CHAPTER 6
SEASONAL VARIATION AND CRITICAL CONDITIONS

This chapter describes the seasonal variation in fecal indicator bacteria, as measured during a wet and dry season in the Russian River Watershed. It describes the critical or extreme condition for the purposes of setting allocations to meet water quality standards.

6.1 SEASONAL VARIATION

6.1.1 WET PERIODS VS. DRY PERIODS

Regional Water Board staff collected water samples for measurement of fecal indicator bacteria at numerous locations in the Russian River Watershed from 2011 to 2013 (NCRWQCB 2012; NCRWQCB 2013a; NCRWQCB 2013b). Water samples were collected in both dry and wet periods for analysis of *E. coli*, enterococci, human-specific *Bacteroides*, and bovine-specific *Bacteroides* bacteria concentrations. Dry period samples were collected after 72 hours of no rainfall. Wet period samples were collected during storm events of at least 0.1 inches of rainfall that were preceded by 72 hours of no rainfall.

Figures 6.1 through 6.4 aggregate these data and compare the distribution of fecal indicator bacteria concentrations sampled during wet and dry weather periods. All three indicator bacteria show significantly higher concentrations measured during wet weather compared to dry weather samples. This finding indicates that higher pathogenic indicator bacteria levels are associated with higher flows that are associated with storm events.

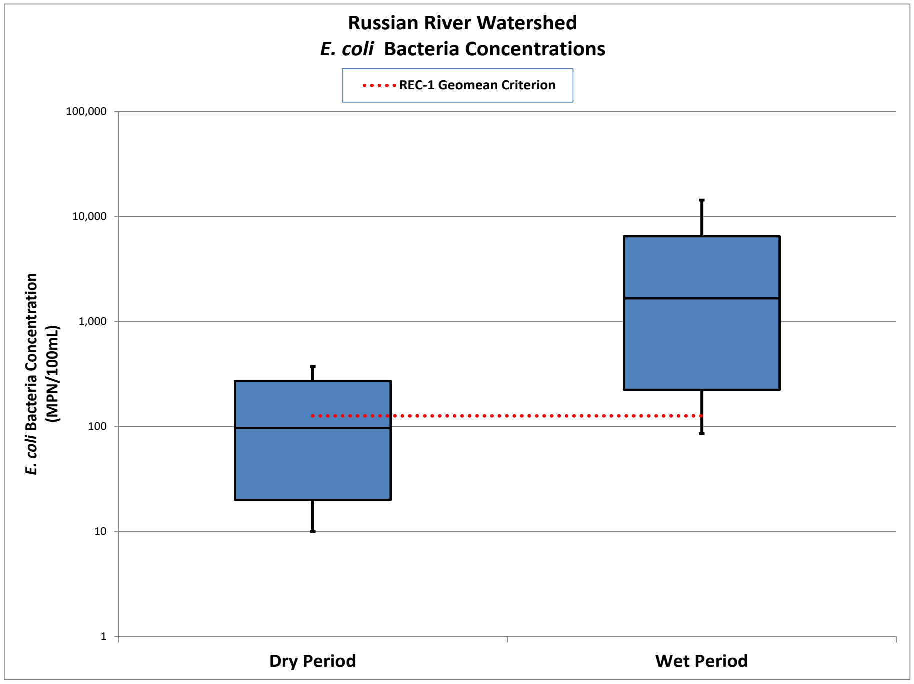

Figure 6.1: Distribution of E. coli Bacteria Concentrations collected during Dry and Wet Weather Periods

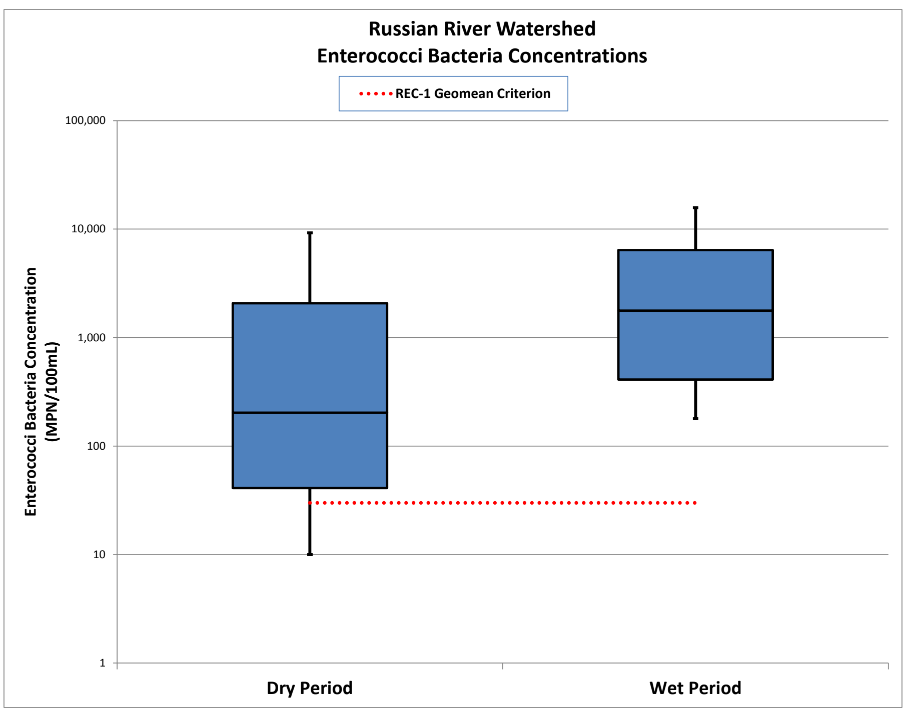

Figure 6.2: Distribution of Enterococci Bacteria Concentrations collected during Dry and Wet Weather Periods

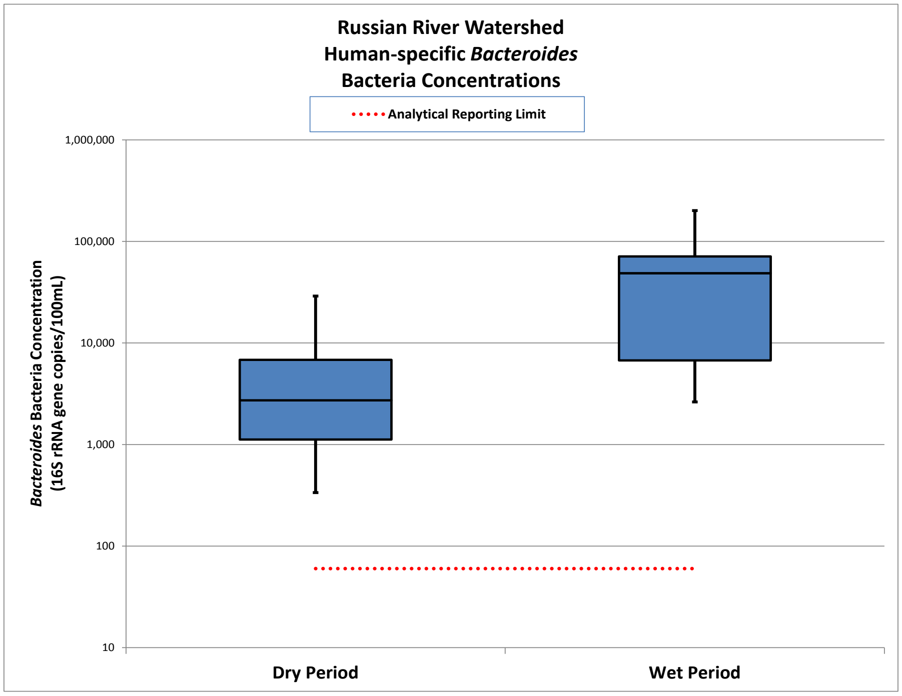

Figure 6.3: Distribution of Human-specific Bacteroides Bacteria Concentrations collected during Dry and Wet Weather Periods. Human-specific Bacteroides were analyzed with the HuBac genetic marker following U.S. EPA (2010) Method B.

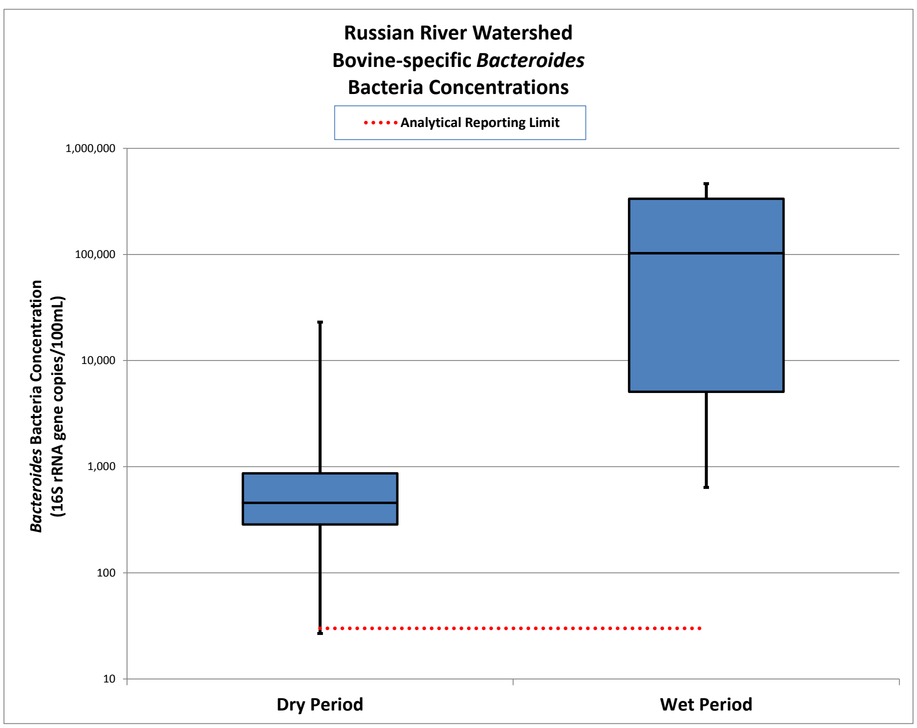

Figure 6.4. Distribution of Bovine-specific Bacteroides Bacteria Concentrations collected during Dry and Wet Weather Periods. Bovine-specific Bacteroides were analyzed with the BoBac genetic marker following U.S. EPA (2010) Method B.

6.1.2 EFFECTS OF LOW MAINSTEM FLOWS

Regional Water Board staff also evaluated the relationship between *E. coli* bacteria concentrations and dry season stream flows in the mainstem Russian River (Butkus 2014b). The assessment found that there is not a statistically significant correlation between summer daily mean stream flow rates and *E. coli* bacteria concentrations at Camp Rose Beach, Veteran Memorial Beach, Steelhead Beach, Johnson's Beach, or Monte Rio Beach, as shown in Figures 6.5 through 6.9. In other words, *E. coli* levels do not vary significantly due to flows in the mainstem during dry summer periods.

This conclusion is supported by an additional analysis undertaken to evaluate if *E. coli* concentrations are different in years with lower flows under a Temporary Urgency Change Petition (TUCP)[1] than in years without a petition (Butkus 2014b; Appendix C). There is no statistically significant difference in *E. coli* concentrations in years with reduced stream flows due to TUCPs in the Russian River at Camp Rose Beach, Veteran Memorial Beach, Steelhead Beach, and Johnson's Beach. Only data from Monte Rio beach showed a statistically significant difference in that *E. coli* concentrations were lower in TUCP years with reduced flows. The reason for the lower *E. coli* levels in lower flows at Monte Rio beach are unknown, but could include less rainfall and runoff or changes in management practices that reduced inputs in years with TUCPs.

6.2 CRITICAL CONDITIONS

In developing a TMDL, the critical condition can be thought of as the "worst case" scenario of environmental conditions in the waterbody, a condition where the pollutant loading is greatest, but the waterbody continues to meet water quality standards. Critical conditions are the combination of environmental factors (e.g., stream flow, air temperature, etc.) that result in the attainment of standards with an acceptably low frequency of occurrence (U.S. EPA 1999).

During wet weather periods, pathogenic indicator bacteria concentrations are much higher than during dry periods, and often exceed the numeric targets. Therefore, wet weather conditions can be considered a critical condition for bacteria levels. However, during the summer, low-flow period there is much more exposure to pathogenic indicator bacteria through recreation. Therefore, summer recreation periods can also be considered a critical

[1] The Sonoma County Water Agency (SCWA) controls and coordinates water supply releases from Coyote Valley and Warm Springs dams in accordance with minimum instream flow requirements specified by the State Water Board. These minimum instream flow requirements vary based on water supply conditions. Since 2002, SCWA has requested temporary changes to the Decision 1610 minimum instream flow requirements from the State Water Board. TUCPs filed from 2010 through 2014 were required by the Russian River Biological Opinion under the Endangered Species Act to reduce instream flow conditions to improve habitat for the threatened and endangered salmonid species.

period. Since both wet and dry periods are critical conditions, the same loading capacities apply throughout the year and should not vary according to season.

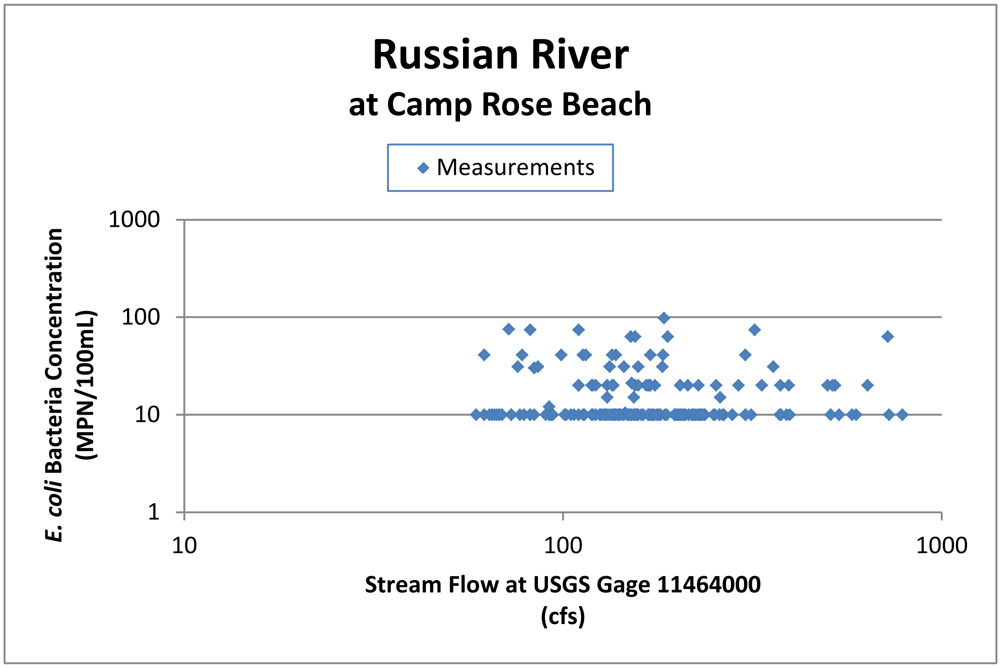

Figure 6.5: Correlation between E coli Bacteria Concentration and Stream Flow Measurements at Camp Rose Beach during the dry season

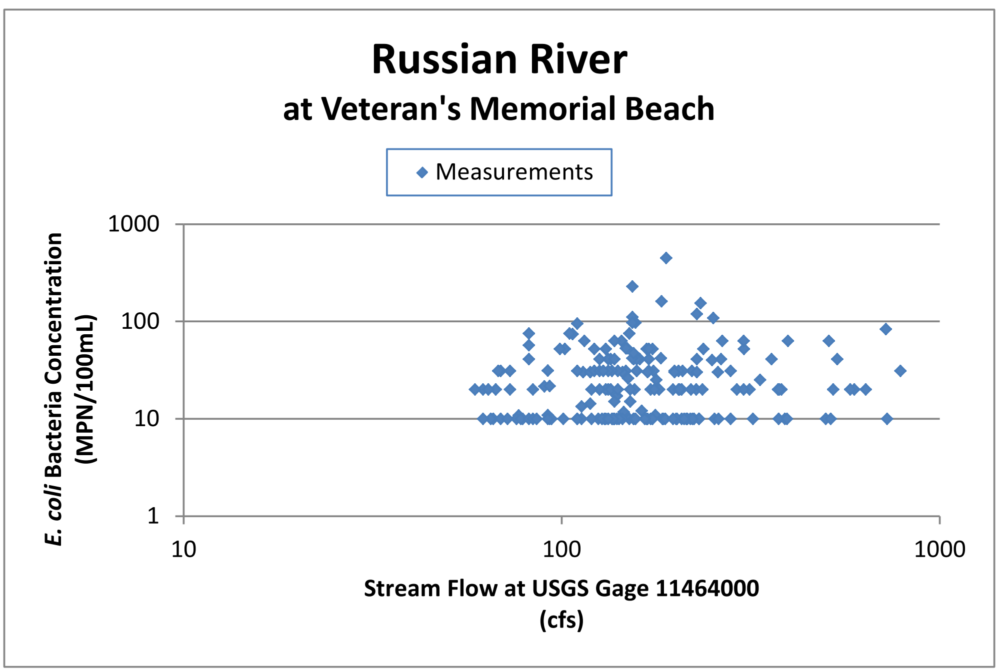

Figure 6.6: Correlation between E coli Bacteria Concentration and Stream Flow Measurements at Veteran Memorial Beach during the dry season

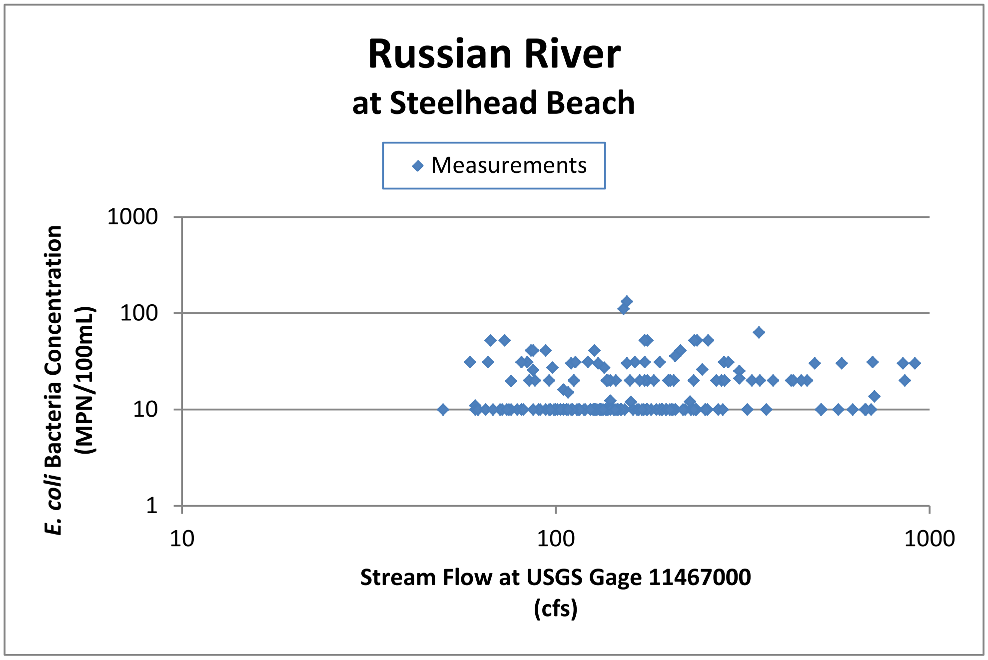

Figure 6.7: Correlation between E coli Bacteria Concentration and Stream Flow Measurements at Steelhead Beach during the dry season

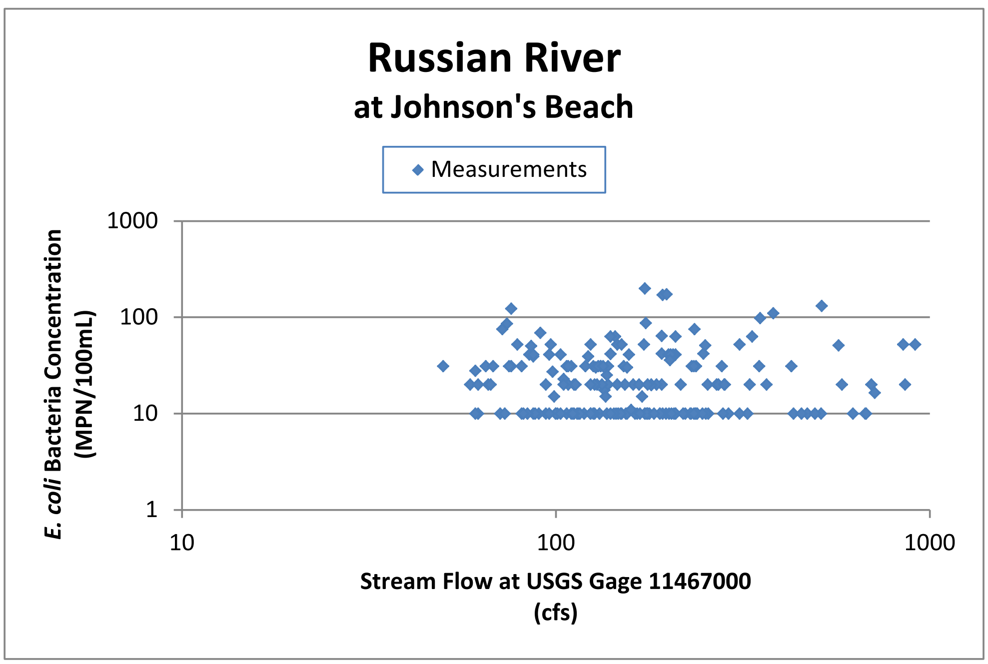

Figure 6.8: Correlation between E coli Bacteria Concentration and Stream Flow Measurements at Johnson's Beach during the dry season

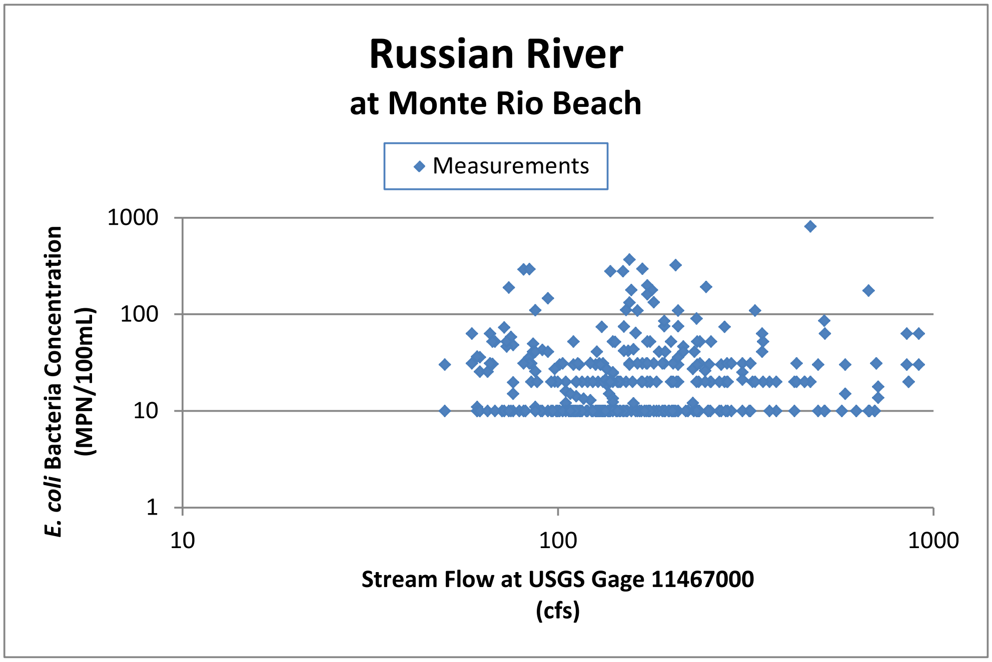

Figure 6.9: Correlation between E coli Bacteria Concentration and Stream Flow Measurements at Monte Rio Beach during the dry season