Introduction

Fecal indicator bacteria (FIB) are found in the feces of most animals, and are used to indicate fecal contamination in water and sediment (R.T. Noble et al.).

California Assembly Bill 411 (AB 411) requires that beaches with more than 50,000 visitors per year, be monitored once a week from April through October (Largier & Taggart 2006).

Health officers must notify the public when bacteria exceed standards by posting warning signs at beaches and closing any beaches suspected of being contaminated with sewage. (Largier & Taggart 2006).

FIB data were transformed to log scale and then graphed to compare tidal range and wind speed to days that the concentrations of FIB exceed state standards.

There is a difference between late summer (Aug-Oct) and early summer (April-June) median concentrations and the number of days that FIB concentrations exceed state standards. In Aug-Oct (2001-2007) 40 - 70% of the days sampled had concentrations of FIB above state standards.

Some of the health issues due to pathogen-contaminated waters are:

- Ear, eye nose and throat infection
- Gastrointestinal infection
- Respiratory infection
- Skin Disease

(R. T. Noble et al 2004)

In this study, I analyzed associations between environmental factors and high concentrations of FIB to find a pattern that can be used to reduce the number of unexpected beach closures and prevent health issues caused by FIB contamination.

Methods

- Campbell Cove Beach is sampled once a week by the County of Sonoma Department of Health Services. Sampling includes filling sample bottles from ankle deep beach water and placing them in a cooler on ice. The samples are then taken back to the County of Sonoma Department of Health Services (CSDHS) laboratory to be analyzed using a defined substrate test (Colilert and Enterolert) to determine the concentration of Total coliform, fecal coliform and enterococcus (CSDHS).
- Historical FIB data are obtained for the years 2001-2007 from CSDHS and environmental data such as wind speed, sea temperature and tidal range from Bodega Marine Laboratory and NOAA.
- FIB data were transformed to log scale and then graphed to determine seasonal differences, yearly differences and to compare tidal range and wind speed to days that the concentrations of FIB exceeded state standards.
- Total coliform (TC), fecal coliform (FC), and Enterococci (ENT) are the three FIB tested at Campbell Cove. The state of California standards for a single sample of FIB are 10,000 most probable number (MPN)/100mL for TC, 400 MPN/100mL for FC, and 104 MPN/100mL for ENT (R.T Noble et al 2003). Persistent levels must remain below geometric mean standards values: 1,000 MPN/100mL for TC, 200 MPN/100mL for FC and 35 MPN/100mL for ENT.

Results

There are seasonal and wind patterns in the occurrence of high concentrations of FIB at Campbell Cove Beach. However, there is no evidence that high concentrations of FIB are affected by temperature or tidal range. Also, the data series is too short to see if FIB concentrations are increasing annually.

For Campbell Cove, there is a difference between late summer (Aug-Oct) and early summer (April-June) median concentrations and the number of days that FIB concentrations exceed state standards. In Aug-Oct (2001-2007) 40 - 70% of the days sampled had concentrations of FIB above state standards.

There is a difference between median concentration during high and low wind speeds. High concentrations of FIB mostly occur when winds are weak.

Questions

Is there a relationship between environmental factors and concentrations of fecal indicator bacteria (FIB) at Campbell Cove Beach?

- Are FIB concentrations higher during certain seasons?
- Are concentrations of FIB increasing annually?
- Does tidal range explain high concentrations of FIB?
- Are concentrations of FIB affected by water temperature?
- Are concentrations of FIB affected by wind?

Conclusion

Beaches with high concentrations of FIB have a higher chance of pathogens being present (R. T. Noble et al 2004).

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Future Work

- Obtain times that samples were collected and find out if samples are collected on incoming or outgoing tide and if that affects high concentration of FIB.
- See if combining environmental factors can help explain changing concentrations of FIB (e.g. High concentrations may occur on incoming or outgoing tide).

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Photo by Jason Low

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