MEMORANDUM

To: Dr. Eileen Cashman

From: Craig Mitchell

Subject: Total and Fecal Coliforms in Strawberry Creek

Date: 10/7/2017

Introduction

Many pathogens that harm humans originate in the fecal discharge of humans and animals. When fecal discharge enters a water body, swimming in or drinking from that water body can cause disease. It is difficult to detect specific pathogens in a water body. (Davis et al. 2009) In order to efficiently monitor water bodies for fecal contamination, tests had to be developed that were indicative of fecal contamination, cheap, easy and safe to perform, and sufficiently sensitive. The bacteriological assays, total and fecal coliforms, met these requirements and is a useful monitoring tool. (Cashman 2017) Spencer Seale, Jonn Geer, and myself performed total and fecal coliforms tests for samples from Upper and Lower Strawberry Creek in McKinleyville, CA in an effort to detect fecal contamination.

Methods

Water samples were taken from Upper and Lower Strawberry creek at 12:20 pm and 12:10 pm respectively on 10/3/2017. They were stored in a cooler and transported to Humboldt State University's engineering 351 lab. A triplicate Fecal Coliform analysis and a triplicate Total Coliform analysis was performed for each sample site in accordance with *Standard Methods 9222 B and 9222 D.* (APHA et al. 2005) Sample volumes of .1, 1, and 10 mL were used for each analysis. The petri dishes were incubated for approximately 23 hours before colony forming units were counted.

Results

Table 1, below, features the mean CFU / 100 mL found for each of the triplicate assays and the corresponding standard deviation. Complete data is available in the appendix.

Table 1 Coliform assay results for Upper and Lower Strawberry Creek.

Location	Bacteriological Assay	Mean (CFU/ 100 mL)	Standard Deviation	Standard Deviation Range from Mean
Upper Strawberry	Total Coliforms	2500	509.9	1990.1-3009.9
Lower Strawberry	Total Coliforms	1900	1393	507-2293
Upper Strawberry	Fecal Coliforms	6.67	9.43	-2.76 -16.10
Lower Strawberry	Fecal Coliforms	13.3	18.9	-5.6 – 32.2

Discussion

Examination of the mean CFU / 100 mL values indicates that total coliforms decreased 2500 to 1900 between the Upper and Lower Strawberry sample sites while fecal coliforms increased 6.67 to 13.3. However, the standard deviation ranges of the mean values for both total and fecal coliforms overlap.

This overlap indicates the data was not precise enough to compare confidently.

Historically, the EPA utilized recreational water quality criteria of less than 2,300 CFU per 100 mL total coliforms and 200 CFU per 100 mL fecal coliforms. Our Upper Strawberry total coliform mean value violates this criterion while the rest of our mean values are below this standard. Currently, the EPA recreational bacteria water quality criteria uses assessments of enterococci and E. coli levels. (EPA 2012)

It is possible that our mean values in this experiment were skewed because of poor sample size choice. In all of the assays, excepting the upper strawberry total coliforms trial, there were no colony forming units for the .1 mL samples after incubation. Additionally, both of the fecal coliforms 1 mL samples grew no colony forming units. The total lack of any colony forming units in these trials could be indicative of insufficient initial bacteria levels to allow proper reproduction. If the trials that grew no colonies are ignored, then the mean of total coliforms at lower strawberry creek (2,850 CFU / 100 mL) also exceeds the recommended standard. Sample sizes should be adjusted upward for future trials if environmental conditions are similar.

Other sources of error include difficulty in precisely counting colony-forming units, especially when colony-forming units seem to be merging.

Conclusions

The coliforms data from Strawberry Creek indicated a potential for excessive total coliforms levels. Further coliforms analysis, with adjusted sample volumes, will provide better insight into the coliforms situation in this water body.

References

APHA, AWWA, and WEF (2005). Standard Methods for the Examination of Water and Wastewater - 21st Edition. Port City Press, Baltimore, MD.

Davis, M. L., & Masten, S. J. (2009). *Principles of Environmental Engineering and Science* (2nd ed.). New York, NY: McGraw-Hill.

EPA. (2012). Recreational Water Quality Criteria. Retrieved October 05, 2017, from https://www.epa.gov/sites/production/files/2015-10/.../rec-factsheet-2012.pd.

Appendix

Data charts and sample calculations included on next page.