

Delaware River Basin Commission

Bacterial Monitoring Results Delaware Estuary 2020

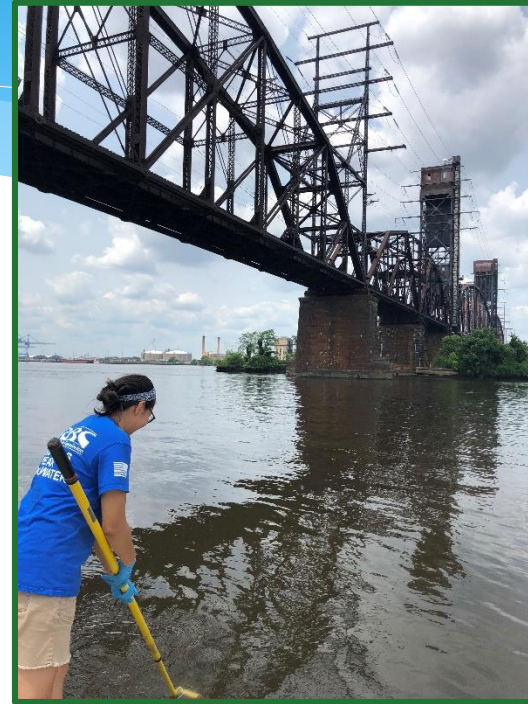
WQAC

December 3, 2020

John Yagecic, PE

Manager, Water Quality Assessment DRBC

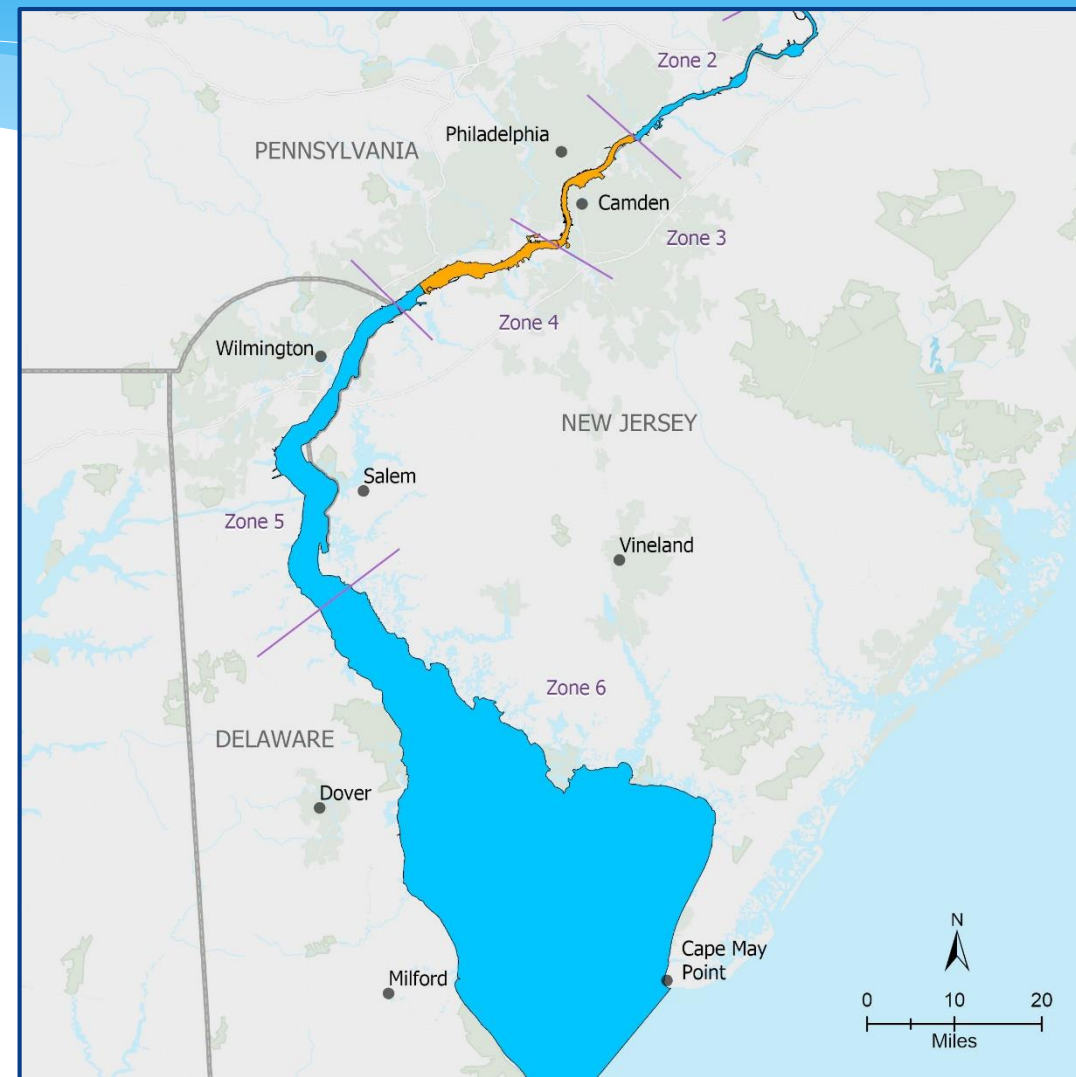
Presented to an advisory committee of the DRBC December 3, 2020.
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Current Recreational Uses / Criteria in Delaware Estuary (DRBC WQ Regs)

Zone	Use	Fecal Coliform	Enterococcus
		Geometric mean colonies per 100 mL	
2	Recreation	200	33
3	Recreation – Secondary Contact	770	88
Upper 4			
Lower 4	Recreation	200	33
5			35
6			

<http://www.nj.gov/drbc/library/documents/WQregs.pdf>



EPA Office of Water 820-F-12-058

Table 1. Recommended 2012 RWQC.

Criteria Elements	Estimated Illness Rate (NGI): 36 per 1,000 primary contact recreators		OR	Estimated Illness Rate (NGI): 32 per 1,000 primary contact recreators	
	Magnitude			Magnitude	
Indicator	GM (cfu/100 mL) ^a	STV (cfu/100 mL) ^a		GM (cfu/100 mL) ^a	STV (cfu/100 mL) ^a
Enterococci – marine and fresh	35	130		30	110
OR					
<i>E. coli</i> – fresh	126	410		100	320
Duration and Frequency: The waterbody GM should not be greater than the selected GM magnitude in any 30-day interval. There should not be greater than a ten percent excursion frequency of the selected STV magnitude in the same 30-day interval.					

^a EPA recommends using EPA Method 1600 (U.S. EPA, 2002a) to measure culturable enterococci, or another equivalent method that measures culturable enterococci and using EPA Method 1603 (U.S. EPA, 2002b) to measure culturable *E. coli*, or any other equivalent method that measures culturable *E. coli*.

<https://www.epa.gov/sites/production/files/2015-10/documents/rwqc2012.pdf>

Monitoring Summer 2020

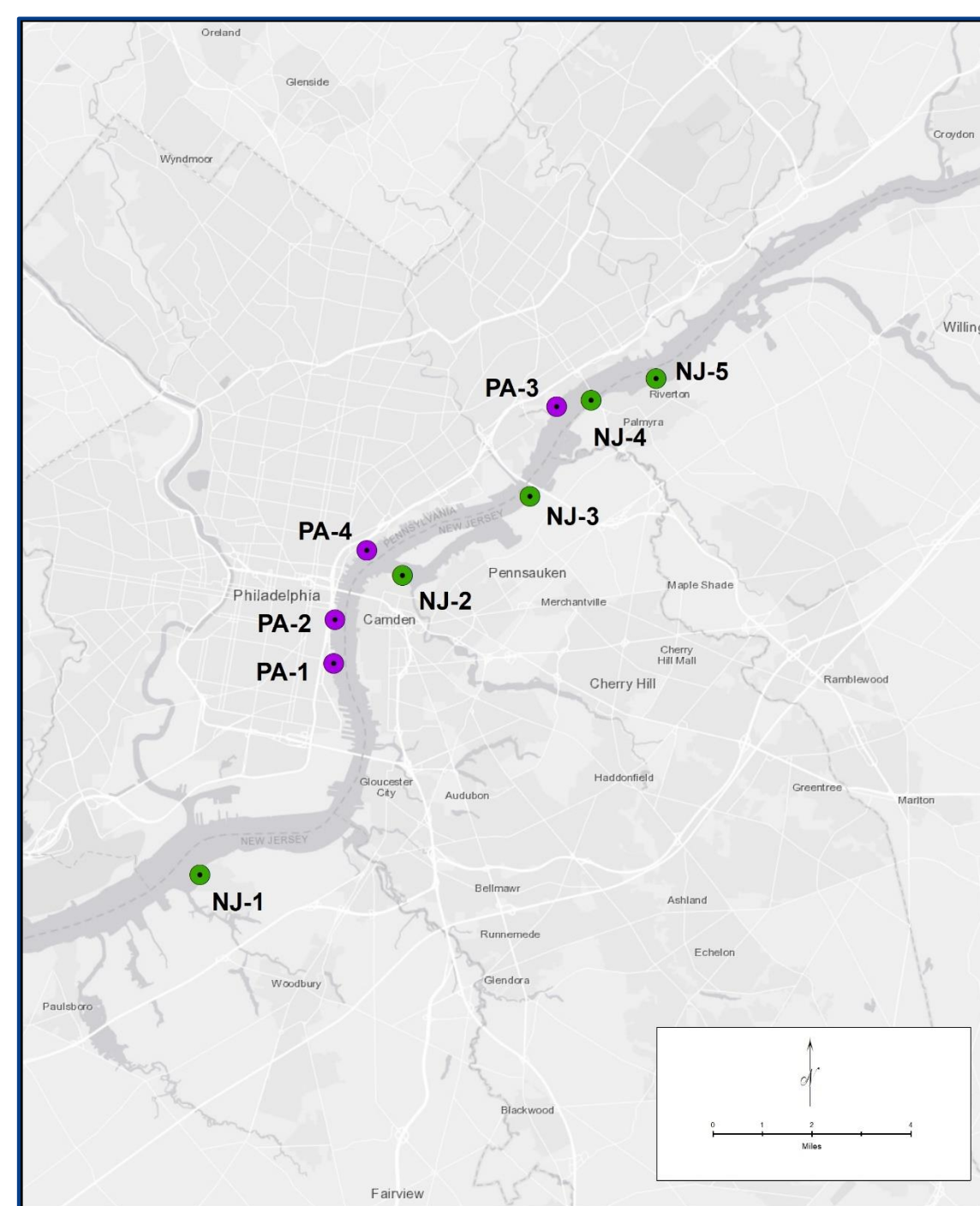
Shore-based, where recreation more likely
 ~ 5x per month, July - September
 Fecal coliform, enterococcus, E. coli

- Riverton Yacht Club (NJ-5)
- Palmyra Cove Nature Center (NJ-4)
- Pennsauken Access (NJ-3)
- Pyne Poynt Park (NJ-2)
- National Park (NJ-1)

NJ

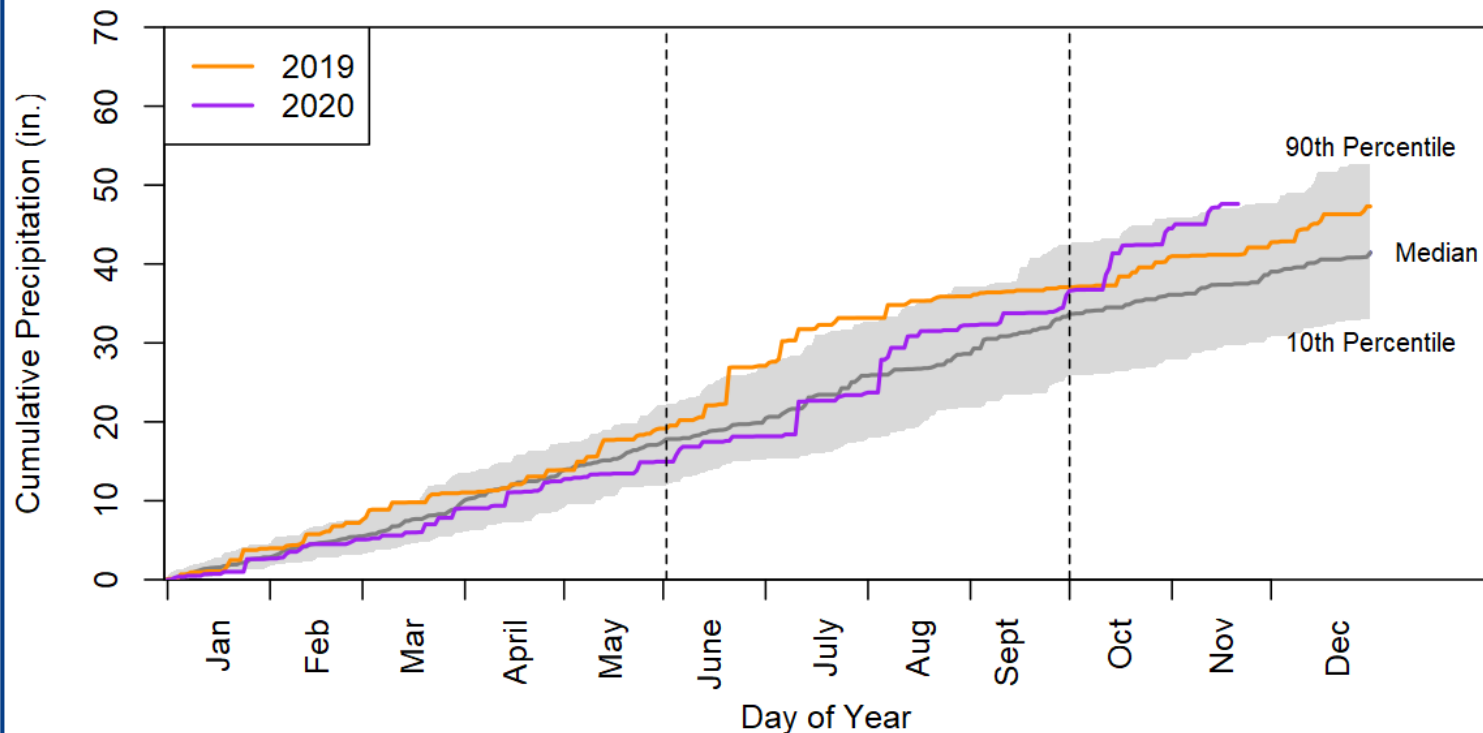
- Washington Ave. Green (PA-1)
- Penn's Landing Lagoon (PA-2)
- Penn Treaty Park (PA-4)
- Frankford Arsenal Boat Ramp (PA-3)

PA



Rainfall in 2019 and 2020

Comparison of 2019 and 2020 Cumulative Rainfall Totals by Day of Year, Philadelphia International Airport



- Cumulative rainfall was less in 2020 during the recreational window
- Expected to see better (lower) bacterial concentrations in 2020
- August 4th Hurricane Isaias

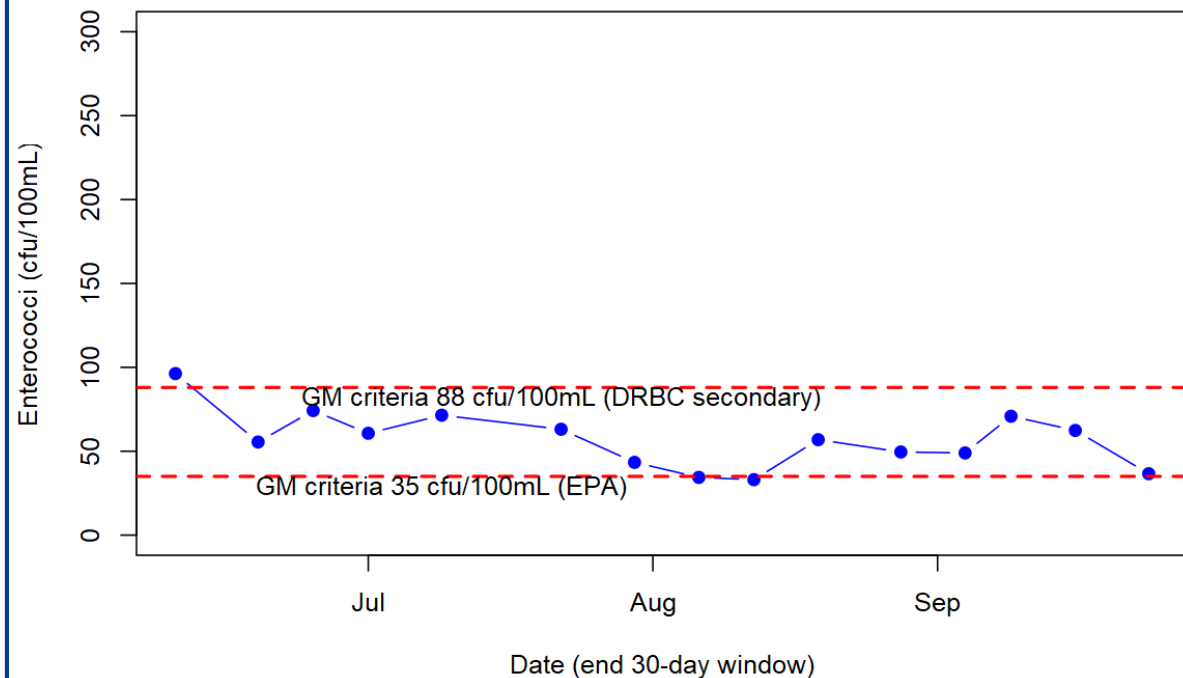
Comparison of 2019 and 2020 Enterococci Results

2019

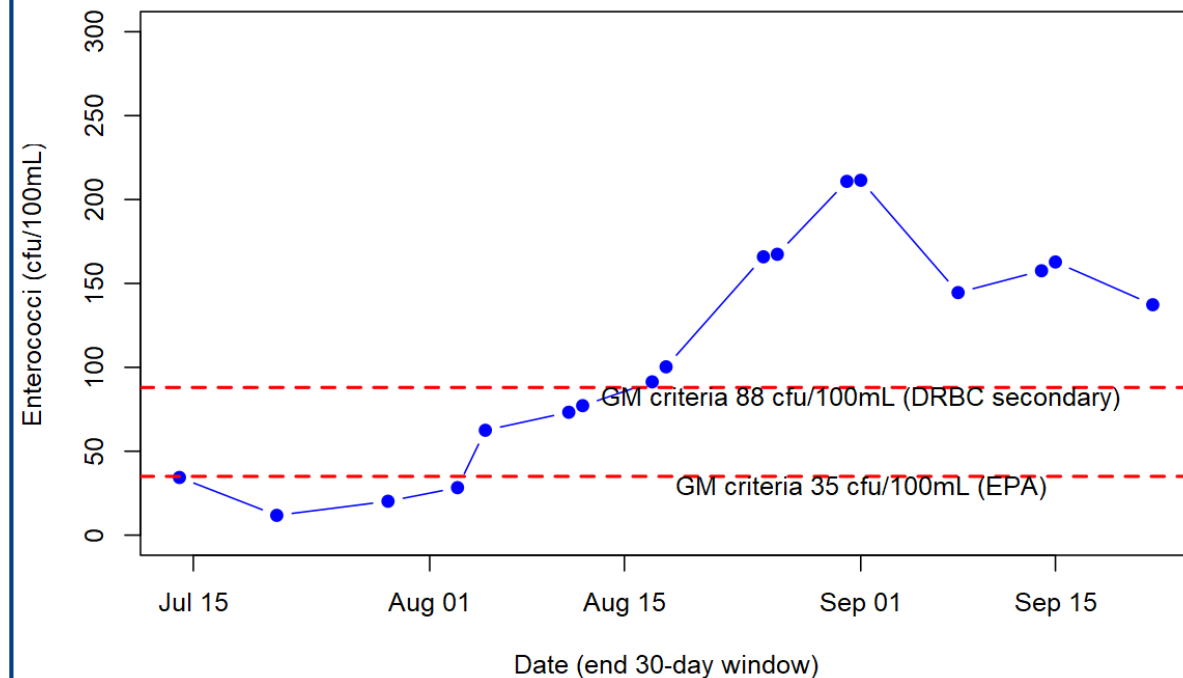
GM calculated using a sliding 30-day window, all sites, reported at last day

2020

Comparison of Delaware Estuary Enterococci to EPA Recommended Criteria, Geometric means



Comparison of 2020 Delaware Estuary Enterococci to EPA Recommended Criteria, Geometric means



Site Specific Comparison to EPA Enterococci Criteria (35 cfu/100mL GM)

2019

Date	NPK	WAG	PLL	PPP	PSA	FAA	PCN	RYC
6/10/2019	53.3	78.4	23	69	70.6	544.7	251.2	94.9
6/19/2019	33	61.3	11.6	64.3	21.9	349	189.1	41.4
6/25/2019	59	156.6	12.8	87.6	22.6	392.5	175	57.4
7/1/2019	81.4	227.4	15.4	91.8	14.2	129.6	100.8	38
7/9/2019	137.5	181.8	20.4	93.5	14.5	232.7	129.7	43.7
7/22/2019	119.5	50.5	13.9	88.1	16.5	245.2	103.1	105.3
7/30/2019	46.1	27.3	11.8	119.8	11.8	140	91.3	66.1
8/6/2019	27.9	30.9	20.7	167.4	11.5	96.3	36.1	27.5
8/12/2019	31.8	40.1	18.7	132.5	22.4	70.3	18	20
8/19/2019	53.4	83.5	53.8	215	26.1	168.1	26.9	20.7
8/28/2019	44.8	142.9	52.7	205.1	19.6	93.7	21.9	14.1
9/4/2019	83.7	129.8	45.2	99.3	20.8	107.3	22.3	18.7
9/9/2019	307.9	109.1	27.7	87	31.2	154.2	58.2	52.1
9/16/2019	135.6	87.2	26.1	100.5	26.5	127.7	61.6	71.1
9/24/2019	55.5	32.4	11.9	48.8	31.1	56.4	47.1	74.8

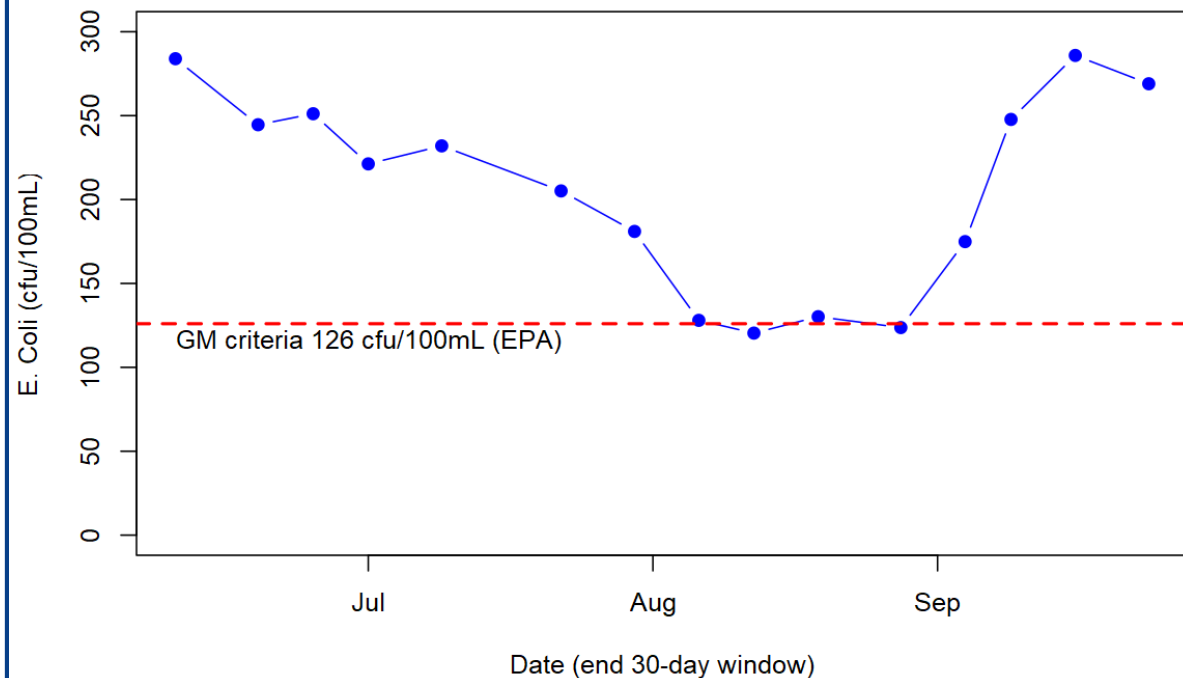
2020

Date	NPK	WAG	PLL	PPP	PSA	FAA	PCN	RYC	PTP
7/14/2020	62.9	16.3	20.2	23.3	25.1	60.8	50.5	64	38.3
7/21/2020	11.2	4.7	4.5	15.7	15.9	7.8	47.7	44.2	6.2
7/29/2020	13.8	9.8	8.6	38.1	14.8	16.3	54.8	44.8	24.3
8/3/2020	17.2	15.2	10.9	87.4	20.8	18.9	74.3	67	23.8
8/5/2020	46.2	29.9	27.1	139	39.5	95.3	139.5	128.4	44.2
8/11/2020	55.2	38.2	30.3	129.8	42.5	151.3	127.5	115.1	70.8
8/12/2020	56.3	48	31.1	142.3	40.9	151.3	131.5	130.1	85.4
8/17/2020	65.1	71.6	29.9	193.9	53.1	176.2	144.1	152.6	95.8
8/18/2020	76	74.7	31.3	237.5	62.2	154.2	160.7	161.1	105.3
8/25/2020	147.2	190.3	50.4	434.3	81.5	261.9	194.9	190.1	196.4
8/26/2020	127	179.8	60.5	385.7	80.6	285.1	219.8	190.1	196.7
8/31/2020	148	192.7	88.3	551.2	132.7	343.9	248.7	364.4	184.5
9/1/2020	129.8	190.5	82	547.3	132.2	343.9	303.9	358.8	197.4
9/8/2020	83.7	147	57.2	270	90.2	179.8	207	247.9	204.3
9/14/2020	132.4	125.7	56.5	356.3	118.6	147.3	295.9	323.7	149
9/15/2020	149.2	120.7	59	398.7	118.3	147.3	292	385.3	119.9
9/22/2020	120.9	97	63.2	284.6	96.4	111.6	254.4	302.2	125

Comparison of 2019 and 2020 E. Coli Results

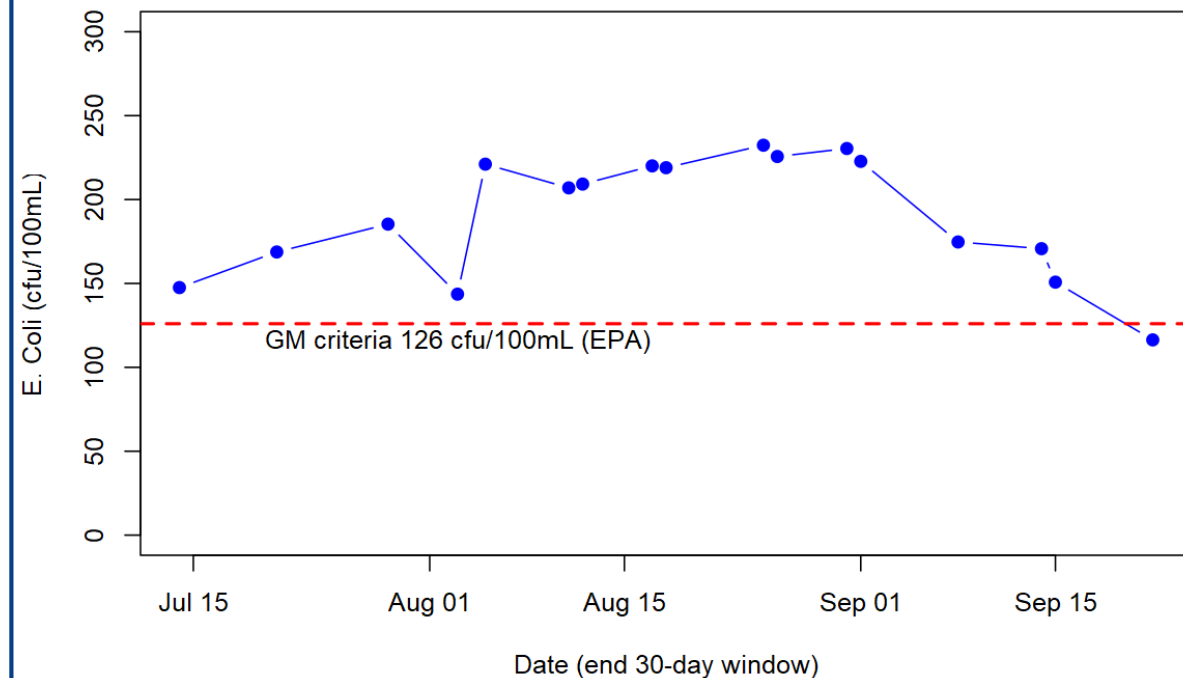
2019

Comparison of Delaware Estuary E. Coli to EPA Recommended Criteria, Geometric means



2020

Comparison of 2020 Delaware Estuary E. Coli to EPA Recommended Criteria, Geometric means



Site Specific Comparison to EPA E. Coli Criteria (126 cfu/100mL GM)

2019

2020

Date	NPK	WAG	PLL	PPP	PSA	FAA	PCN	RYC
6/10/2019	132.7	212.9	174.4	759.6	223.3	889.9	300.5	168.5
6/19/2019	104.7	212.9	123.1	809.6	177.2	737.5	309.5	142.6
6/25/2019	185.5	429	177.4	786.8	240.5	105.2	309.5	182
7/1/2019	332.2	737.8	326.8	140.6	194.9	50	301.1	173.8
7/9/2019	316.4	599.5	312.5	168.2	182.3	87.4	381.6	144.5
7/22/2019	414.3	356.6	352.8	92.5	139.1	111.9	359.4	118.2
7/30/2019	182.2	182.3	233.6	138	130.1	283.9	400.3	84.9
8/6/2019	28.6	265.2	292.3	1162.8	95.8	109.6	131.4	38.7
8/12/2019	40.2	172.7	342.8	1716.9	72.2	83.3	47.4	61.7
8/19/2019	57.9	124.5	257.9	1817.9	75.6	137.1	57.1	58.1
8/28/2019	35.2	146.7	296.5	2059.7	76.8	111.8	48.4	55.3
9/4/2019	72.2	200.9	588	1771.8	104.4	186	50.8	76.8
9/9/2019	491.2	134.1	505.8	1279.5	121	285.7	115.8	158.4
9/16/2019	416.1	145.6	516.7	968.6	220.4	388.6	157.3	115.2
9/24/2019	216.4	231.3	892.6	203.9	235.2	362.9	147.2	139.6

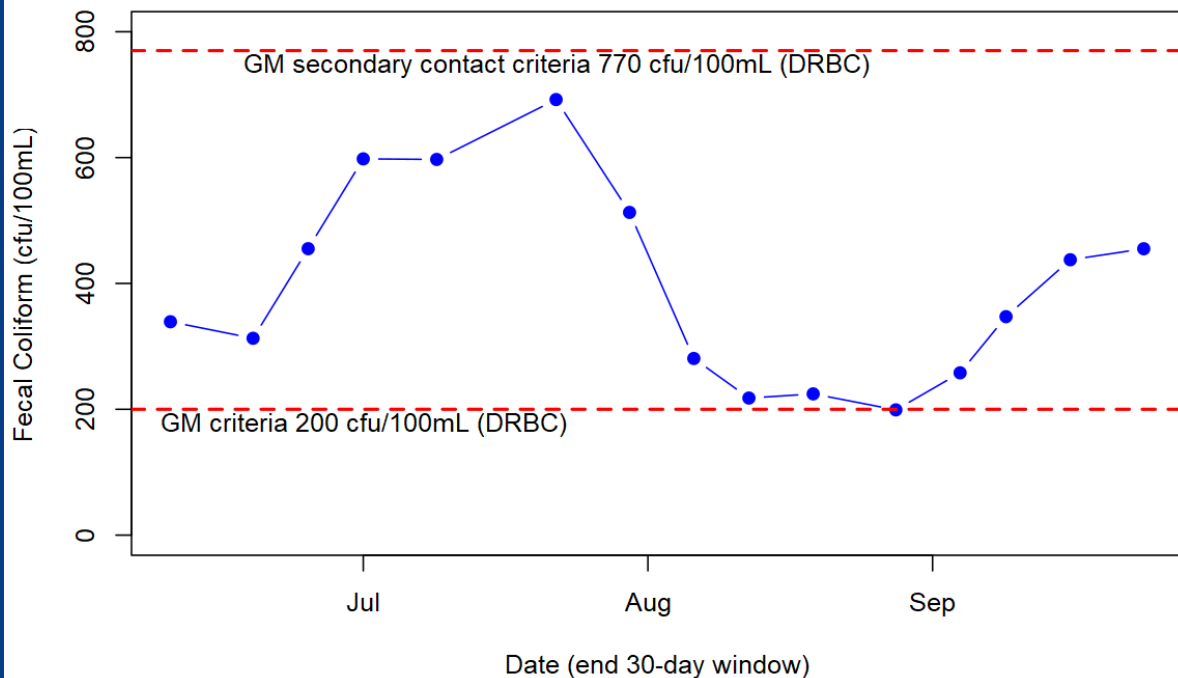
Date	NPK	WAG	PLL	PPP	PSA	FAA	PCN	RYC	PTP
7/14/2020	107.1	77.1	70.8	727	209.5	461.1	79.8	48	148.3
7/21/2020	185.8	53.2	38.8	902.3	191.4	186.5	439.4	273	125
7/29/2020	146.3	62.1	34.9	1477.6	178.2	198.4	314.8	194.5	185.8
8/3/2020	95.6	54	29.6	1630.8	142.9	139.7	265.7	158.6	95.6
8/5/2020	154.2	96.3	65.3	1505.9	185.6	317.5	354.3	231.3	149.8
8/11/2020	159	95.9	67.9	1240.4	172.4	337.6	329.2	154.3	161
8/12/2020	150.3	97.5	74.6	1143.8	193.6	337.6	311.9	173.1	186.3
8/17/2020	161.7	111.9	83.7	1329.4	171.2	320.5	307.8	200.3	192.5
8/18/2020	176.5	108.9	88	1420.8	168.5	239.7	305.8	207.2	192.4
8/25/2020	143.4	164.6	113.5	1304	187.1	344.5	219.8	150.7	239.2
8/26/2020	130.1	165.4	116.5	1188.8	200.1	338.7	187.9	150.7	232.9
8/31/2020	121.9	182.3	155.3	995.3	218.4	361.8	191	201.2	220
9/1/2020	107.1	180.7	155.1	1098.5	208.3	361.8	165.2	185.2	235.3
9/8/2020	95.8	138.4	130.8	667.3	176.8	204.4	113.8	153.6	234.9
9/14/2020	106.5	138.3	120.6	623.5	163.1	211.7	104.3	179.5	208.3
9/15/2020	106.3	119.4	109.3	533.3	145.2	211.7	94.8	140.4	151
9/22/2020	80.8	94.4	89.9	348.6	107.4	163.8	83.9	102.1	117

Comparison of 2019 and 2020 Fecal Coliform Results

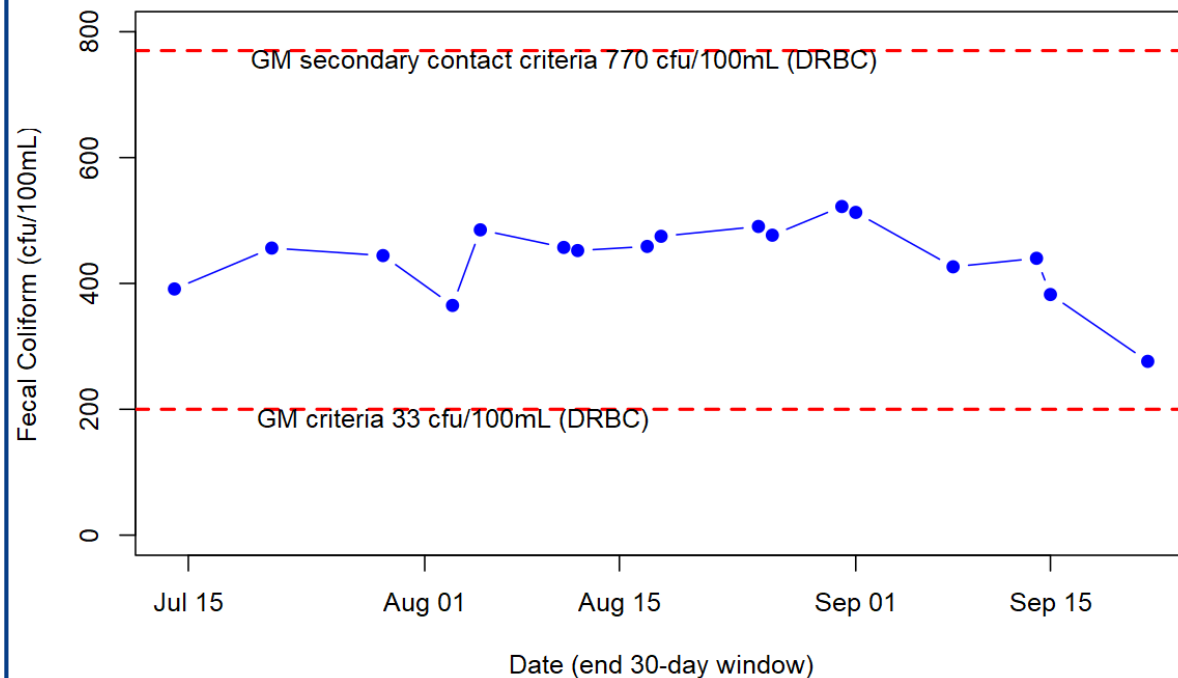
2019

2020

Comparison of Delaware Estuary Fecal Coliform to DRBC Current Criteria Recreational Use, Geometric means



Comparison of 2020 Delaware Estuary Fecal Coliform to DRBC Current Criteria Recreational Use, Geometric means

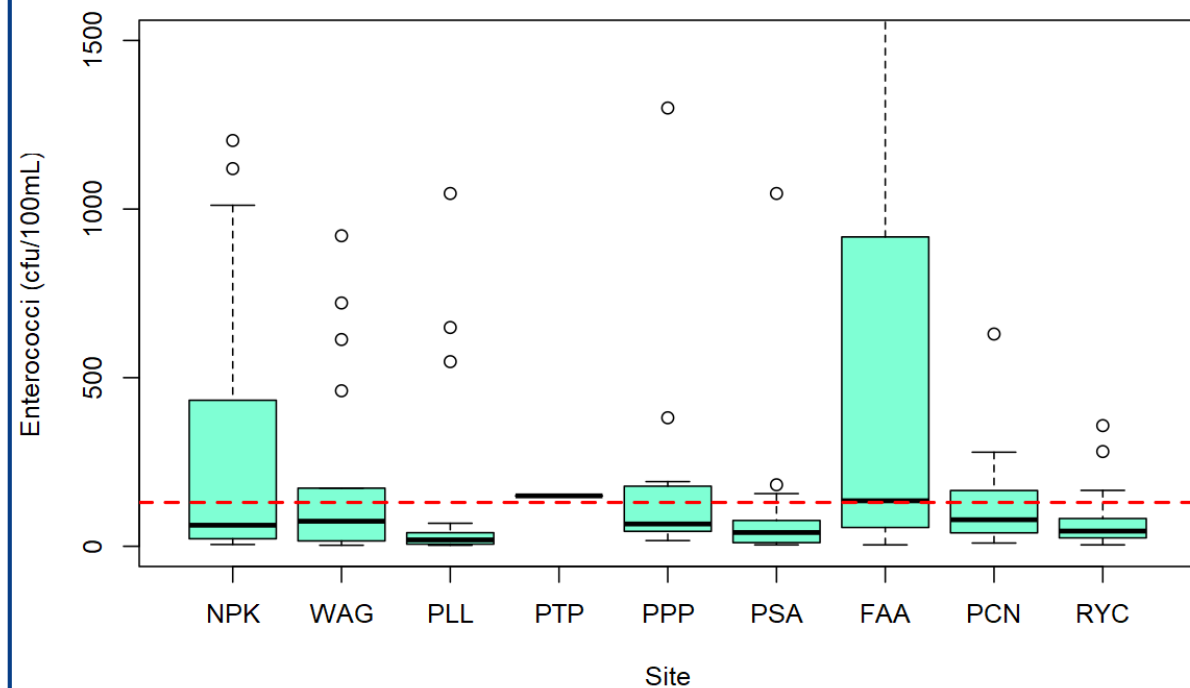


Comparison to EPA STV Criteria for Enterococci

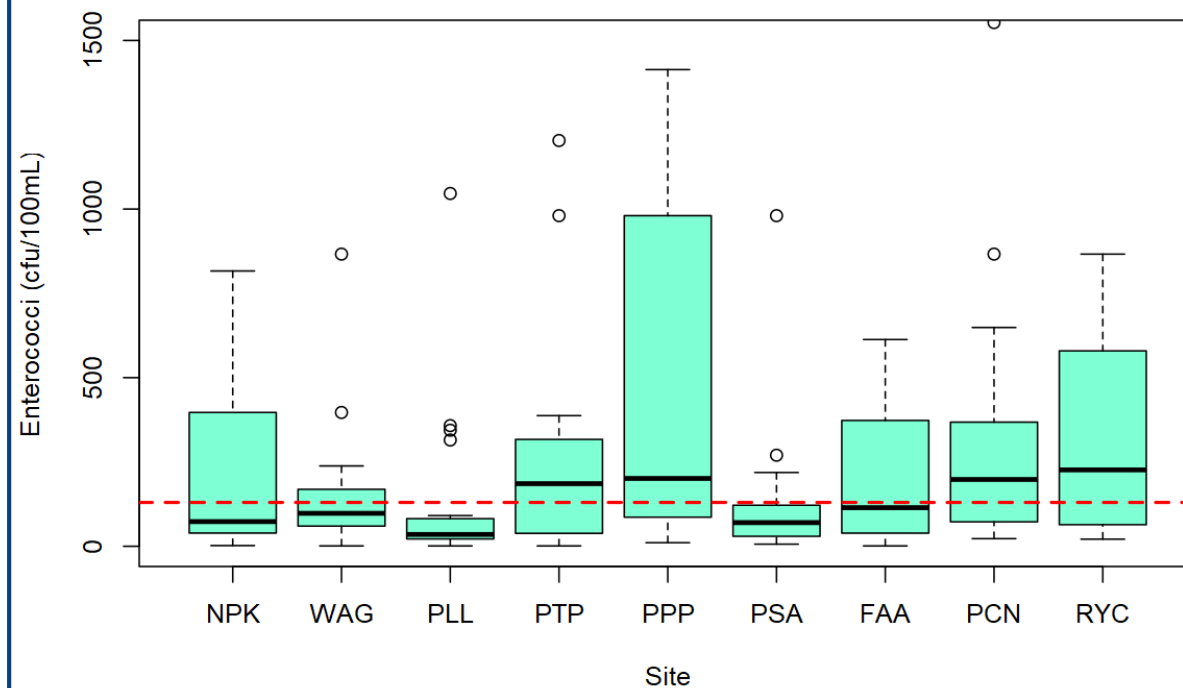
2019

2020

Enterococci by Sample Site compared to EPA STV of 130 cfu/100mL (36 illnesses per 1000)



2020 Enterococci by Sample Site compared to EPA STV of 130 cfu/100mL (36 illnesses per 1000)

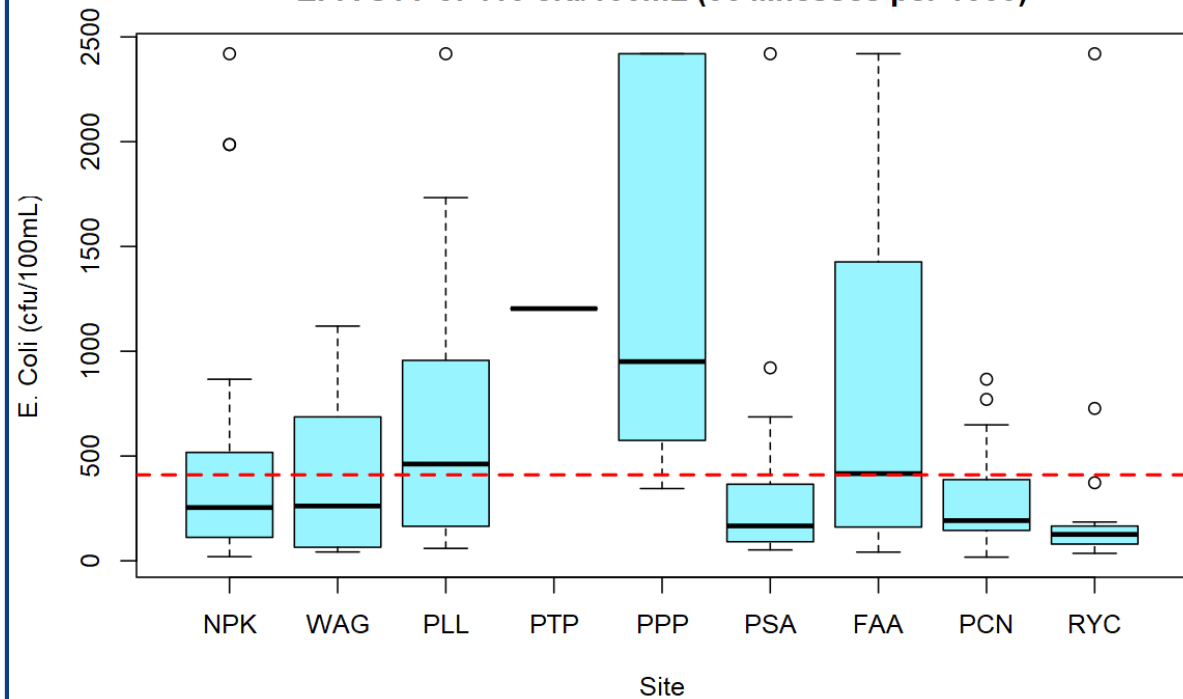


Comparison to EPA STV Criteria for E. Coli

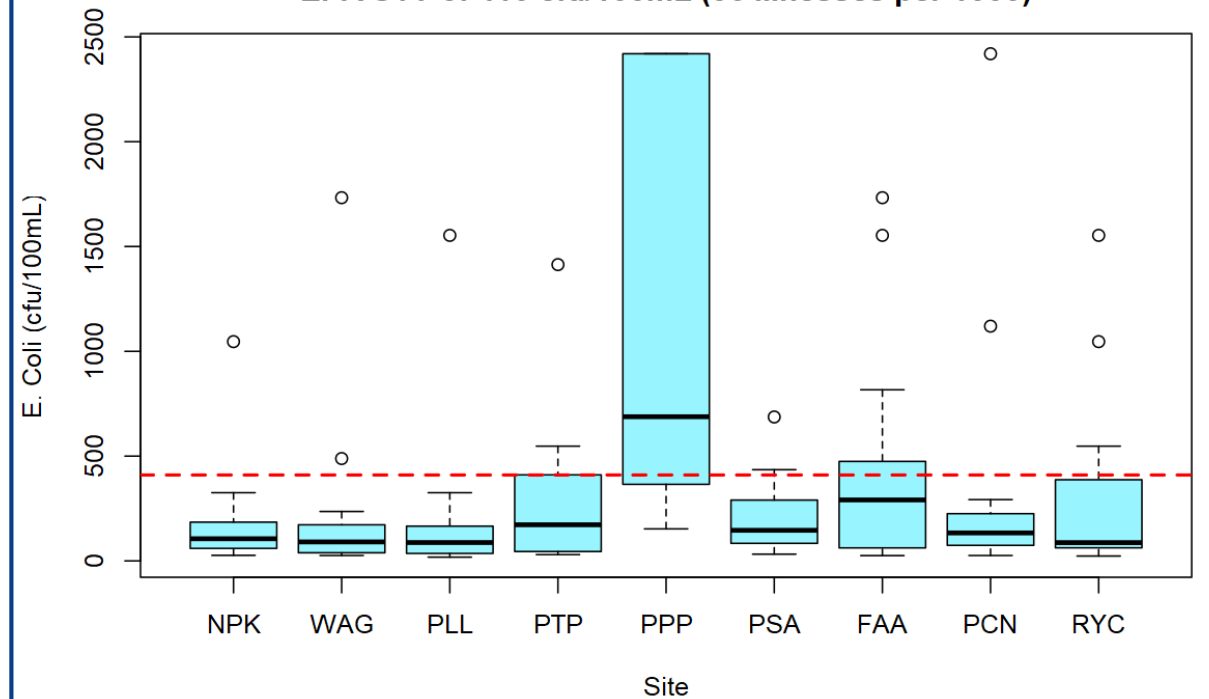
2019

2020

E. Coli by Sample Site compared to EPA STV of 410 cfu/100mL (36 illnesses per 1000)



2020 E. Coli by Sample Site compared to EPA STV of 410 cfu/100mL (36 illnesses per 1000)



% 'Open' based on EPA STVs only

Site Name	Site	2019 % Open	2020 % Open	Change
Pennsauken Access	PSA	83%	76%	↓
Riverton Yacht Club	RYC	78%	47%	↓
Palmyra Cove Nature Center	PCN	67%	50%	↓
Penns Landing Lagoon	PLL	67%	82%	↑
National Park	NPK	59%	71%	↑
Washington Avenue Green	WAG	56%	76%	↑
Frankford Arsenal Boat Ramp	FAA	31%	54%	↑
Pyne Poynt Park	PPP	20%	25%	↑
Penn Treaty Park	PTP	NA	57%	

Used an index:

$$((EC/STV_{EC}) + (ENT/STV_{ENT}))/2$$

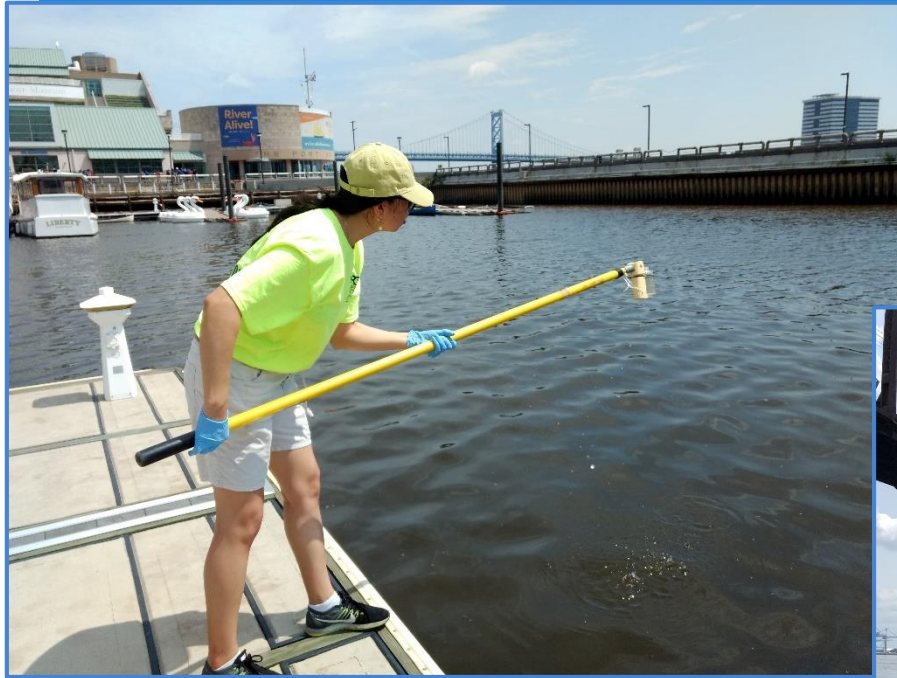
- Values < 1 : Open
- Values > 1 : Closed

Interpretation

- 2020 results were not substantially better than 2019 results
- Results continue to show site-to-site differences and temporal differences

2021 Monitoring

- Boat-based transects to assess mid-channel verses near-shore differences
- Awaiting a proposal from DNREC to assess human-derived versus wildlife-derived bacteria
- Coordinating with USGS on possible expansion of Fluidion sensor deployment (real-time bacteria measurement)



Questions & Discussion