Section F:
Evaluating Beneficial Use: Recreation

2008 Ohio Integrated Report

F1. Background

Prior to the 2002 IR, the reporting of recreational use impairment in Ohio was sporadic. Section 305(b) reports (1998 and earlier) may have included an indication of the potential for recreational use impairment in various streams, but a cohesive listing was not presented. The 2002 IR employed a uniform methodology to examine readily available data on fecal coliform counts. This approach was based on counting the number of exceedances of the secondary contact recreational use maximum criterion (5000/100 ml fecal coliform or 576/100 ml *E. coli*). Any assessment unit with five or more samples over the last five years above these values was listed as impaired.

The 2004 IR adopted a more statistically robust methodology for assessing the recreational use attainment of the State's surface waters linked more directly with the applicable water quality standards. The methodology adopted in 2004 continues to be used in 2008. The linkage of the methodology to the Ohio WQS is summarized in the following chart and subsequent text.

Bathing Waters		
Indicator	Criterion (Table 7-13, OAC 3745-1-07)	Assessment Method
E. coli	Geometric mean *E. coli* content (either MPN or MF), based on not less than five samples within a thirty-day period, shall not exceed 126 per 100 ml and *E. coli* content (either MPN or MF) shall not exceed 235 per 100 ml in more than ten per cent of the samples taken during any thirty-day period	For the three Lake Erie assessment units, exceedance of the geometric mean bathing water criterion or an exceedance of the single sample maximum for more than 10% of the recreation season is considered impairment of the bathing water use.
Primary Contact		
Indicator	Criterion (Table 7-13, OAC 3745-1-07)	Assessment Method
Fecal coliform	Geometric mean fecal coliform content (either MPN or MF), based on not less than five samples within a thirty-day period, shall not exceed 1,000 per 100 ml and fecal coliform content (either MPN or MF) shall not exceed 2,000 per 100 ml in more than ten per cent of the samples taken during any thirty-day period	Statewide data on rivers and streams were not extensive enough to allow direct comparison of geometric mean to the water quality criterion of 1000; data pooled from all sources over period of record were used; thresholds used for impairment of primary contact use were 75th percentile compared to 1000 and 90th percentile compared to 2000.

F2. Evaluation Method

Lake Erie

Attainment of recreational water quality standards for the three Lake Erie assessment units was based upon examination of *E. coli* data provided by the Ohio Department of Health (ODH). Routine bacteria monitoring is performed by local health districts, ODH, and the Northeast Ohio Regional Sewer District (NEORSD) in order to monitor bacteria levels at public bathing beaches and advise the public when elevated bacteria are present that represent an increased risk of contracting waterborne illness as a result of exposure to pathogens while recreating in the water. Bacteria data collected by local or state health agencies at public beaches during the recreation season from 2002 through 2006 were included in the analysis. Ohio's water quality

standards define the recreation season as May 1 - October 15, though Lake Erie beach monitoring typically commences in late May and concludes Labor Day weekend.

Each of the 23 beaches (shown in Figure F-1) were individually analyzed to evaluate the percentage of recreation days during which the bathing water geometric mean water quality criterion of 126/100 ml was exceeded (2002-2005) or bathing water single sample maximum criterion of 235/100 ml was exceeded (2006).

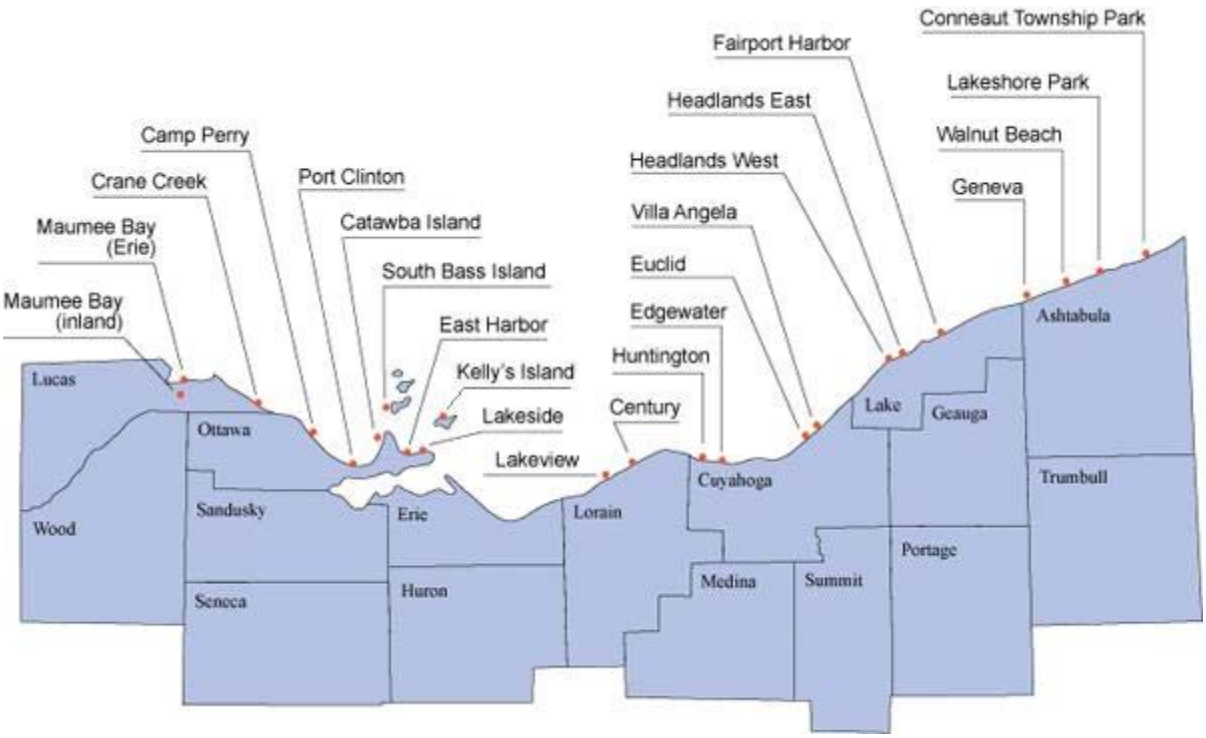

Figure F-1. Lake Erie beaches sampled by Ohio health departments.

The total number of recreation days in a recreation season for any particular beach was determined by adding the number of days beginning with the first day of sampling and ending with Labor Day. The total number of days that a beach exceeded the bathing water geometric mean criteria was determined by adding the total number of days during the recreation season (as defined above) during which the running geometric mean of the samples exceeded the criteria. The running geometric mean was computed using results from the five previous measurements. Once the running geometric mean exceeded the criterion, it was assumed to continue exceeding the criterion until further sampling documented that the criterion was not being exceeded. Similarly, a beach was presumed to meet the criterion following a measurement that met the criterion until a subsequent sample was found to exceed the criterion.

Recommendations for posting beach advisories through Ohio's Lake Erie beach monitoring program continued to rely on exceedances of the *E. coli* geometric mean criterion of 126/100 ml through the 2005 recreation season. Beginning in 2006, beach advisory recommendations were based upon exceedances of the single sample maximum *E. coli* criteria of 235/100 ml in compliance with provisions of the 2004 federal BEACH Act rule. As envisioned in Ohio's 2006 IR, the 2008 IR accounts for this transition by tracking the exceedance frequency of the single

sample maximum criterion starting with the 2006 data rather than the running geometric mean data used for previous years.

The exceedance frequency was determined for each beach over a five-year period (2002-2006). The 5-year beach data for the individual beaches were pooled into the corresponding Lake Erie recreation assessment units in order to determine the attainment status for each of the three assessment units. Attainment status for each Lake Erie assessment unit was based upon whether the average number of days the geometric mean *E. coli* bathing water quality criteria exceeded ten days (2002-2005 data) or the frequency of exceedance of the single sample maximum *E. coli* criterion was greater than 10% (2006 data). It should be noted that data from the three beaches in Lake County (Headlands-East, Headlands-West, and Fairport Harbor) were not included in determining attainment status since the County failed to submit required documentation necessary to make a determination as to whether it could be considered Level III credible data as required under Ohio law. However, data from Lake County were included for informational purposes in an attempt to be consistent with previous reports that did include data from these beaches.

The basis for using a benchmark of ten days (10% of a typical 100-day recreation season) is Ohio's 1998 State of the Lake Report prepared by the Ohio Lake Erie Commission (Ohio LEC, 1998). While the stated goal in this report for beaches is to have clean beaches all of the time (no days under advisement) the report considered having ten or fewer days under advisement to be "excellent." The Ohio Lake Erie Commission's latest edition of the State of the Lake Report (2004) continues to use these benchmarks in rating the swimmability of Lake Erie beaches along Ohio's 262-mile shoreline. The 2008 IR also continues to use these criteria in determination of impairment at the assessment unit level. In addition, statistical summaries are included for individual beaches to provide additional detail and permit performance comparisons among individual beaches.

Rivers and Streams

The 2008 recreational use impairment list was developed using ambient fecal coliform data collected from May 2002 to October 2006. These data were obtained from the STORET and SWIMS databases, which contain ambient monitoring data collected by Ohio EPA and ambient monitoring data collected by point source dischargers, respectively. Data collected outside of the recreation season, as defined in Ohio's Water Quality Standards, were excluded from the analysis. Values reported as "too numerous to count" and values reported as "greater than" were also excluded from further analysis in cases where it was not possible to estimate the maximum (e.g., the dilution series used in the analysis was not known). In addition, values reported to be "less than" values ranging from 100 to 2,000 were excluded. Approximately 30,550 fecal coliform bacteria records were used in the analysis, of which approximately 33% were from STORET and 67% were from SWIMS. Data were sorted into their respective 11-digit and large river assessment units using a geo-spatial analysis of the latitude/longitude data associated with each fecal coliform value.

Statistical computations were performed using the pooled dataset of all fecal coliform data from within an assessment unit. Statistical analyses performed include computation of the geometric mean, median, 75th percentile, and 90th percentile of the fecal coliform data for each assessment unit for which data were available. Statistical computations were performed using Microsoft Excel 2003. The geometric mean, median and percentile values were computed using the computational functions within the spreadsheet program. A tally of the number of

ambient sites and the number of NPDES dischargers reporting fecal coliform data to Ohio EPA's SWIMS database was made for each assessment unit. The quantity of fecal coliform data included in the statistical analysis for each assessment unit was also tallied (MOR, ambient, combined total).

Recreational use assessment determinations were based on a comparison of the 75th percentile to Ohio's geometric mean fecal coliform criterion of 1,000 and the 90th percentile to Ohio's single sample maximum fecal coliform criterion of 2,000. An assessment unit was determined to be impaired when either the 75th percentile exceeded 1,000 fecal coliform or the 90th percentile exceeded 2,000 fecal coliform. A minimum of three sampling locations within the assessment unit and 15 measurements were required in order to make an assessment determination.

F3. Results

Using the methodology outlined in the previous section and available data, results for the Recreation Use are presented here. Results are presented for Lake Erie assessment units, watershed assessment units, and large river assessment units.

Lake Erie Public Beaches

Information about water quality conditions at Lake Erie public bathing beaches is summarized in Tables F-1 through F-3 and Figure F-2. The location of these beaches is shown in Figure F-1.

Table F-1 contains the seasonal geometric mean *E. coli* levels at each of Ohio's 23 public beaches along Lake Erie for the past five recreational seasons (2002-2006). Highlighted cells indicate impairment of the recreational use at a given beach in a given year. The table also indicates the number of beach advisories for each beach based upon the two following decision criteria:

1. Comparison of the five sample rolling geometric mean to Ohio's geometric mean *E. coli* criterion for beaches (126/100 ml) has been employed by the Ohio Department of Health and local health departments to trigger the issuance of beach advisories through 2005.
2. Ohio began using the single sample maximum *E. coli* criterion for beaches of 235/100 ml to trigger the issuance of beach advisories in 2006. This change was made to comply with the federal BEACH Act rule, which became effective on December 16, 2004.

In Table F-2, the data are aggregated into the three Lake Erie assessment units. The table indicates the number of days (and the percentage for all years) when Ohio Lake Erie public beaches exceeded Ohio's bathing water geometric mean *E. coli* criterion (2002-2005) or single sample maximum criterion (2006) compared to the total number of days in the sampling period. Data for the past five recreation seasons were examined to track the number of days over the sampling period when the geometric mean of 5 consecutive samples within a 30-day period exceeded the bathing water *E. coli* criterion of 126. For the full five-year period, the percentage of days at a beach having criteria exceedances ranged from 0% to a high of 39%. These extremes coincided with remoteness from pollution sources along the Lake Erie Island beaches compared to the close proximity of urban areas in Lorain and Cuyahoga counties where inputs of storm water runoff and combined sewer overflows are known sources of bacteria.

As depicted in Figure 11, the frequency with which individual beaches were recommended for a swimming advisory based on elevated bacteria levels above the state water quality standards ranged from 0% at several beaches to near 90% of the 2003 recreation season at Edgewater beach and in 2004 at Lakeview beach. Considerable variation in the frequency of advisories was observed between beaches. However, several beaches stand out as consistently good performers over the last five recreation seasons, including Catawba, Century, Conneaut, Crane Creek, East Harbor, Geneva, Headlands East, Headlands West, Kelly's Island, South Bass Island, and Walnut Beach. These beaches infrequently exceeded the goal of fewer than 10 days per season under advisement. There were also several beaches that performed poorly on a consistent basis with two or more of the last five seasons under advisement for more than one-third of the season, including Edgewater, Euclid, Lakeshore, Lakeview, and Villa Angela beach.

High variation in bacteria levels was also seen between seasons for some beaches. For example, Lakeview beach was under advisement for 88 days in 2004, but only under advisement for 14 days in 2005. In general, bacteria levels were considerably lower at Ohio's Lake Erie public beaches in 2005 compared to 2003 and 2004. Six of the 23 public beaches monitored exceeded the goal of ten or fewer days in the recreation season recommended for an advisory posting, compared to fourteen of the beaches in 2003 and ten of the beaches in 2004. This is probably a result of the dry summer Ohio experienced in the summer of 2005 compared to the wet summers of 2003 and 2004. In 2006, bacteria levels were higher at 16 of the beaches compared to 2005, particularly at Headlands-East, Headlands-West, Euclid, Huntington, Lakeshore, Edgewater, Crane Creek, and the Maumee-Erie beaches.

Impairment of the bathing water recreational use was determined by pooling data from beaches in each of the three Lake Erie assessment units and calculating the percentage of days in the recreational season when the *E. coli* criterion was exceeded. A threshold of impairment was set at 10 days per season based upon the Ohio Lake Erie Commission's evaluation system (Ohio LEC, 1998). Results are shown in Table F-3.

Table F-1. Seasonal geometric mean *E. coli* levels at Ohio's 23 public beaches along Lake Erie.

Beach	2002			2003			2004			2005			2006	
	Seasonal geomean	# of days Posted		Seasonal geomean	# of days Posted		Seasonal geomean	# of days Posted		Seasonal geomean	# of days Posted		Seasonal geomean	# of days Posted
		5-day	SSM		5-day	SSM		5-day	SSM		5-day	SSM		SSM
Catawba Island	12	0	1	10	13	8	17	9	12	8	0	6	9	8
Century	34	2	14	15	0	6	37	7	16	35	6	11	35	10
Camp Perry	36	7	9	64	17	27	45	14	17	63	29	30	93	27
Conneaut	18	0	6	17	8	8	50	12	18	28	4	15	28	16
Crane Creek	33	1	11	35	2	12	28	0	2	33	7	9	92	21
Edgewater	79	36	21	273	92	57	59	9	11	63	6	18	81	21
East Harbor	9	0	2	18	11	13	18	0	1	8	0	7	11	4
Euclid State Park	143	44	29	68	31	17	82	30	19	34	7	16	148	52
Fairport Harbor	32	0	13	77	24	21	47	13	10	38	11	18	53	8
Geneva State Park	29	0	3	23	1	4	44	10	21	34	5	18	29	14
Headlands East	37	0	17	25	0	3	30	0	13	39	0	15	69	25
Headlands West	33	0	17	26	0	8	22	0	10	26	0	15	61	24
Huntington	54	10	25	71	25	20	47	12	21	40	6	21	83	30
Kelleys Island	22	0	0	7	0	7	9	0	0	12	0	0	8	0
Lakeshore Park	116	59	31	85	31	24	97	42	39	34	5	11	64	30
Lakeside	16	0	3	36	26	18	15	0	12	17	0	9	26	14
Lakeview	178	53	39	48	11	15	399	88	58	56	14	15	25	14
Maumee - Erie	56	8	10	115	44	36	75	20	16	66	8	31	95	23
Maumee - Inland	32	0	1	49	15	14	62	21	14	71	33	24	47	10
Port Clinton	11	0	6	36	28	39	27	3	7	12	12	14	23	8
South Bass Island	3	0	0	12	0	0	3	0	0	3	0	0	4	0
Villa Angela	180	69	49	254	77	53	81	24	27	105	40	30	184	44
Walnut	31	2	9	13	0	2	16	0	5	31	0	9	37	12

Highlighted cells indicate impairment of the recreational use. Impairment is triggered by an exceedance of the geometric mean on a seasonal basis *(Seasonal geomean)*, or if the 5-sample running geometric mean (2002-2005) *(5-day)* or the single-sample maximum criteria (2006) *(SSM)* are exceeded more than 10% of the time during a season. The beach season is defined for this analysis as the time *E. coli* monitoring commences, typically in late May, though the end of the Labor Day weekend. The number of days posted is determined by counting the number of days a criteria is exceeded. Days for which no monitoring data were collected are presumed to be in exceedance if the preceding day's bacteria level exceeded the criteria. Likewise, unmonitored days are presumed to be below the criteria when preceded by a monitored day that was below the criterion.

Table F-2. The number of days (and the percentage for all years) when Ohio Lake Erie public beaches exceeded Ohio's single sample maximum *E. coli* criterion compared to the total number of days in the sampling period, 2002 – 2006.

Beach	2002	2003	2004	2005	2006	All years (%)
Western Basin Assessment Unit						
Camp Perry	9/85	27/106	17/98	30/98	27/91	110/478 (23%)
Catawba Island State Park	1/85	8106	12/98	6/98	8/91	35/478 (7%)
Crane Creek State Park	11/104	12/106	2/98	9/98	21/91	55/497 (11%)
East Harbor State Park	2/85	13/105	1/98	7/98	4/91	27/477 (6%)
Lakeside	3/85	18/106	12/98	9/98	14/91	56/478 (12%)
Maumee Bay State Park (inland)	1/103	13/105	14/98	24/98	10/91	63/495 (13%)
Maumee Bay State Park (Erie)	10/103	36/105	16/98	31/98	23/91	116/495 (25%)
Port Clinton	63/91	39/105	7/98	14/98	8/91	74/495 (15%)
Central Basin Assessment Unit						
Century Beach	14/85	6/98	16/98	11/98	10/84	57/463 (12%)
Conneaut Park	6/85	8/98	18/98	15/98	16/84	63/463 (14%)
Edgewater State Park	21/106	57/106	11/106	18/106	21/105	128/529 (24%)
Euclid State Park	29/85	17/97	19/98	16/98	52/105	133/483 (28%)
Fairport Harbor	13/105	21/111	10/105	18/105	8/105	70/531 (13%)
Geneva State Park	3/85	4/98	21/98	18/98	14/84	60/463 (13%)
Headlands State Park (East Beach)	17/106	3/111	13/105	15/105	25/105	73/532 (14%)
Headlands State Park (West Beach)	17/106	8/111	10/105	15/105	24/105	74/532 (14%)
Huntington Beach	25//98	20//98	21/106	21/105	30/98	117/505 (23%)
Lakeshore Park	31/85	24/98	39/98	11/98	30//84	135/463 (29%)
Lakeview	39/85	15/98	58/98	15/98	14/84	141/470 (30%)
Villa Angela State Park	49/105	53/105	27/106	30/106	44/105	203/527 (39%)
Walnut Beach	9/85	2/98	5/98	9/98	12/84	37/463 (8%)
Lake Erie Island Assessment Unit						
South Bass Island State Park	0/83	7/92	0/92	0/92	0/84	7/443 (2%)
Kelly's Island State Park	0/83	0/78	0/86	0/92	0/84	0/423 (0.0%)

Figure F-2. Seasonal frequency of advisory postings at Ohio's Lake Erie public beaches.

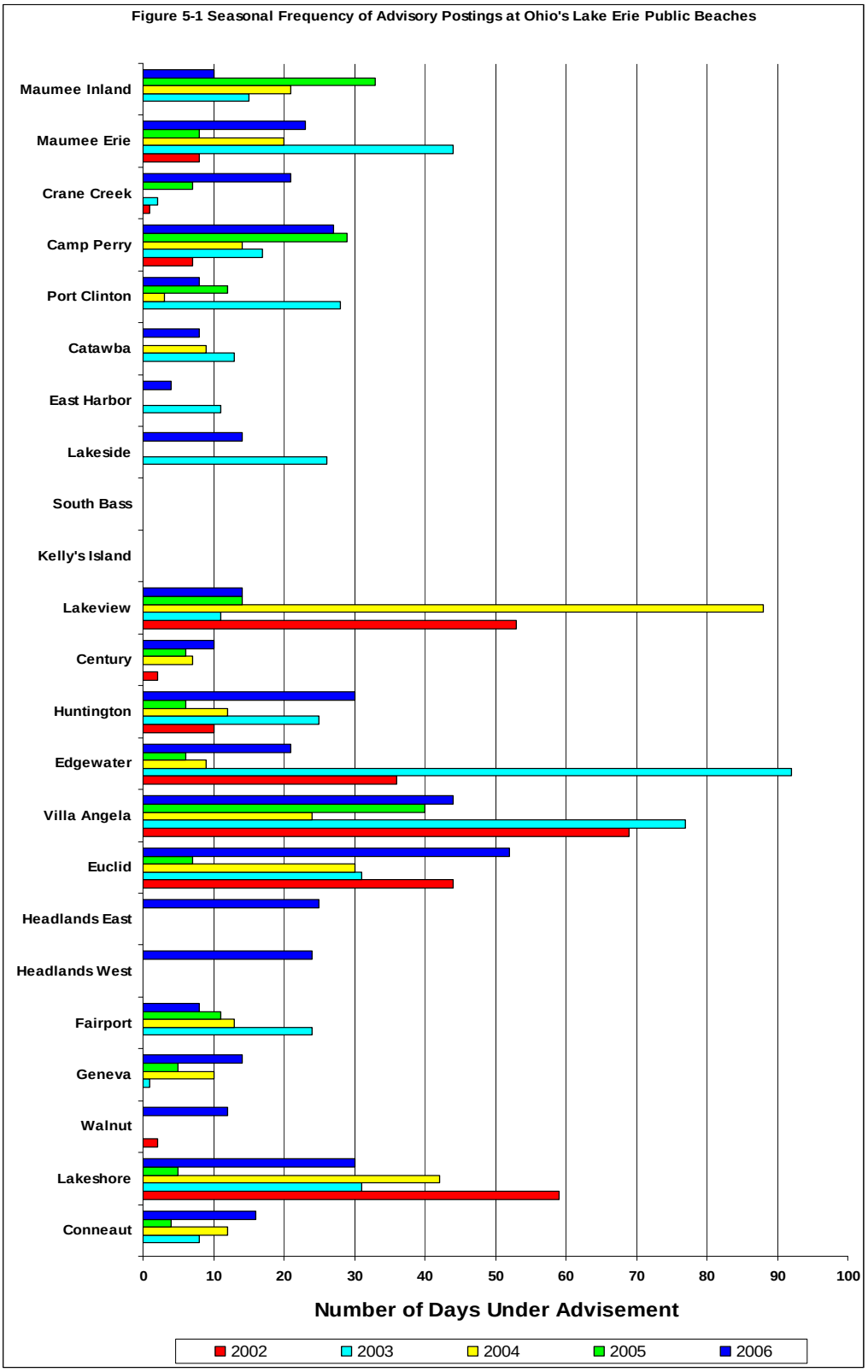

Table F-3. Bathing water geometric mean *E. coli* exceedance frequency at 23 Lake Erie public beaches from 2001-2005 (pooled by Lake Erie assessment unit to report attainment status)**.**

	Western Basin	Central Basin	Lake Erie Islands
Number of beaches	8	10	2
Total recreation days	3893	4829	866
Total days in exceedance	536	1074	7
Exceedance percentage	13.8%	22.2%	0.1%
Average # of days *E. coli* criteria exceeded per beach per season [1]	13.4	21.5	0.7
Attainment status	Non attainment	Non attainment	Full attainment

Rivers and Streams

Approximately 30,000 bacteria measurements were used in the 2008 recreational use attainment evaluation. Two-thirds of these data were generated by dischargers monitoring ambient conditions in streams upstream and/or downstream of their 001 discharge and provided to Ohio EPA through SWIMS. The remaining third of the fecal coliform data were generated by Ohio EPA's Division of Surface Water as part of routine ambient monitoring associated with annual drainage basin surveys conducted around the state. Using the methodology described in Section F2, it was possible to determine the status of recreational use attainment of 47% of the WAUs. This is similar to the assessment capacity in the 2004 and 2006 integrated report assessment cycles (see Table F-4). The overall attainment and impairment rates and the changes between reporting years are summarized in Table F-4. Attainment and impairment rates are based on the total number of watersheds for which sufficient data were available, and not on the total number of assessment units in the state.

Table F-4. Overall differences in the assessment of recreation use attainment, 2004 to 2008.

	2004 Report		2006 Report		2008 report	
	Number	Percentage	Number	Percentage	Number	Percentage
Total AUs	354	100	354	100	354	100
Assessed	166	47	154	43	166	47
Attaining Recreation Use	56	33	57	37	63	38
Impaired Recreation Use	110	67	97	63	103	63
Not Assessed	188	53	200	57	188	53

Data availability affected the status of 38 assessment units. Sufficient data are now available to determine the recreational attainment status for 25 assessment units for which attainment decisions could not be made in 2006 because of insufficient data. Of these 25 assessment units, 15 were determined to be impaired while 10 were determined to attain the recreational use. There were also 13 assessment units for which sufficient data were available to make a determination regarding recreational use attainment in 2006, but for which insufficient data are available for the 2008 report. Of these 13 assessment units, 6 were previously attaining the recreational use while 7 were not.

There were six assessment units identified as impaired in the 2006 IR that are now identified as attaining the recreational use designation. In both reports, the methodology used to assess recreational use attainment status is based upon a comparison of the 75th and 90th percentile fecal coliform data in a WAU to the primary contact recreation criteria of 1,000 and 2,000, respectively. Watershed assessment units in which neither percentile exceeds the criteria are defined as attaining the recreation use. Table F-5 compares the results of the 2006 analysis with the results of the 2008 analysis for the five assessment units.

Table F-5. Assessment units listed as impaired for recreation use in 2006 and found to be in attainment in the 2008 report.

Assessment Unit	Description	2006 Results			2008 Results		
		# sites/ # samples	Percentile values		# sites/ # samples	Percentile values	
			75th	90th		75th	90th
04100010 050	Portage River (downstream South/Middle Branches to downstream North Branch)	3/164	1125	2500	3/132	978	2000
04110001 040	East Branch Black River (downstream Coon Creek to mouth)	9/100	777	2020	4/95	560	1648
04110001 050	Black River; Lake Erie tributaries East of Black River to West of Porter Creek)	10/172	622	2440	4/160	580	1903
05030103 001	Mahoning River Mainstem (downstream Eagle Creek to Pennsylvania border)	7/358	922	2101	9/411	885	2000
05060001 190	Big Darby Creek (headwaters to downstream Sugar Creek)	40/216	1105	3100	3/61	740	1490
05060002 070	Salt Creek (headwaters to upstream Queer Creek)	30/94	888	2740	30/85	780	1660

Four WAUs identified as attaining the recreational use in the 2006 IR are now identified as impaired for recreational use in the 2008 IR (Table F-6). In the 2006 report, all four of these WAUs were identified as attaining the recreation use because both the 75th percentile of the fecal coliform data was below the primary contact recreation geometric mean criterion of 1000 and the 90th percentile of the fecal coliform data was below the single sample maximum criterion of 2,000. In 2008, all four of these AUs exceeded the 90th percentile threshold of 2,000, and one of the AUs also exceeded the 75th percentile threshold of 1,000 fecal coliform.

Table F-6. Assessment units listed as attaining for recreation use in 2006 and found to be impaired in the 2008 report.

Assessment Unit	Location Description	2006 Results			2008 Results		
		# site/ # samples	Percentile values		# site/ # samples	Percentile values	
			75th	90th		75th	90th
04100010 030	Middle Branch Portage River (headwaters to downstream Rocky Ford Creek)	4/56	750	1800	4/56	1200	2765
04110001 070	Rocky River; East Branch Rock R.; Lake Erie tributaries (west of Porter Cr. to west of Cuyahoga R.)	21/738	420	1400	5/239	1000	5140
04110002 050	Cuyahoga River (downstream Brandywine Cr. to downstream Tinkers Cr.); excluding Cuyahoga R. mainstem	7/491	790	2000	7/478	900	2210
05080001 001	Great Miami River Mainstem (downstream Tawawa Creek to mouth)	14/925	693	2000	16/989	700	2320