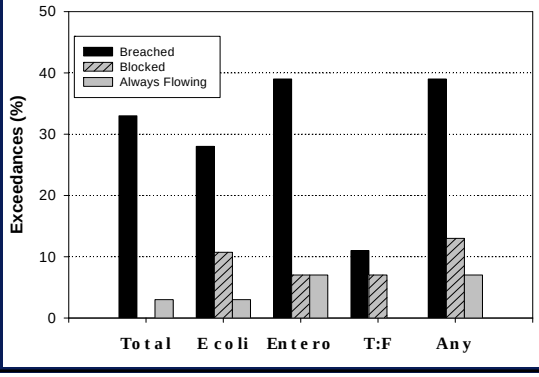
Effect of Seasonality



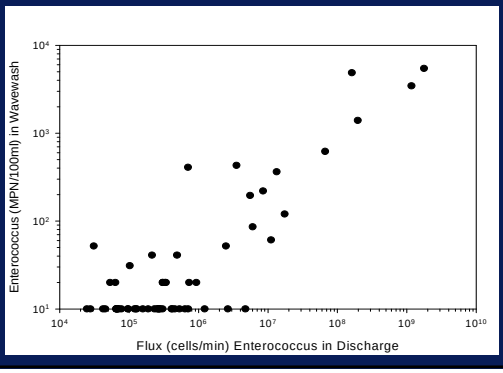
Effect of Storm Size



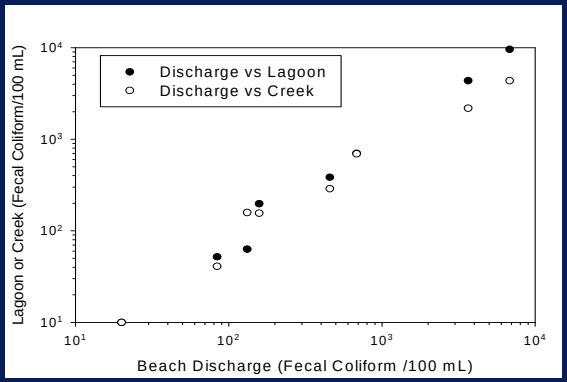
Effect of Breaching



Relationship Between Discharge and Receiving Water



Effect of Lagoons In Wet Weather



Effect Of Lagoon In Dry Weather

	Lagoon Breached		Lagoon Not Breached	
	# Storms	Avg.# Birds	# Storms	Avg.# Birds
Leo Carillo	4	24	-	-
San Onofre	4	<1	1	0
San Mateo	-	-	4	131

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