Participatory Science for Beach Water Quality: Estimating Impacts from Freshwater Discharges

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Prof. Ali Boehm (P.I.) & Prof. Jenna Davis (collaborator)

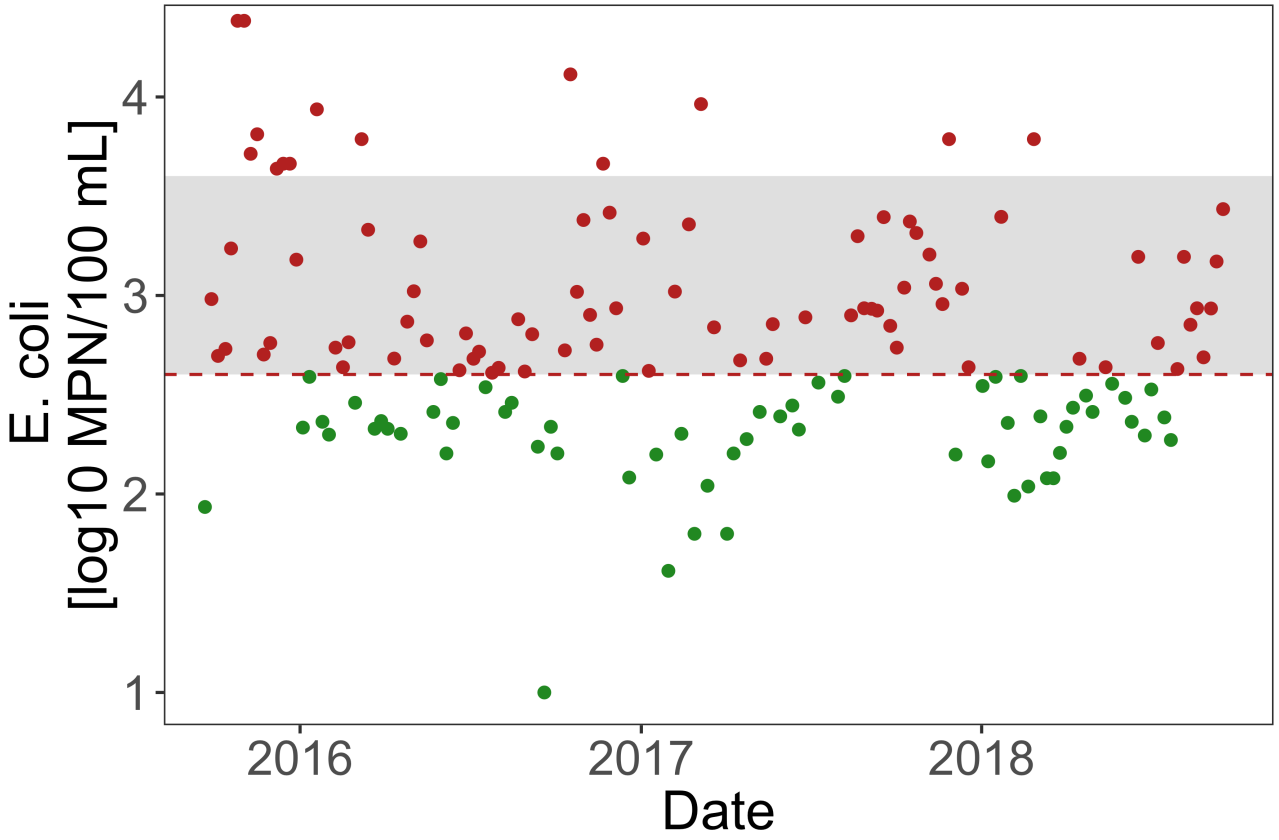
Fecal pollution of surface water: a problem in US

Annually in US:

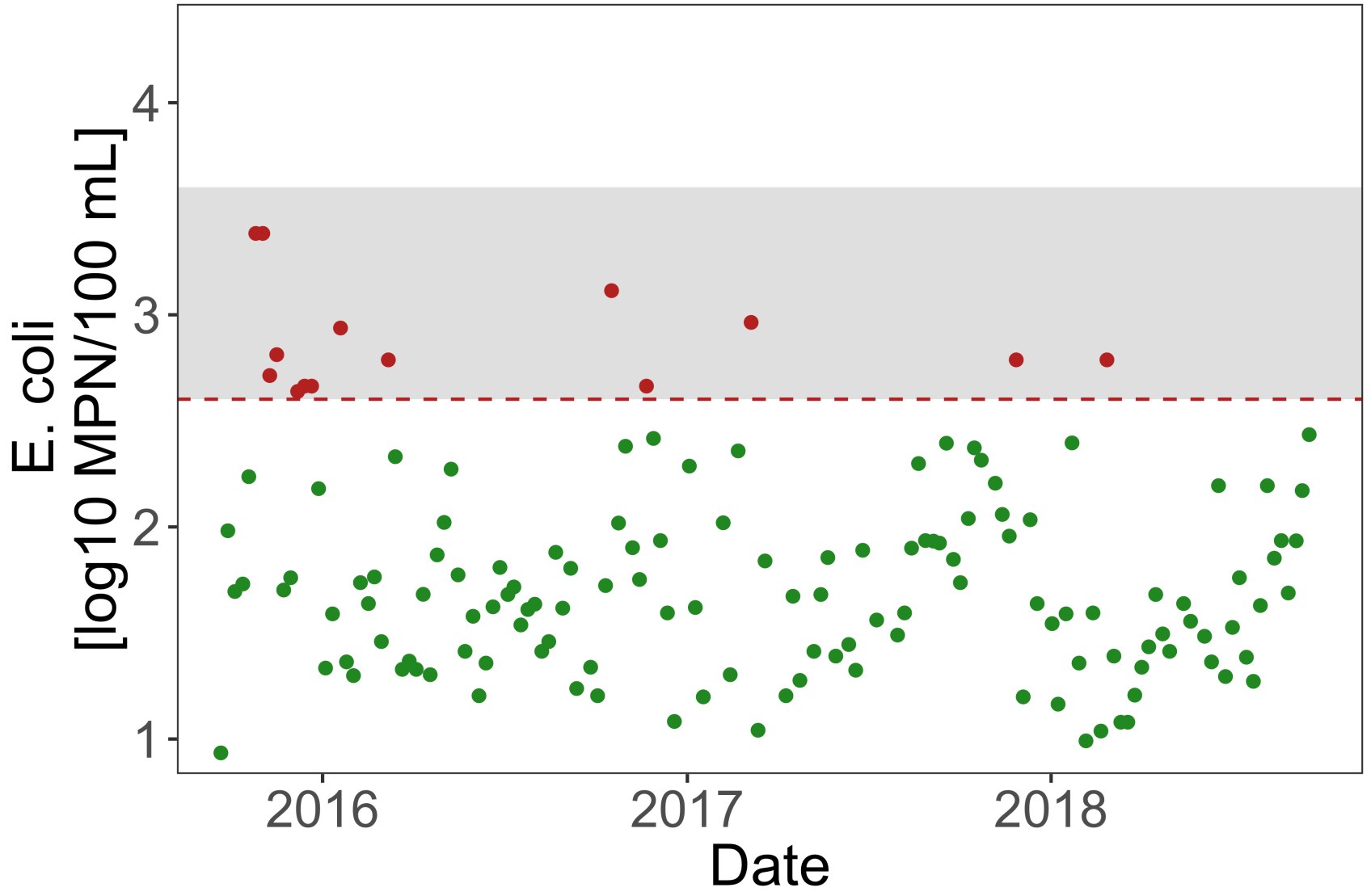
- 4 billion surface water recreation events
- 90 million illnesses
- $2.2-$3.7 billion in costs

Rivers & creeks discharge pollution to beaches

- “Remain 300 ft. from a flowing creek…” – San Mateo County
- Monitor FIB at one location



Shoreline dilution distance



90% dilution

Goals

1. Estimate shoreline extent of impact from freshwater discharges to beaches

2. Utilize participatory monitoring to accomplish (1) with simple salinity measurements

3. Assess whether volunteer retention is improved by informational feedback

Water quality

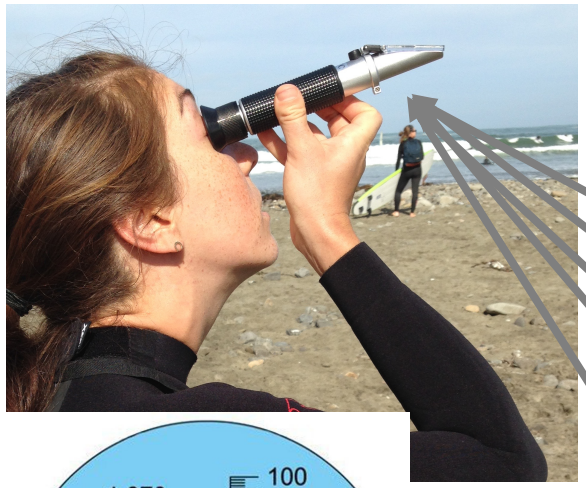
Methods: sampling & measurements

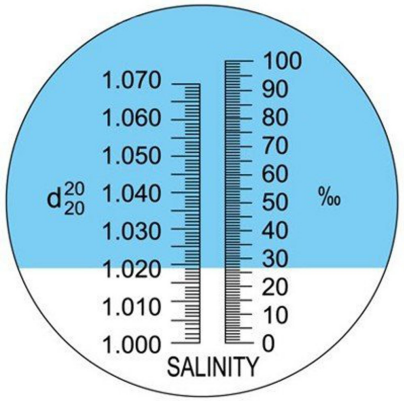
Field measurements

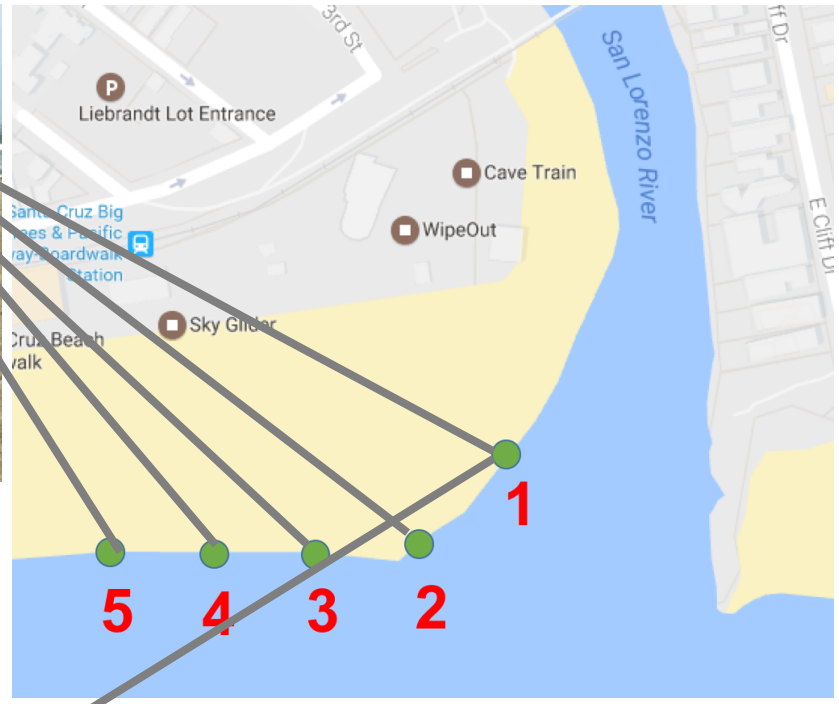
- Salinity (refractometer)

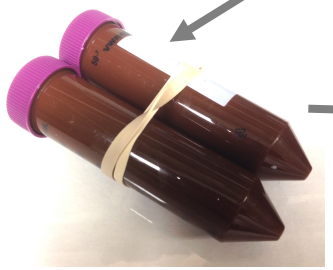
Lab measurements

- Validate 20% of salinity measurements









Salinity measurement summary

46 volunteers enrolled

1,452 measurements submitted by 36 volunteers

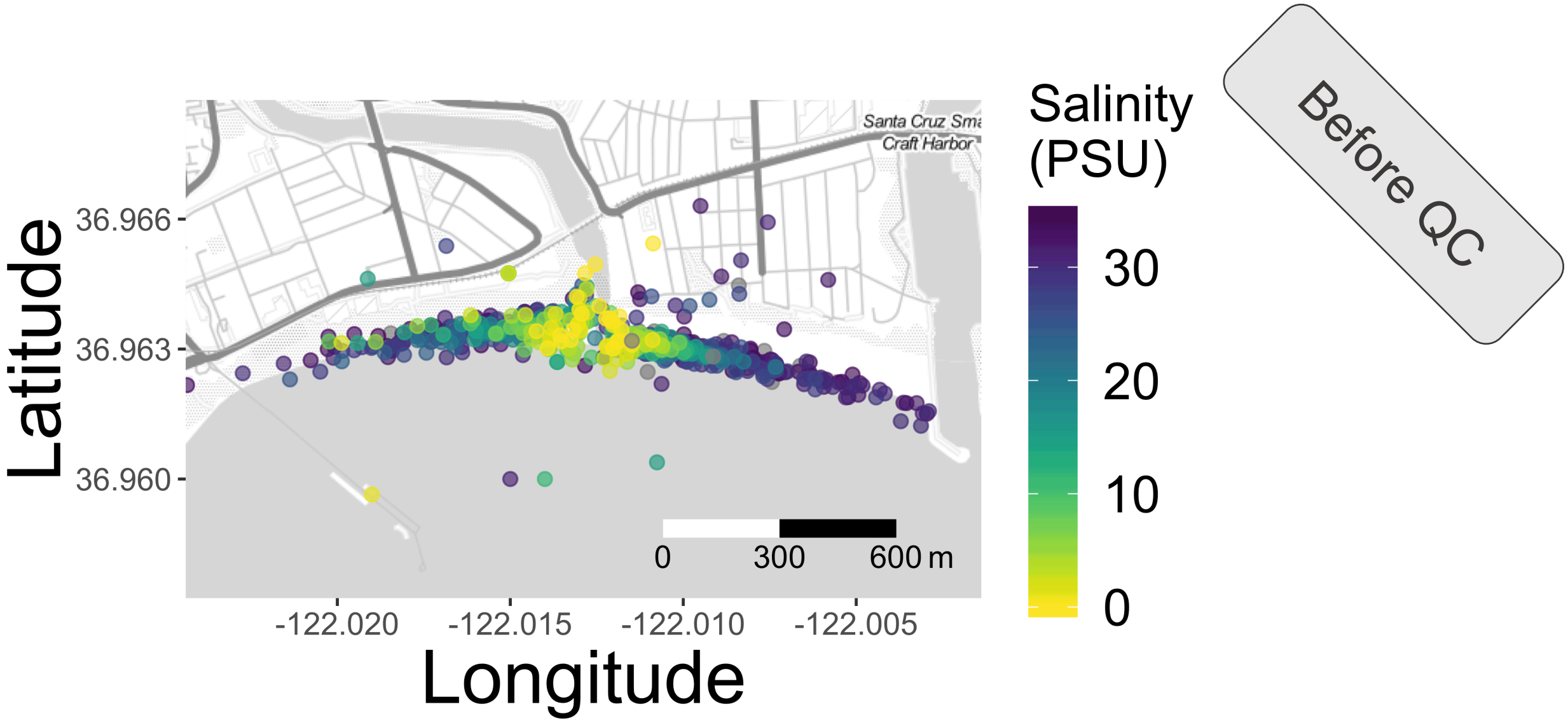
San Pedro Creek

60% of days covered

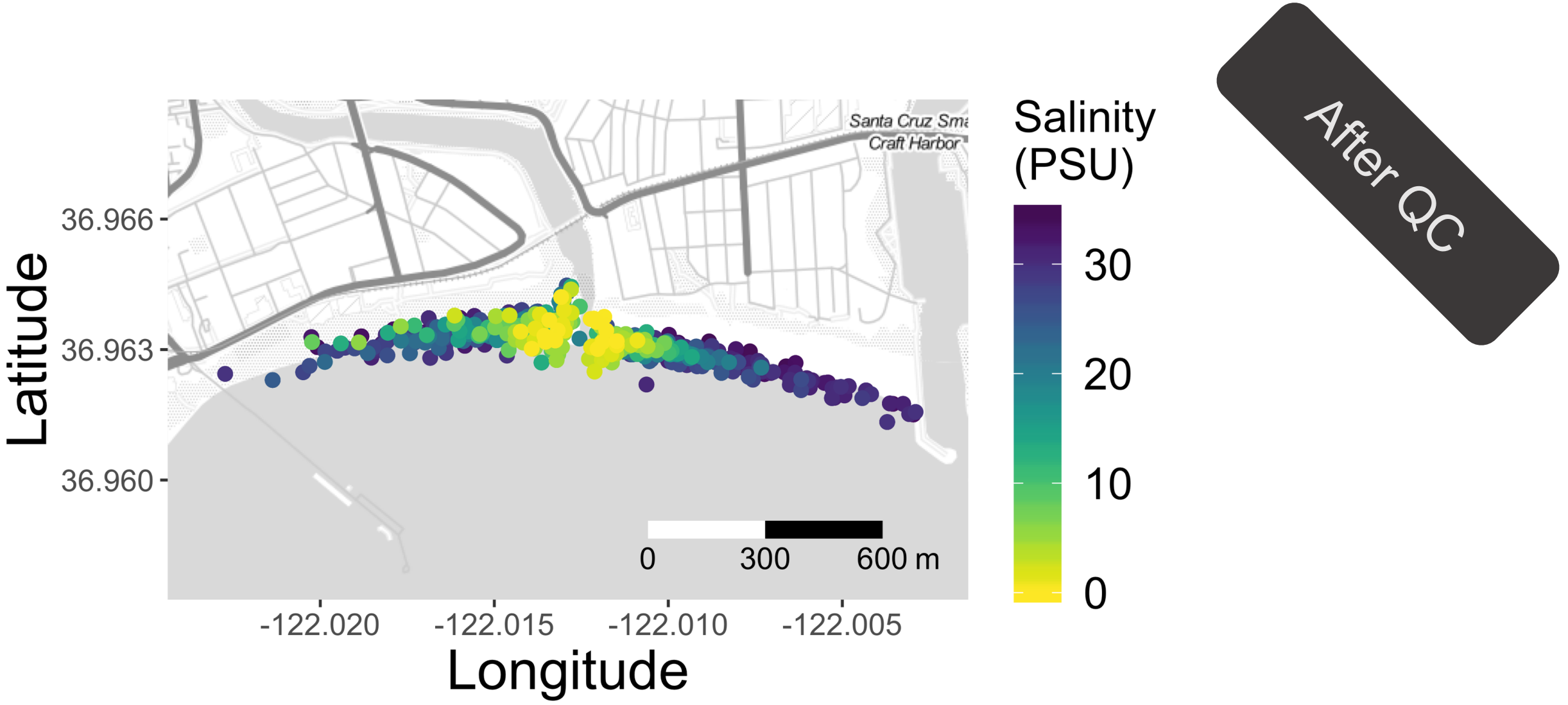
San Lorenzo River

79% of days covered

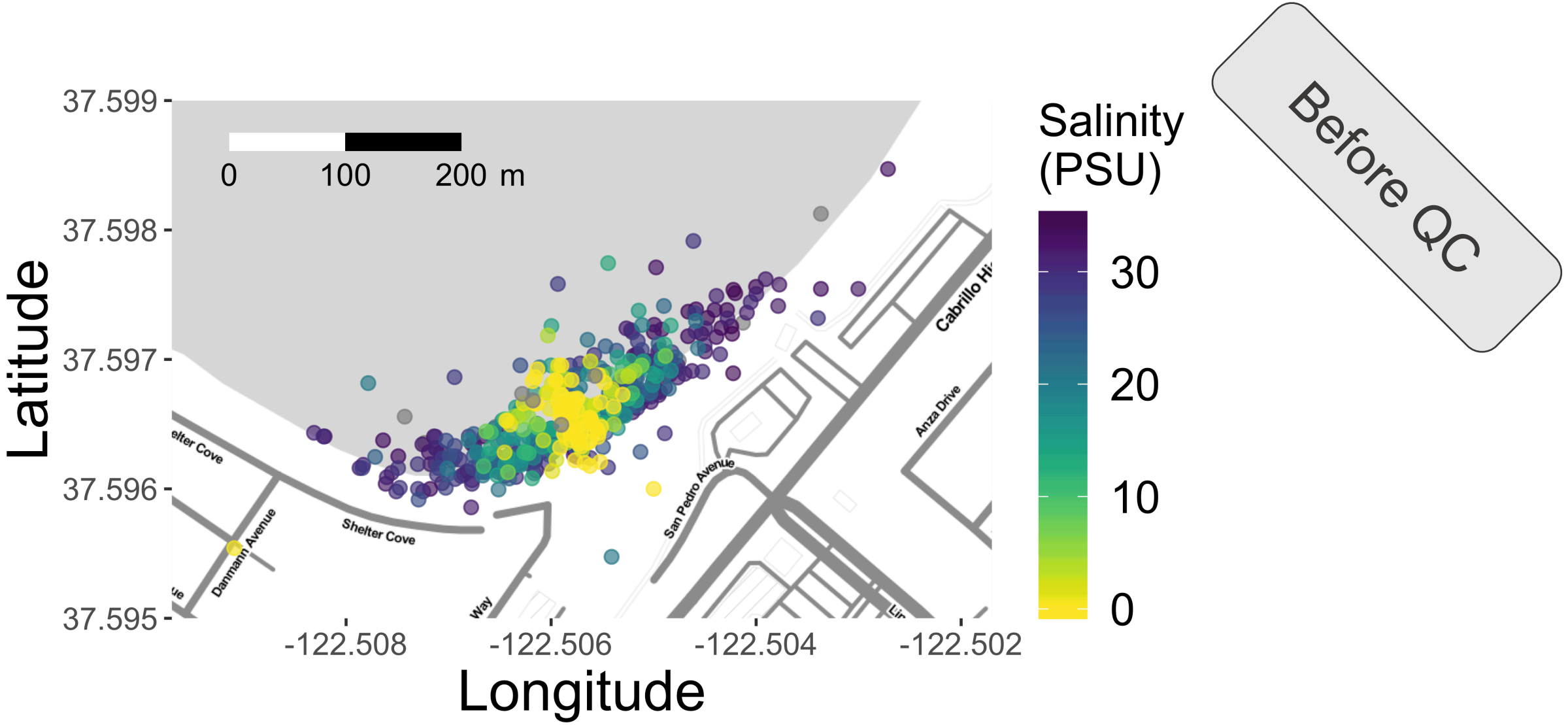
Salinity measurements – San Lorenzo River



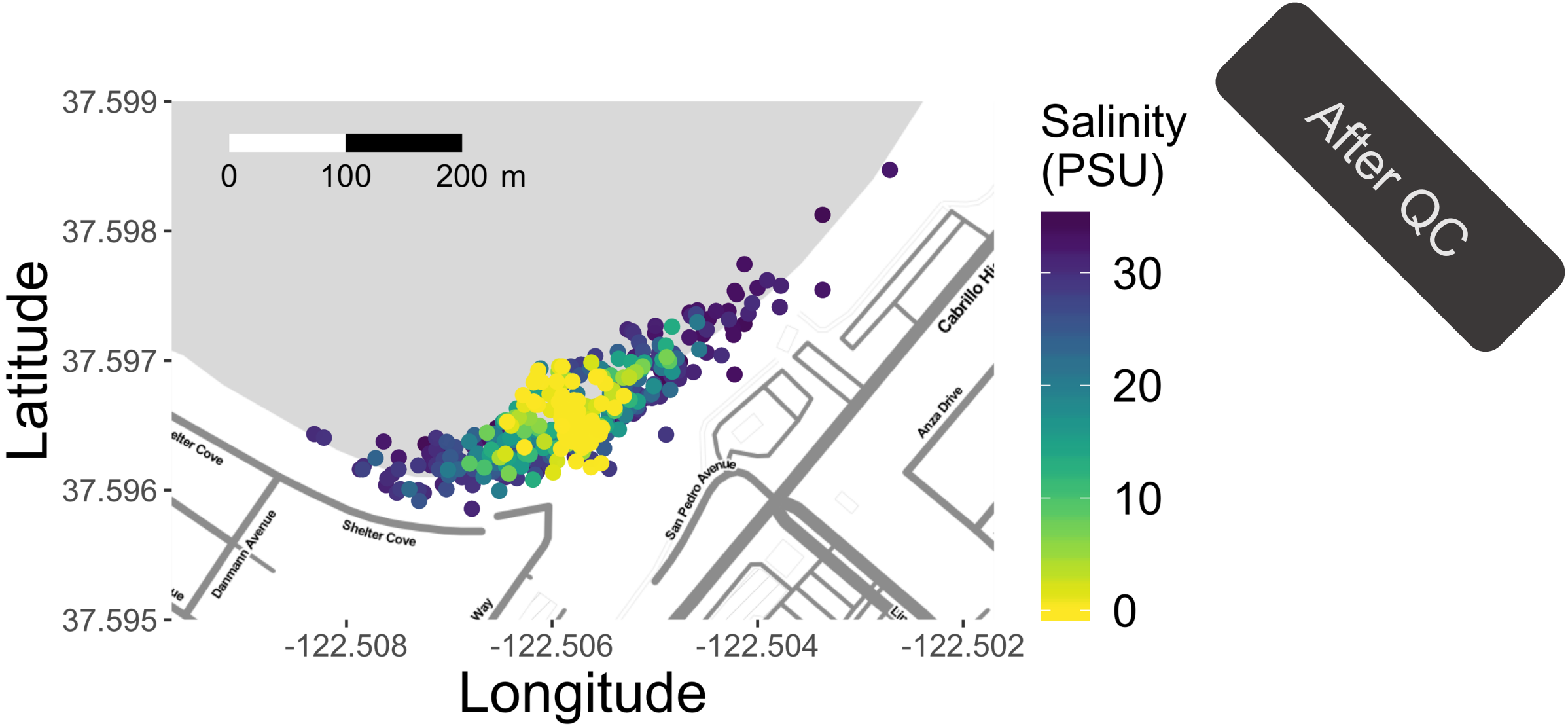
Salinity measurements – San Lorenzo River



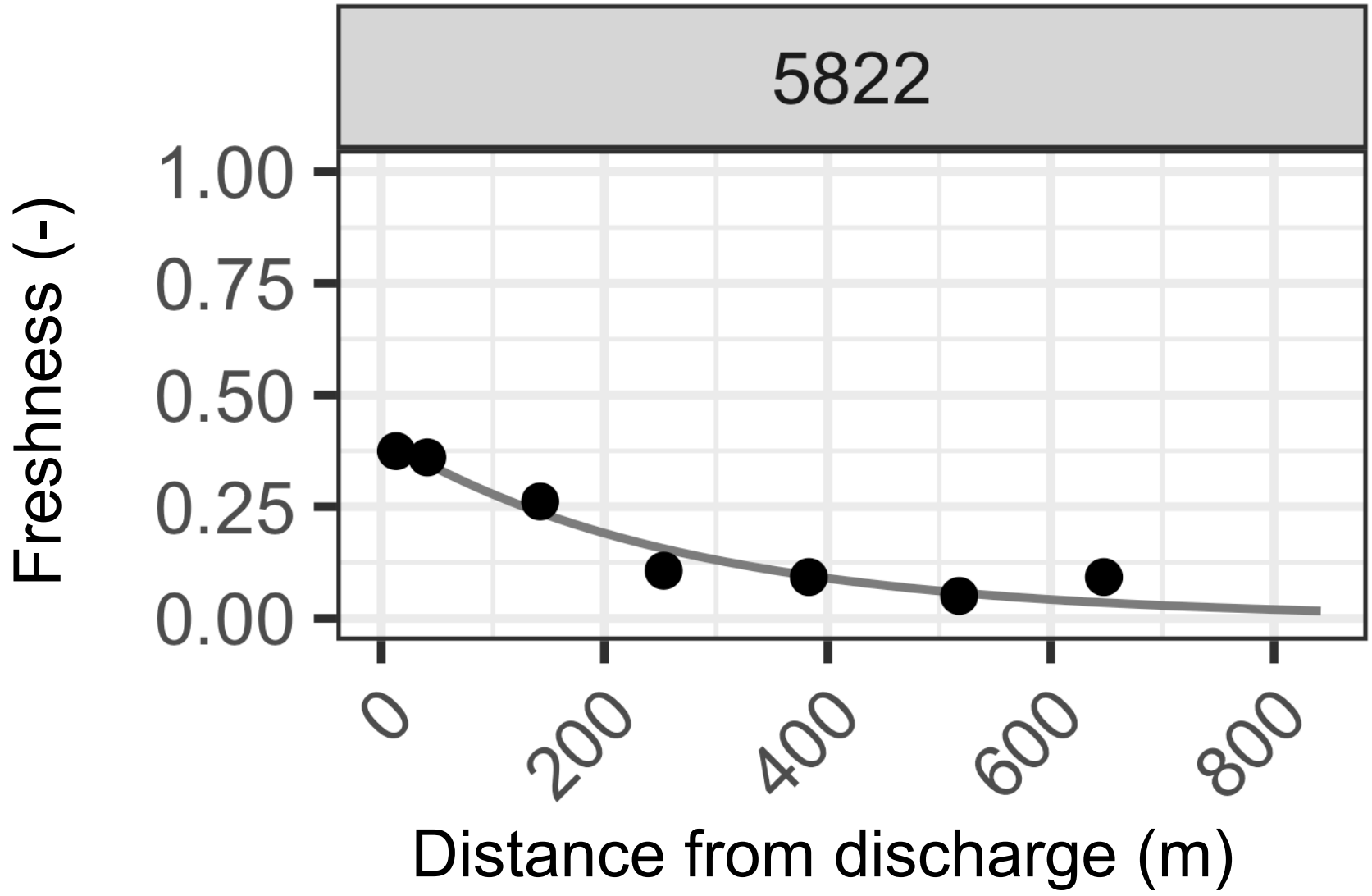
Salinity measurements – San Pedro Creek



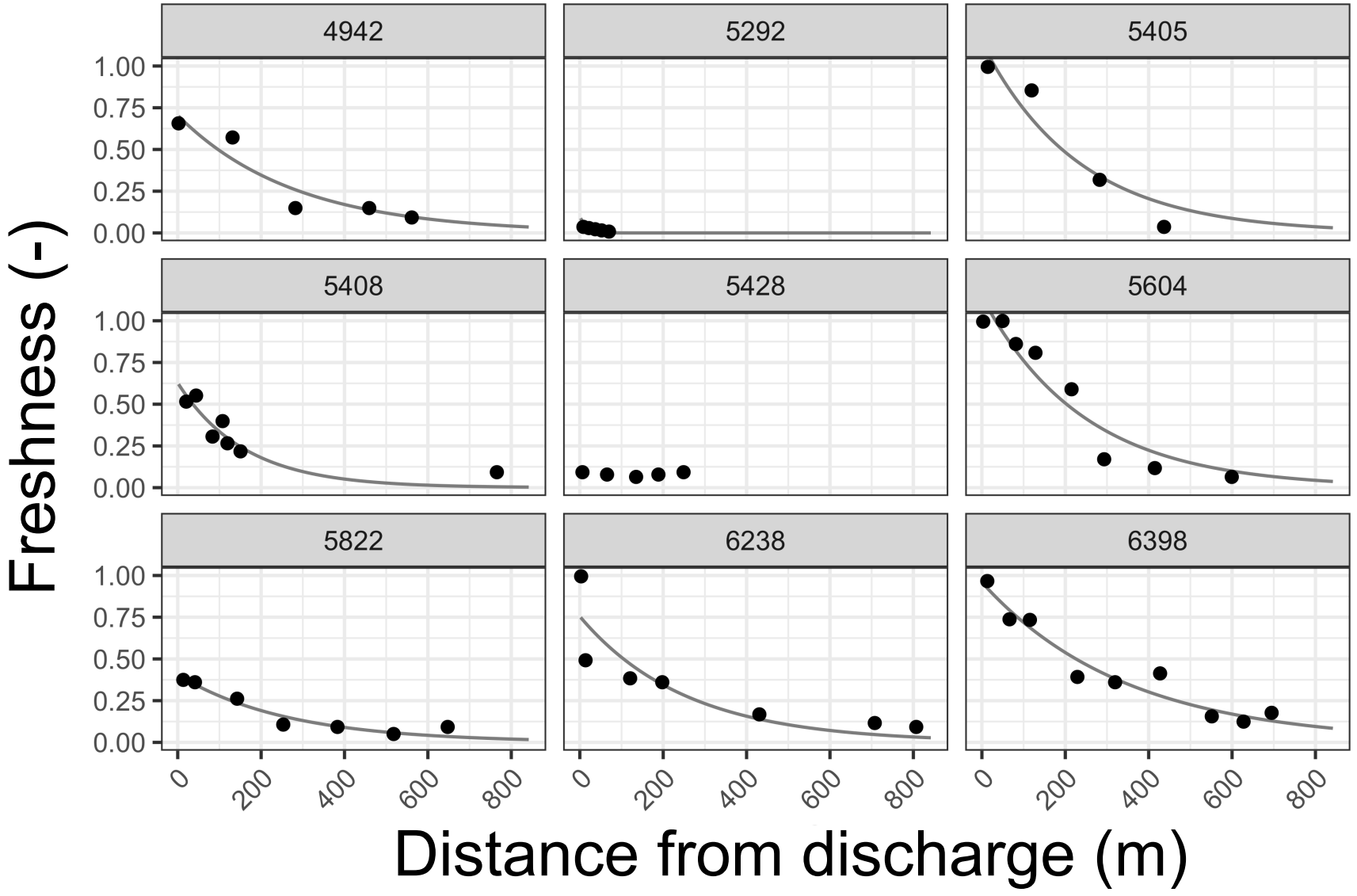
Salinity measurements – San Pedro Creek



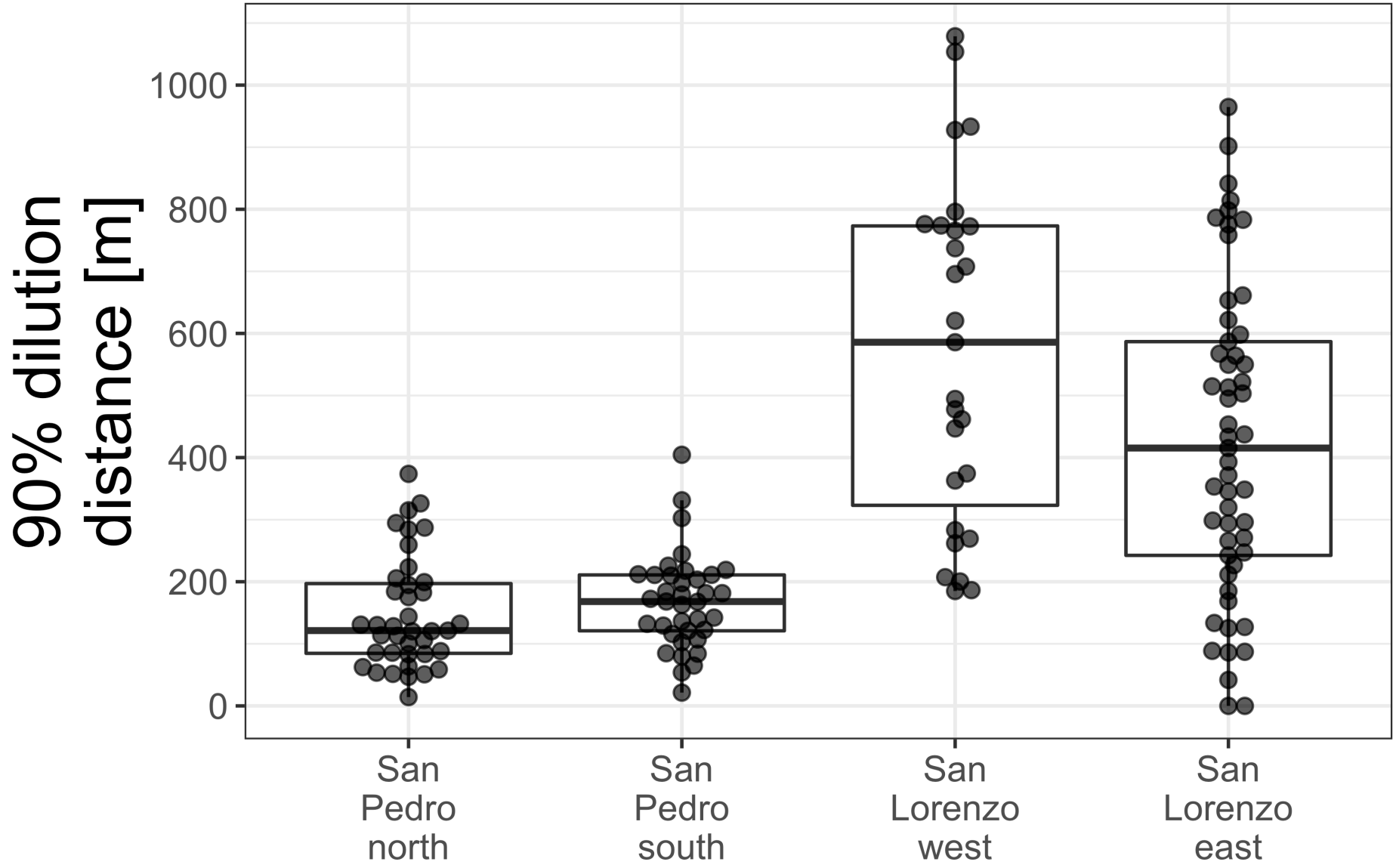
Individual salinity profiles



Individual salinity profiles

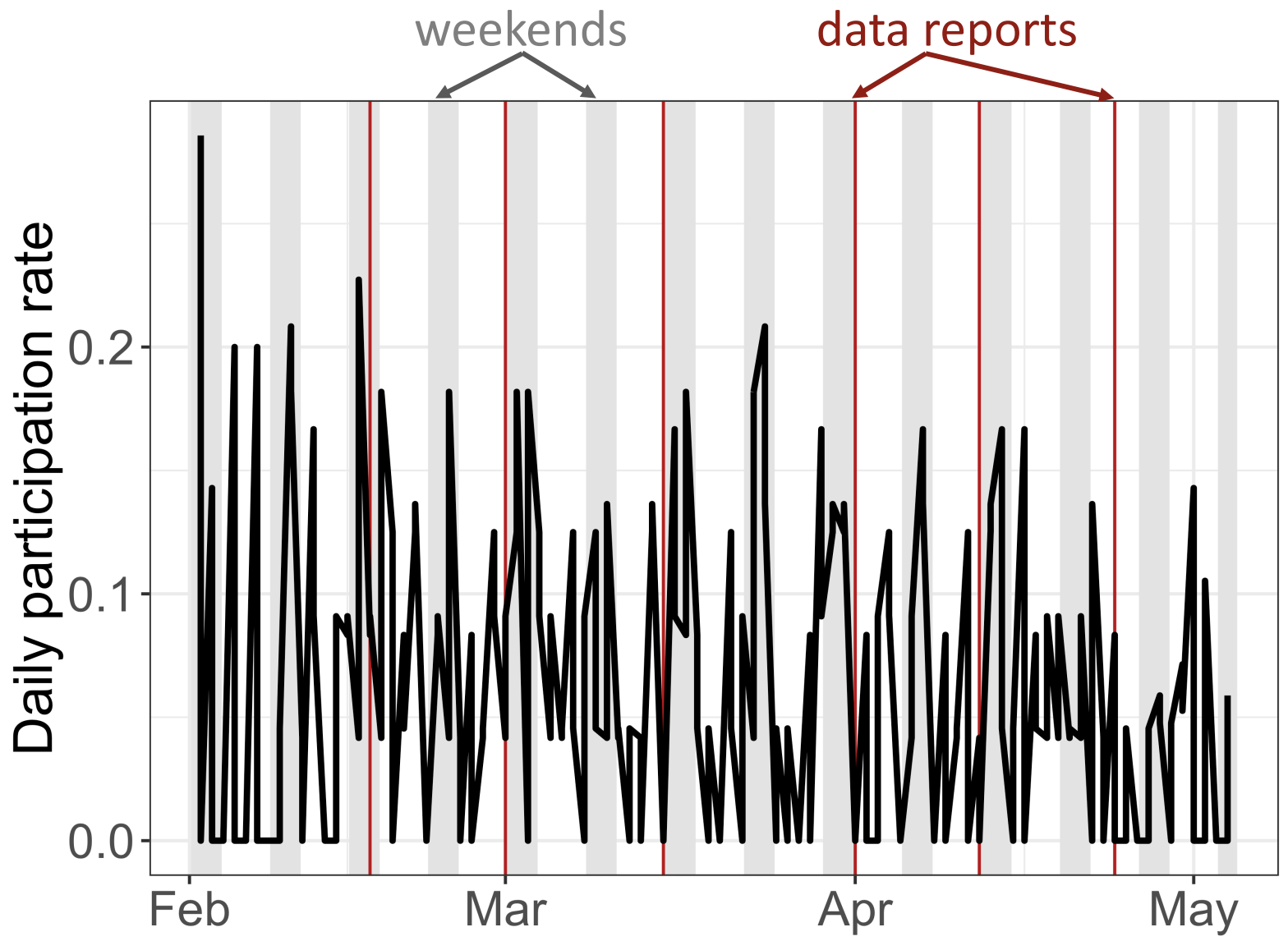


Shoreline impact distance

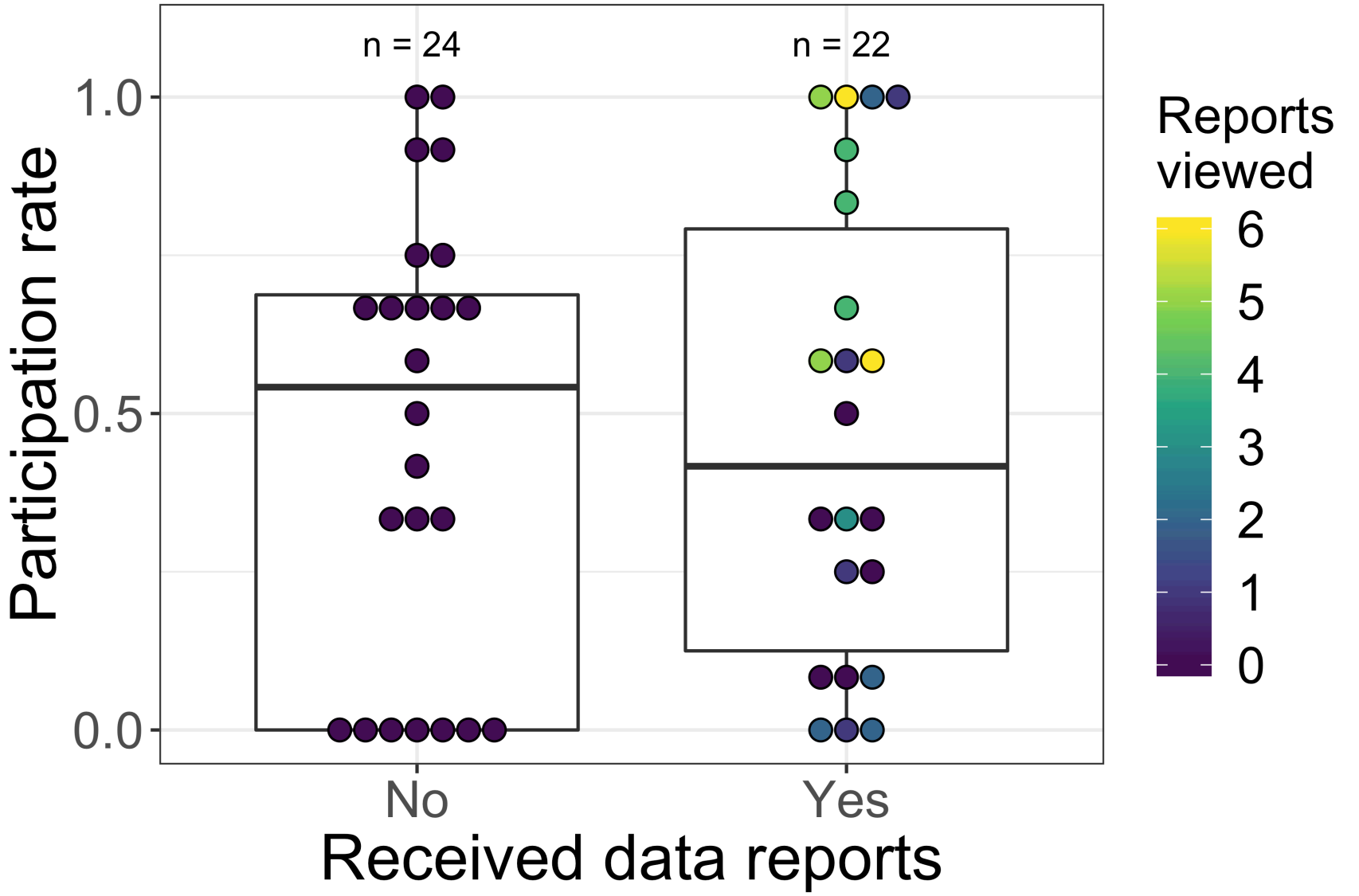


Participation patterns

Volunteer retention



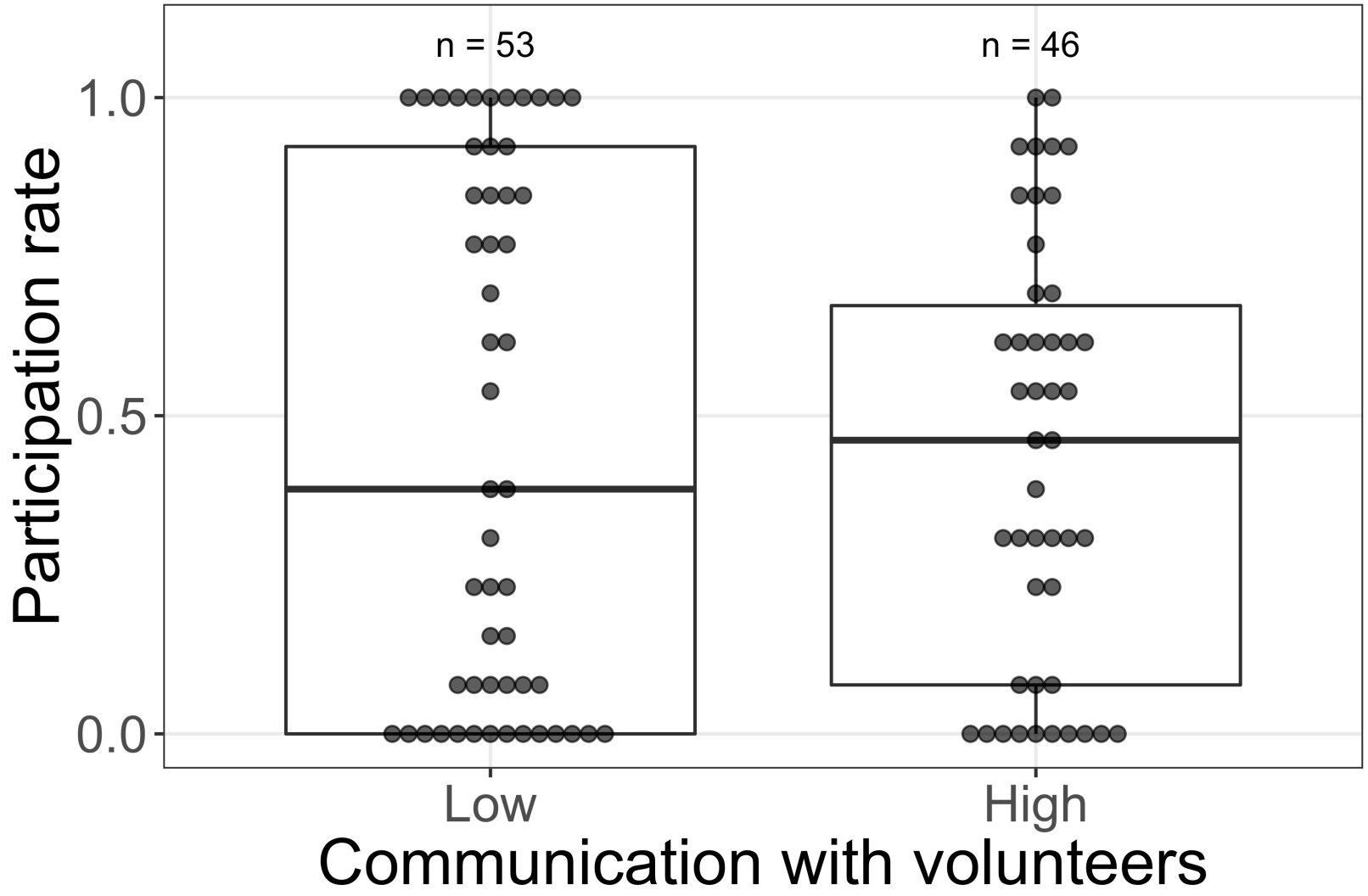
Receiving data reports did not impact retention



Analysis

- Randomized treatment assignment (stratified on city and gender)
- Longitudinal regression
- Controlled for obstacles to participating

No evidence of higher participation under higher communication project design



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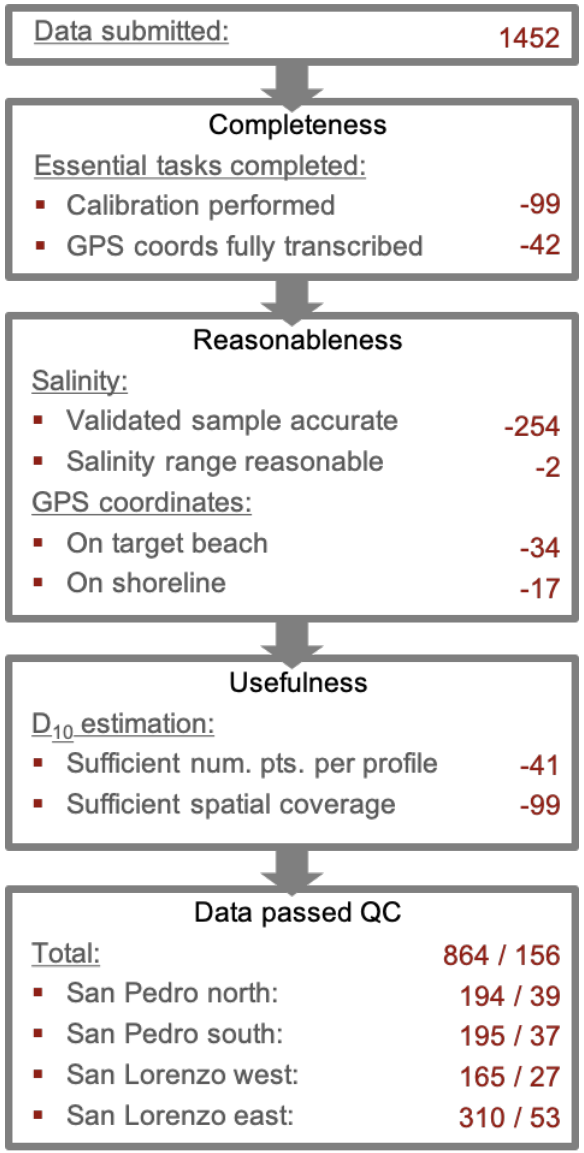
SANTA CRUZ MUSEUM of natural history

Thanks most of all to the volunteers!


Extra content

Quality Control Implemented



Background: water quality monitoring

Monitoring with culturable fecal indicator bacteria

We measure cFIB

- *E. coli* and *Enterococcus*

Exceed 3% risk threshold → post warning

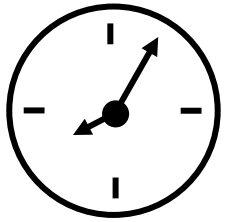
Advantages

- Linked to swimmer illness
- Simple to measure
- Established capacity

Our monitoring has shortcomings

cFIB shortcomings

- Time
- Source
- Pathogens



Monitoring scheme shortcomings

- Spatial extent