California Regional Water Quality Control Board

Central Valley Region

Lower American River Bacteria Study

Fecal Bacteria Source Investigation 2019-2022

Final Data Summary

May 2024

California Water Boards | Central Valley Water Board

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Overview

A multi-year study on the Lower American River provides important information on recreational water quality and the sources of fecal pollution contributing to elevated bacteria levels in the river. Study results indicate that birds are the largest and most consistent source of fecal pollution. Dogs were also a persistent source in some areas, but humans were not found to be a significant source of fecal contamination to the river.

This collaborative study was initiated to investigate frequent high bacteria measurements at popular recreation areas on the American River. The Central Valley Regional Water Quality Control Board (Central Valley Water Board), Sacramento County Regional Sanitation District (Regional San), Sacramento Area Sewer District,[1] Sacramento Stormwater Quality Partnership,[2] and Sacramento County Regional Parks jointly developed and funded the study.

Background

The Lower American River flows west through Sacramento County from Nimbus Dam at the base of Lake Natoma to the confluence with the Sacramento River. This 23-mile reach is bounded by the American River Parkway and is protected as a recreational river within the California and National Wild and Scenic Rivers Systems. The river is a popular destination for boating, swimming, fishing, and other recreational activities.

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[1] As of January 1, 2024, Regional San and the Sacramento Area Sewer District merged into one district, referred to as the Sacramento Area Sewer District (SacSewer).

[2] The Sacramento Stormwater Quality Partnership is comprised of Sacramento County and the cities of Sacramento, Citrus Heights, Elk Grove, Folsom, Galt, and Rancho Cordova.

The Central Valley Water Board has conducted extensive monitoring on the Lower American River since 2007 to track whether water quality supports swimming and other recreational uses. Sampling has shown that fecal indicator bacteria results at recreation areas in the lower few miles of the American River frequently exceed the water quality objectives.

Statewide bacteria water quality objectives[3] were developed to protect recreational users from the effects of pathogens. Pathogens are small organisms, such as bacteria and viruses, that can cause illness. The primary source for pathogens is untreated fecal pollution from humans and other animals. Since it is not practical to monitor for all possible pathogens, fecal indicator bacteria are commonly used as evidence of pollution and an increased risk of illness. The indicator bacteria used for freshwater is *Escherichia coli* (*E. coli*). *E. coli* is a species of bacteria that is abundant in the feces of warm-blooded animals, making it an excellent indictor organism.

It is important to identify the sources of fecal contamination in order to understand the human health risk. Humans and other animals can carry pathogens, but not all sources pose the same health risk.

Study Design

The goals of this study were to investigate the elevated fecal indicator bacteria levels and collect information about the sources of fecal pollution in the Lower American River. The study focused on the lower 6-mile reach of the river in order to target the areas with the highest historical bacteria levels and potential upstream sources. To make the most of limited resources and collect a high-resolution dataset, it was agreed to break the study into two phases. Phase 1 and 2 of the monitoring each focused on dry weather conditions over adjacent 3-mile segments of the river. To have a robust dataset for analysis, 30 sampling events were completed during each phase.

Monitoring stations were selected to provide information on spatial trends and potential sources of fecal pollution. Stations were distributed upstream and downstream of potential sources and on both banks of the river. Stations were included on both the south (river left) and north (river right) banks to characterize source inputs along both banks, because there is unlikely complete mixing of sources from one bank to the other due to the size and hydrology of the river. Additional stations were monitored to characterize sources in dry weather urban runoff. The monitoring stations are shown in Figures 1 and 2.

Monitoring for Phase 1 of the source tracking study was completed during the summers of 2019 and 2020. Phase 1 focused on dry weather conditions in the upper 3-mile reach from Paradise Beach to Sutter's Landing Regional Park. Twelve locations were

[3] Statewide bacteria water quality objectives are included in part 3 of the Water Quality Control Plan for Inland Surface Water, Enclosed Bays, and Estuaries Plan of California (https://www.waterboards.ca.gov/plans_policies/docs/bacteria.pdf).

monitored during Phase 1: 2 urban runoff stations and 10 river monitoring stations, including 2 midstream locations at the upstream and downstream ends of the study reach.

Monitoring for Phase 2 focused on dry weather conditions in the 3-mile river reach from Sutter's Landing Regional Park to the confluence with the Sacramento River. Monitoring for Phase 2 was completed during the summers of 2021 and 2022 and included 12 river monitoring locations and 1 urban runoff station.

River samples were collected from the bank of the river in ankle to knee-depth water. Bacteria levels are frequently higher in the shallow water at the edges of waterbodies and represent the highest risk for children recreating along the shoreline. Urban runoff samples were collected directly from the sump or drainage channel upstream of the American River.

Figure 1. Map of the Phase 1 study area showing the river and urban runoff monitoring locations. Station symbols indicate whether they are a river monitoring station (orange) or urban runoff station (green), as well as the proportion of E. coli results that exceed the bacteria water quality objective (WQO).

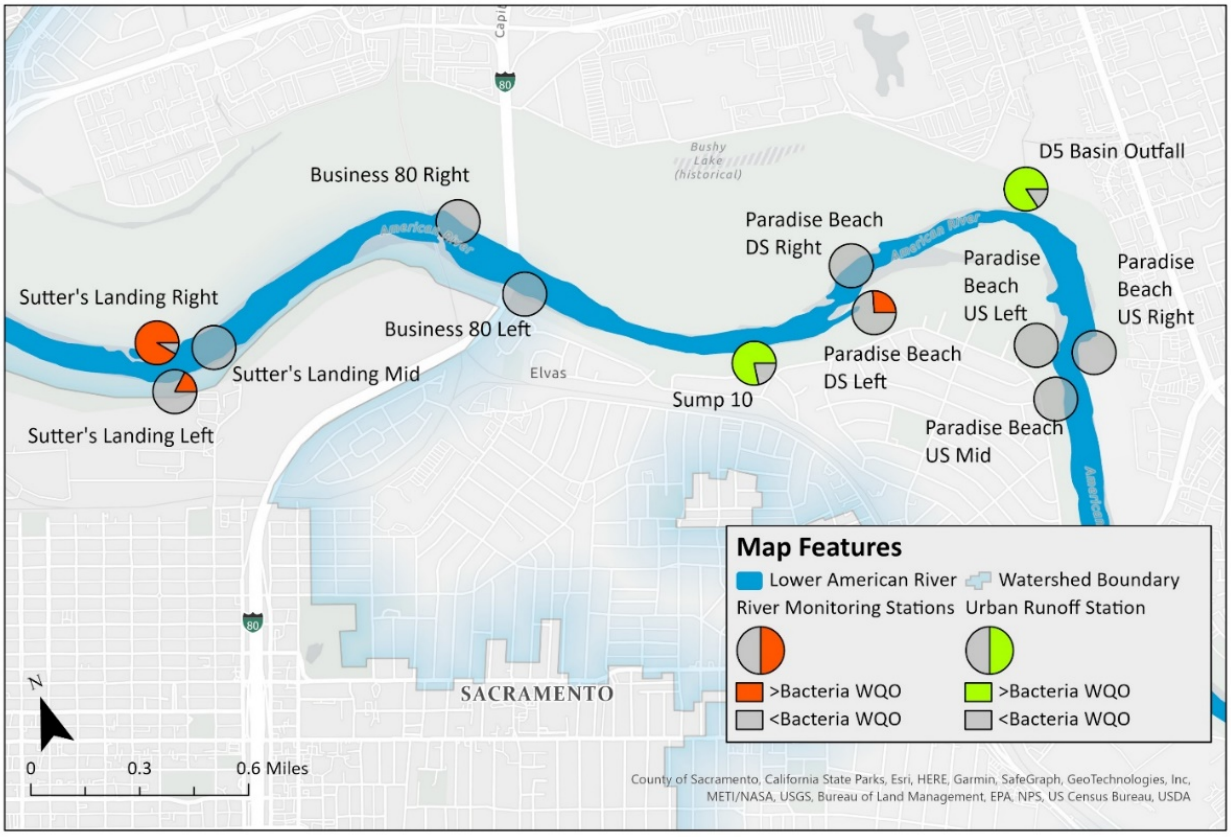
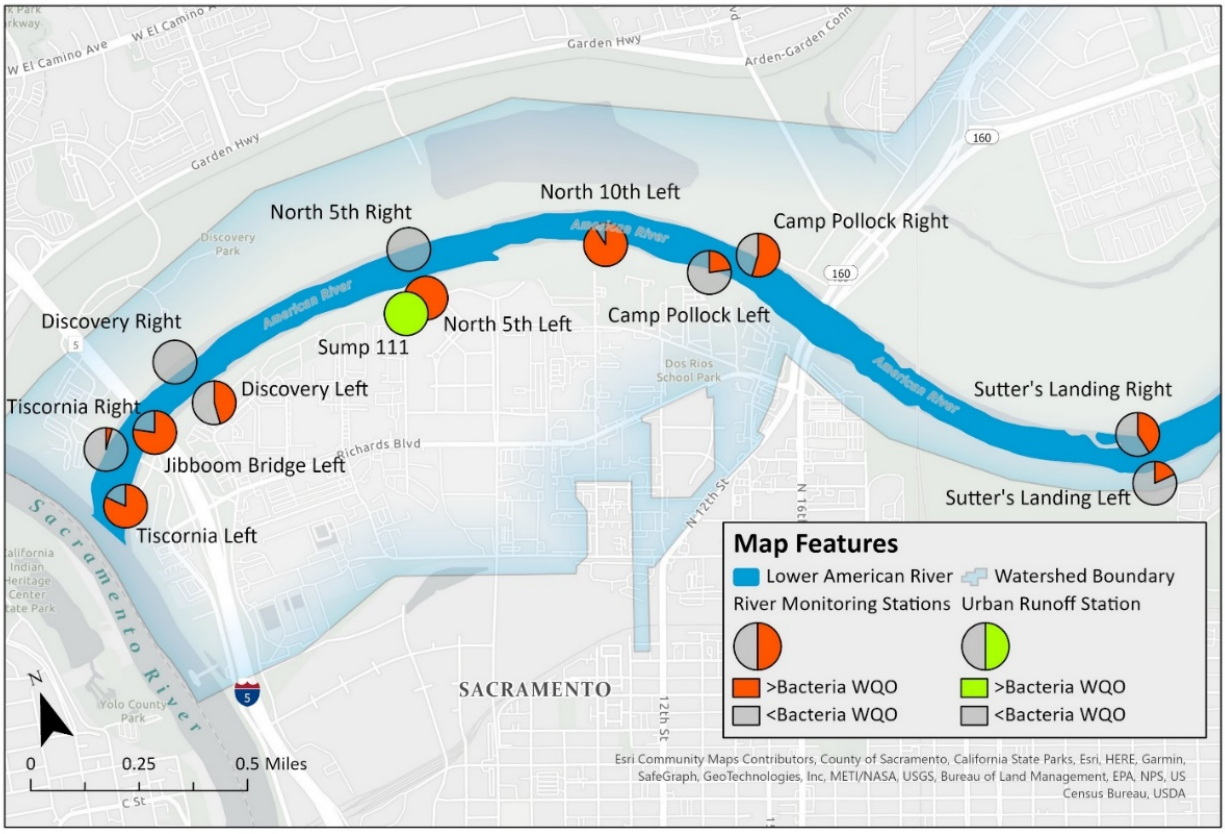


Figure 2. Map of the Phase 2 study area showing the river and urban runoff monitoring locations. Station symbols indicate whether they are a river monitoring station (orange) or urban runoff station (green), as well as the proportion of E. coli results that exceed the bacteria water quality objective (WQO).



Results

Recreational Water Quality

All samples were analyzed for the indicator bacteria *E. coli* and compared to the statewide bacteria water quality objectives for freshwater. The freshwater *E. coli* objective is a 6-week rolling geometric mean of 100 colony forming units (cfu) or most probable number (MPN) per 100 milliliters (mL). MPN and CFU are different methods to estimate the number of bacteria in a water sample. For this study, an MPN method (Standard Method 9223B) was used.

Monitoring results show that most locations in Phase 1 of the Lower American River Bacteria Study generally meet the bacteria water quality objectives (see Figure 1). The exception is the right bank at Sutter's Landing, where more than 90% of samples exceeded the bacteria objective.

In contrast, multiple stations in the Phase 2 reach frequently exceeded bacteria water quality objectives. Of the 12 river monitoring stations, 10 had at least one exceedance of the 6-week rolling geometric mean objective for *E. coli* and 5 stations exceeded the

objective more than half the time. The monitoring stations and summary of exceedances are shown in Figure 2.

All three of the urban runoff stations regularly exceeded the bacteria objectives during the study period. These included 2 stormwater and urban runoff collection sumps and the gravity outfall at Chicken Ranch Slough (D5 Basin). These systems are not used for recreation but represent a potential source of bacteria to the American River.

Sources of Fecal Contamination

Samples with *E. coli* levels greater than 100 MPN/100 mL were submitted for microbial source tracking (MST) analysis. MST uses host-specific genetic markers for bacteria present in feces to identify the source of fecal pollution and is an established tool in California and nationwide. MST samples were analyzed for human, dog, and bird genetic markers. Nearly half of Phase 2 samples were submitted for MST analysis, while about a third of Phase 1 samples were submitted due to lower *E. coli* counts.

The MST results for both Phase 1 and Phase 2 of study indicate that birds are the largest and most consistent source of fecal contamination (see Figure 3) in the river. The marker for birds was detected in more than 70% of all river samples and 17 of the 20 riverbank locations had detection rates above 50%.

Dogs are also a consistent source of fecal contamination in some areas. The marker for dogs was detected in 43% of river samples and 8 of the 20 riverbank locations had detection rates of at least 50%.

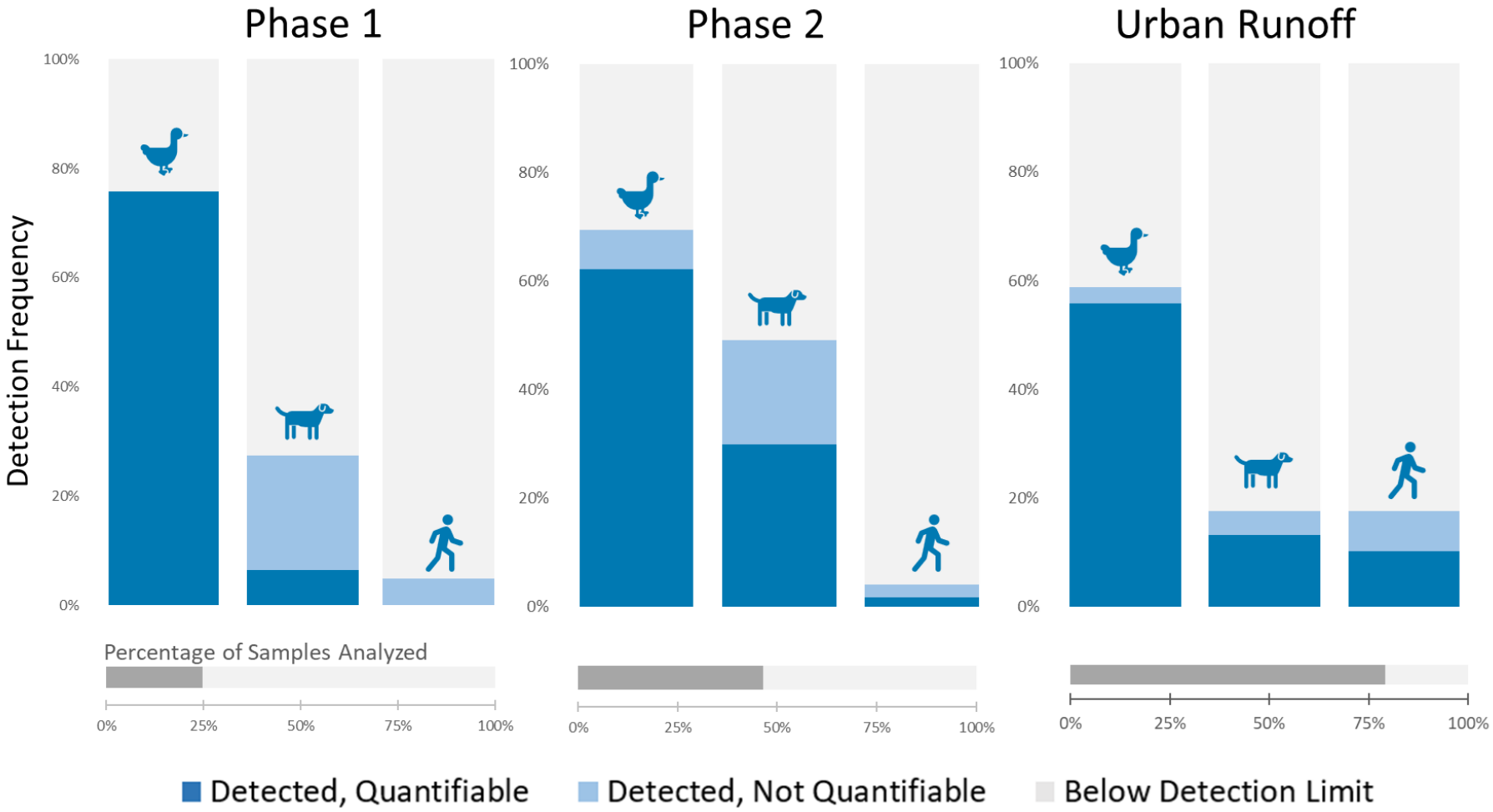
With a detection rate of 4% in river samples, humans were not a significant or consistent source of fecal contamination in the river during the study period. Three river samples had quantifiable levels of the human marker: the right bank at North 5th Street on July 27, 2021; the left bank at North 5th Street on May 17, 2022; and the left bank at Tiscornia Beach on September 6, 2022.

MST results for the urban runoff stations also indicate the most consistent source of fecal contamination is birds (59%). Dogs and humans were each detected in 18% of urban runoff samples. Sump 111 had 6 detections of the human marker, all within a 6-week period in July-August 2022. This accounted for half of the human marker detections in urban runoff samples.

Conclusion

The local community and visitors to the Lower American River should be aware of water quality conditions that may impact their health. Monitoring of *E. coli* levels has continually shown some popular recreation areas frequently exceed bacteria objectives, indicating an increased risk of illness. Central Valley Water Board staff will continue to monitor sites along the river to keep water managers and our community informed about current *E. coli* levels. The latest results can be found on an interactive online map that is updated weekly during the recreation season.

Figure 3. Summary of MST sample data for river and storm drainage outfall locations. Each set of bar graph shows the percentage of sample results that were below the detection limit, detectable but not quantifiable, and detected above the quantification limit for the bird, dog, and human markers. The detection limit is the lowest concentration (i.e., the smallest amount) that can be detected by the method. The quantification limit is the lowest concentration a sample can be measured with reasonable accuracy and precision. Results that are between the detection and quantification limits are detectable but not quantifiable, meaning the targeted marker was present but at too low of a concentration to determine the amount.



The source study found that bird sources are the most consistent source of fecal contamination in the river. Geese and other waterfowl frequently congregate along the river and are often seen in beach areas. Dogs were also found to be a persistent source in some areas of the river. Animals can carry pathogens that are harmful to people.

The marker for humans was detected infrequently and at low levels in samples collected from the Lower American River, suggesting minimal sources. Detections in urban runoff, such as those at Sump 111, indicate the presence of human sources and warrant further review and possible source investigations. However, no corresponding human signal was detected in the American River downstream of Sump 111 or other urban runoff stations and *E. coli* levels in the river did not correlate with *E. coli* urban runoff concentrations.

The information collected in this study will be used to build an understanding of human health risk, evaluate where water quality supports recreational use, and inform future fecal source control strategies.

Further Reading

California Bacteria Water Quality Objectives: https://www.waterboards.ca.gov/bacterialobjectives/

California Microbial Source Identification Manual: https://bit.ly/SourceIDManual

California Safe to Swim Portal: https://bit.ly/Safe2Swim

Lower American River Bacteria Study Plan and Sampling and Analysis Plans are available on request by e-mailing Alisha.Wenzel@waterboards.ca.gov.