

COVID-19 Surveillance Project

Presentation to the SCCWRP Commission
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Background

- Wastewater epidemiology is a great concept
 - Allows for tracking population levels of the SARS-CoV-2 virus
 - None of the drawbacks of individual testing
- California is a national leader in promoting the concept
 - More than 35 wastewater treatment plants collecting samples
 - More than a dozen research programs
 - CDC has chosen California as a pilot location
- State Board is partnering with California 5 utilities and CDPH to pilot use
 - One of only 8 states
 - SCCWRP member agencies account for 80% of this effort

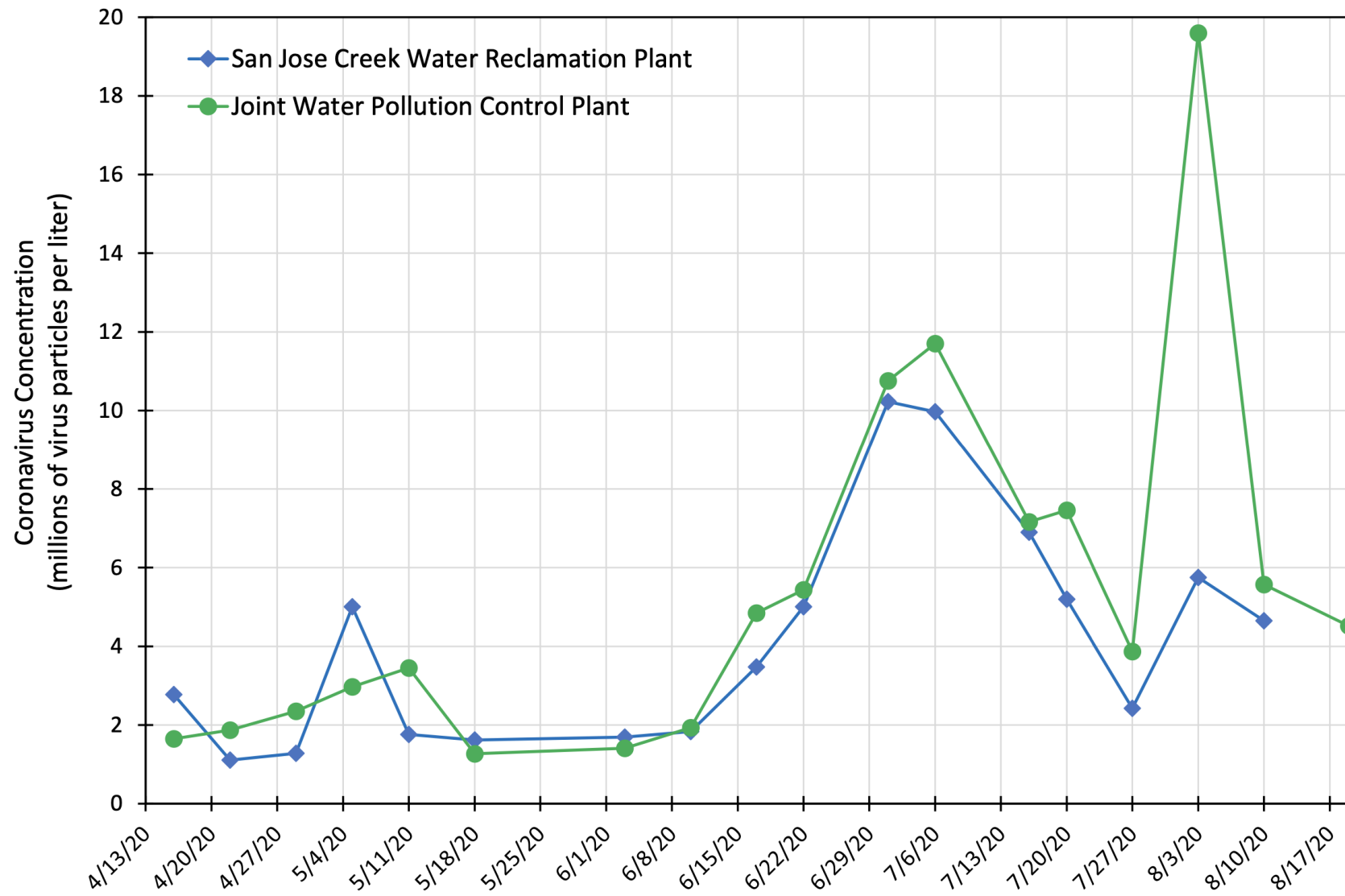
Statement of the Problem

- Emphasis has been on speed
 - As a result, many different methods to measure the virus are in use
- Differences in methods leads to lack of compatibility of results across labs, plants, and regions
- These differences also lead to disparities in measurement sensitivity
 - Of particular concern when moving into small sewersheds to track outbreaks

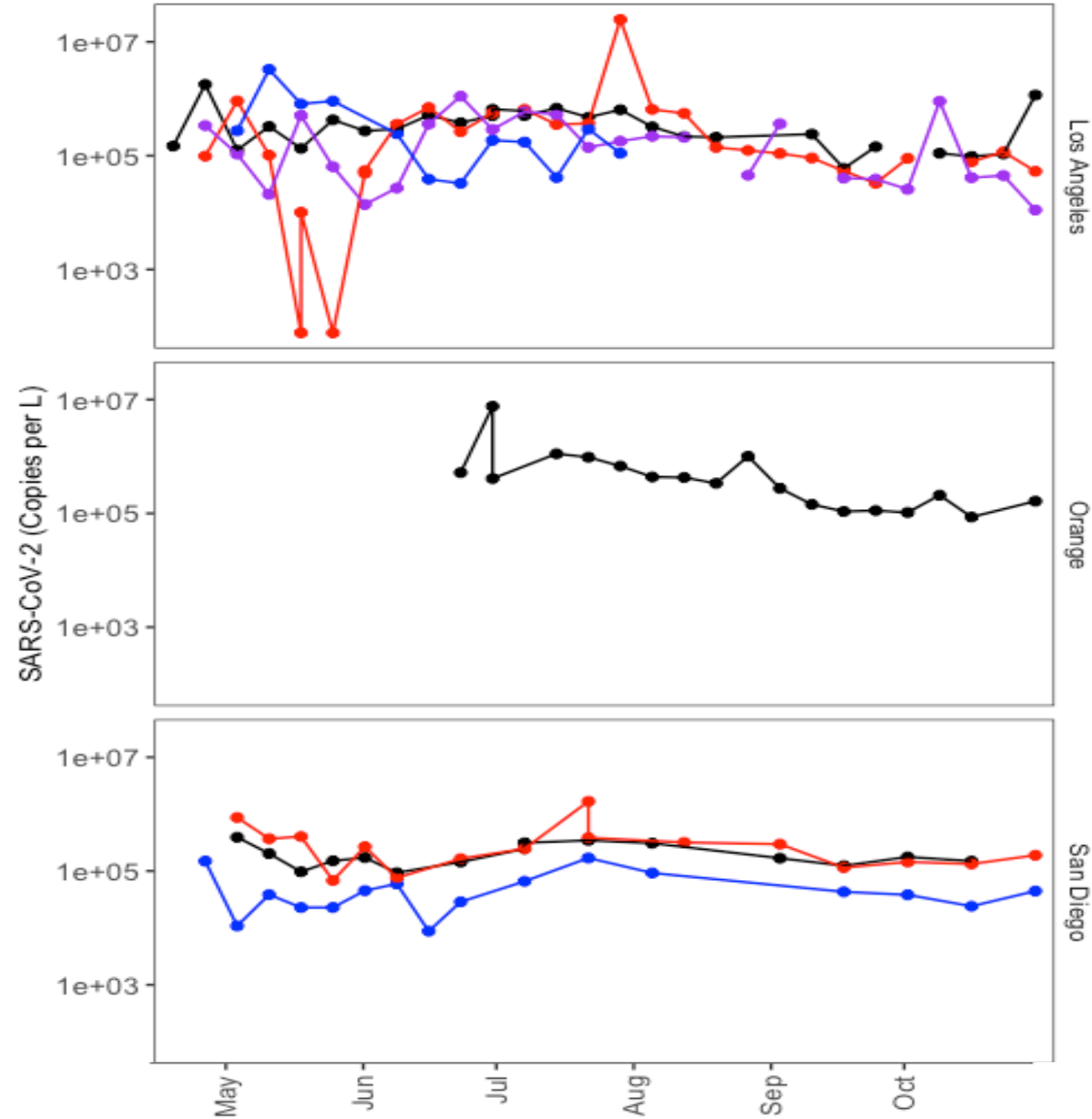
Goals of this Project

- Collect and process samples to assist member agencies and the Public Health community
- Investigate sources of variability in method sensitivity

Coronavirus in Sewage at Inlet to Two Wastewater Treatment Plants
(Weekly Averages thru 8/19/2020)



Coronavirus in Sewage at Inlets to Seven POTW's



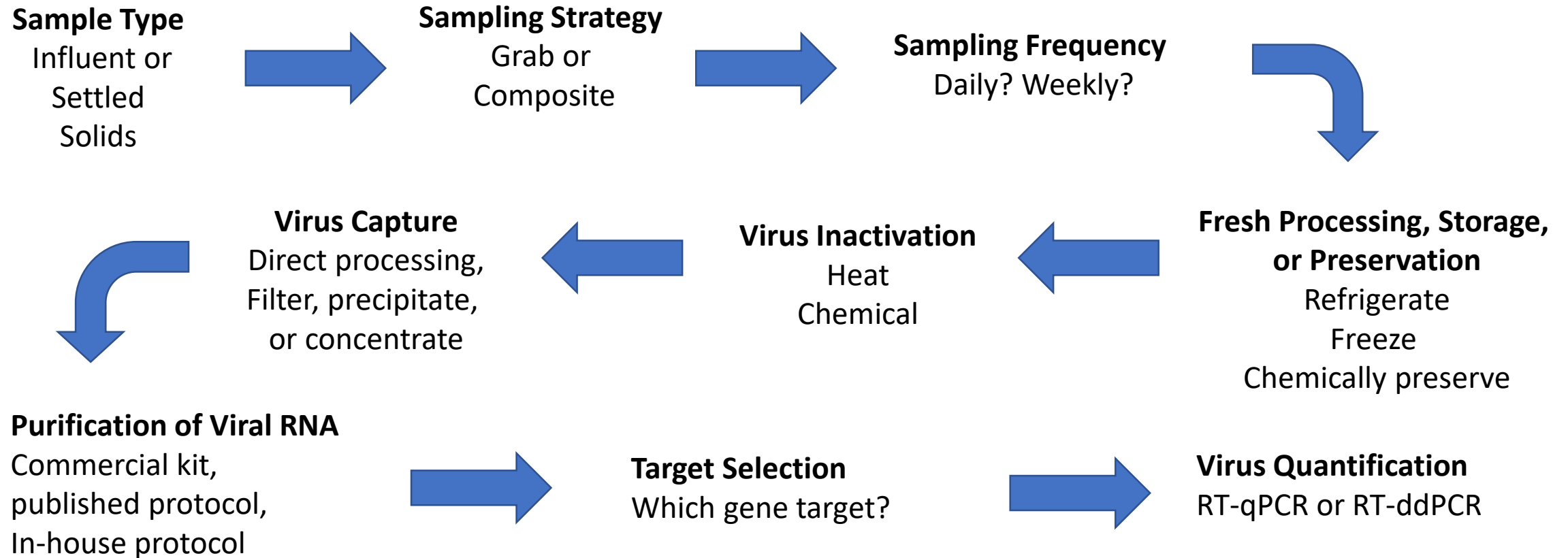
Approach to Goal One

- Collaboration with Stanford
 - Nationwide study (largest of its kind)
 - 25 plants throughout the state
 - SCCWRP responsible for the entirety of southern California
- Collect and measure SARS-CoV-2 virus in over 300 primary influent and settled solids samples (April – November)
 - Hyperion
 - San Jose Creek, JWPCP, Valencia
 - Point Loma, North City South Bay
 - OCSD

Approach to Goal Two

- Identify and investigate sources of variability in method sensitivity
- Use controlled experiments determine effect of individual factors on results

Potential Sources of Variability

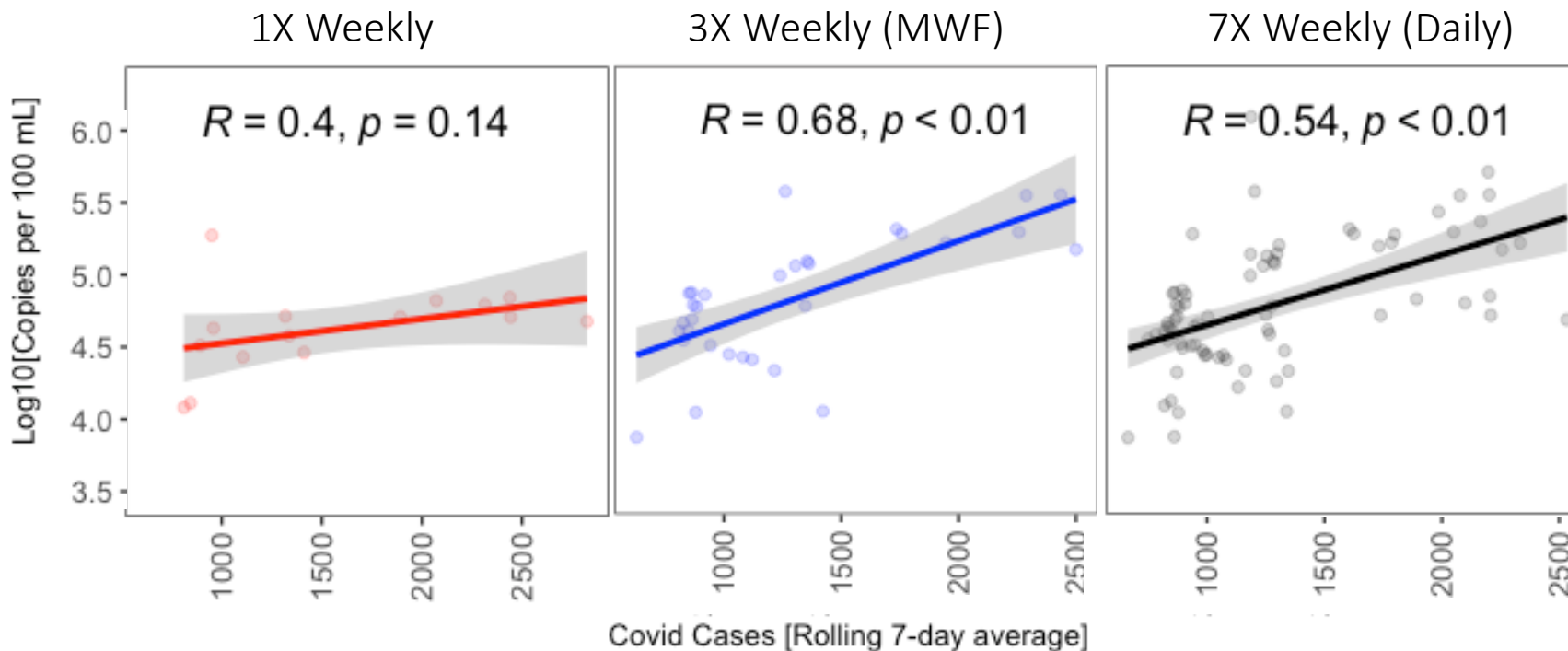


Sampling Frequency

- How often do we need to sample to adequately track virus levels in the population?
- We have four months of daily data that allows us to examine this question

How frequently should you sample?

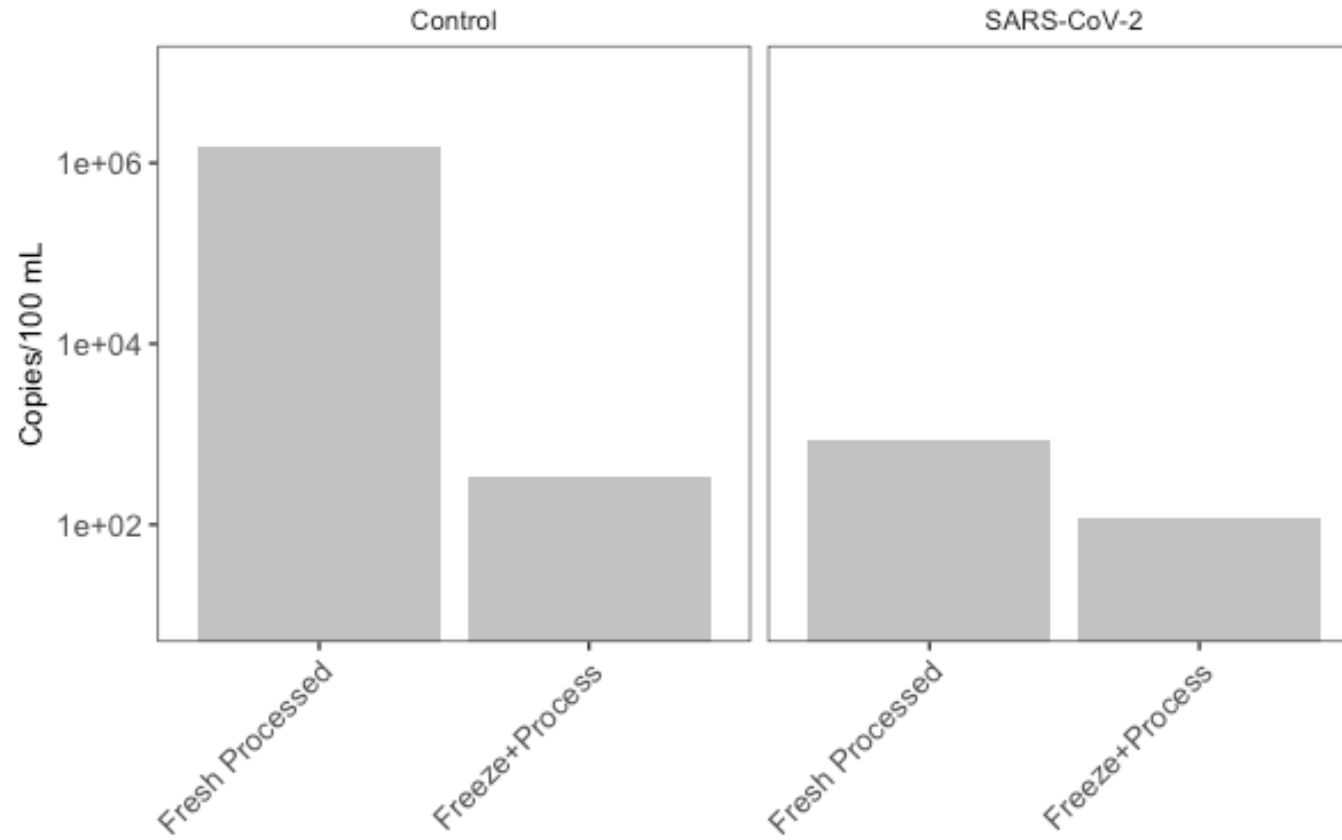
- No significant relationship between Covid case counts and **weekly** wastewater samples
- Significant relationship with **3X** or **daily** samples



Frozen Sample Preservation

- Many of you collected and froze samples for later processing
- Some more fragile viruses are highly susceptible to degradation when frozen and thawed in a water matrix
 - Important to know how freezing effects the SARS-CoV-2 virus levels
- We conducted controlled experiments with corona virus spiked into influent samples

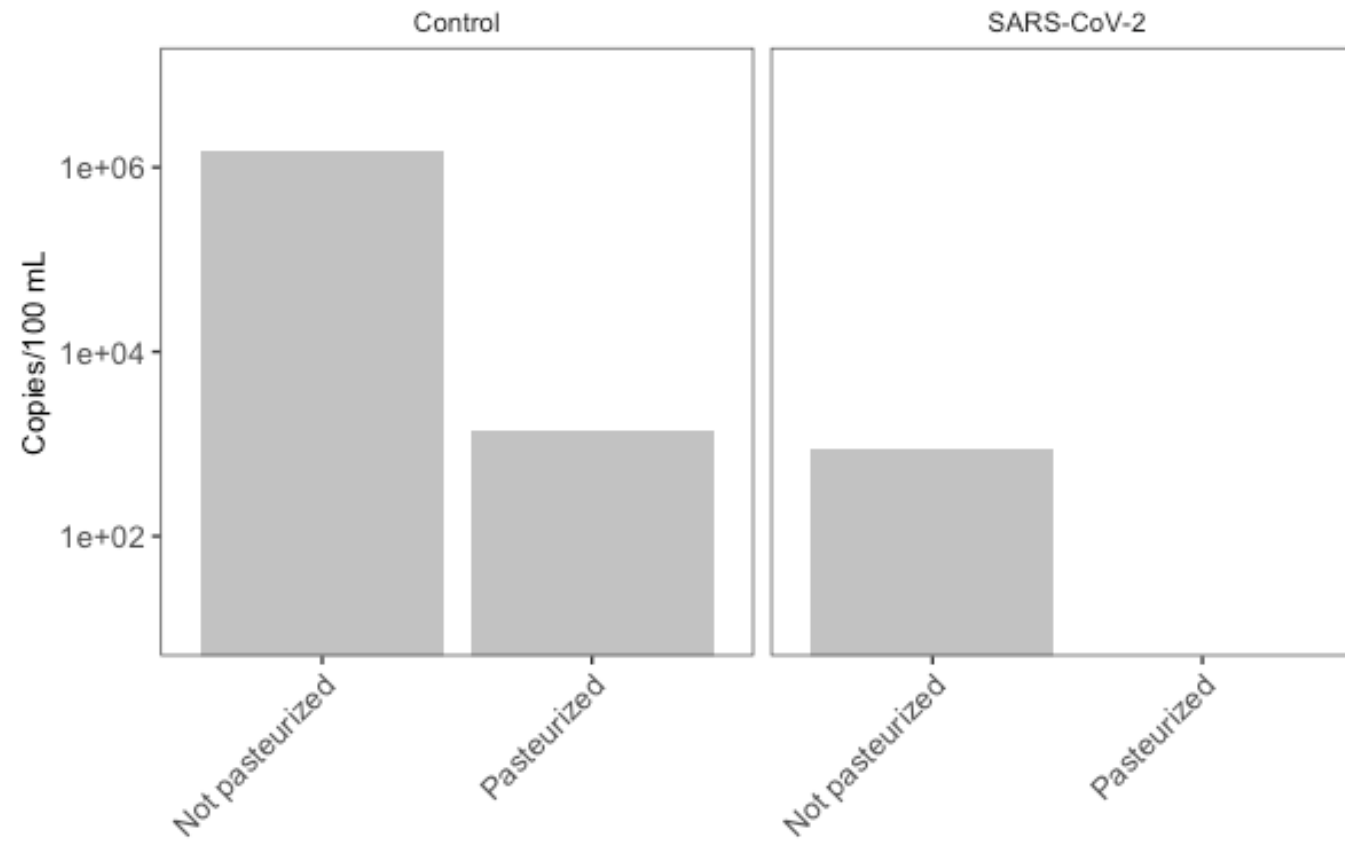
Effect of Freezing



Virus Deactivation

- Clinical labs that work with SARS-CoV-2 are required to have a Biosafety Level 3 (BSL3) rating
 - Most labs processing wastewater for SARS-CoV-2 would require expensive modifications to meet this criterion
- Heat treatment (Pasteurization) prior to handling allows non-BSL3 rated labs to process wastewater samples
 - Common step in many methods
- We conducted controlled experiments to determine effect of heat treatment on measurement sensitivity

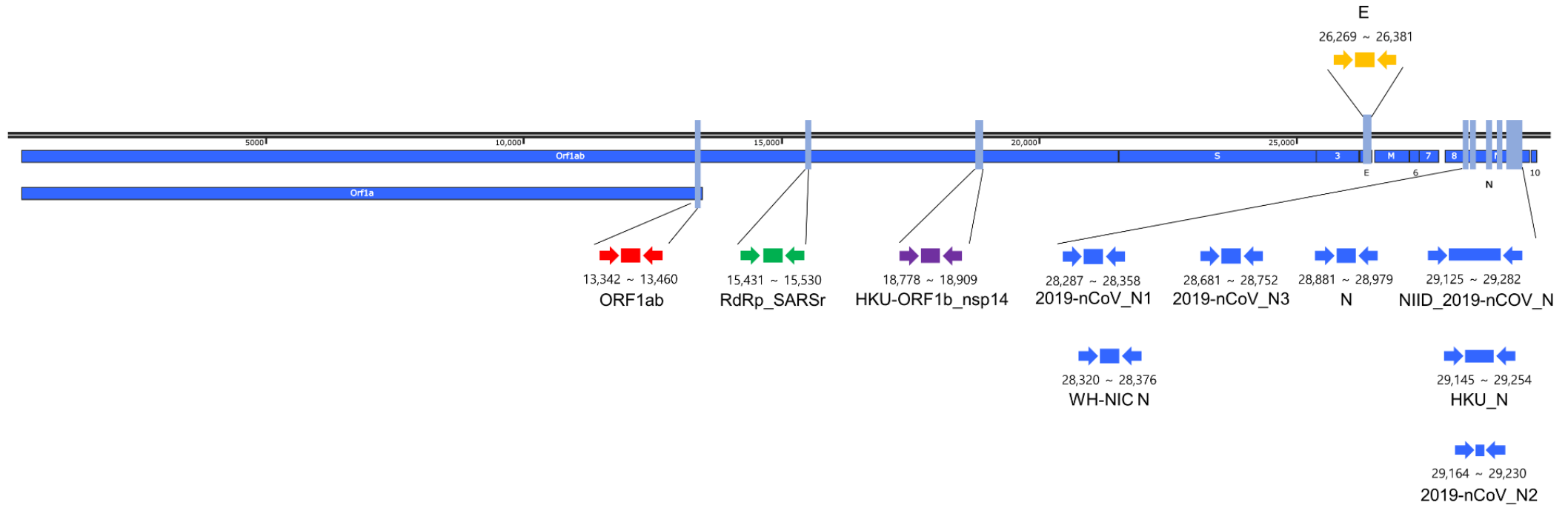
Virus Deactivation



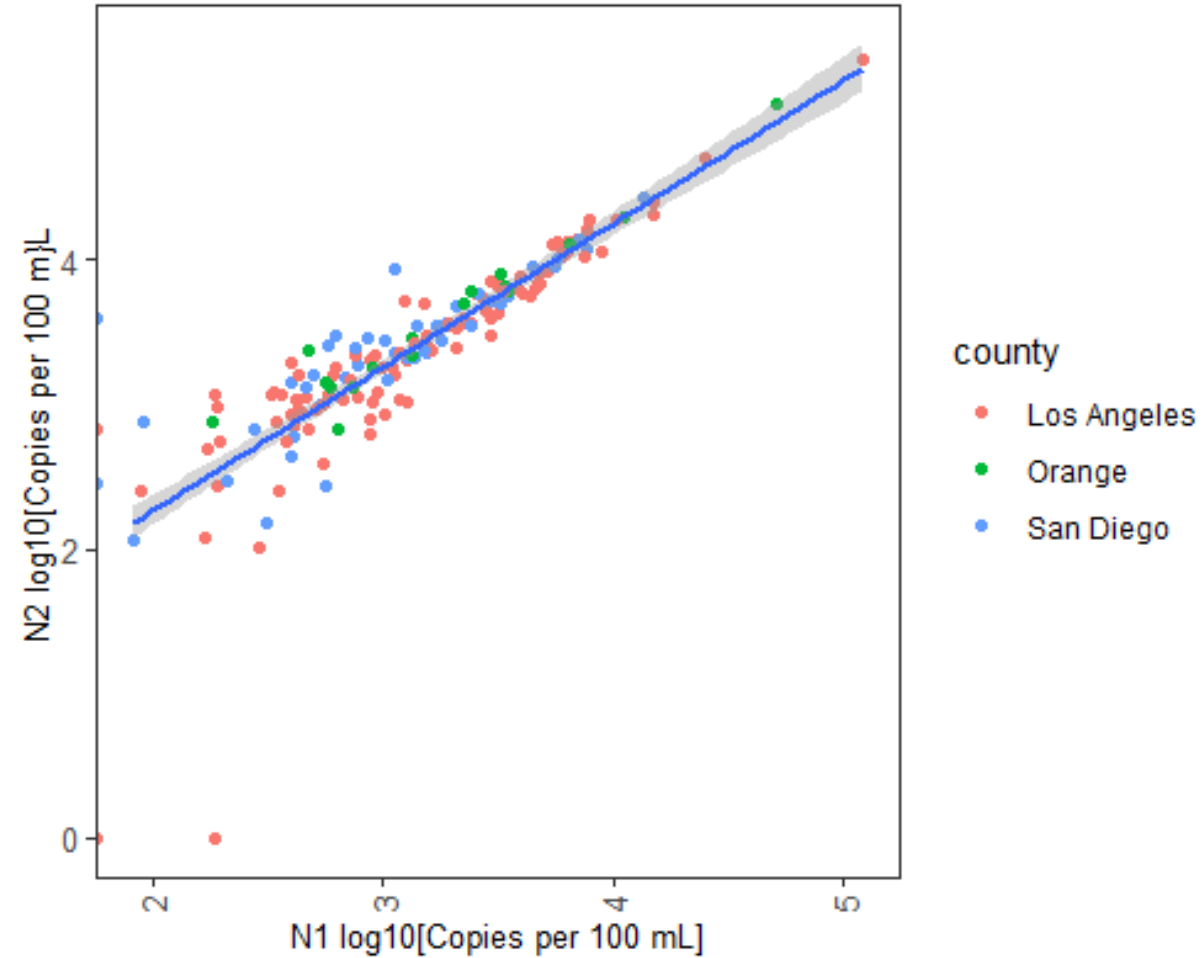
Gene Targets

- Multiple primers sets are available (WHO, CDC, Commercial)
- When the pandemic hit, labs had to make a choice as to which of the available targets to measure

Targets for SARS-CoV-2 RT-PCR Assays



Comparison of N1 vs N2 Genes



Work in Progress

- Comparison between grab and composite samples
- Comparison between paired influent and settled solids samples
- Comparison of virus detection methods

Summary

- Methods matter
 - Several steps can change outcome by more than 2 orders of magnitude
 - Don't change methods over the course of monitoring
- When virus concentrations are low, you may need to switch to a more sensitive methods
 - Source tracking in small sewersheds, dormitories, or nursing homes
- Have only shown data for a few sources of variability we identified
 - Stay tuned

Next Steps

- We have submitted an NIH proposal with UCI to virus strain typing
 - Allows us to use mutations in the virus to track its spread throughout the region
- Sampling for Stanford Project is complete
 - Continuing to sample at two facilities at the request of member agencies