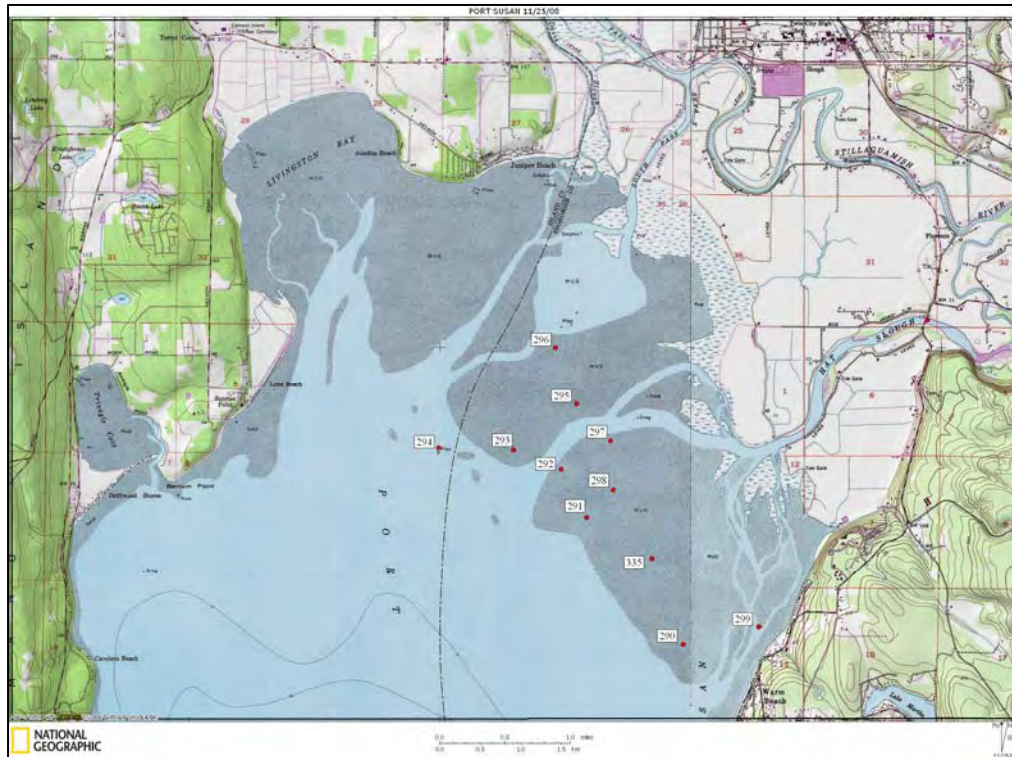


# Status and Trends Summary

## Fecal Coliform Pollution in Port Susan 2005-2008

December 24, 2008



Office of Shellfish and Water Protection

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## Introduction

The Washington State Department of Health (DOH) protects consumers from eating shellfish contaminated by pollution. To do this DOH continually monitors marine water for fecal pollution in shellfish growing areas, and searches for pollution sources on shorelines and adjacent uplands.

**Systematic Random Sampling (SRS).** DOH uses a systematic random sampling (SRS) method mandated by the National Shellfish Sanitation Program (NSSP) to monitor shellfish growing areas. DOH measures levels of fecal bacteria in water samples collected at sampling stations in each area. Under SRS, samples are collected at roughly even intervals over time. SRS purposely avoids targeting specific environmental factors, such as season, weather, tide, etc. SRS also requires a substantial minimum sample size (30 results) to classify growing areas. As a result, DOH data represent a wide range of environmental conditions encountered in the growing area. SRS ensures that unbiased, high-quality data are available for DOH tasks.

**NSSP Growing Area Criteria.** DOH uses the data gathered under SRS primarily to classify shellfish beds according to level of fecal pollution (see Appendix A). DOH also uses NSSP statistics to evaluate status and trends in fecal pollution. DOH applies the following NSSP criteria:

- The concentration of fecal coliform bacteria cannot exceed a geometric mean of 14 organisms per 100 milliliters (ml) in water (applied in all cases).
- The estimated 90<sup>th</sup> percentile cannot exceed 43 organisms per 100 ml of water (applied to areas where only nonpoint sources are present).

DOH uses a minimum of 30 results to calculate the criteria.

## Status and Trends Analysis for Port Susan

DOH calculated NSSP statistics (geometric means and 90<sup>th</sup> percentiles) for each Port Susan sampling station. Statistics were calculated for the earliest sampling date possible (i.e., having the minimum required 30 results) and for all subsequent sampling dates through 2008.

Results for status and trends of fecal pollution in Port Susan are shown in this report in three ways:

1. Status of individual stations in 2008 (pie charts in Figure 1)
2. Trend at individual stations, 2005-2008 (symbols in Figures 1, graphs in Figure 2)
3. Trend in growing area using the fecal pollution index (FPI), 2005-2008 (Figure 3)

DOH uses 90<sup>th</sup> percentiles to make inferences about status and trends because they are more sensitive than geometric means to change in pollution impact. Both geometric means and 90<sup>th</sup>

percentiles are included in the graphs in Figure 2.

**Status of fecal pollution at each individual station in Port Susan in 2008 (Figure 1).**

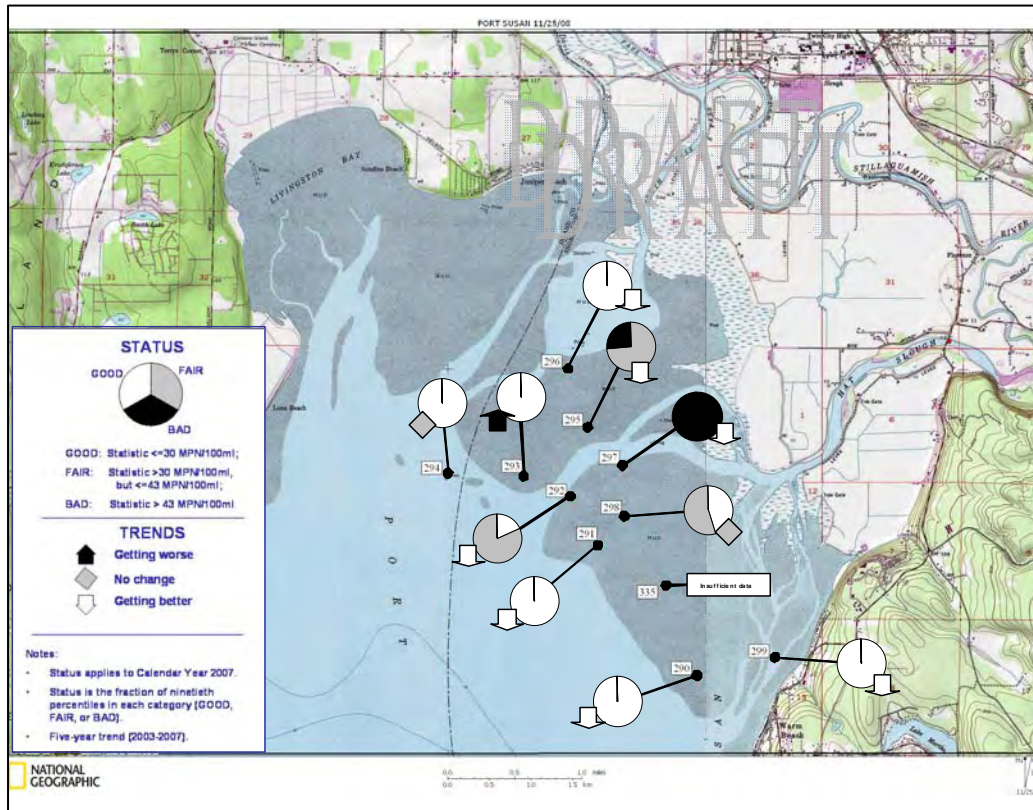
Ninetieth percentiles calculated for each station in 2008 were sorted into three categories:

- **GOOD:** 90<sup>th</sup> percentiles do not exceed the DOH “Threatened” threshold of 30 MPN per 100ml
- **FAIR:** 90<sup>th</sup> percentiles exceed the “Threatened” threshold, but do not exceed the NSSP closure criterion of 43 MPN per 100ml.
- **BAD:** 90<sup>th</sup> percentiles exceed the NSSP closure criterion of 43 MPN per 100ml.

Pie charts in Figure 1 show the fraction of 90<sup>th</sup> percentiles in each category.

**Trend of fecal pollution at each station in Port Susan (Figure 1).** Figure 1 shows symbolically the changes in fecal pollution at each station for the four years 2005-2008. A white arrow pointing down means fecal pollution is decreasing. A black arrow pointing up means fecal pollution is increasing. A grey diamond means no significant change has occurred. Spearman’s Rho was used to test the significance of the trends (significant at  $p < 0.05$ ).

**Figure 1. Status and trends in fecal pollution at Port Susan 2005-2008.**



**General Observations on Figure 1:**

- Seven of ten stations showed significantly decreasing 90<sup>th</sup> percentiles, suggesting improvement.
- Four of five stations along Hat Slough channel showed the greatest degree of fecal contamination. However, three of these showed improving trend.

**Trend of fecal pollution at each station in Port Susan (Figure 2).** Figure 2 shows graphs of geometric means and 90<sup>th</sup> percentiles for stations in Port Susan for the period from 2005 through 2008. The Spearman’s rho test results are shown on each graph. (Note: the graphs show statistics calculated from individual results, not individual results.)

**Figure 2. Trend in geometric means and ninetieth percentiles (NSSP statistics) from 2005 through 2008 at DOH stations in Port Susan.**

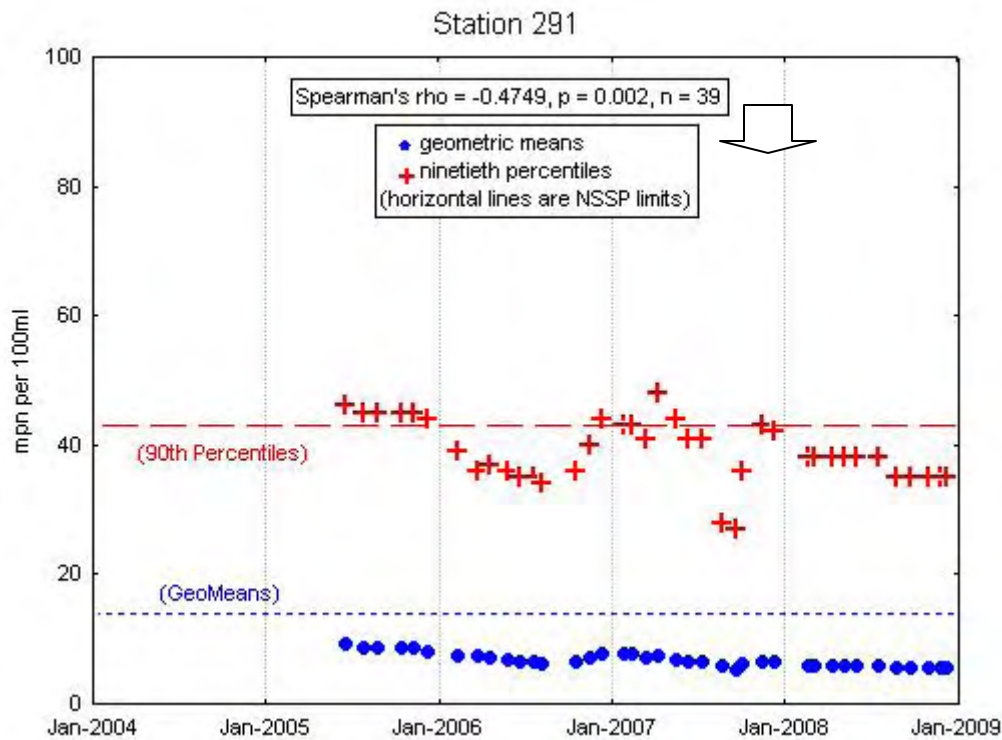
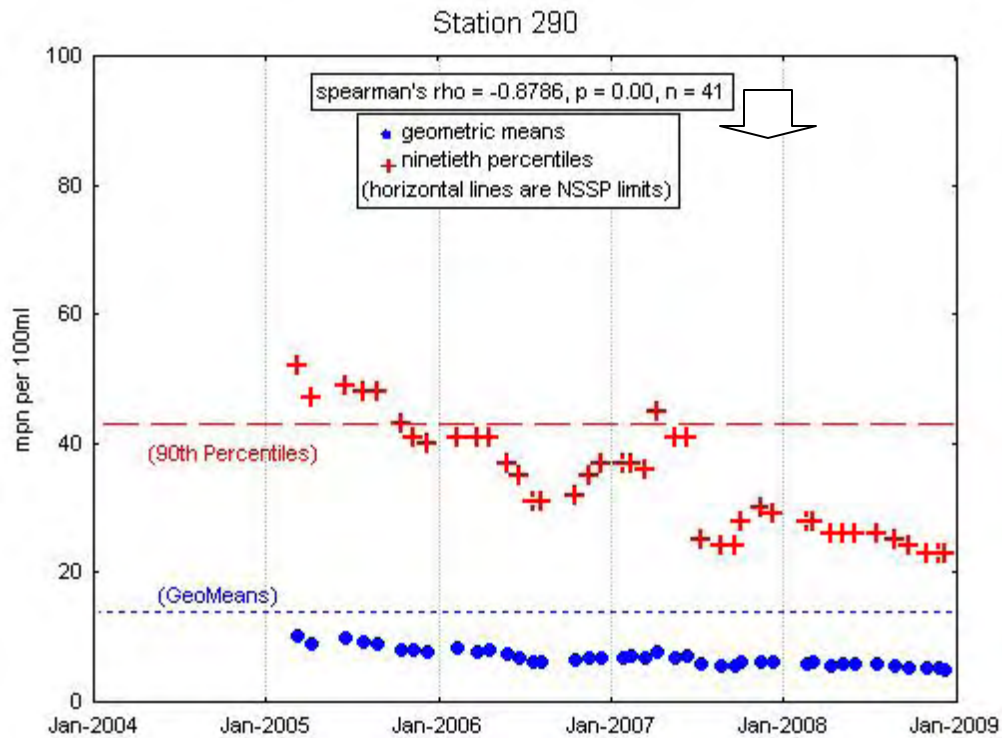


Figure 2. (Cont.)

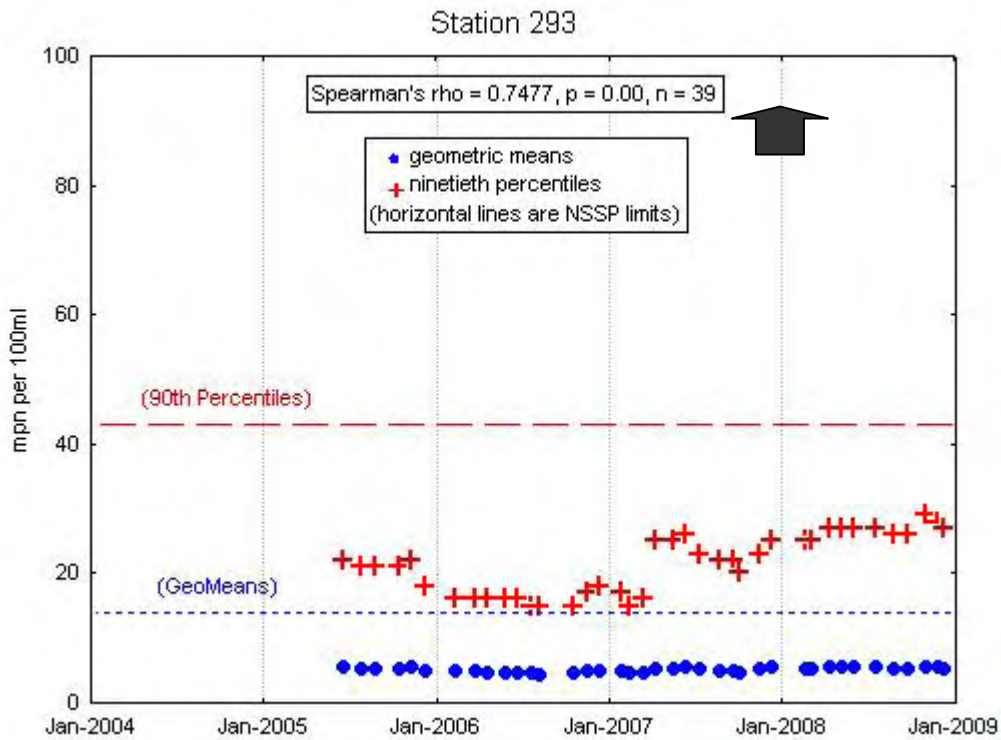
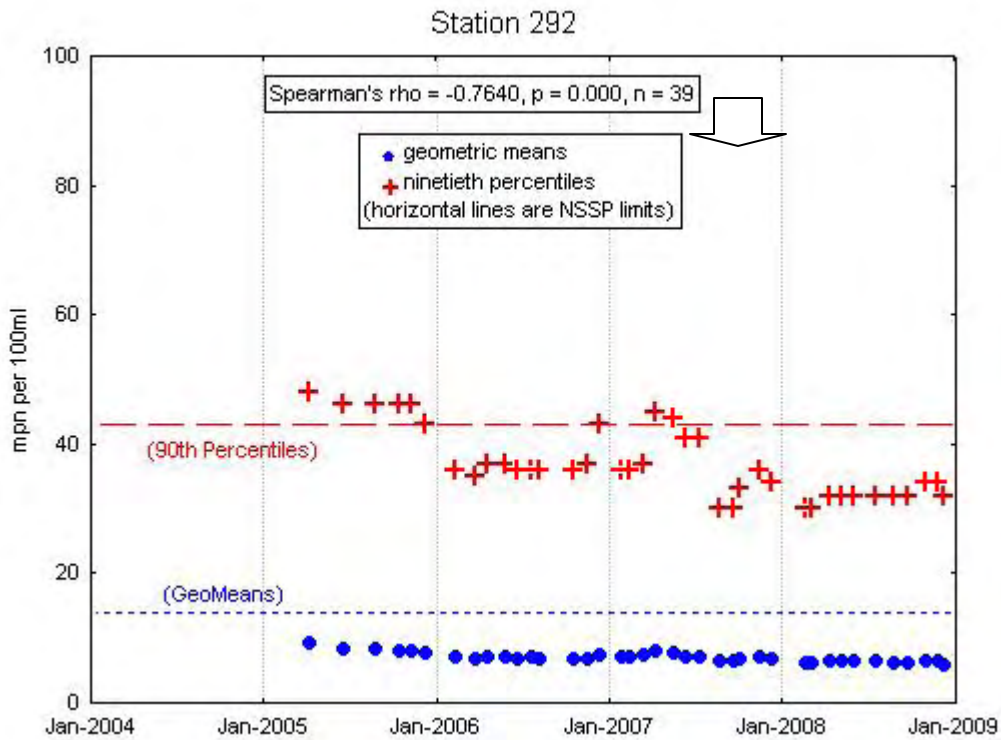


Figure 2. (Cont.)

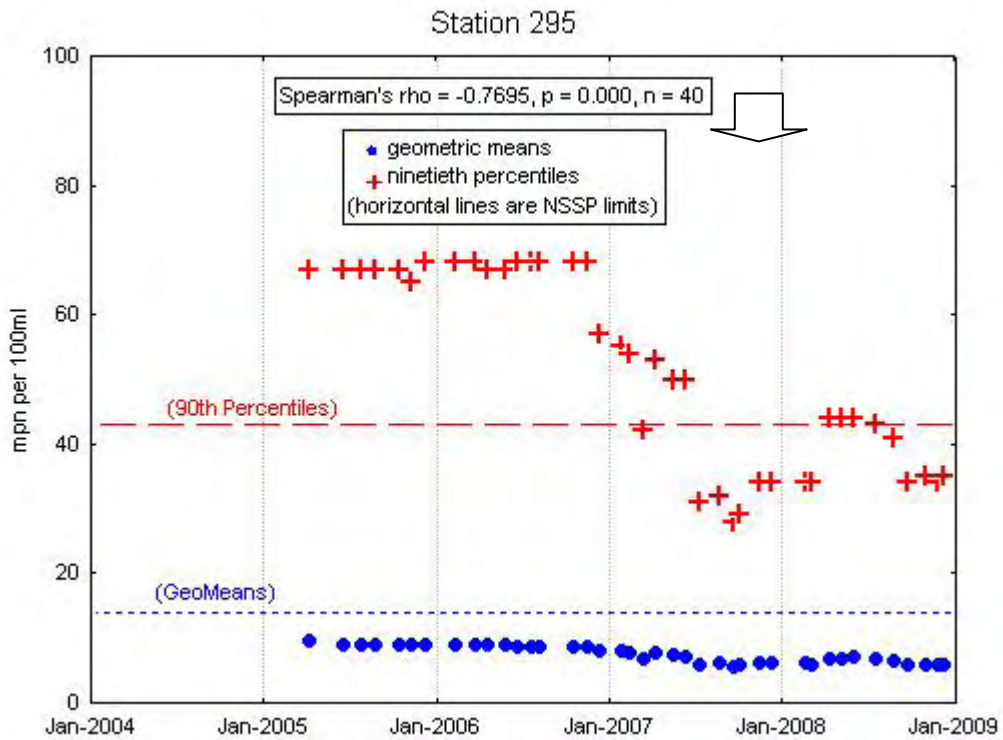
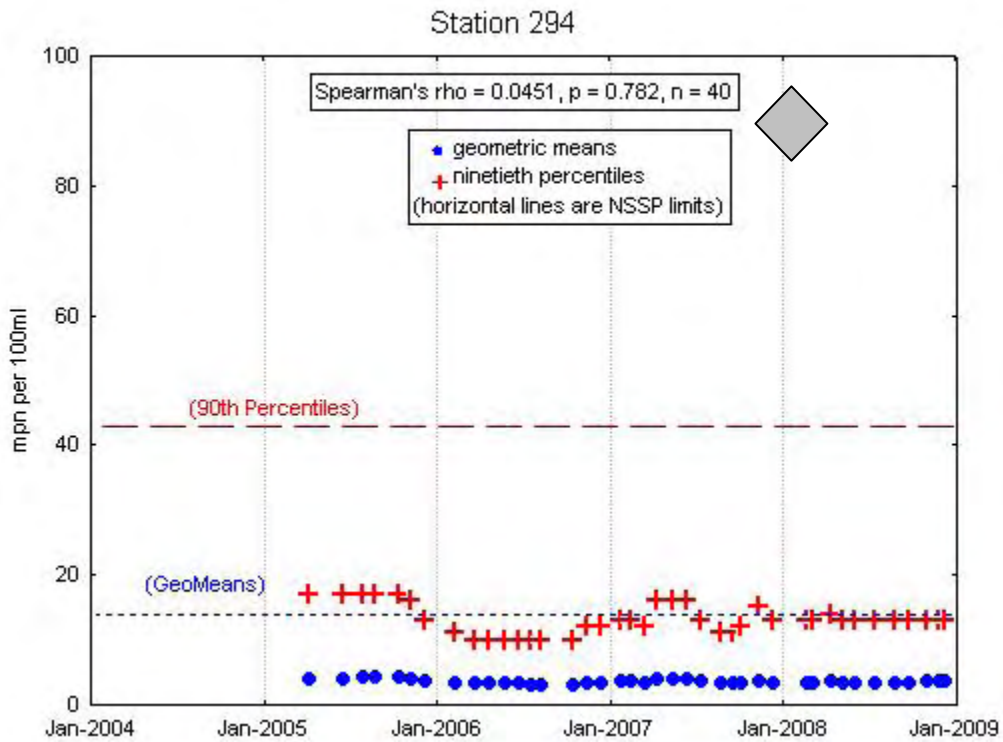


Figure 2. (Cont.)

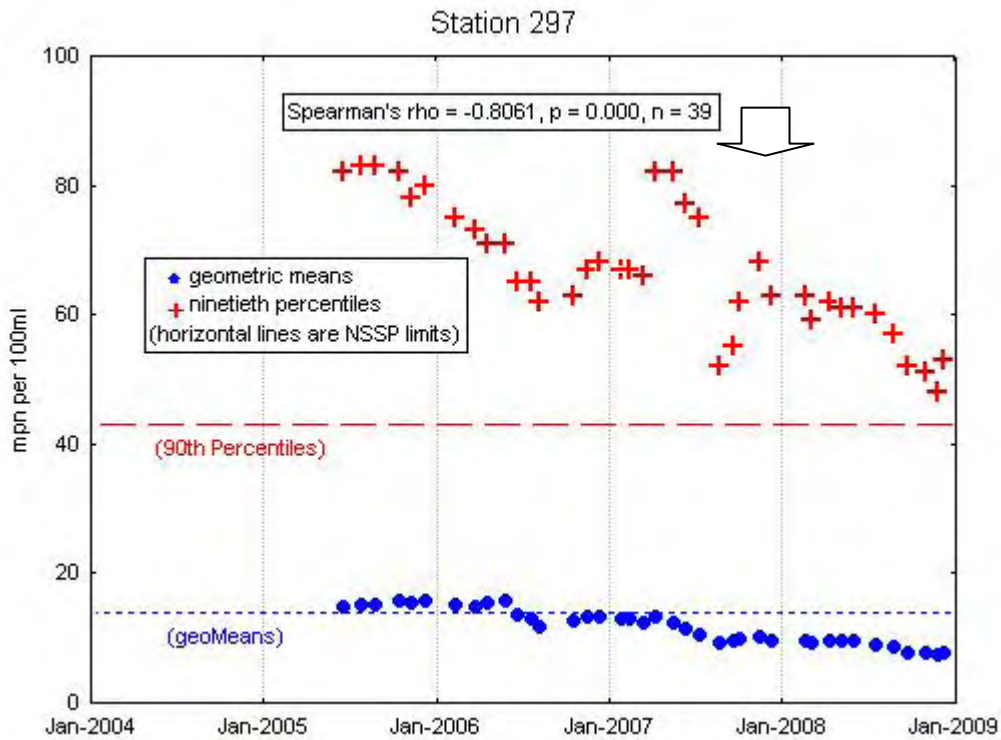
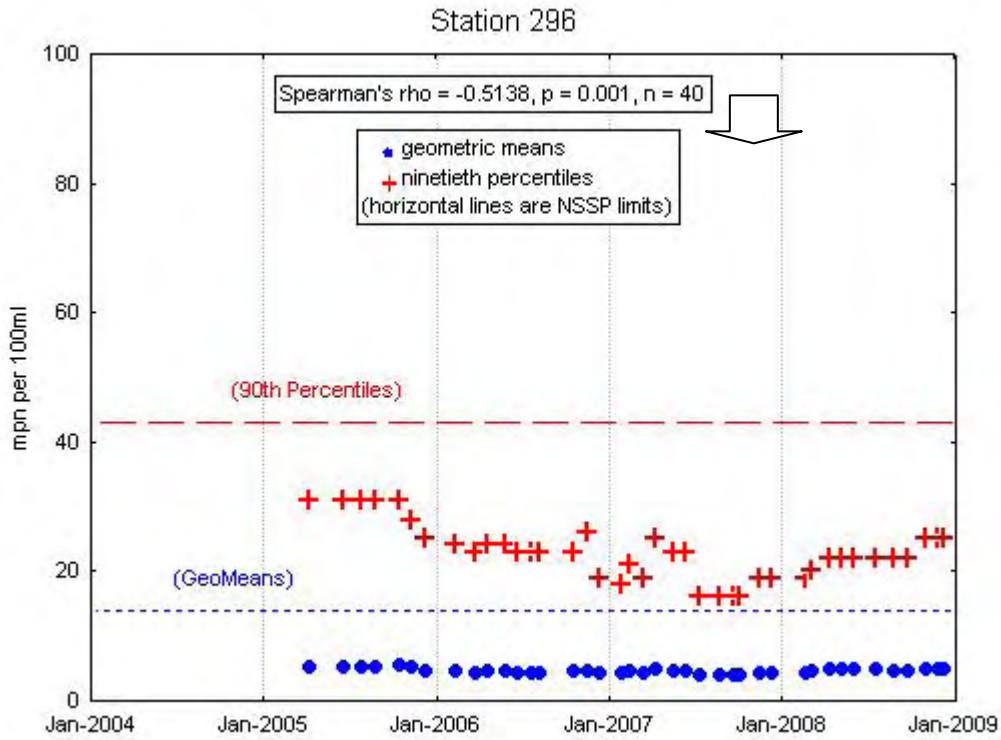
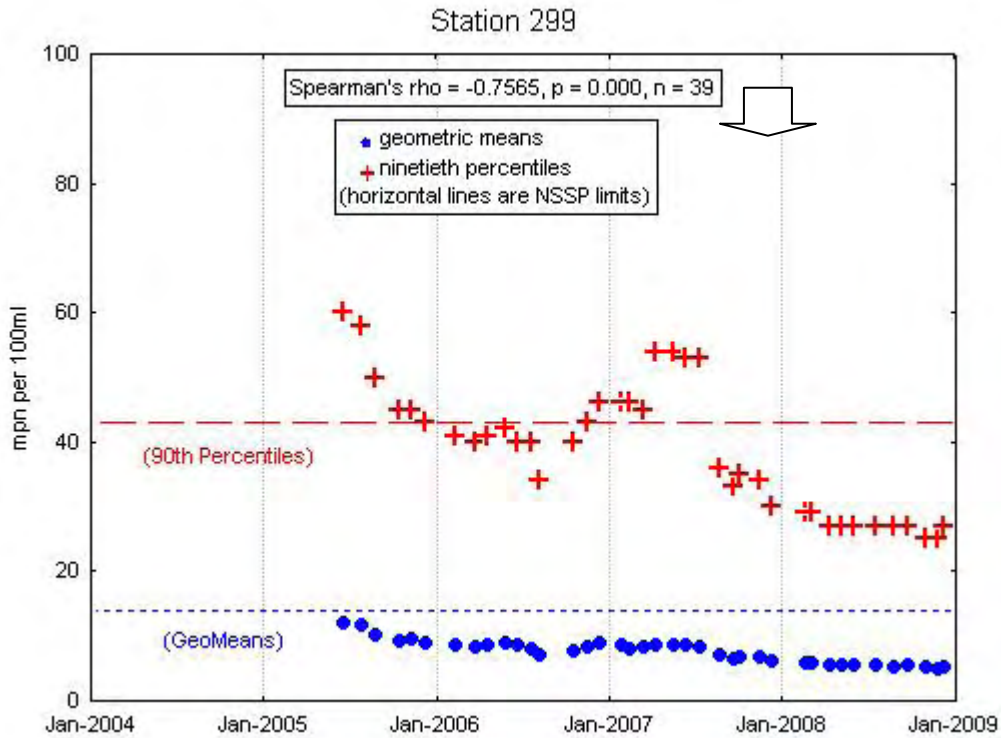
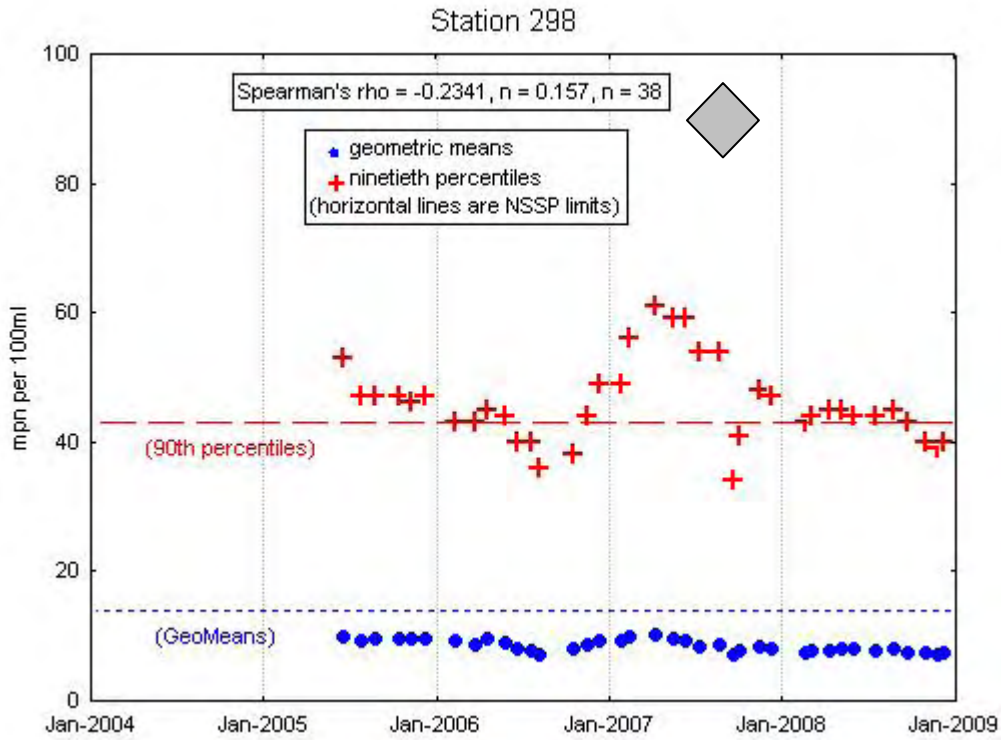


Figure 2. (Cont.)



## General Observations based on Figure 2:

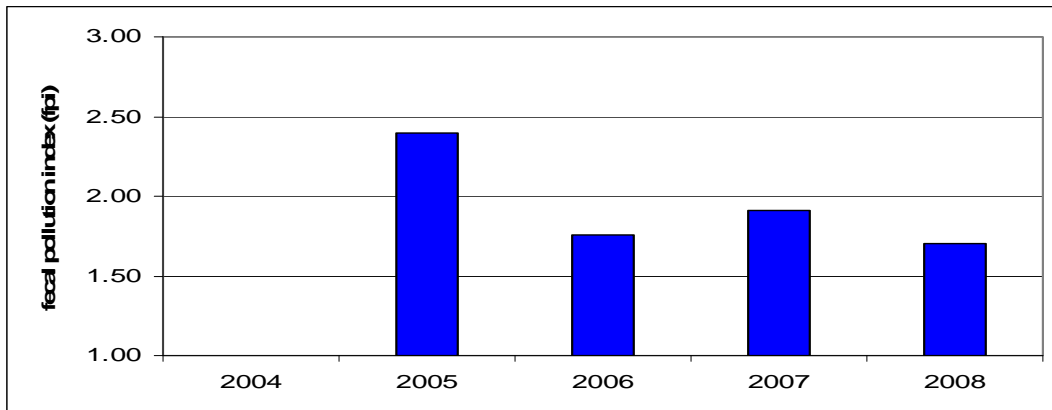
- Seven of 10 stations in Port Susan show significant reduction in 90<sup>th</sup> percentiles (stations 290-293, 296, 297, and 299). The reductions suggest improvement.
- Station 297, the most contaminated site, near Hat Slough, also suggests improvement.
- Station 293 shows a significant increase in 90<sup>th</sup> percentiles fecal pollution. The increase suggests degradation has occurred.
- Two stations (Stations 294 and 298) show no change. Station 294 is consistently low in pollution. Station 298 is elevated.
- The two stations showing no significant change (Stations 294 and 298) show relatively low pollution.

**Trend of Fecal Pollution in Port Susan 2005-2008.** DOH developed the Fecal Pollution Index (FPI) to provide a single value to describe the annual status of fecal pollution. The FPI is useful for summarizing fecal pollution trend within a shellfish growing area.

For each year 2005-2008, the 90<sup>th</sup> percentiles for all dates and stations in Port Susan were sorted into three categories (GOOD, FAIR, BAD) as described on page 4. The fraction of 90<sup>th</sup> percentiles within each category was then multiplied by a corresponding weighting factor (GOOD: x1.0; FAIR: x2.0; or BAD: x3.0). The weighted fractions are then added to produce an annual FPI.

The FPI ranges between 1.0 and 3.0. If all the 90<sup>th</sup> percentiles in a year are GOOD, the index is 1.0 (i.e., 100% GOOD 90<sup>th</sup> percentiles  $\times$  1.0 = 1.0). If all the 90<sup>th</sup> percentiles are BAD, the FPI is 3.0 (i.e., 100% BAD 90<sup>th</sup> percentiles  $\times$  3.0 = 3.0). FPIs typically range between 1.0 and 3.0.

**Figure 3. Trend in fecal pollution impact in Port Susan from 2005 through 2008 estimated by the fecal pollution index (FPI).**



### **General Observation of Figure 3:**

- The record is too short to be statistically certain about overall trend in fecal pollution impact in Port Susan.

## • APPENDIX A

### Classifying Shellfish Growing Areas

DOH applies guidelines set by the National Shellfish Sanitation Program (NSSP). Each harvest area is classified into one or more of four categories:

- An area is classified **Approved** for unlimited harvest if water quality criteria are met and significant pollutant sources are absent.
- An area is classified **Conditionally Approved** if water quality criteria are met, except during pollution events that are *episodic* and *predictable*, such as rain-related runoff. Harvests from Conditionally Approved areas require a “Conditionally Approved Area Management Plan” (or CAAMP).
- An area is classified **Restricted** if it is subject to limited pollution. Shellfish from Restricted areas cannot be harvested directly. They may be “relayed” under strict supervision to clean waters for natural cleansing.
- If an area receives pollution that is *chronically excessive* and/or *unpredictable*, it is classified **Prohibited (P)**.

To classify a growing area, DOH evaluates two questions:

1. Does the area comply with the NSSP requirements for unlimited harvest of shellfish (Approved)?
2. If unlimited harvesting is not possible, are there conditions under which harvesting can be done (Conditionally Approved)?

**Question 1: Does an area comply with Approved classification?** DOH collects water samples in the growing area according to SRS (see **Introduction** on page 3). NSSP requires at least 30 samples be collected from each sampling station in a growing area. DOH calculates a geometric mean and a 90<sup>th</sup> percentile from the 30 results. These are compared to the NSSP criteria. Both the geometric mean and 90<sup>th</sup> percentile must meet the NSSP criteria.

1. The concentration of fecal coliform bacteria cannot exceed a geometric mean of 14 organisms per 100 milliliters (ml) in water (applied in all cases).
2. The estimated 90<sup>th</sup> percentile cannot exceed 43 organisms per 100 ml of water (applied to areas where only nonpoint sources are present); OR not more than ten percent of the samples are to exceed 43 organisms per 100 ml of water (applied where point sources are present).

Besides the collection of fecal pollution data, DOH carries out a “shoreline survey” of the upland watershed and the marine shoreline to find and assess pollution sources. DOH cannot approve an area if the shoreline survey reveals pollution that presents a public health hazard, even if the water quality meets the NSSP criteria. If statistics from all stations meet the NSSP criteria and

the shoreline survey does not reveal significant pollution that presents a public health hazard, DOH classifies the area Approved.

**Question 2. Can a growing area be classified Conditionally Approved?** If a shellfish growing area cannot be classified as Approved, DOH looks at the data to see if it can be classified Conditionally Approved. If conditions are found that would allow safe harvest, DOH prepares a “Conditionally Approved Area Management Plan” (CAAMP) for the area.

The most common Conditionally Approved classification is based on 24-hour rainfall. To set the rain-related condition, statistics are recalculated from edited data (i.e., fecal coliform results from the rainiest days are removed) to see if an upper limit on 24-hour rainfall exists below which harvest can be done. DOH puts the rainfall limit into a “Conditionally Approved Area Management Plan” (CAAMP) for the area. The CAAMP for Drayton Harbor requires that the Conditionally Approved portion of Drayton Harbor be closed for six days after a 24-hour rainfall total of 0.75 inch or more.

Growing areas may also be classified Conditionally Approved based on season. To set the seasonally related condition, DOH calculates NSSP statistics after removing fecal coliform data collected during the rainiest months. If the statistics calculated from the edited data comply with the NSSP criteria, DOH prepares a CAAMP that permits harvest during the approved months. Under the seasonal CAAMP for Dungeness Bay, shellfish may be harvested during all months except November through January.

DOH reviews the classification of a growing area periodically. An objective review requires updated analysis of the water quality and the shoreline survey. For this reason DOH continues fecal pollution monitoring under SRS to ensure unbiased results are available when needed. Thus, DOH sampling continues even while the area does not meet the conditions specified in the CAAMP.