ARIZONA STATE UNIVERSITY

"Accidental" Urban Wetland Networks along the Salt River in Phoenix, AZ

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INTRODUCTION

- Increases in available nutrients and bacteria in urban streams are at the forefront of research concerns within the ecological and medical communities
- Stream pollutants are expected to become increasingly problematic under projected changes in drought frequency and storm severity in Phoenix:
  - Drier conditions increase erosion by water during storm events, and microbial and nutrient transport is often principally associated with sediment transport
  - Pollutants such as nitrogen and pathogenic bacteria accumulate on urban surfaces during dry periods, and thus tend to be higher in stormwater when the storms are preceded by relatively dry conditions
- Extensive wetland networks have formed in the bed of the otherwise dry Salt River, fed by outfalls carrying storm and wastewater

STUDY OBJECTIVES

- Quantify nutrient and pathogenic load of outfalls feeding the Salt River wetlands, during baseflow and storm conditions
- Quantify contribution of wetland areas to reductions in nutrient and pathogenic load as storm and wastewater flows through them

FIGURE 1. Study Sites Along Salt River in Phoenix, AZ

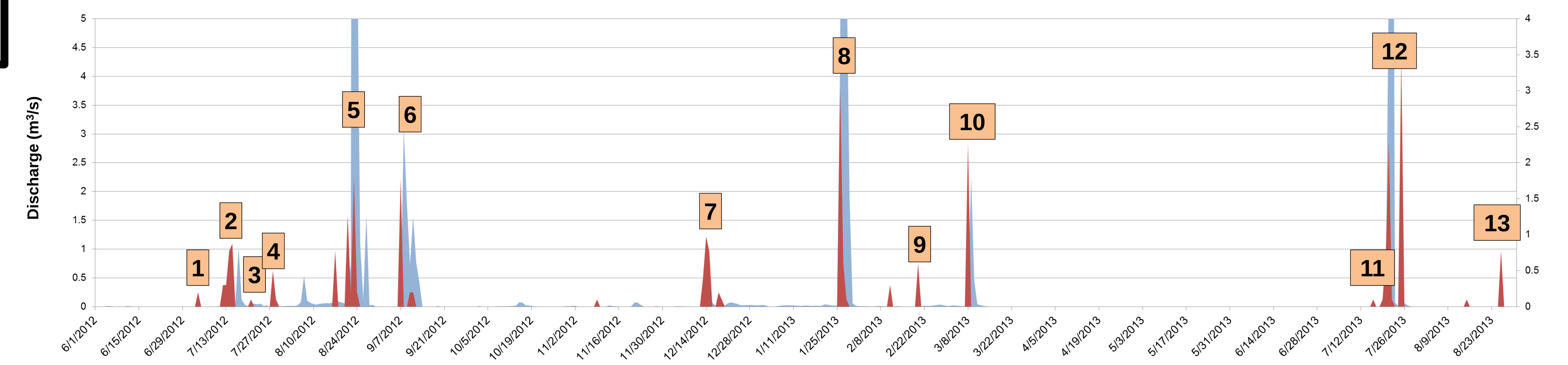
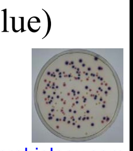


FIGURE 2. Discharge in the Salt River (blue) and precipitation in Phoenix (red), 2012-2013. Outfalls and associated "accidental" wetlands were sampled during 13 storm events, indicated with numbered orange boxes.

METHODS

- Water samples collected during baseflow and storm conditions at five wetland areas fed by outfalls (Fig. 1) at the following locations: in the outfall, mid-wetland below the outfall, and near the outlet of the wetland area
- Samples processed within 8 hrs for nutrient and coliform/*E. coli* concentration:

  - Nutrients: samples filtered within 8 hrs of collection using combusted GF/F filters and frozen. Dissolved ions (PO_4^{3-}, NO_3^-, NH_4^+, Cl^-) concentrations determined using an ion chromatograph and LACHAT colorimeteric analyzer
- - Coliforms/*E. coli*: 500 µL of each water sample plated in a dilution series on plates with selective media (Chromocult®) and incubated at 70°C for 20-24 hrs; each plate used to enumerate the total number of coliform (pink) and *E. coli* (blue) colonies (see photo, right)



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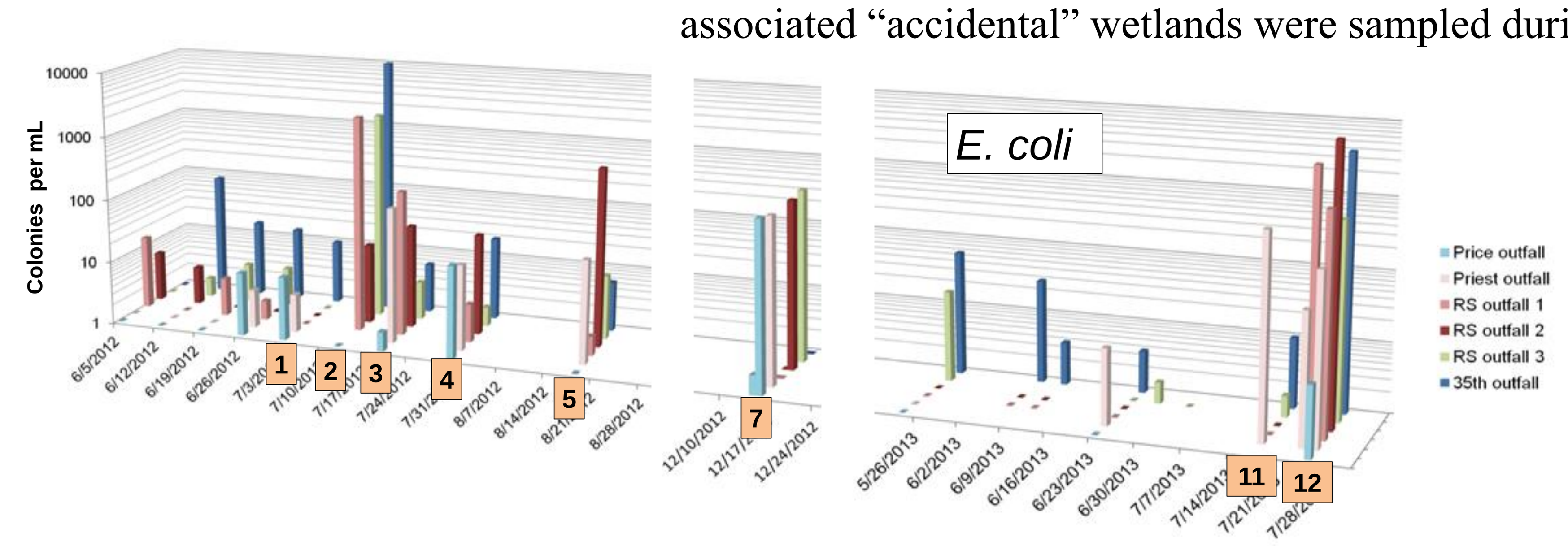
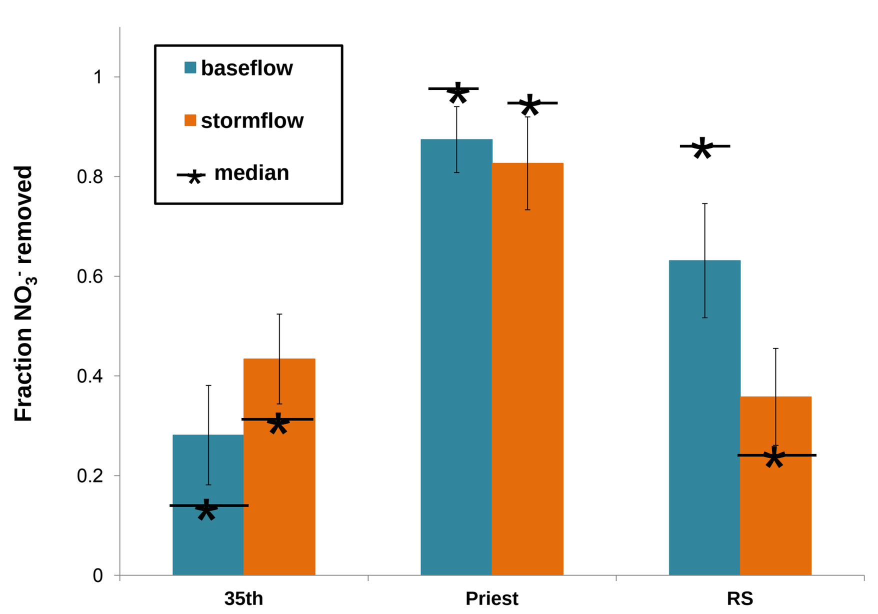


CONCLUSIONS AND FUTURE DIRECTIONS

- Large pulses of both *E. coli* and nutrients (NO_3^-, NH_4^+, PO_4^{3-}) were observed during storms, although high concentrations of NO_3^- were also observed during baseflow conditions
- Source tracking is being utilized to determine the origin of microbial pollution
- Disappearance of *E. coli* and NO_3^- along flowpaths downstream of the outfalls suggests a high capacity for retention of pollutants in the wetlands
- Oxygen status appears to be an important mediator of pollutant removal, but may be less important during stormflow conditions at some sites
- Isotope tracer experiments and/or spiraling experiments will be performed to further elucidate the fate of inorganic N at these sites



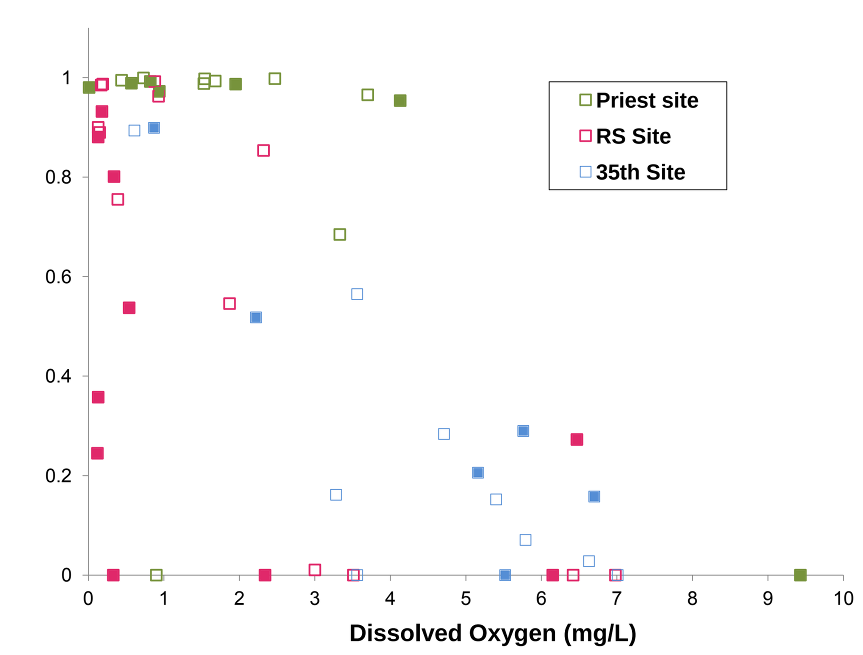
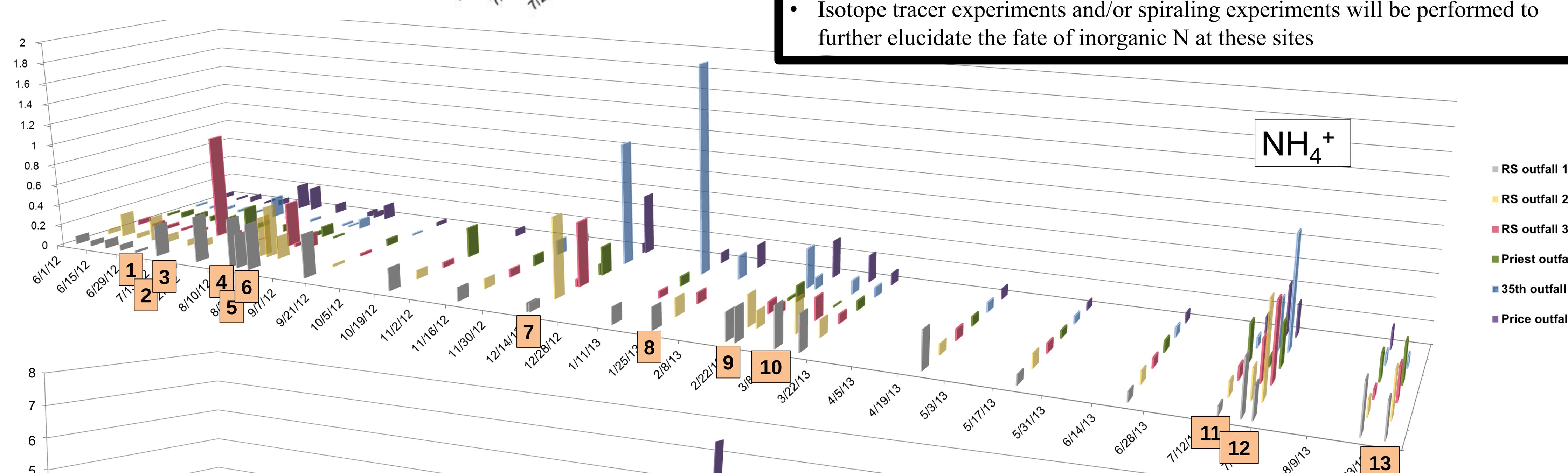
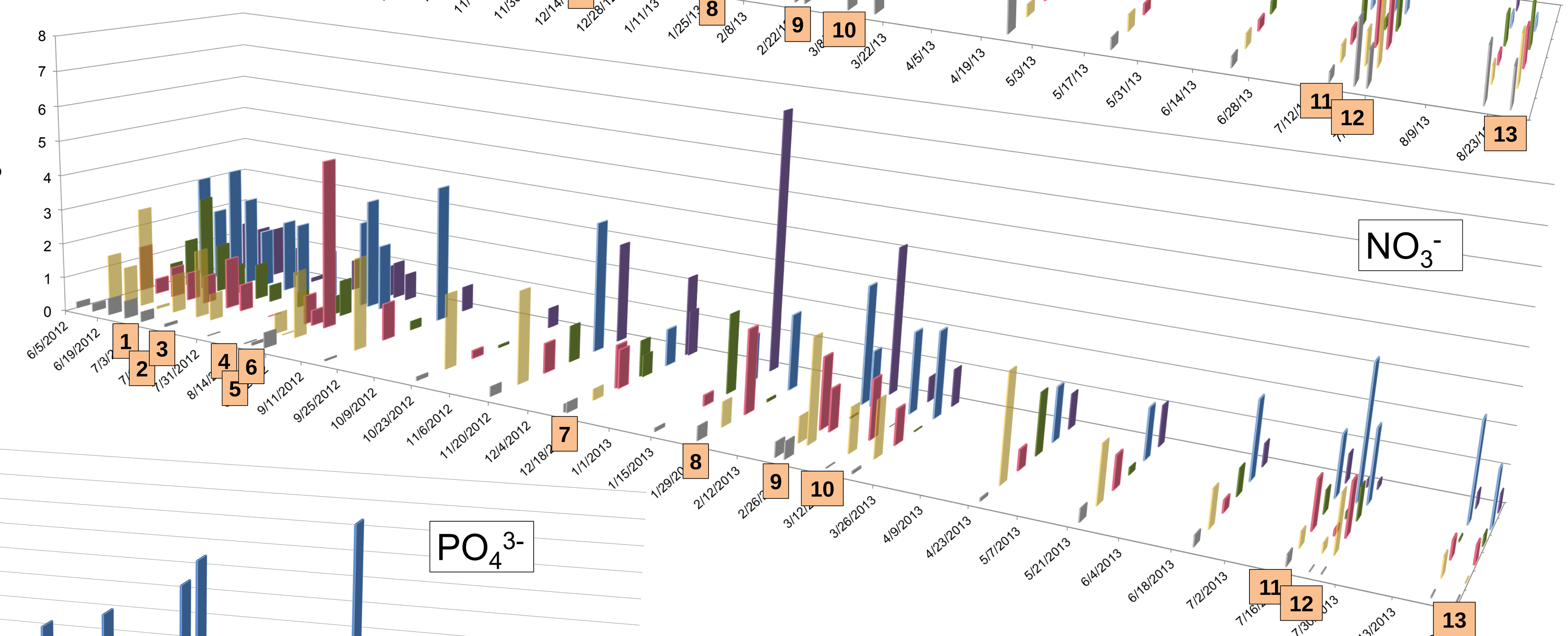


FIGURE 3. Removal of NO_3^- through wetlands at below outfalls during baseflow and storm flow was relatively high (left), and appeared to be mediated by oxygen status in sediments during baseflow (open symbols) and storm flow (filled symbols)

FIGURE 5. Priest Drive site during baseflow (top) and storm flow (bottom) conditions





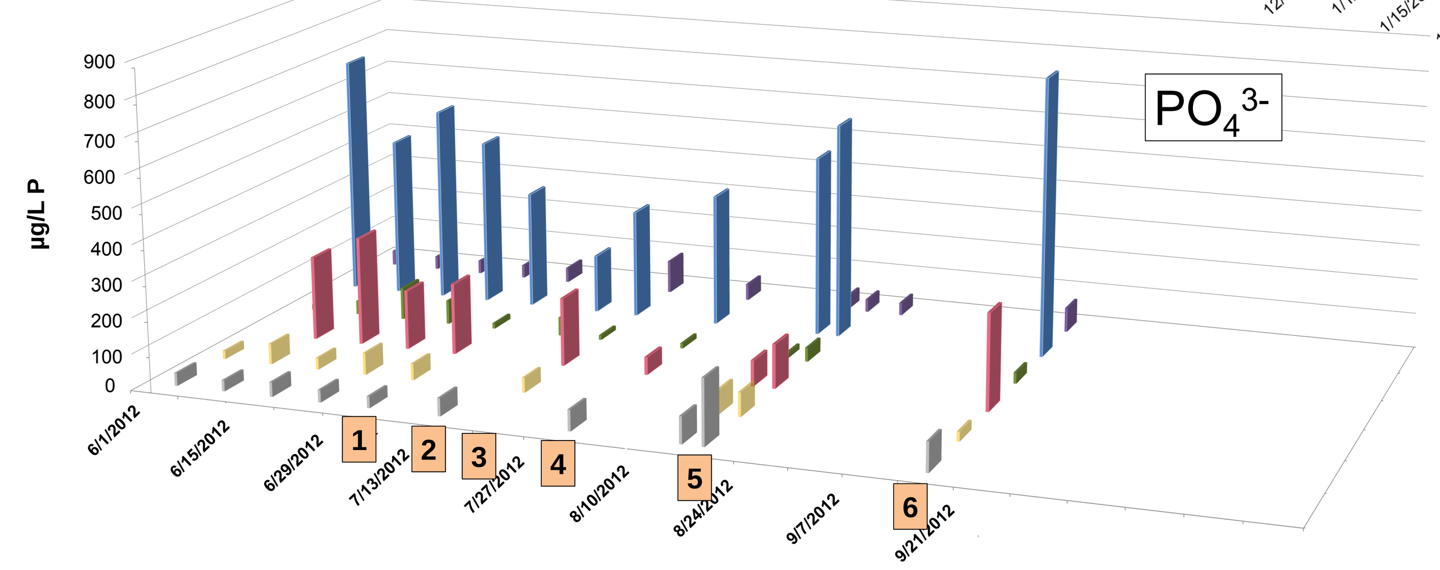


FIGURE 6. *E. coli*, NH_4^+, NO_3^-, and PO_4^{3-} concentrations spike in outfalls along the Salt River during storm flow. NO_3^- and, in some outfalls, PO_4^{3-} concentrations, are also high during baseflow.

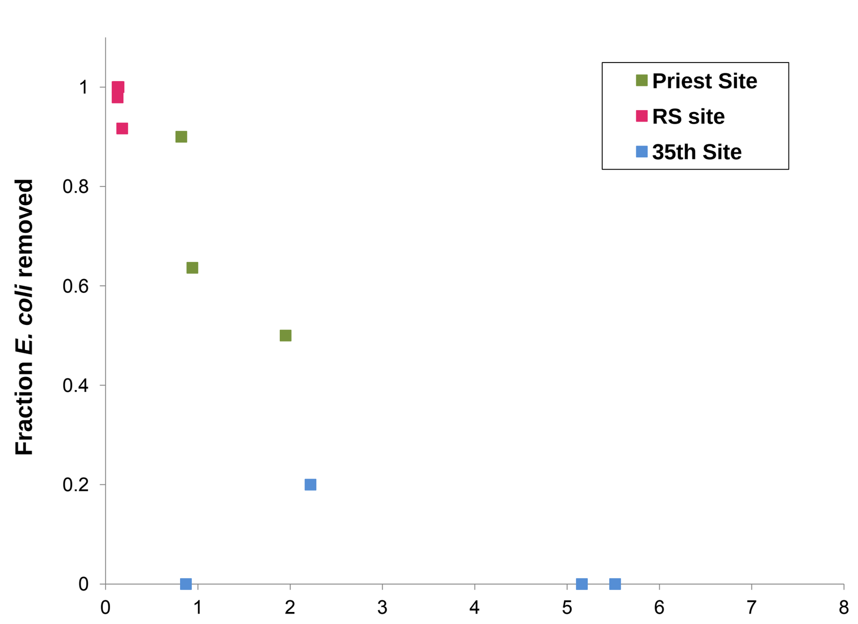


FIGURE 4. Removal of *E. coli* through wetlands below outfalls was high at Priest and Rio Salado sites, even during storm flow, and appeared to be mediated in part by oxygen status of sediments

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