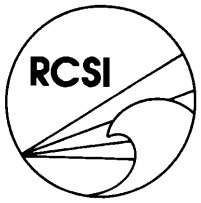


*Rochester Committee*
*for Scientific Information*
*Rochester, NY*

*RCSI Bulletin 193*
*Clean Water at Ontario Beach:*
*Water Pollution Study in Summer of 1975*

*By: David B. Bauer & George G. Berg*
*December 1975*

*THE ROCHESTER COMMITTEE FOR SCIENTIFIC INFORMATION*
*P. O. Box 5236, River Campus Station*
*Rochester, New York 14627*

Bulletin #193

December 1975

# Clean Water at Ontario Beach: Water Pollution Study in Summer of 1975

by
David B. Bauer and Dr. George G. Berg

## Summary

The bathing area at Ontario Beach Park in Charlotte showed consistently low levels of bacterial contamination in tests conducted by the RCSI during the second half of the summer of 1975. It was the first summer RCSI has found this beach to be clean since the beginning of its water testing program in 1964. The results are an independent confirmation of similar tests made by the Monroe County Health Department.

The RCSI sampled water off the beach at nineteen equally placed sites, two evenings a week beginning July 15 and ending August 12. Water was tested for three kinds of bacteria which indicate water pollution by sewage.

In no sample did the total count of coliform bacteria reach 2400/100 ml, the figure set by the New York State Department of Health as the maximum median count for bathing areas. Of a total of 148 samples tested, 89% showed counts of less than 500/100 ml. These samples were considered free of pollution with bacteria associated with sewage.

Fecal coliform tests run on 132 samples showed that 95% of the samples had counts below 100/100 ml. The highest count was 310 colonies/100 ml. Fecal coliforms are found in fresh, untreated sewage. Low counts indicate very low levels of contamination by intestinal organisms which might cause diseases. Counts of 200/100 ml are considered low.

Fecal streptococcus tests provided further evidence that the water at the beach had low levels of fecal contamination during the test period.

It appears that the Pure Waters Program of mending sewers and upgrading sewage treatment plants in the County of Monroe is succeeding in controlling water pollution at Ontario Beach.

The highest counts for all 3 kinds of bacteria occurred after rainstorms. This contamination has in the past been traced to sewage spilled from the Rochester combined storm and sanitary sewer system into the Genesee River. Although the counts did not reach hazard levels in 1975, RCSI data suggest that the beach is not safe at all times from heavy pollution by spills of municipal sewage. The beach now appears to be safe for bathing except when storms or accidents cause municipal overflow.

Two actions are suggested:

1. That the County establish a Charlotte beach management system which permits swimming when the water is clean, keeps the sand clean, and provides for keeping bathers away when the water is polluted, and;

2. that the New York State Department of Health review the data on the condition of the beach along with the County beach management system and consider opening the beach to public swimming in 1976.

## Methods

When weather permitted, samples of water were collected from 19 sites along the shore of Ontario Beach on Tuesdays and Thursdays between 6:30 p.m. and 8:30 p.m. Collections began the week of July 13, 1975 and ended the week of August 10, 1975. Samples were taken six inches below the surface in areas where the water was three feet deep (± 4 inches). Sites were approximately 175 feet apart at variable distances from shore, always located along an established directional line using permanent onshore landmarks. The varying distances from shore were used to compare levels of contamination in near-shore sites with sites further offshore.

The RCSI set up its own microbiology laboratory to test the water samples. A complete description of the equipment and procedures is available from the secretary (request RCSI Testing Procedures, 1975). Counts were made by standard methods (1, 2). These included the use of Millipore filters, incubators, and a water bath equipped for precise temperature control (44.5°C ± 0.1°C) as required for tests of fecal coliforms.

Other variables monitored in the study were Cladophora growth at the sampling sites and near the shoreline, water temperature, air temperature, wind direction and velocity, wave height, swell height, presence of bathers or animals in the immediate vicinity of the sampling site, and rain.

## Results

### 1. Evidence of Clean Water

When tests of total coliform bacteria were used as a measure of pollution, they showed that Ontario Beach water was clean enough to meet the public health standards for swimming. Total coliform counts were made on 148 samples. Counts were lower than 500/100 ml in 89% of the samples, and exceeded 1000/100 ml in only 3% of the samples. The highest single count was 2180/100 ml, and the highest mean daily count was 709/100 ml (Appendix, Tables 1, 2, 3a).

These numbers show clean water by established public health standards. For example, New York State Public Health Law set a count of 2400/100 ml as a standard for pollution control at bathing beaches. Even higher counts were allowed by the law. Up to half the samples tested may exceed 2400/100 ml and up to 20% of all samples tested may exceed 5000/100 ml (Part 700 of Codes, Rules and Regulations of New York State) (4). The water we tested at Ontario Beach was even cleaner, since all samples were well below the limit.

Total coliform bacteria were counted, because they measure a group of bacteria that grow in sewage. This is possibly the single most informative measure of water pollution in terms of the total amount of undisinfected sewage from all sources which may be present. For example, these coliform bacteria will survive and even multiply in sewage that stood for several days in a sewer and was then flushed out by rain. Total coliforms are thus a measure of sanitation at the sewers, and low counts indicated Ontario Beach was not being polluted by undisinfected sewage. The meaning of a few higher counts is explained in the Discussion.

## 2. Evidence of Sanitary Condition of Water

Fecal coliforms were counted in 132 samples. 95% of these were below 100/100 ml. 3% were between 100 and 200, and 1.5% between 200 and 300. The one remaining high count was 310/100 ml (Appendix, Tables 1, 2, 3b).

Fecal coliforms normally live in the gastrointestinal tract of warm blooded animals, and multiply only at body temperature; they are found in great numbers in fresh, raw sewage and die out after some 48 hours in the open. Some disease-bearing organisms, such as Salmonella, survive for a limited time in sewage in the same way as fecal coliforms (3). For this reason, the New York State Health Department uses a count of 200 fecal coliforms/100 ml as an indication of hazard to health. Counts well over 1000/100 ml were recorded at Ontario Beach in previous years. In the summer of 1975, all counts were low, and all but 2% of the samples were below the official hazard level.

Fecal streptococci were counted in 152 samples. 77% of the samples had counts below 100/100 ml. Another 16% fell between 100 and 200, 6% between 200 and 400, and the single highest count was 610/100 ml (Appendix, Tables 1, 2, 3c). Fecal streptococci have properties similar to fecal coliforms. They are not disease-bearers, but they are routinely used to demonstrate the extent of pollution of a body of water with fresh, undisinfected sewage. The counts confirmed the results of tests of fecal coliforms, showing that the water was in an acceptably sanitary condition by this health hazard indicator.

## 3. Increased Pollution After Rain

There were two rainstorms during the test period (July 11-13 and July 24-28). Samples collected within 48 hours after each rainstorm had the highest total coliform counts of the sampling period (Appendix, Tables 2, 3a, 4), and included all the samples with counts in excess of 1000/100 ml. An exceptionally high count of fecal strep was found in one sample taken after the first rainstorm, and the two highest counts of fecal coliforms were found in samples taken after the second rainstorm.

Rainfall drains into Rochester's combined storm and sanitary sewer system, and flushes raw sewage from many overflow outlets into the Genesee River. One such outlet is at Boxart Street. A "slug" of raw sewage then flows with the river to Lake Ontario. Given a favoring wind and current, it reaches Ontario Beach a day or two after it entered the River. Our tests indicated that sewage overflowing into the Genesee River was still reaching Ontario Beach.

## 4. Correlation of Algae with Water Pollution

The filamentous green alga Cladophora was found in larger amounts toward the east end of the beach, and was especially abundant at the shoreline east of collection site 12. Water samples were taken in deeper water, beyond the line of algae, but the highest bacterial counts also came from the eastern end of the beach. On seven of the eight test days, the sample with the highest total coliform count was collected east of site 12. Four of the five samples with more than 1000 total coliforms were collected east of site 12. This part of the beach also yielded five of the seven peak counts of fecal coliforms, and five of the eight peak counts of fecal strep. When the entire eastern half of the beach was compared with the western half, most of the clean samples came from the west side; 27% of samples were scored at less than 100 total coliforms per 100 ml on the west side, compared to 11% on the east side.

The wind at the lakeshore is westerly most of the time. Northeasterly winds come with storms or changes of weather. Ontario Beach faces the Rochester embayment, where water currents usually flow in a loop (called a gyre), counterclockwise, so that materials carried into the lake by the Genesee River are brought around to the beach. The near-shore current carries suspended particulates and algae from west to east. Filamentous algae may thrive at the east end of the beach because this is where winds and currents bring fertilizing chemicals from the Genesee River, or they may pile up there from fragments carried by the currents along the lakeshore, or both.

Bacteria concentrate on floating particles in water, and the matted algae trap the particles as would a filter. Water samples would give misleadingly high bacterial counts if they were taken near a disturbed clump of algae. For the purposes of this study, we took care to make sure that our water samples contained just lake water, without contamination by bacteria shaken out of the algae or stirred up from the bottom mud.

5. Bathers and Pollution

There is a sandbar under water opposite collection sites 13 through 17. The bottom between the sandbar and the shoreline has more protection from waves than the bottom elsewhere along the beach. Bacterial counts showed significantly more pollution in the water on days when this part of the lake bottom was disturbed by bathers.

On July 15, there were approximately 400 bathers in this area, and nearly an many bathers at other sites on the beach, particularly sites 2 through 6. Total coliform counts were higher than usual only between the sandbar and shore, but not in the other area where bathers had congregated. Again, on July 30, with approximately 350 people in the same two areas, high counts were found only at sites 13, 14, 16, and 17. On other dates, when no bathers were present in this area at sampling time, the total coliform level was comparable to that of the rest of the beach's eastern half. The extra coliform bacteria consequently did not come from bathers, but came from polluted bottom sediments which accumulated in the protected stretch of the lake.

Discussion

The RCSI began its reports on water pollution in the Rochester area in 1964. We continued to find high levels of water pollution by sewage through the summer of 1974. We are happy to report a great improvement in the summer of 1975. The water at one lakefront beach remained consistently sanitary through the testing period conducted during the bathing season. Our results agreed with the results of water tests done by the County Health Department, though the Department took samples more frequently and found a wider range of counts.

There is only one explanation for this improvement. The Pure Waters Division of Monroe County has been repairing sewers and upgrading the sewage treatment plant in Rochester, and the work has finally begun to pay off. City sewage is now contained and processed well enough, so that Ontario Beach can meet the New York State water standards for public bathing.

Ontario Beach is now closed to public swimming by a ruling of the New York State Department of Health. The RCSI suggests that the Health Department examine the results of the 1975 tests of water by the County Health Department and the RCSI, and to check whether the water at Ontario Beach should be reclassified

as suitable for public use before the summer of 1976, even though the beach is still vulnerable to pollution by overflows from the combined storm and sanitary sewer system of the City of Rochester.

Reports of clean water are only one of the conditions necessary for the safe use of the beach. Other county agencies will have to take on responsibilities which remain beyond the scope of the Pure Waters Division. For example, a public beach should be policed and cleaned to keep the sand free of dog droppings and of broken glass. Lifeguards should be posted near the water, and not at the beach fence, as they were in 1974. Most important of all, the beach should be closed effectively to public access on days when the water is heavily polluted by accidental spills of sewage.

These responsibilities are currently scattered among the County Parks Department, the County Department of Health, and the Police Department.

The need for an emergency closing system for the beach was shown by the tests reported in this bulletin. Sewage spilled into the Genesee River still floated to Ontario Beach. The spots of pollution occasionally found near the beach in the summer of 1975 were small, but major spills of sewage leading to heavy pollution have to be expected and provided for. The County Health Department operates a pollution monitoring system (5), and is working on a pollution warning system. The County Health Officer, Dr. Haughie, can only post the beach closed, but can not fence it in, or keep bathers out.

Ontario Beach should not be considered safe for public swimming until the county has provided a workable pollution warning and emergency closing system for the beach.

The work of keeping Lake Ontario clean is just beginning to show results in Monroe County. Ontario Beach water is now in an acceptably sanitary condition, but it is not as clean as it should be for the full enjoyment of swimming. The growth of Cladophora reported in this bulletin shows that the Rochester embayment is still fertilized by municipal and suburban wastes. The RCSI predicts further improvement of water quality, as the Pure Waters Division continues its program of repairing sewers and upgrading sewage treatment plants (6).

References

(1) *Standard Methods for the Examination of Water and Wastewater*, A.P.H.A., 13th Ed., 1971

(2) Millipore Corporation pamphlets, Bedford, Mass.; *"Total Coliform Analysis"*, form AB 311; *"Fecal Streptococcus Analysis"*, form AB 312; *"Fecal Coliform Analysis"*, form AB 313; May 1974

(3) Geldreich, E. E., *Buffalo Lake Recreational Water Quality: A Study in Bacteriological Data Interpretation.* Water Research 6: 913-924, 1972

(4) Wilson, D., and G. Berg, *"How Not to Lie with Statistics"*, RCSI Bulletin #15, July 1966

(5) Hetzel, Peter, *"Monitoring the Lower Genesee"*, RCSI Bulletin #191, November 1975

(6) Berg, Olga, *"The Environmental Quality Bond Act of 1972"*, RCSI Bulletin #145, Sept. 1972

Appendix

Table 1. Mean* Total Coliform, Fecal Coliform and Fecal Strep Counts for Sites 1-19 Over a Four-Week Period (July 15, 1975 to August 12, 1975); ranges of counts at right of each mean. The sites are numbered from west to east.

| Site # | Mean Total Coliform | Range | Mean Fecal Coliform | Range | Mean Fecal Strep | Range |
|---|---|---|---|---|---|---|
| 1 | 277 | 0-530 | 30 | 0-60 | 98 | 20-380 |
| 2 | 456 | 30-2130 | 24 | 0-70 | 40 | 0-90 |
| 3 | 222 | 30-440 | 16 | 0-60 | 44 | 0-120 |
| 4 | 232 | 20-650 | 21 | 0-70 | 55 | 0-160 |
| 5 | 239 | 50-500 | 44 | 0-150 | 61 | 0-180 |
| 6 | 251 | 80-600 | 51 | 0-160 | 95 | 0-610 |
| 7 | 160 | 0-440 | 37 | 0-110 | 26 | 10-70 |
| 8 | 209 | 50-400 | 22 | 0-70 | 46 | 10-130 |
| 9 | 329 | 100-530 | 46 | 0-90 | 80 | 20-310 |
| 10 | 270 | 140-440 | 39 | 0-70 | 64 | 10-160 |
| 11 | 276 | 10-450 | 53 | 0-90 | 64 | 0-180 |
| 12 | 255 | 70-410 | 58 | 0-170 | 38 | 10-80 |
| 13 | 420 | 40-1180 | 86 | 10-310 | 61 | 0-270 |
| 14 | 709 | 120-1800 | 70 | 0-280 | 93 | 0-380 |
| 15 | 209 | 140-420 | 30 | 0-60 | 121 | 30-390 |
| 16 | 489 | 70-960 | 38 | 0-70 | 84 | 0-280 |
| 17 | 364 | 60-670 | 57 | 10-210 | 90 | 0-210 |
| 18 | 259 | 20-480 | 30 | 0-70 | 44 | 10-150 |
| 19 | 579 | 20-2180 | 24 | 0-50 | 80 | 0-230 |

* "Mean" is the arithmetic mean

Table 2. Mean* Total Coliform, Fecal Coliform, Fecal Strep Counts for the Eight Test Days During the Four-Week Test Period (July 15, 1975 to August 12, 1975). Ranges of counts at right of respective mean.

| Date of Test | Mean Total Coliform | Range | Mean Fecal Coliform | Range | Mean Fecal Strep | Range |
|---|---|---|---|---|---|---|
| 7/15/75 | 605 | 80-2180 | 45 | 0-170 | 86 | 0-610 |
| 7/17/75 | 128 | 0-260 | -- | -- | 54 | 10-210 |
| 7/22/75 | 397 | 0-900 | 49 | 10-110 | 76 | 10-280 |
| 7/28/75 | 335 | 110-980 | 54 | 10-210 | 101 | 30-230 |
| 7/30/75 | 301 | 20-1390 | 108 | 0-310 | 102 | 0-390 |
| 8/5/75 | 322 | 50-670 | 50 | 10-90 | 47 | 0-310 |
| 8/7/75 | 399 | 280-650 | 18 | 0-90 | 15 | 0-40 |
| 8/12/75 | 139 | 20-440 | 10 | 0-90 | 41 | 0-180 |

* Arithmetic mean

Table 3a. Distribution Chart of Total Coliform Counts of 19 Sites for Each Test Date.

| Test Date | 0-99 | 100-199 | 200-299 | 300-399 | 400-499 | 500-599 | 600-699 | 700-799 | 800-899 | 900-999 | 1000-1999 | 2000-2199 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 7/15/75 | 2 | 4 | 3 | 3 | 2 | 0 | 0 | 0 | 0 | 2 | 1 | 2 |
| 7/17/75 | 4 | 13 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 7/22/75 | 1 | 1 | 3 | 2 | 6 | 4 | 1 | 0 | 0 | 1 | 0 | 0 |
| 7/28/75 | 0 | 4 | 5 | 4 | 4 | 0 | 0 | 0 | 0 | 1 | 0 | 0 |
| 7/30/75 | 9 | 2 | 1 | 2 | 0 | 0 | 2 | 0 | 0 | 0 | 2 | 0 |
| 8/5/75 | 3 | 1 | 3 | 6 | 3 | 1 | 2 | 0 | 0 | 0 | 0 | 0 |
| 8/7/75 | 0 | 0 | 2 | 9 | 4 | 3 | 1 | 0 | 0 | 0 | 0 | 0 |
| 8/12/75 | 9 | 5 | 3 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

Table 3b. Distribution of Fecal Coliform Counts of 19 Sites for Each Test Date

| Test Date | 0-50 | 51-100 | 101-150 | 151-200 | 201-250 | 251-300 | 301-350 | Over 350 |
|---|---|---|---|---|---|---|---|---|
| 7/15/75 | 14 | 2 | 1 | 2 | 0 | 0 | 0 | 0 |
| 7/17/75 | - | - | - | - | - | - | - | - |
| 7/22/75 | 10 | 7 | 1 | 0 | 0 | 0 | 0 | 0 |
| 7/28/75 | 11 | 7 | 0 | 0 | 1 | 0 | 0 | 0 |
| 7/30/75 | 12 | 5 | 0 | 0 | 0 | 1 | 1 | 0 |
| 8/5/75 | 10 | 9 | 0 | 0 | 0 | 0 | 0 | 0 |
| 8/7/75 | 18 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| 8/12/75 | 18 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |

Table 3c. Distribution of Fecal Strep Counts of 19 Sites for Each Test Date

| Test Date | 0-99 | 100-199 | 200-299 | 300-399 | 400-499 | 500-599 | 600-699 | Over 699 |
|---|---|---|---|---|---|---|---|---|
| 7/15/75 | 15 | 2 | 0 | 1 | 0 | 0 | 1 | 0 |
| 7/17/75 | 14 | 4 | 1 | 0 | 0 | 0 | 0 | 0 |
| 7/22/75 | 14 | 3 | 2 | 0 | 0 | 0 | 0 | 0 |
| 7/28/75 | 10 | 8 | 1 | 0 | 0 | 0 | 0 | 0 |
| 7/30/75 | 14 | 2 | 1 | 2 | 0 | 0 | 0 | 0 |
| 8/5/75 | 15 | 3 | 0 | 1 | 0 | 0 | 0 | 0 |
| 8/7/75 | 19 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 8/12/75 | 17 | 2 | 0 | 0 | 0 | 0 | 0 | 0 |

Table 4. Peak Counts of the Three Tests Performed on Samples of the 19 Sites, with the Site Number in Parentheses. Peak counts arranged by test date.

| Date | Total Coliform | | Fecal Coliform | | Fecal Streptococcus | |
|---|---|---|---|---|---|---|
| | Peak Count | Test Site | Peak Count | Test Site | Peak Count | Test Site |
| 7/15/75 | 2180 | (19) | 170 | (12) | 610 | (6) |
| 7/17/75 | 260 | (13) | -- | -- | 210 | (17) |
| 7/22/75 | 900 | (14) | 110 | (7) | 280 | (16) |
| 7/28/75 | 980 | (19) | 210 | (17) | 230 | (19) |
| 7/30/75 | 1390 | (14) | 310 | (13) | 390 | (15) |
| 8/5/75 | 670 | (17) | 90 | (9, 14) | 310 | (9) |
| 8/7/75 | 650 | (4) | 90 | (9) | 40 | (15, 17) |
| 8/12/75 | 440 | (11) | 90 | (11) | 180 | (11) |