



# QMRA of L.A. Coastal Waters

Nicholas Poon, Advisor: Linda Tseng, Summer Research 2020

## Background Information

In 2009-2010, bacteria and human bacteroides samples were collected at multiple storm drain locations within Los Angeles. Water flows from the storm drains to the outfall on the beach.

Stations at the beaches monitor the water for three main fecal indicator bacteria (FIB): Enterococcus (Ent), Fecal Coliform (FC), and Total Coliform (TC). FIB are generally not harmful, but they are used to determine the presence of fecal matter (and other pathogenic bacteria).

## Purpose

The purpose of this research is to evaluate recreational swimmers and surfer's risk (likelihood) of contracting gastrointestinal illnesses (GI) at each station along the beach. This is done by using shoreline sampling data from 2009 to 2010 to perform quantitative microbial source tracking (QMRA) evaluation.

After performing QMRA on each monitoring station, we then compare the risk of GI at each station with the levels of human bacteroides data already collected to see if there is any correlation between the two.

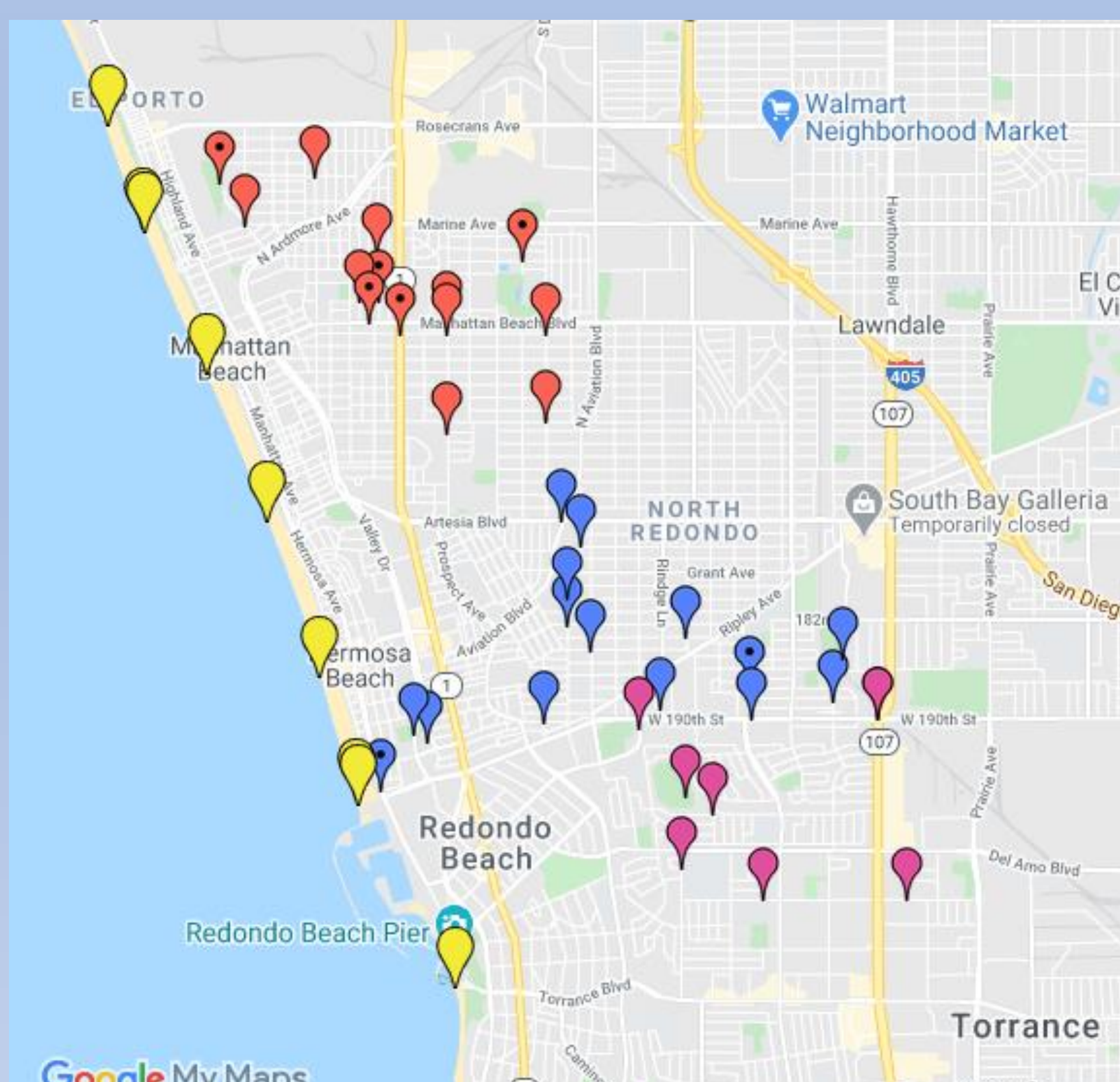


Figure 1. Map of L.A.

## Methods and Materials

We first filtered the data, removing all storm impacted days (all days 72 hours after recorded precipitation) [data obtained from National Oceanic and Atmospheric Administration].

To perform the QMRA, we then determined the best model for each FIB at all stations by fitting all available distributions in MATLAB® onto the histograms of each FIB across all stations.

We narrowed down distributions based on shape. Then, we picked the best model by comparing the geometric mean of every distribution to the actual geometric mean of the data. We determined that a lognormal distribution fit distributions for all FIB.

Using the determined models of each FIB, we performed a risk assessment, with the dose-response models Eq. 1 and Eq. 2 (1), for each station and FIB. Finally, following the EPA guidelines, we determined the frequency that the waters at each station would exceed EPA guidelines.

$$\text{Eq. 1 } p(\text{ill})_{FC, \text{day}} = 1 - \left[ 1 + \left( \frac{D_{FC, \text{oral}}}{N_{50}} \right) * \left( 2^{\frac{1}{\alpha}} - 1 \right) \right]^{-\alpha}$$

$$\text{Eq. 2 } p(\text{ill})_{ENT, \text{day}} = \left[ 1 - \exp \left( -\frac{D_{ENT, \text{oral}}}{k} \right) \right] * \Psi$$

## Results and Conclusion

After performing QMRA on each station, we found that stations near storm drains (DHS113, DHS115, and SMB6-2) had higher frequencies of exceeding EPA regulations. This meant that swimmers and surfers who are in waters near these stations, are more likely to contract GI. We also determined that surfers have a higher risk of GI than recreation swimmer.

## References:

1. Tseng and Jiang. Marine Pollution Bulletin vol. 64 (2012), 912-918.

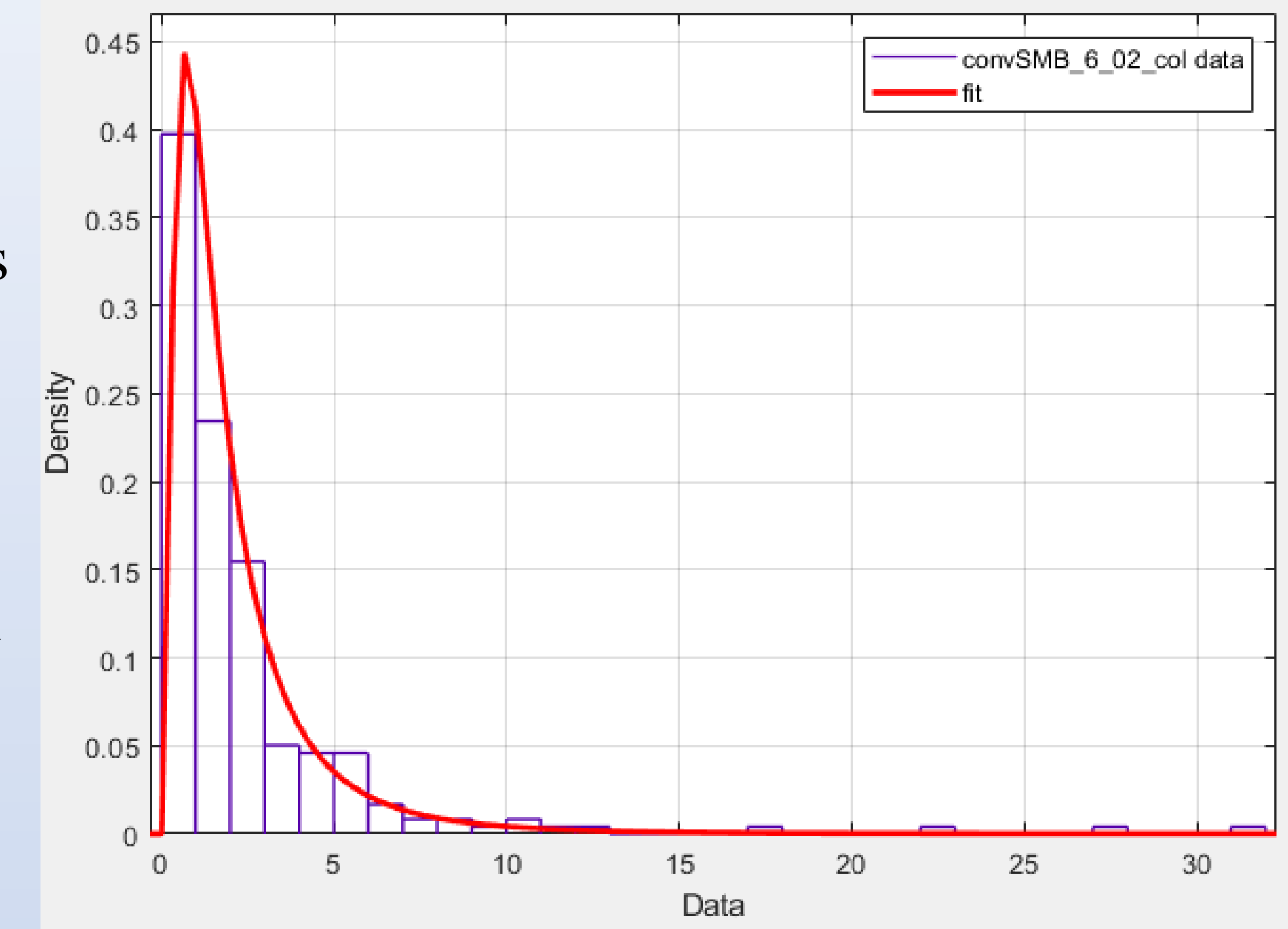


Figure 2. Lognormal distribution of FC concentration at station SMB 6-2

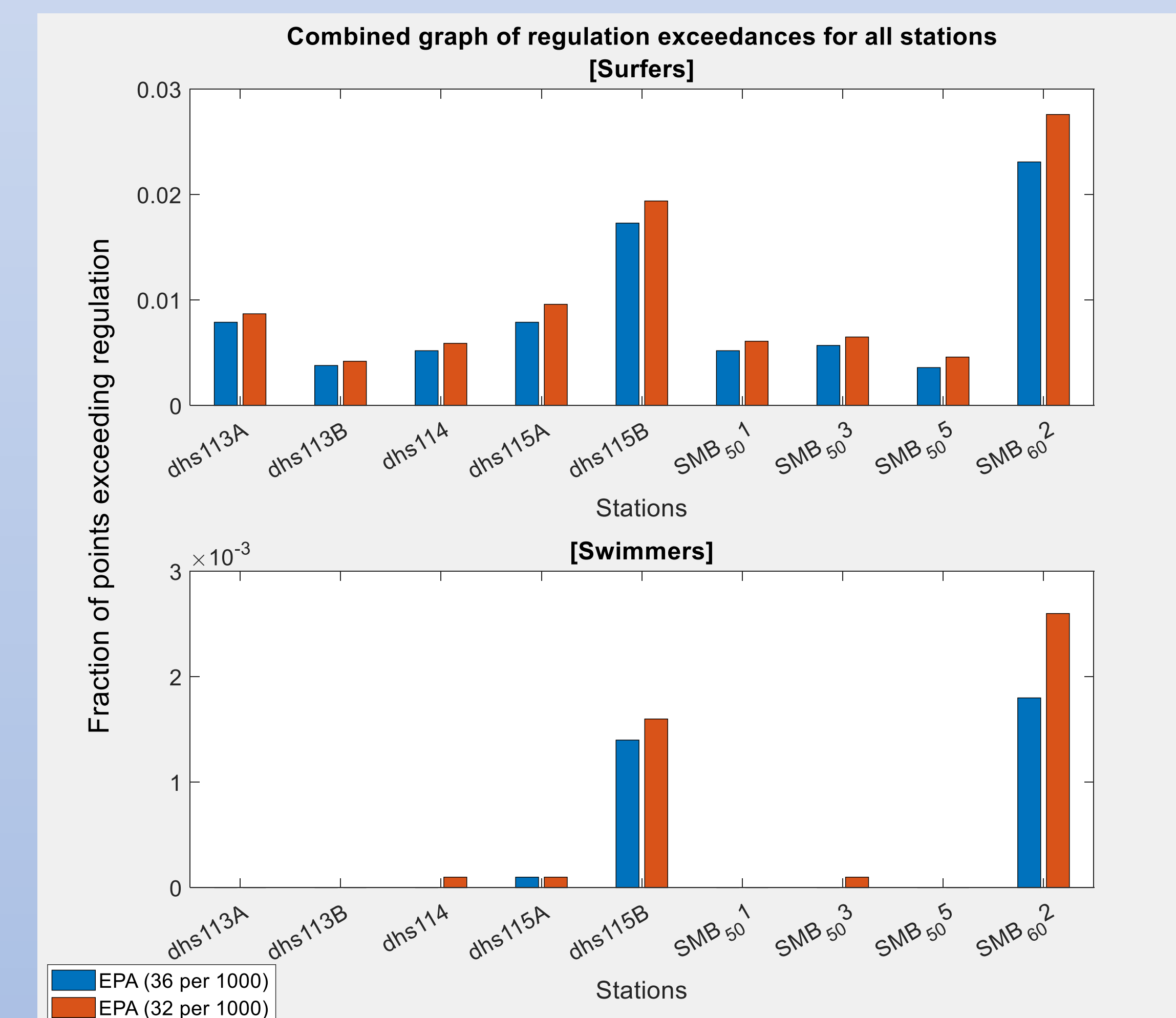


Figure 3. Bar graph of EPA guideline exceedance frequencies at each station

## Acknowledgments

We would like to thank the Summer Research Program for providing funding and Scott Adler for collecting monitoring data.

Beach stations marked yellow. Red, Blue, Purple markers are storm drains.