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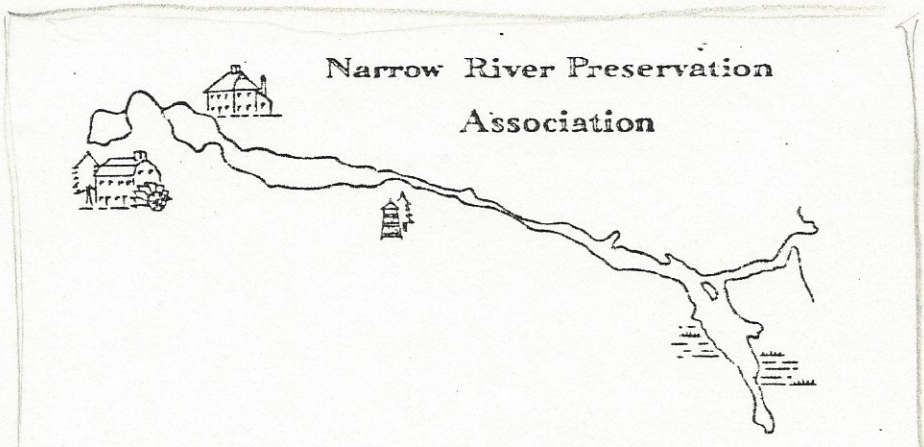
WATER QUALITY OF THE NARROW RIVER 1959-1979

by John McN. Sieburth
Vice President for Scientific Affairs



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Narrow River Preservation Association

INTRODUCTION

The Narrow River Preservation Association is an organization of residents along the Pettaquamscutt River (Narrow River) and friends of the River who are concerned with land use in the Pettaquamscutt Basin and the effect of this land use upon the water quality of the estuary. Originally organized in 1970 to prevent the private development of Boy Scout land (Kelgrant), the scope of interest expanded to water quality when Professor Paul Hargraves became Vice President for Scientific Affairs (1973-78).

The unsuitability of much of the soil in the Pettaquamscutt watershed for septic tank systems is aggravated by minimal lot sizes and the absence of specifications for septic systems before 1969. What is worse, none of the three towns bordering Narrow River have ordinances for the maintenance of septic systems, or a system for compliance. Many homeowners are ignorant of the basics for septic system operation and maintenance, most do not have the alternate year pumpout recommended for working systems, and some do not even know where their tanks and leachfields are (Warshall, 1979). A working and maintained septic system will digest much of the sewage anaerobically and treat the effluent in the leachfield, where at worst soluble materials such as nitrate enter the water system. Failing systems overload the septic tank and leachfield, and fecal material, through soil percolation and overflow into storm drainage systems, enters the watershed.

The health hazards associated with fecal contamination of waterways are due to the potential presence of pathogenic enteric bacteria and viruses in numbers sufficient to cause disease. Since these pathogens are usually difficult to culture and occur sporadically, they are not measured directly. Instead the presence of coliforms is measured. Coliforms are gram negative, aerobic, non-spore forming, lactose fermenting bacilli that are commonly found in the feces of humans and warm-blooded animals. Those coliforms that grow and ferment lactose at 44.5^{o}C are even more specific indicators of fecal contamination. The finding of fecal coliforms in water indicates the probable presence of enteric pathogens.

By experience it has been determined that if there is sufficient dilution of fecal material to keep numbers below 70 total coliforms per 100 milliliters of water sample or fecal coliforms below 14 per 100 ml, there is little possibility of contracting diseases through eating raw shellfish. However, if the median of 15 samples taken in a block exceeds these values or if 10% of the samples exceed 240 total coliforms or 43 fecal coliforms per 100 ml of sample, the water fails the standards for shellfishing (Houser, 1965). Brackish swimming waters should not exceed 700 total coliforms per 100 ml. The water samples should be taken during the most unfavorable time of the year. For Narrow River, this is the summer months of June through September.

To meet these standards, the tidal flushing in the Pettaquamscutt River basin must dilute fecal material from all sources to acceptable levels. To dilute out the coliforms from the excrement of just one person to acceptable levels requires some 8 million cubic feet of coliform-free dilution water. It would not take many failing septic systems feeding into the many storm drains of the basin to overload the diluting capacity of the Narrow River.

THE NRPA TESTING PROGRAM

The apparent decline in the aesthetic and physical quality of Narrow River waters noted by long-term residents, the often heard stories of illnesses following the consumption of raw shellfish and swimming in Narrow River, coupled with horror stories of failing septic systems and fetid backyards and storm drains have aroused suspicions of water quality. From June through September 1974, Paul Hargraves, with Carol Repasz, conducted a coliform study at 5 stations on Narrow River, obtaining a series of 10 samples. The stations and mean results were as follows:

Station	Location	Mean Coliforms/100 ml
1	Dunes Club	7,643
2	Watergate Apts.	1,574
3	Mettatuxet	1,330
4	Forest Lakes	164
5	Gilbert Stuart Outlet	1,553

These results led the investigators to conclude that it is unlikely that any sample from any of these five stations would contain less than 70 coliforms per 100 ml and that to continue the classification of Narrow River as a Class

SA estuary on the basis of sporadically acceptable counts at only one or two sites is to ignore a potentially dangerous health hazard. The lower Pettaquamscutt River (Pettaquamscutt Cove area) was further tested by Hargraves, Repasz and Gaines from June through August 1975, who found that this area far exceeded the state standard for coliforms in SA water and recommended that this area be closed to the direct harvesting of shellfish. The sporadic pulses of high counts between Sprague Bridge and the river mouth led to the Dunes Club as a point source. These studies brought in DEM which required the upgrading of the sewage disposal system of the Dunes Club, but there was no admission of general pollution by DEM. With the election of John Sieburth to the post of Vice President for Scientific Affairs of NRPA in September 1978, a study was planned to settle the issue of whether or not Narrow River is safe for shellfishing and recreational use, and if not, to locate the sources of pollution such as failing individual sewage disposal systems (ISDS), to educate the public in the river basin concerning the maintenance and optimum operation of their septic systems, and to return the river to a class SA estuary in fact as well as in name. The failure to accept past NRPA testing was a questioning by the state of the methodology and validity of the data. Apparently the microbiological work of University professors was not good enough for government work. With this in mind, arrangements were made to have the assays of total coliforms, fecal coliforms, and E. coli, performed by a federal laboratory located 8 miles from the river, according to the same standard methods used by the state.

Samples from ten arbitrarily picked locations along the estuary (Fig. 1, Table 1) were collected by Sieburth and volunteers according to standard methods using 1-liter sterile polyethylene bottles which were delivered within the hour to the lab. To avoid thermal stress and the requirement for resuscitation to allow for the repair and recovery of injured cells, the bulk of the water sample was used to maintain temperature. The icing of samples without such procedures will generally give falsely low results.

The complete data of the monthly coliform surveys for the ice-free months between November 1978 and October 1979 are given in Table 2. In addition to total coliforms, fecal coliforms, and E. coli as indices of fecal pollution, the counts of Aeromonas were also taken as an index of enrichment by household effluents. The one series of dissolved organic carbon (DOC) analyses for 14 November 1978 show a range between 1.42 and 3.44 mg of DOC per liter, values representative of Narragansett Bay between Rhode Island Sound and Jamestown Bridge in the West Passage of the Bay. They are very different from the DOC levels encountered in

the eutrophied waters of the Upper Bay which range between 5 and 7 mg C per liter. The dismissal of the high coliform counts in the Narrow River as being due to eutrophication appears unwarranted. The seasonal distribution of total coliform counts for all ten stations is shown in Fig. 2. Note the high incidence of samples exceeding the shellfishing requirements in the summer and even some of the fall months.

The difficulty with all such surveys is that they show results for only one point in time. For an estuary, with its tidal flushing, some of the variation may be tidal, some seasonal, while the time of day may also have an influence. To obtain an idea of the variation encountered due to tidal movement and temporal variations, three mid-river stations (Middle Bridge, Mettatuxet Yacht Club and Lacey Bridge) were sampled at 2-hour intervals over a 12-hour span for two consecutive days in August 1979. The tidal and total coliform variation is shown in Figures 3 and 4. High coliform populations in the hundreds to thousands persist through time and tidal cycles. The cyclical nature of the coliform counts shows a high background level with high populations from specific point sources superimposed. A further look at this data in Fig. 5 shows the influence of time of day on the maximal total coliform counts along the midsection of Narrow River. Maximal counts were observed around dinner time, coinciding with an increased consumption and disposal of water. Looking at this data for a possible influence of tide, as in Fig. 6, indicates that the highest counts were at low tide at the middle station while the lowest counts were on an incoming tide especially at the lower station (verifying the similar observation for Coney Island Beach by Cabelli et al., 1974). This data suggests that to comply with the spirit of federal regulations concerning coliform testing of shellfish beds under most unfavorable conditions, the samples should be taken in blocks of at least 15, in the summer during a low tide that occurs during the evening dinner hour.

The high counts obtained during this study were the deciding factor in notifying both the Department of the Environment and the Department of Health three weeks in advance of making the results public at the 1979 annual meeting of NRPA. The lack of response to our registered mail containing the results prompted notification of the press. Following publication, the DEM temporarily closed Narrow River to shellfishing until it could do its own testing. The joint September testing by DEM and NRPA, which confirmed our findings (see clipping), led to a joint meeting on 24 October 1979 with DEM, NRPA, CRMC, town and other officials to plan cooperative efforts to monitor and improve the water quality of the Narrow River.

STATE TESTING

At that meeting, a report entitled "Shoreline Survey and Shore Sampling of Pettaquamscutt River, 4, 5 and 13 September 1979" was presented by DEM. Although both the NRPA and DEM results showed that all 10 stations were polluted according to either total coliform or fecal coliform assays, DEM biologist Robert Richardson wrote that these analyses showed "moderate levels of coliform bacteria in sample results have not changed from our 1975 survey." The sanitary condition of the Pettaquamscutt River was found to be in very good condition, with no evidence of direct sewage contamination within the tidal area of the River....The sanitary significance of bacteriological samples alone, being used to close or open a shellfishing area, is in doubt here, particularly in the absence of any direct sewage discharge." The final remark was "Unless more information is provided to the contrary, there does not appear enough evidence to warrant continued emergency closure of this area to shellfishing."

Fortunately the condition of Narrow River has not reached that of upper Narragansett Bay where the "greaseballs" are unmistakable. The author submits that Narrow River is significantly polluted during the summer months and that by the state's own standards it fails to meet the criteria of a Class SA estuary. The NRPA does not want to change the classification of this estuary or to close it to shellfishing permanently, but to recognize that there are enough defective ISDS in the area to cause apparent levels of coliforms indicative of fecal pollution. A major public education and ISDS upgrading and maintenance program is needed. The release of the Richardson report to lawyers and engineers who have used it as evidence for obtaining zoning variances along the Narrow River, with no opportunity to include NRPA results and interpretations, was unfortunate and prejudicial.

A positive feature of the new DEM policy of releasing old records of coliform assays of Narrow River waters is that we now can see how "clean" the estuary was in former years. The incidence of samples exceeding the State limits for shellfishing are summarized in Table 3. Two decades ago a series of 138 samples obtained from the 3 bridges at monthly intervals between November 1959 and February 1961 was the most extensive survey to date. Of the 138 samples, 52 were polluted (38%) on a yearlong basis. However, the significance of this data is that during the summer shellfishing and recreational season 24 of 33 samples (73%) were

polluted. The importance of this was obscured in the State report listing yearly medians of 43, 43 and 23 coliforms per 100 ml for Sprague Bridge, Middle Bridge and Lacey Bridge, respectively, when the summer medians were 240. This is a misleading interpretation of the data. Even averaging NRPA data by the standard log mean procedure (Table 5) shows that on a year-round basis the log mean of 9 of the 10 NRPA stations exceeds the state standard and that for the summer months the log mean of all stations also fail those standards. This was also true of the log mean of the summer samples taken by the State Department of Health in 1960 (see Table 6). The log mean in the summer often reached 400 per 100 ml. The National Technical Advisory Committee on Water Quality to the Secretary of the Interior (NTAC, 1968) made the following recommendation: "Fecal coliforms should be used as the indicator organism for evaluating the microbiological suitability of recreation waters. As determined by multiple-tube fermentation or membrane filter procedures and based on a minimum of not less than five samples taken over not more than a 30-day period, the fecal coliform content of primary contact recreation waters shall not exceed a log mean of 200/100 ml, nor shall more than 10 percent of total samples during any 30-day period exceed 400/100 ml." The Narrow River certainly fails these criteria during the recreational season.

The intensive sampling of Narrow River in 1959-61, with its warning signals in the June-September results, was apparently followed by only 5 samples taken in a 12-year period. Sampling did not resume until the NRPA started testing in 1974 and the results were published in the press. State tests for the summer months at Sprague and Lacey Bridges left obvious gaps in June, August and September (see Table 3). Despite the biased sampling, 18 polluted samples out of 28 (62%) were obtained. The NRPA data for 1978-79 is summarized in Table 4. Of the 90 samples, some 57-59% are polluted on a yearlong basis while 90% of the summer samples were polluted.

What the data says is that in two decades the incidence of polluted summer samples has only increased from 73% to 90%. This can be interpreted to mean that much of the damage was done before 1960 and we are living with the developers' rape, or that pollution is a natural characteristic of the basin. The sporadic peaking of pollution from undetected sources in Figures 3 and 4 indicate that the former is closer to the truth. The defective ISDS uncovered during the ongoing septic system survey by NRPA, DEM and RIPE (Rhode Island Projects for the Environment) plus the use of fluorimetry to pinpoint household discharge should do much to help Peter Janaros of DEM to rectify failing systems. However,

it is only through public education and a concerted drive by NRPA to curtail wastewater production at the source, that progress will be made in reducing the incidence of pollution to acceptable levels. The members of NRPA look forward to working with Jim Fester and Peter Janaros of DEM in achieving this goal. Continued monitoring of the river for coliform data, the basis of estimating fecal contamination, and unequivocal enforcement of the State's own water quality standards, are needed to protect the tri-town population of the estuary and to avoid troublesome variances in the coastal zone.

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ACKNOWLEDGEMENTS

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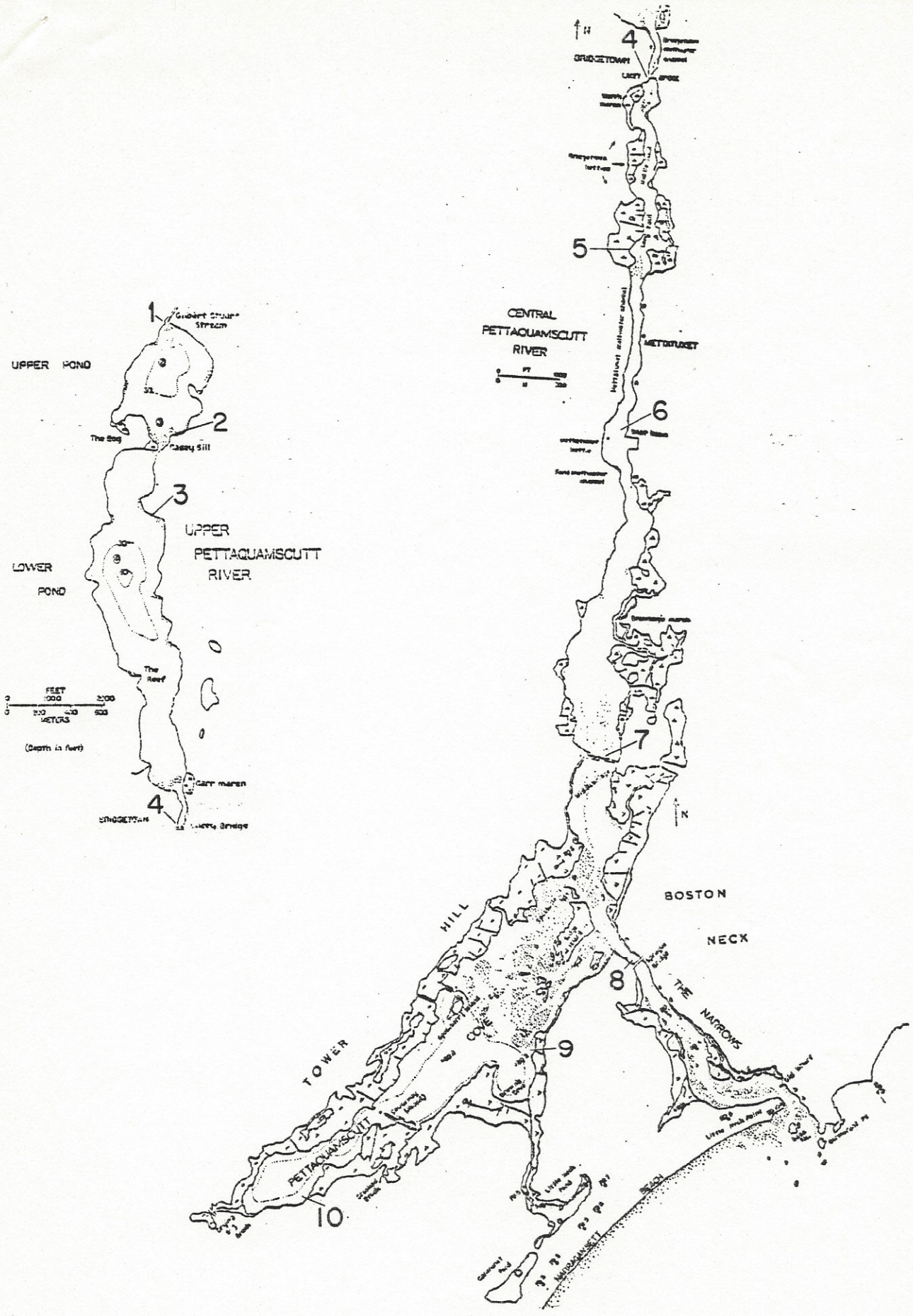

Fig. 1. The ten NRPA sampling stations for the 1978-79 water quality survey; location descriptions in Table 1.

Table 1.

NARROW RIVER SAMPLING STATIONS 11/78

1. GILBERT STUART BROOK. Park in lot opposite Gilbert Stuart House (across road on east bank of brook.) Walk to the southerly of the two bridges and sample from a point in midstream below the confluence of the two streams.

2. BOYS CLUB. Take Carroll Rd. west off Rte. 1A (just south of Saunderstown). Turn right at first road, then go straight past Carpenter Lane; road becomes dirt. Inside Boys Club gates turn left (west) and go down the hill on long dirt road, past Boys Club office to sandy beach just north of "Hazard Hall". Walk south to a point of land south of beach and near narrows, where there are a number of large rocks. Sample straight off the rocks.

3. FOREST LAKES. Take Indian Trail west off Rte 1A all the way to river. Park at beach, follow path just north of beach between beach and house. Sample off the point of land just north of the beach.

4. LACEY BRIDGE. Sample from northwest corner of the bridge opening, off the pile of boulders.

5. MIDDLEBRIDGE ROAD. Park on road just north of Radial Drive, cross vacant lot just north of the houses and cross marsh to river for sampling.

6. METTATUXET. Take Mettatuxet Road west off Rte 1A to South River Rd. Turn south and park at Mettatuxet Yacht Club. Walk along northern side of the boat basin to river, sample off the northern point.

7. MIDDLE BRIDGE. Sample from the rocks at the northeast corner of the bridge opening from as far out as possible into the channel.

8. SPRAGUE BRIDGE. Park in lot southwest of the bridge just off Rte. 1A. Sample from the rocky point in the river between the parking lot and the bridge itself.

9. WATERGATE. Take Starr Drive west off Rte. 1A all the way to the river - it becomes a narrow dirt road after passing the apartment houses. Sample off end of the road.

10. NARRAGANSETT SCHOOL (Pettaquamscutt Cove). Turn north on Mumford Rd. off Narragansett Avenue beside tennis courts. Pass school, turn right on Riverside Drive. Park at vacant lot just before first house on left. Cross field to cove and sample below old cedar tree on bank.

Table 2a. NRPA Water Quality Survey of the Pettaquamscutt River, 1978-79.

Narrow River Survey — November 14, 1978

Station	Total Coliforms per 100 ml	Fecal Coliforms per 100 ml	E. coli per 100 ml	Aeromonas per 100 ml	Water Temp. °C	Dissolved organic[1] carbon (mg/L)
1. Gilbert Stuart	5	2	2	1433	10.0	lost[2]
2. Boys Club	23	13	13	7	11.1	3.44
3. Forest Lakes	130	5	5	500	12.0	3.44
4. Lacey Bridge	13	< 2	< 2	97	10.0	3.06
5. Middlebridge Road	49	49	49	33	10.0	2.10
6. Mettatuxet	49	11	11	20	11.8	1.86
7. Middlebridge	33	23	23	7	11.4	1.42
8. Sprague Bridge	33	23	23	10	11.0	1.56
9. Watergate	130	33	33	80	9.8	2.42
10. Narragansett Jr. High	70	23	23	47	9.6	2.32

Narrow River Survey — December 12, 1978

Station	Total Coliforms per 100 ml	Fecal Coliforms per 100 ml	E. coli per 100 ml	Aeromonas per 100 ml	Water Temp. °C
1. Gilbert Stuart	49	2	3	50	3.0
2. Boys Club	49	4	9	70	2.0
3. Forest Lakes	54	2	7	0	0.5
4. Lacey Bridge	49	2	5	20	2.5
5. Middlebridge Road	130	13	11	150	2.5
6. Mettatuxet	49	11	8	50	3.0
7. Middlebridge	13	5	7	2	6.5
8. Sprague Bridge	46	7	8	2	6.5
9. Watergate	240	7	8	70	0.0
10. Narragansett Jr. High	350	8	11	20	3.0

Narrow River Survey — April 10, 1979

Station	Total Coliforms per 100 ml	Fecal Coliforms per 100 ml	E. coli Per 100 ml	Water Temp. °C
1. Gilbert Stuart	49	17	7	6.0
2. Boys Club	17	8	18	6.0
3. Forest Lakes	13	5	3	6.0
4. Lacey Bridge	17	5	8	5.5
5. Middlebridge Road	110	13	10	5.0
6. Mettatuxet	22	8	8	5.25
7. Middlebridge	21	5	6	4.5
8. Sprague Bridge	17	5	3	5.3
9. Watergate	130	7	18	5.3
10. Narragansett Jr. High	32	17	3	5.8

Table 2b. NRPA Water Quality Survey of the Pettaquamscutt River, 1978-89.

Narrow River Survey — May 8, 1979

Station	Total Coli-forms per 100ml	Fecal Coli-forms per 100ml	*E. coli* per 100ml	Aeromonas per 100ml	Water Temp. °C
1. Gilbert Stuart	79	5	10	15	16.0
2. Boys Club	23	2	2	10	17.0
3. Forest Lakes	13	5	1	20	16.0
4. Lacey Bridge	46	33	9	90	17.0
5. Middlebridge Road	33	5	3	30	16.5
6. Mettatuxet	11	4	5	0	16.0
7. Middlebridge	7	<2	0	0	12.5
8. Sprague Bridge	7	2	4	0	12.5
9. Watergate	11	2	1	0	14.0
10. Narragansett Jr. H.	20	<2	7	0	16.5

Narrow River Survey — June 5, 1979

Station	Total Coli-forms per 100ml	Fecal Coli-forms per 100ml	*E. coli* per 100ml	Aeromonas per 100ml	Water Temp.°C
1. Gilbert Stuart	920	540	250	4196	18.0
2. Boys Club	110	17	16	1798	18.5
3. Forest Lakes	130	49	124	1499	19.0
4. Lacey Bridge	350	79	125	932	18.5
5. Middlebridge Road	280	49	38	1265	19.0
6. Mettatuxet	920	49	40	1132	19.0
7. Middlebridge	110	27	18	340	17.2
8. Sprague Bridge	460	33	20	210	16.9
9. Watergate	170	79	43	700	18.2
10. Narragansett Jr. H.	9200	94	399	5600	16.2

Narrow River Survey — July 10, 1979

Station	Total Coli-forms per 100 ml	Fecal Coliforms per 100 ml	*E. coli* per 100 ml	Aeromonas per 100 ml	Water Temp. °C
1. Gilbert Stuart	49	17	7	12,000	21.75
2. Boys Club	79	17	40	1,600	23.0
3. Forest Lakes	79	49	10	650	22.0
4. Lacey Bridge	540	13	15	370	23.0
5. Middlebridge Rd.	110	27	18	800	23.0
6. Mettatuxet	220	220	37	0	22.7
7. Middle Bridge	5400	5400	3500	0	20.5
8. Sprague Bridge	7	7	1	10	17.0
9. Watergate	350	79	23	310	20.0
10. Narragansett Jr. High	28	23	55	290	22.5

Table 2c. NRPA Water Quality Survey of the Pettaquamscutt River, 1978-79.

Narrow River Survey — August 7, 1979

Station	Total Coliforms per 100ml	Fecal Coliforms per 100ml	E. coli per 100ml	Aeromonas per 100ml	Water Temp. °C
1. Gilbert Stuart	1600	170	70	1000	24.5
2. Boys Club	240	49	10	1200	27.0
3. Forest Lakes	920	130	130	330	26.0
4. Lacey Bridge	920	170	20	560	26.0
5. Middlebridge Rd.	2400	170	40	490	24.5
6. Mettatuxet	540	170	63	260	24.0
7. Middle Bridge	130	79	18	0	21.5
8. Sprague Bridge	22	6.8	8	0	24.0
9. Watergate	110	23	35	120	27.0
10. Narragansett Jr. High	920	240	80	7000	26.0

Narrow River Survey — September 4, 1979

Station	Total Coliforms per 100 ml	Fecal Coliforms per 100 ml	E. coli per 100 ml	Aeromonas per 100 ml
1. Gilbert Stuart	790	17	6	9400
2. Boys Club	460	33	100	1432
3. Forest Lakes	790	49	45	167
4. Lacey Bridge	240	49	31	210
5. Middlebridge Road	240	49	100	100
6. Mettatuxet	350	110	70	170
7. Middlebridge	700	79	42	50
8. Sprague Bridge	170	46	30	10
9. Watergate	170	79	26	10
10. Narragansett Jr. High	5400	350	27	5200

Narrow River Survey — October 16, 1979

Station	Total Coliforms per 100 ml	Fecal Coliforms per 100 ml	E. coli per 100 ml	Water Temp. °C
1. Gilbert Stuart	79	1.4	3	9.5
2. Boys Club	220	7	7	8.0
3. Forest Lakes	70	13	10	10.0
4. Lacey Bridge	130	23	17	12.0
5. Middlebridge Rd.	170	33	16	11.0
6. Mettatuxet Y.C.	79	33	8	11.0
7. Middle Bridge	170	33	22	10.0
8. Sprague Bridge	23	23	3	12.0
9. Watergate	33	33	4	12.0
10. Narragansett Jr. High	280	230	63	9.0

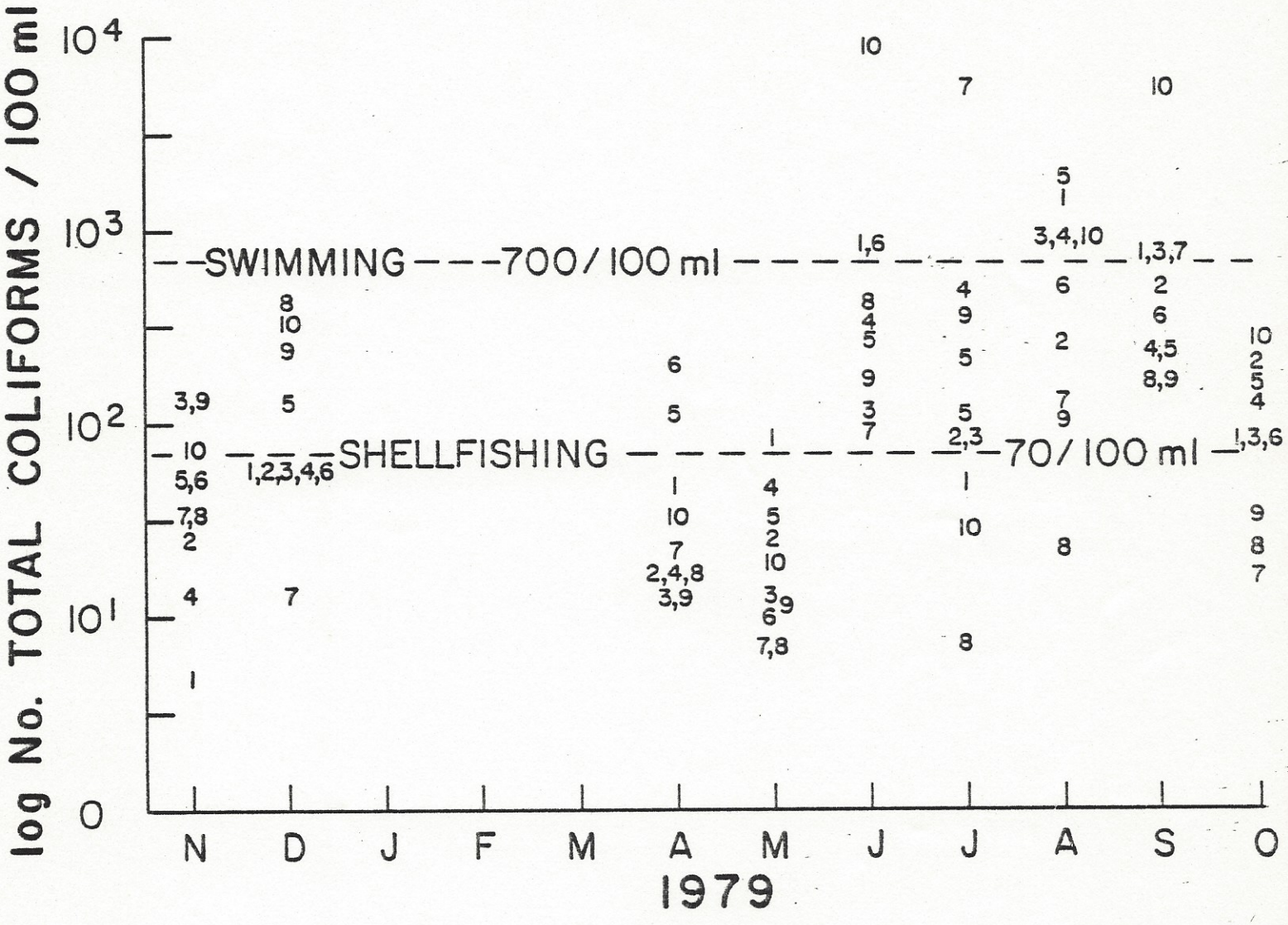

Fig. 2. The seasonal distribution of total coliform counts at the ten sampling stations along Narrow River during the 1978-79 NRPA Water Quality Survey.

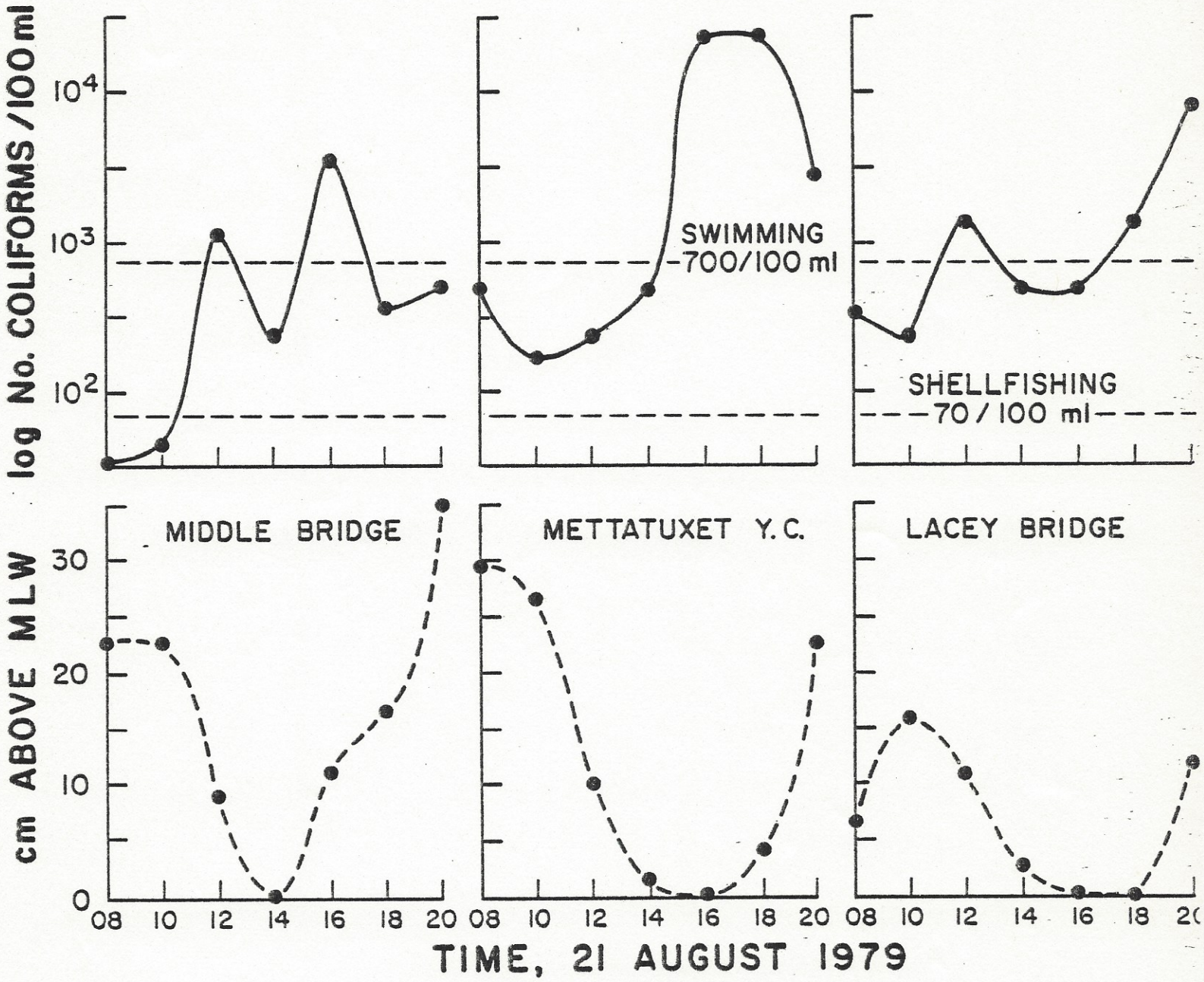

Fig. 3. The variation of total coliform counts with the tidal cycle at three mid-Narrow River sampling stations.

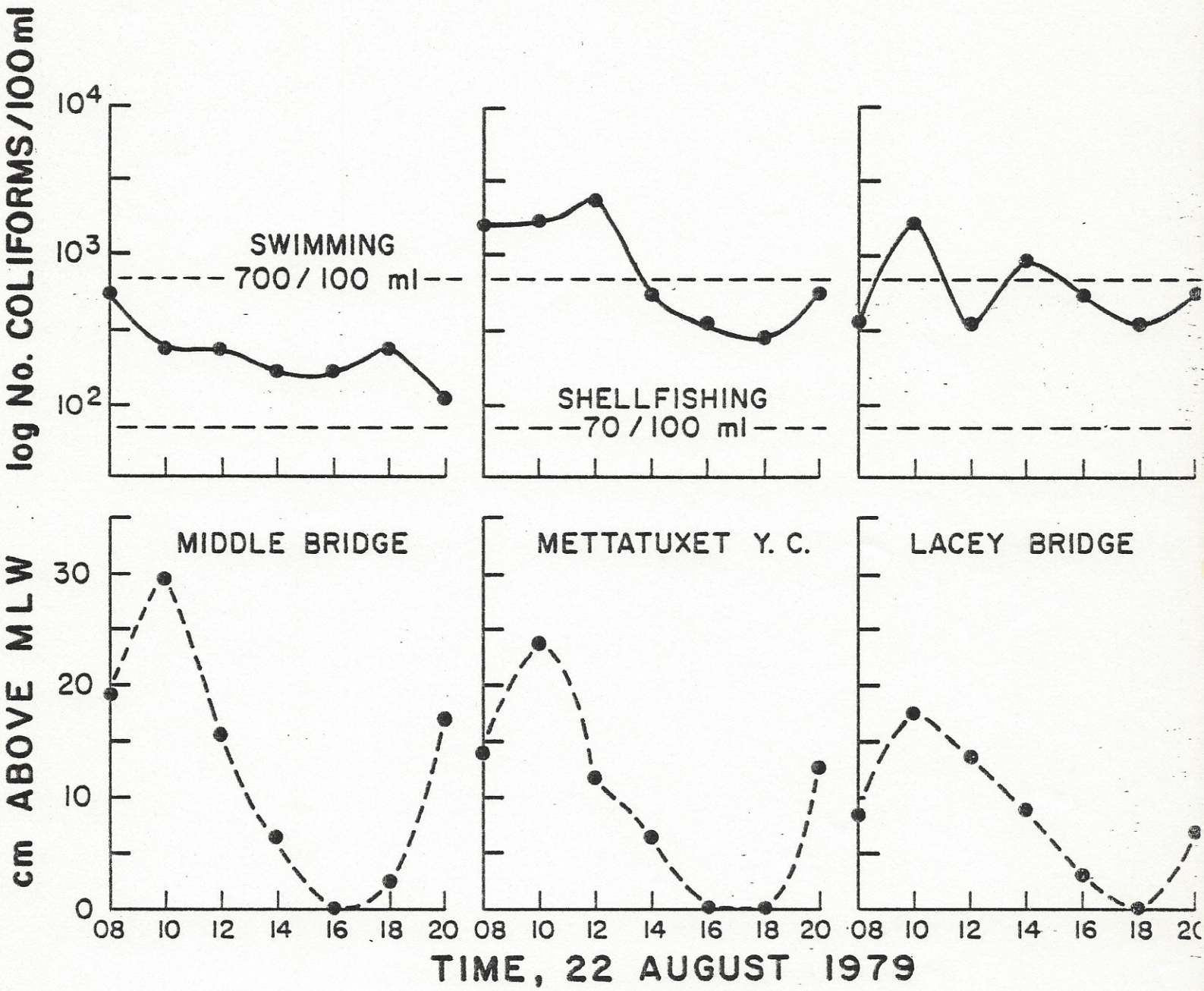

Fig. 4. A total coliform and tidal cycle study made the day following that of Fig. 3 to observe the day to day variation.

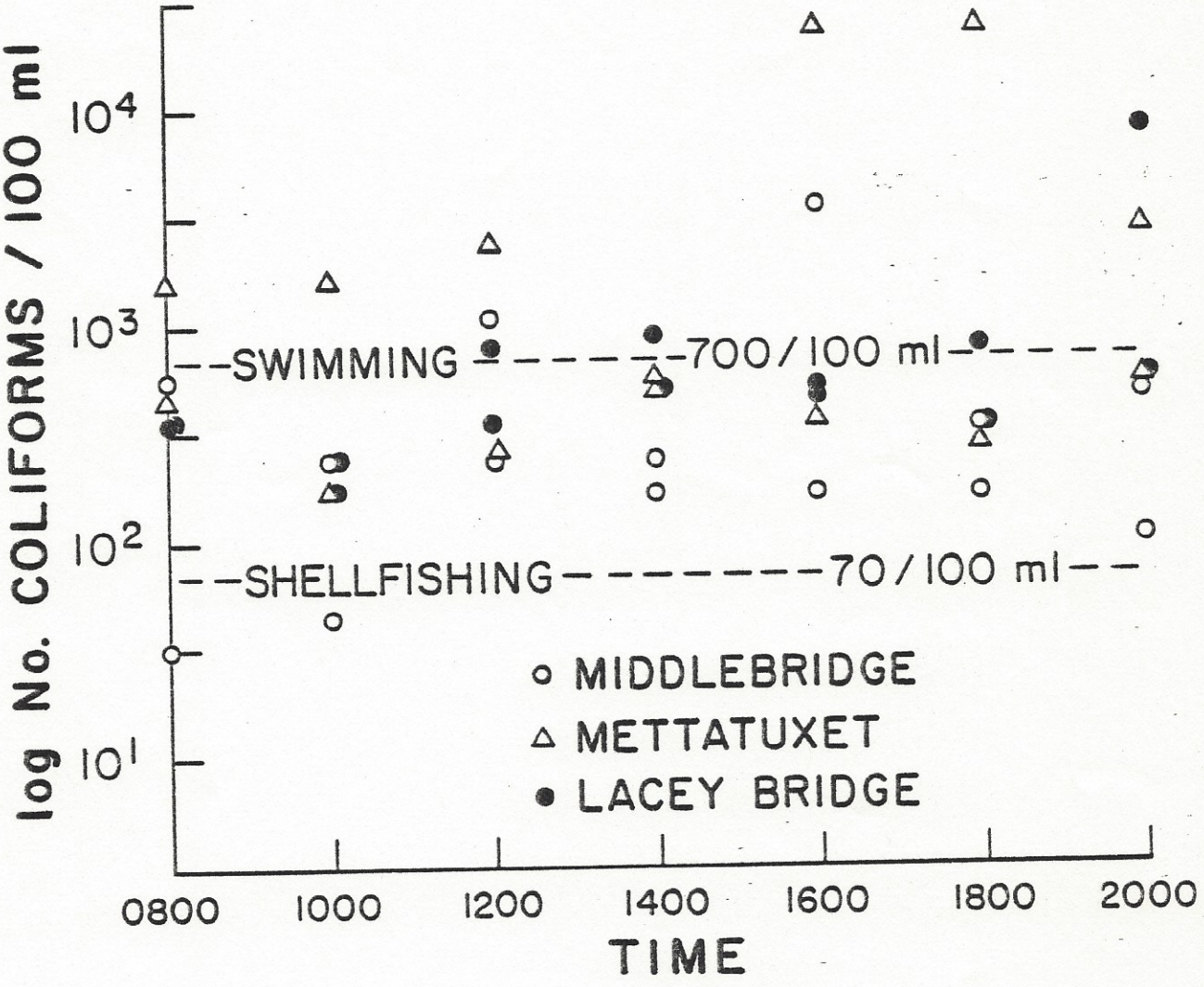

Fig. 5. The influence of time of day on the maximal total coliform counts at three mid-Narrow River stations (21 & 22 August 1979).

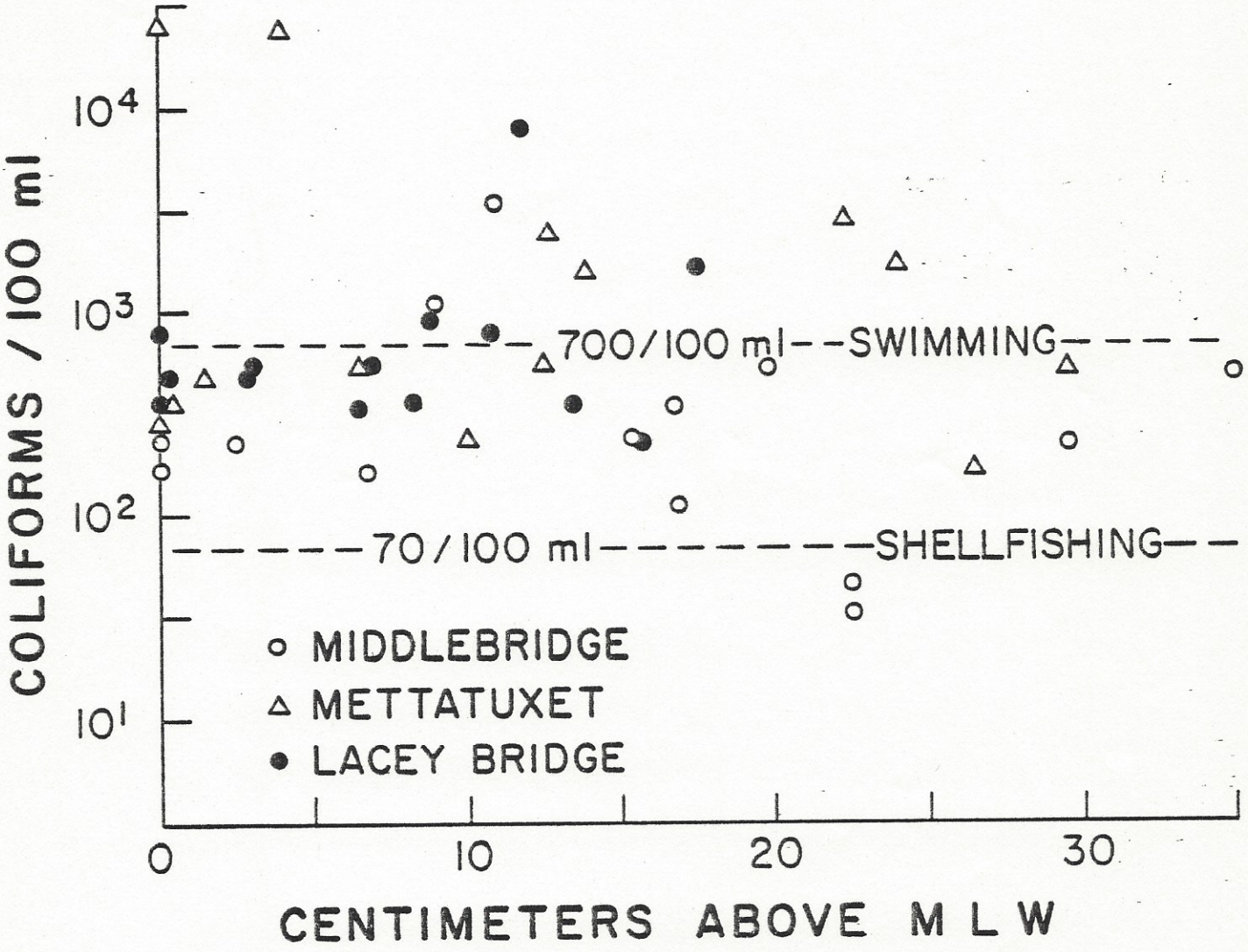

Fig. 6. The influence of the tide on the total coliform counts at three mid-Narrow River stations (21 & 22 August 1979).

DEM test confirms pollution of river

By CHANNING GRAY
Journal-Bulletin Staff Writer

PROVIDENCE — The state Department of Environmental Management yesterday disclosed that its tests of the Narrow River support the findings of a local conservation group that show the southern Rhode Island waterway is badly polluted and should be closed to shellfishing.

W. Edward Wood, DEM director, said the testing his agency conducted last week along the seven-mile estuary "would tend to support" earlier testing by the Narrow River Preservation Association. The association made public its findings last month.

Wood said a shellfishing ban imposed by the state Department of Health will remain in effect for an indeterminate period and acknowledged that "perhaps it (the river) should have been closed some time ago."

James W. Fester, chief of DEM's Water Resources Division, said the state tested 10 stations along the river and found all unsafe for shellfishing.

Fester said the results ranged from 93 coliforms per 100 milliliters of solution to 2,300 coliforms per 100 millitiers. The state prohibits shellfishing in waters found to have more that 70 coliforms per 100 milliliters present.

* * *

COLIFORM IS a bacterium found in human feces and, although it is not harmful, it may indicate the presence of sewage in the water.

Fester said, however, that sources other than sewage may have contributed to the high readings. He said decaying plants and bird droppings in the water often result in elevated coliform counts.

According to Fester, the highest reading the state found — 2,300 coliforms — was taken in Pettaquamscutt Cove, a large inlet near the mouth of the river. He noted, however, that the fecal coliform count (bacterium found in the feces of warm-blooded animals) was 430. If sewage were the only source of pollution, Fester said, he would expect the fecal coliform count to be about the same as the total coliform count.

An inspection of the river last week by state biologists found extremely high coliform counts — about 23,000 — in an open culvert leading from a swampy area near the Watergate apartment complex in Narragansett. He said biologists also tested a drainage outlet in the area and found that to have less than 23 coliforms.

N. Kingstown, S. Kingstown, Narragansett

The Narrow River Preservation Association launched its water-quality study last November but did not disclose the results of its tests until it discovered alarmingly high concentrations of contamination in pockets of the river. State health authorities at the urging of DEM closed the river after learning of the results.

* * *

ACCORDING TO Wood, DEM will take additional water samples and examine the shoreline for possible sources of sewage that may be entering the river. He did not say when that would take place.

W.E.R. LaFarge, Narrow River Preservation Association president, said last night that although he is dismayed by the state's test results, he is pleased that the problem has been acknowledged and that steps apparently are being taken to correct it.

"For the first time in the history of the Narrow River," said LaFarge, "we are all in agreement that a problem exists and nothing can be done until that happens."

LaFarge said his group will meet Tuesday to study what can be done to more precisely identify the sources of the contamination and eventually clean up the river.

"We all need to know a great deal more and the question is how do we find it out," he said. "I think the state has to play a key role it that area." Wood said he is awaiting results of a second set of tests taken by the preservation group which is being forwarded to him by the U.S. Environmental Protection laboratory in West Kingston, where the water samples were analyzed.

The state tested the following sites with these results: Gilbert Stuart Brook near the river's source, 930 coliforms; a Boys' Club swimming facility on the upper pond, 93 coliforms; Forest Lakes, housing development on the western shore, 230 coliforms, and Lacey Bridge on Route 138, 150 coliforms.

Other sites were Middlebridge Road, 430 coliforms; the Mettatuxet area, 150 coliforms; Middlebridge Bridge, 230 coliforms, Spa ague Bridge at Route 1A, 93 coliforms, the Watergate apartment complex in Narragansett, 93 coliforms, and Pettaquamscutt Cove behind the Narragansett Junior High School, 2,300 coliforms.

Table 3. The seasonal incidence of coliform pollution in Narrow River as sampled by the Rhode Island State Department of Health/Department of the Environment, 1959-1978

Year	Station (Bridge)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Fraction Polluted
1959	Lacey											1/4	1/3	2/7
	Middle											1/4	1/3	2/7
	Sprague											3/4	2/3	5/7
1960	Lacey	1/6	1/3	0/4	1/5	1/2	3/4	1/2	1/3	2/2	0/3	0/2	0/2	11/38
	Middle	2/6	0/3	1/4	3/5	0/2	3/4	0/2	3/3	2/2	1/3	0/2	1/2	16/38
	Sprague	1/6	0/3	0/4	3/5	0/2	2/4	2/2	3/3	2/2	1/3	2/2	0/2	15/38
1961			0/1											0/1
			1/1											1/1
			0/1											0/1
1972	Lacey												1/1	1/1
	Sprague												0/1	0/1
1973	Lacey						1/1							1/1
	Sprague	1/1					1/1							2/2
1974	Lacey			0/1	0/1	0/1		0/1		1/1	1/1		1/1	3/7
	Sprague			1/1	0/1	0/1		0/1		0/1	0/1		1/1	2/7
1975	Lacey		0/1	0/1	0/1	1/1		1/1	1/1		1/1	1/1	1/1	6/9
	Sprague		0/1	1/1	0/1	0/1		0/1	1/1		1/1	0/1	1/1	4/9
1976	Lacey	0/1		1/1	1/1	1/1	1/1	1/1	1/1	0/1	0/1	0/1	1/1	7/11
	Sprague	1/1		1/1	0/1	1/1	1/1	0/1	1/1	1/1	0/1	1/1	1/1	8/11
1977	Lacey	1/1	1/1	1/1	0/1	1/1		1/1	0/1		0/1	0/1	1/1	6/10
	Sprague		1/1	0/1	0/1	0/1		1/1	0/1		0/1	0/1	0/1	2/9
1978	Lacey	1/1	0/1		0/1	0/1	1/1	1/1	1/1	1/1	1/1			6/9
	Sprague	0/1	0/1		0/1	0/1	0/1	1/1	1/1	0/1	0/1			2/9
							13/18 (72%)	9/16 (56%)	13/17 (76%)	9/14 (64%)				102/234(44%)

Table 4. Narrow River Preservation Association Coliform Survey, 1978-79.

STATION	Coliforms	1978 Nov	Dec	1979 Apr	May	Jun	Jul	Aug	Sep	Oct	Fraction Polluted
1. Gilbert Stuart	Total	5	49	49	79*	920*	49	1600*	790*	79*	5/9
	Fecal	2	2	17*	5	540*	17*	170*	17*	1.4	5/9
2. Boys Club	Total	23	49	17	23	110*	79*	240*	460*	220*	5/9
	Fecal	13	4	8	2	17*	17*	49*	33*	7	4/9
3. Forest Lakes	Total	130*	54	13	13	130*	79*	920*	790*	70*	6/9
	Fecal	5	2	5	5	49*	49*	130*	49*	13	4/9
4. Lacey Bridge	Total	13	49	17	46	350*	540*	920*	240*	130*	5/9
	Fecal	2	2	5	33*	79*	13	170*	49*	23*	5/9
5. Middle-bridge Rd.	Total	49	130*	110*	33	280*	110*	2400*	240*	170*	7/9
	Fecal	49*	13	13	5	49*	27*	170*	49*	33*	6/9
6. Metta-tuxet	Total	49	49	22	11	920*	220*	540*	350*	79*	5/9
	Fecal	11	11	8	4	49*	220*	170*	110*	33*	5/9
7. Middle Bridge	Total	33	13	21	7	110*	5400*	130*	700*	170*	5/9
	Fecal	23*	5	5	2	27*	5400*	79*	79*	33*	6/9
8. Sprague Bridge	Total	33	46	17	7	460*	7	22	170*	23	2/9
	Fecal	23*	7	5	2	33*	7	6.8	46*	23*	4/9
9. Water-gate	Total	130*	240*	130*	11	170*	350*	110*	170*	33	7/9
	Fecal	33*	7	7	2	79*	79*	23*	79*	33*	6/9
10. Narra. School	Total	70*	350*	32	20	9200*	28	920*	5400*	280*	6/9
	Fecal	23*	8	17*	2	94*	23*	240*	350*	280*	7/9
Polluted	Total	3	3	2	1	10	7	9	10	8	53/90 (59%)
	Fecal	5	0	2	1	10	8	9	10	7	51/90 (57%)
						100%	75%	90%	100%		

*= samples containing 70 or more total coliforms per 100 milliliters or 15 or more fecal coliforms per 100 milliliters.

Table 5. The monthly and station log mean total coliform values for the Narrow River, 1978-1979.

STATION	1978 Nov	Dec.	1979 Apr	May	Jun	Jul	Aug	Sep	Oct	Log Mean	Antilog
1.	0.70	1.69	1.69	1.89	2.96	1.69	3.20	2.89	1.89	2.07	118
2.	1.36	1.69	1.23	1.36	2.04	1.89	2.38	2.66	2.34	1.88	95
3.	2.11	1.73	1.11	1.11	2.11	1.89	2.96	2.89	1.85	1.97	99
4.	1.11	1.69	1.23	1.66	2.54	2.73	2.96	2.38	2.11	2.05	112
5.	1.69	2.11	2.04	1.52	2.45	2.04	3.38	2.38	2.23	2.20	160
6.	1.69	1.69	1.34	1.04	2.96	2.34	2.73	2.54	1.89	2.02	105
7.	1.52	1.11	1.32	0.85	2.04	3.73	2.11	2.85	2.23	1.97	95
8.	1.52	1.66	1.23	0.85	2.66	0.85	1.34	2.23	1.36	1.52	33
9.	2.11	2.38	2.11	1.04	2.23	2.54	2.04	2.23	1.52	2.02	105
10.	1.85	2.54	1.50	1.30	3.96	1.45	2.96	3.73	2.45	2.42	261
Log	1.57	1.83	1.48	1.26	2.60	2.12	2.606	2.678	1.987		
A-log	37	68	30	18	394	131	404	476	97		

Table 6. The log mean total coliform values of the Department of Health samples of three bridge stations on Narrow River, Summer 1960.

STATION	Jun	Jul	Aug	Sep	Mean Log	Anti-Log
Lacey Bridge	2.17	2.12	1.78	3.13	2.3	199
Middle Bridge	2.14	1.36	2.67	2.63	2.19	157
Sprague Bridge	1.99	2.50	2.50	2.90	2.47	299
Mean	2.10	1.99	2.32	2.89		
Antilog	125	98	209	776		