

**GROWING AREA CLASSIFICATION REVIEW OF OGUNQUIT RIVER
RELATED TO TIDAL STAGES
AUGUST 21-25, 2000**

Final Report – July 21, 2003

Introduction

FDA, in cooperation with the Maine Department of Marine Resources (DMR), completed a file and field review of the Ogunquit River, Maine shellfish growing area during August 21-25, 2000. This review was conducted in response to a request by the Interstate Shellfish Sanitation Conference (ISSC) for FDA to examine the methods used by DMR to classify shellfish growing waters for consistency with the requirements of the National Shellfish Sanitation Program (NSSP) cited in the Model Ordinance, Chapter IV.02. In fulfilling this request, the Ogunquit River was one of four Maine growing areas visited. This report pertains only to the review conducted on the classification of the Ogunquit River shellfish growing area.

FDA representatives Ira Somerset, NE Regional Shellfish Specialist, Paul DiStefano, Office of Seafood, and Virgil Carr, Office of Compliance, conducted the review. Maine Department of Marine Resources (DMR) personnel, including Amy Fitzpatrick, Laura Livingston, Jan Barter, and Bob Goodwin, assisted FDA during the review.

FDA's review was based on information obtained during a field visit and data obtained from the water quality database furnished by DMR. Information assessed from the database in this review comprises about an 8-year period, from May 1993 to August 2000. Information reviewed includes the dates and times of water sample collections, tidal stage at the times of collections, corresponding fecal coliform MPN levels, salinities, and cumulative amounts of rainfalls occurring 0, 1, and 2 days before sample collection dates.

The shellfish resource in the Ogunquit River is comprised of soft shell clams (*Mya arenaria*) growing in the intertidal mud flats. The shellfish growing waters in the Ogunquit River can receive fecal contamination from non-point sources within the drainage basin, and pollution impacts from these are expected to be rainfall and runoff related. The mouth of the Ogunquit River is located on Bigelow Bight, and it appears that the waters from Bigelow Bight pose little potential as a source of polluted water entering the Ogunquit River on flood tides. This report provides a description and an analysis of the influence that hydrologic and hydrographic factors exert on water quality in the Ogunquit River, and an assessment of the need to consider these factors when determining adverse pollution conditions in the classification of the Ogunquit River.

Classification of the Ogunquit River Shellfish Growing Area

On July 7, 1999 the portion of Ogunquit River from the Beach Road Bridge near its mouth to the Ocean Drive Footbridge, an area approximately 0.8 nautical miles in length, was reclassified to Conditionally Approved during the period October 1 to April 30

annually. The Conditionally Approved portion of the river consists of about 0.8 of the 1.4 nautical miles in the estuary. A map of the Ogunquit River is shown in **Figure 1** (NOAA Chart 13286).

Presentation of Data

FDA specifically related the times that water samples were collected to the occurrences of high tides, and the bacteriological water quality results for four sampling stations in the DMR database (Stations 6, 7, 8, and 9) in this regard (i.e., the number of hours before or after high tide). Each water sample collection time was sorted into 3-hour intervals around high tide, as used by DMR to describe flood and ebb tides. Sample station 6 is located at the southern part of the conditionally approved shellfish harvest area and sample station 9 is at the northern part of the conditional area. **Table 1** shows the total number of samples collected and the numbers collected two or more hours before and after high tide.

Table 1. Numbers of Samples Taken Two or More Hours Before and After High Tide - Data Period May 1993 – August 2000

Station	Total Number of Samples Taken		No of Samples Taken 2 or More Hours <u>Before</u> High Tide		No of Samples Taken 2 or More Hours <u>After</u> High Tide	
	Closed	Open	Closed	Open	Closed	Open
	May 1-Sep 30	Oct 1-Apr 30	May 1-Sep 30	Oct 1-Apr 30	May 1-Sep 30	Oct 1-Apr 30
6	29	35	10	7	2	7
7	39	55	11	13	5	13
8	32	54	9	13	3	12
9	41	51	10	12	4	11

The majority of sample collections occurred within two hours (before or after) of the occurrences of high tide. This was true for both the open (55% during October 1 – April 30) and the closed (61% during May 1 – September 30) periods of the year. Thus, the emphasis of monitoring by DMR occurred at near high tide.

Sanitary Survey

The city of Ogunquit has a wastewater treatment facility that discharges treated sewage offshore about 1 nautical mile north of the entrance to the Ogunquit River. The offshore discharge is not expected to contribute contamination to the river on flood tide.

The potential for contamination of the conditionally approved area exists from pollution sources originating within the Ogunquit River drainage area. Most potential sources are expected to be nonpoint that would likely occur only following rainfall and runoff events.

Time of Sample Collection Relative to High Tide

Tidal stage can exert a significant influence on water quality determinations. Ordinarily, samples obtained around low tides are expected to capture the effects occurring from

pollution sources when the least amount of dilution would take place. Thus, the time of sampling can be an important factor in determining shellfish area classification. The times of sample collections relative to the occurrences of high tides for four stations are shown graphically in **Figures 2A-2H**. A separate plot is shown for each sample station and for each seasonal period, open (October 1-April 30) and closed (May 1-September 30). With the exception of samples collected at high flood, high, and high ebb tides, sample collection times were defined relative to high tide. This was done from data provided by DMR to FDA of actual collection times for samples taken on ebb and flood tides (>1.5 hours before and after high tide). By comparing the actual collection times with tide tables for Kennebunkport (43°21' North Latitude by 70°28' West Longitude), FDA computed and plotted the recorded time of sample collection relative to the time for high tide (**Figures 2A-2H**). High tide data are plotted at one of three positions (times) relative to high tide (0 hours, 0.5 hours before high tide, and 0.5 hours after high).

Table 1 emphasizes the fact that DMR collected the majority of water samples close to high tide, during the period ranging from two hours before to two hours after high water. Few samples were collected during tidal stages representative of low water.

Samples Taken After Rainfall-Runoff Conditions

The data were reviewed for the timing of samples taken following rainfall events of 0.5 inches or greater occurring within 24 hours prior to sampling. Also noted were accumulated rainfalls that occurred on day 0 (the day of sampling). No information was available indicating how much of the rain occurring on day 0 fell before or after the times of sampling. Rainfalls that occurred after the times of sampling would not have a bearing on water quality, whereas those that occurred prior to sampling might impact fecal coliform levels. To assess effects from rainfalls that occurred before the times of sampling, an hourly recording of rainfall would be needed. The Ogunquit River has a relatively small watershed so effects of runoff following rainfall are expected to be rapid. **Table 2** illustrates the tidal conditions occurring when samples were collected one day after rainfalls of 0.5 inches or greater. A variety of tidal conditions occurred during the times of sampling. During the open period there usually were more samples collected one day after 0.5 inches of rainfall or greater than were collected during the closed period.

Table 2. Numbers of Samples Collected Following 0.5 Inches of Rainfall Occurring The Day of Sampling and One Day Before Sampling

Station	Number of Samples Collected After 0.5 Inches of Rain					
	Open Period		1-day tide Stage	Closed Period		1-day tide Stage
	0-day	1-day		0-day	1-day	
6	2	3	E,H,E	2	3	F,H,E
7	3	7	E,LE,F,E,E,H,E	2	4	H,HF,LE,L
8	4	5	E,F,E,H,E	2	4	H,HF,HE,F
9	3	6	E,E,F,E,H,E	2	4	H,HF,HE,F

Most water samples were collected during periods that were dry (<0.5 inches/day). At station 6, near the mouth of the Ogunquit River, of the 35 samples collected during the open period (**Table 1**), only two were obtained when 0.5 inches or greater rainfall occurred on day 0 (the day of rainfall). Only three samples were collected when a rainfall of >0.5 inches (0.61", 0.90" and 0.77") occurred one day prior to sampling. No elevated fecal coliform levels were found at Stations 6, 7, and 8. At station 9, however, four of the six total samples recorded were collected during ebb tides, with fecal coliform MPN values determined as 43, 93, 2.9 and 9.1 per 100ml. This indicates that a rainfall impact can occur at this station. Station 9 is the furthest upstream location sampled in the conditionally approved area, situated right on the closure line. The other two samples among the six total were collected during flood and high tides, and minimal effects from rainfall were seen in MPN values (See **Table 2** and **Figure 1**).

It does not appear that appreciable impacts from rainfall occur following runoff during the open period in the conditional area, except at station 9, which is located on the footbridge at the closure line. These findings indicate that monitoring during the open period (October 1-April 30) should emphasize samples collected following rainfall, especially on the closure line at the Ocean Drive Footbridge near Station 9.

Water Quality During Open (Oct 1-Apr 30) and Closed Periods (May 1-Sep 30)

Seasonal comparisons are shown in **Table 3**. The geometric mean and estimated 90th percentile values for the two seasons verify the need for the conditionally approved management plan for this growing area based on season.

Table 3. Comparison of Sample Results for the Open and Closed Periods

Station	OPEN October 1 - April 30			CLOSED May 1 - September 30		
	No. Samples	GM	Est 90 th	No. Samples	GM	Est 90 th
6	35	6.1	26	29	8.4	47
7	55	5.0	15	39	21.6	208
8	54	7.0	36	32	35.3	377
9	51	8.0	41	41	24.0	134

Geometric mean and 90th percentile MPN values for all four stations during the open period are below the NSSP approved area criteria. During the closed period these values for Stations 7, 8, and 9 exceed the NSSP criteria. Station 6, near the mouth of the Ogunquit River had the best water quality of any station during the closed period. The poorer water quality upstream at stations 7, 8, and 9 indicates that contamination originates from the watershed. This has been discussed previously, when it was noted that runoff from rainfall affected water quality at the most northerly monitoring location, station 9, more than it affected stations downstream.

Tidal Considerations

Observations made near the mouth of the Ogunquit River confirmed that significant tourist activities are located and occur there. Some of these activities include restaurants located on land accessible only by small bridges (both foot and automobile). In question was how sewage from these facilities is transported out of the area into the collection system. Also of note was the presence of an exposed manhole near a foot-bridge located just south of the small bridge on the mainland side, and what appeared to be a partially uncovered cast iron sewer line extending to the water's edge.

This review confirms that water quality during the summer period is much poorer than during the winter, and the conditionally approved management concept has been appropriately applied. There is an indication that the increased summertime fecal coliform levels are not necessarily related to runoff. Another factor is the increased activity near the mouth of the estuary and the possibility that the sewage collection system in that vicinity becomes overloaded. The shoreline survey of this area should be updated to confirm that contamination from human activities is properly transported to the collection system.

To assess and clarify this situation further, water quality on flood and ebb tides was compared to all data determined during the closed period (May 1-Sep 30), for purposes of assessing tidal differences in sampling results. **Table 4** shows fecal coliform MPN results for all samples taken two hours or more (≥ 2) either before or after high tide during the closed period. Geometric mean values also are shown for comparison. For stations 7, 8, and 9, the geometric mean values for both the flood and ebb tide samples are consistently greater than the geometric mean values for all samples collected (including those collected at near high tide, the majority) for the closed period. This illustrates that fecal coliform levels are greater for samples collected two or more hours before and after high tides, when less dilution water is present, than they are for samples collected at high tides. However, there does not appear to be much difference between the flood and ebb tide sample results.

The results seen for Station 6 are not what might be expected for a location so close to the mouth of the estuary. Here, fresh marine waters should serve to reduce fecal coliform levels, and a geometric mean of 10 fecal coliforms per 100 ml, shown in **Table 4**, would normally not be expected in incoming sea water. However, flood tide levels appear to exceed those found for ebb tides and overall. The effects from local sources of contamination may account for the higher-than-expected fecal coliform levels determined during flood tides. This suggests that shoreline survey work is needed.

Table 4. Fecal Coliform MPN per 100 ml for Flood and Ebb Tide Samples Collected More Than 2 Hours Before or After High Tide – Closed Period (May 1-September 30)

<u>Station 6</u>	Flood Tide	Ebb Tide	All Data
6	2.9	3.6	
6	2.9	3.6	
6	2.9		
6	2.9		
6	3.6		
6	3.6		
6	23		
6	43		
6	43		
6	460		
Number of Samples	10	2	29
Geometric Mean	10.6	3.6	8.4
<u>Station 7</u>	Flood Tide	Ebb Tide	All Data
7	2.9	2.9	
7	3.6	3.6	
7	3.6	93	
7	15	93	
7	23	460	
7	23		
7	43		
7	93		
7	93		
7	240		
7	1200		
Number of Samples	11	5	39
Geometric Mean	31.7	33.4	21.6
<u>Station 8</u>	Flood Tide	Ebb Tide	All Data
8	3.6	43	
8	3.6	93	
8	23	150	
8	43		
8	43		
8	93		
8	240		
8	460		
8	460		
Number of Samples	9	3	32
Geometric Mean	51.6	84.3	35.3

Table 4. (Continued)

<u>Station 9</u>	Flood Tide	Ebb Tide	All Data
9	3.6	15	
9	9.1	23	
9	9.1	23	
9	23	93	
9	23		
9	23		
9	93		
9	240		
9	240		
9	460		
Number of Samples	10	3	41
Geometric Mean	39.4	29.3	24

Summary and Conclusions

- Water quality in the Ogunquit River is much better during the winter than during the summer season. The lower portion of the Ogunquit River appears to be appropriately classified as conditionally approved based on season, open when there are fewer tourist activities occurring (from October 1 to April 30). However, the classification of the upper portion of the river at the conditionally approved and restricted boundary (Station 9) needs reassessment. Water quality at this location appears to reflect effects of nonpoint pollution exiting from the restricted area.
- Special emphasis should be placed on monitoring after rainfall events of 0.5 inches or greater at or near the times of low tide to assess the impacts of upstream and nonpoint sources on water quality.
- The area's shoreline survey should be updated, particularly around the entrance to the Ogunquit River. The primary purpose of the update should be to verify that sewage collection systems along the shore and across the bridge are intact, not overloaded, and properly transferring sewage to the collection system. This investigation might help determine whether increased human activities during the summer are directly related to water quality during the summer season.

Recommendations

- Further sanitary survey work is recommended, conducted to identify pollution sources near the entrance of the Ogunquit River. Analysis shows that waters at flood tides are poorer in quality than should be expected this close to an ocean outlet.
- Special emphasis should be given to monitoring the water quality following rainfall events of 0.5 inches or greater, especially at Station 9 on the closure line, and this monitoring also should emphasize low or near low tides.



Department of Marine Resources
Legal Notice of Shellfish Closure Area

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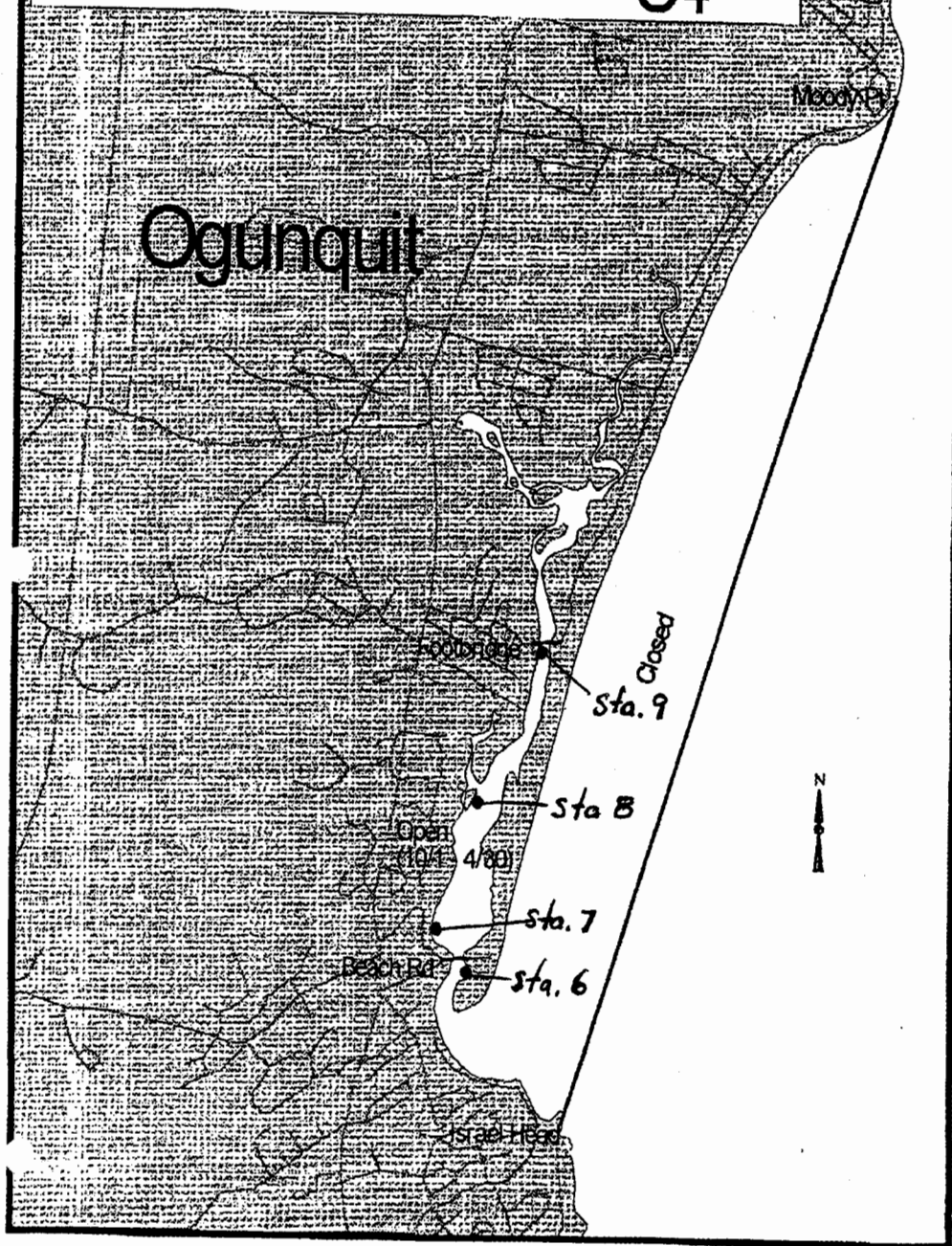


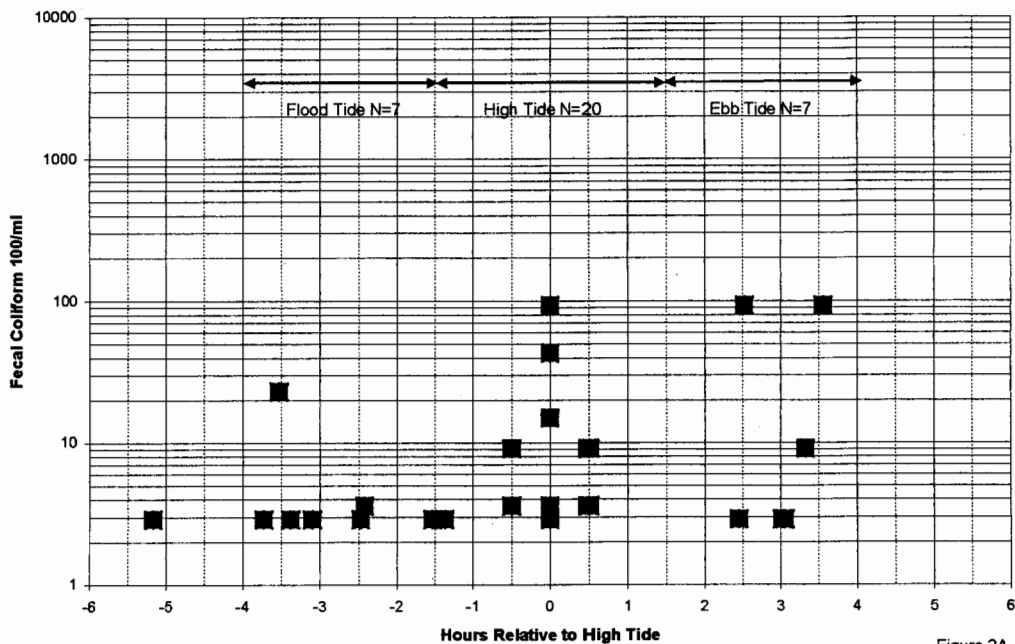
Figure 1

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Figure 1

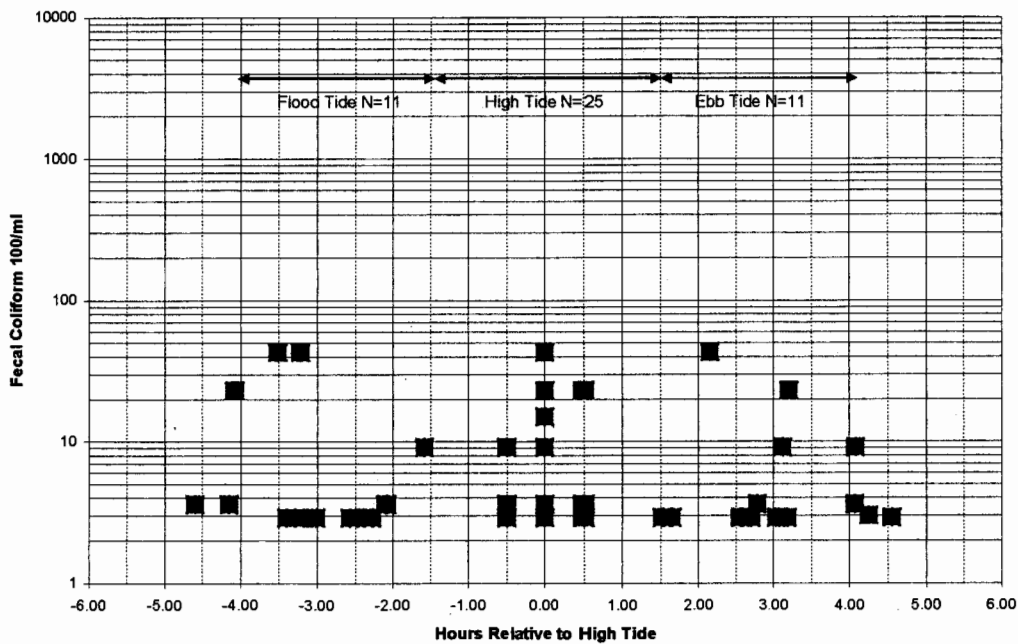
Ogunquit Sta 6 January, February, March, April, October, November, December, 1993 - 2000

Fecal Coliform Relative to High Tide



Ogunquit Sta 7 January, February, March, April, October, November, December, 1993 - 2000

Fecal Coliform Relative to High Tide



Ogunquit Sta 8 January, February, March, April, October, November, December, 1993 - 2000
Fecal Coliform Relative to High Tide

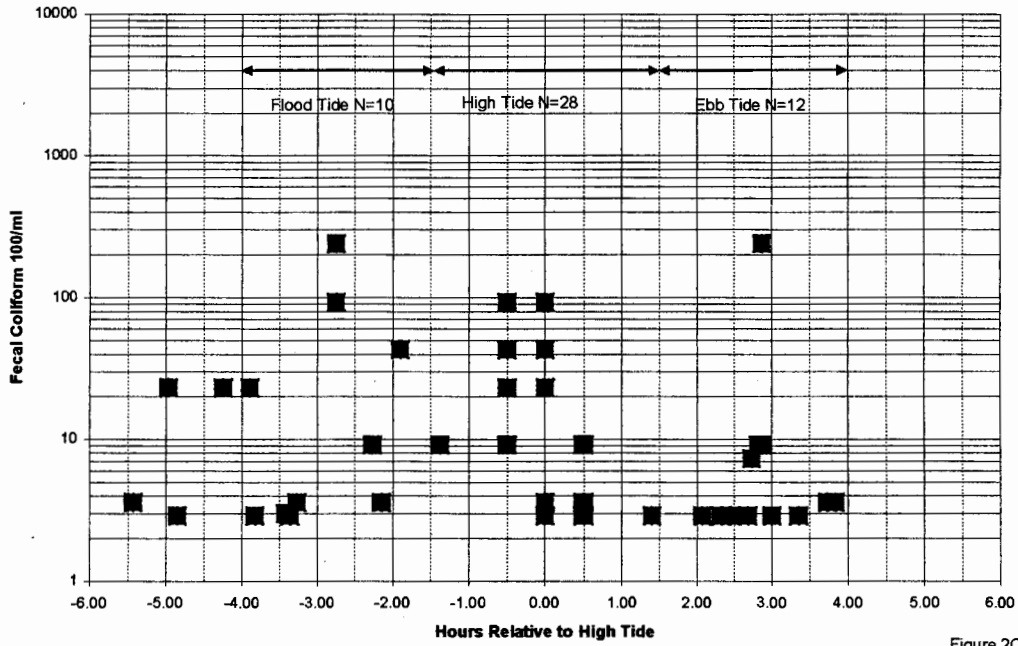


Figure 2C

Ogunquit Sta 9 January, February, March, April, October, November, December, 1993 - 2000
Fecal Coliform Relative to High Tide

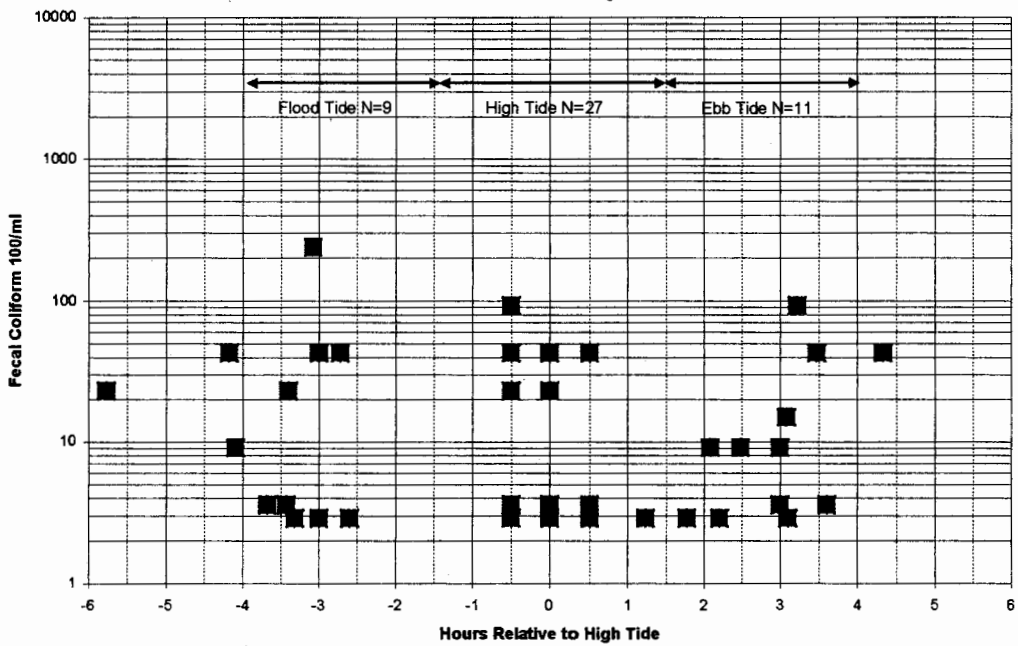


Figure 2D

Ogunquit Sta 6 May, June, July, August, September, 1993 - 2000
Fecal Coliform Relative to High Tide

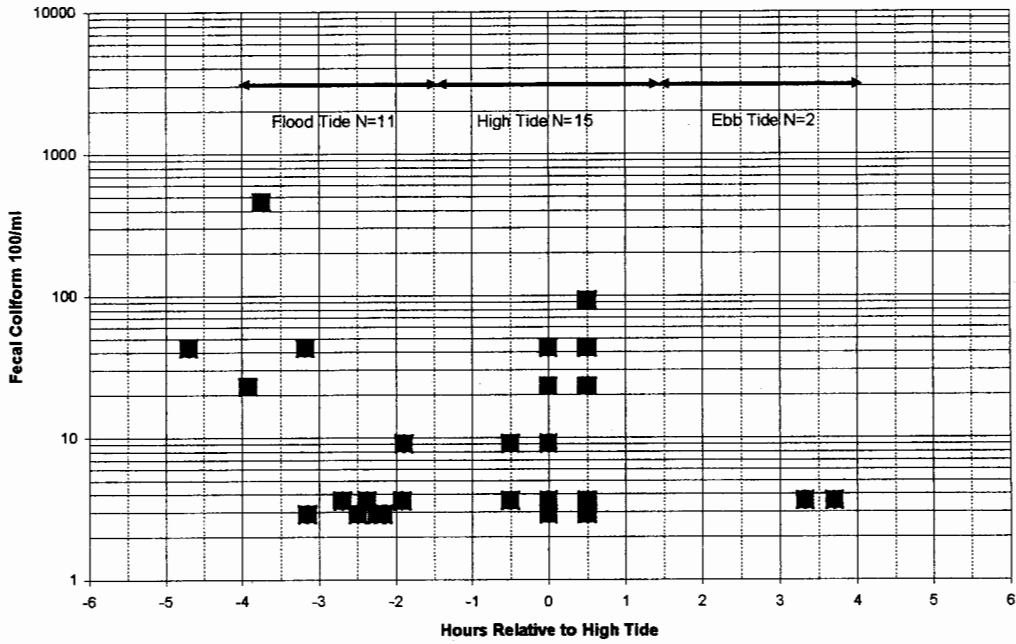


Figure 2E

Ogunquit Sta 7 May, June, July, August, September, 1993 - 2000
Fecal Coliform Relative to High Tide

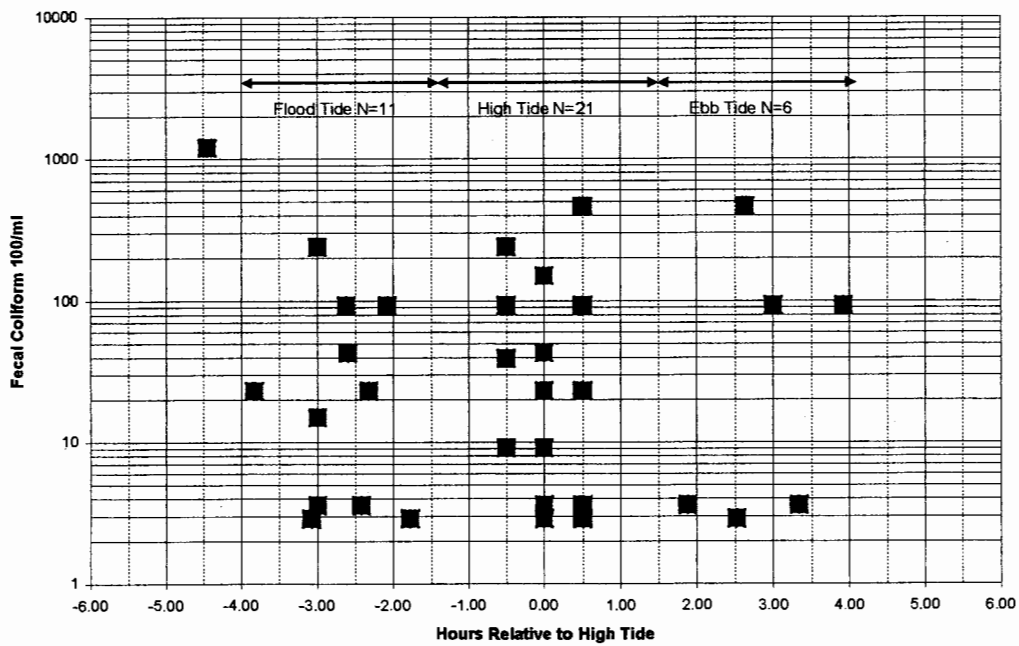


Figure 2F

Ogunquit Sta 8 May, June, July, August, September, 1993 - 2000

Fecal Coliform Relative to High Tide

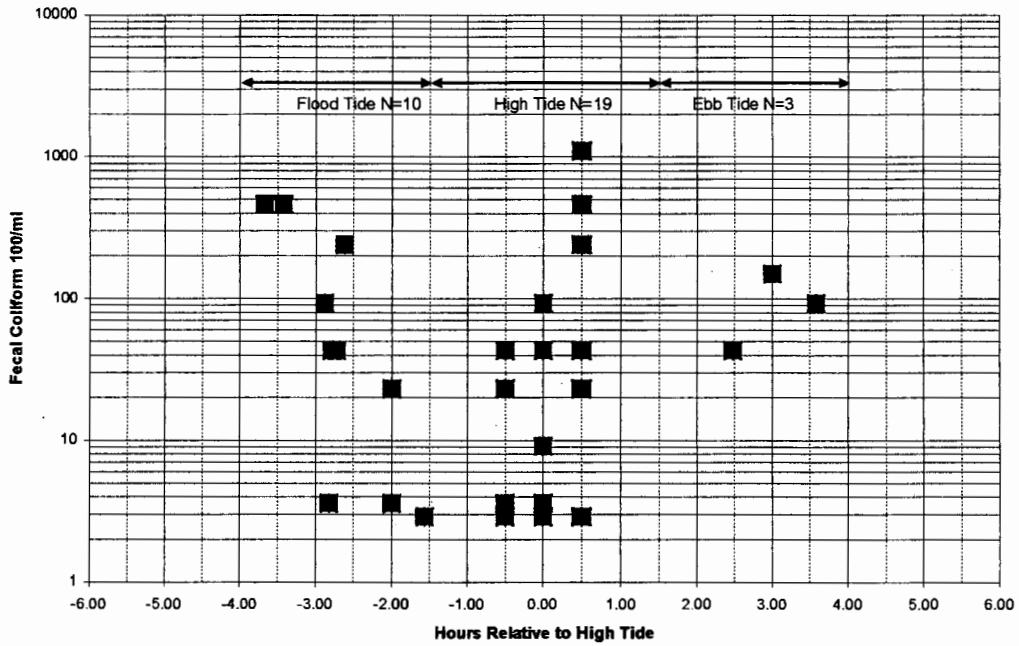


Figure 2G

Ogunquit Sta 9 May, June, July, August, September, 1993 - 2000

Fecal Coliform Relative to High Tide

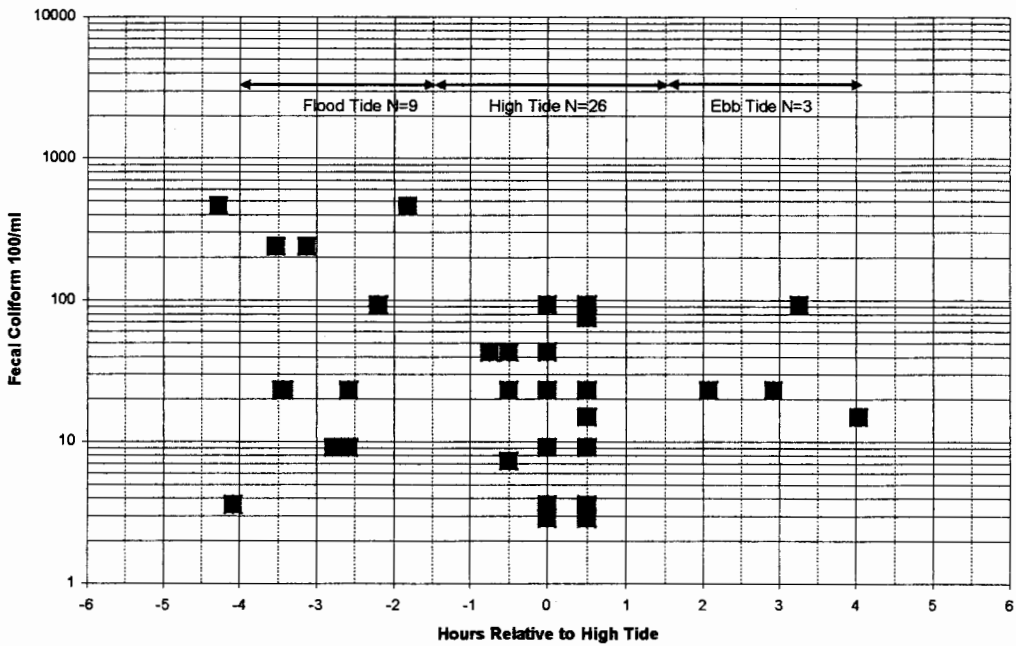


Figure 2H