Delaware River Basin Commission

DRBC 2022 Monitoring Activities and Updates

Joint STAC-MACC Meeting

May 24, 2022

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Summer 2022 Bacteria Monitoring

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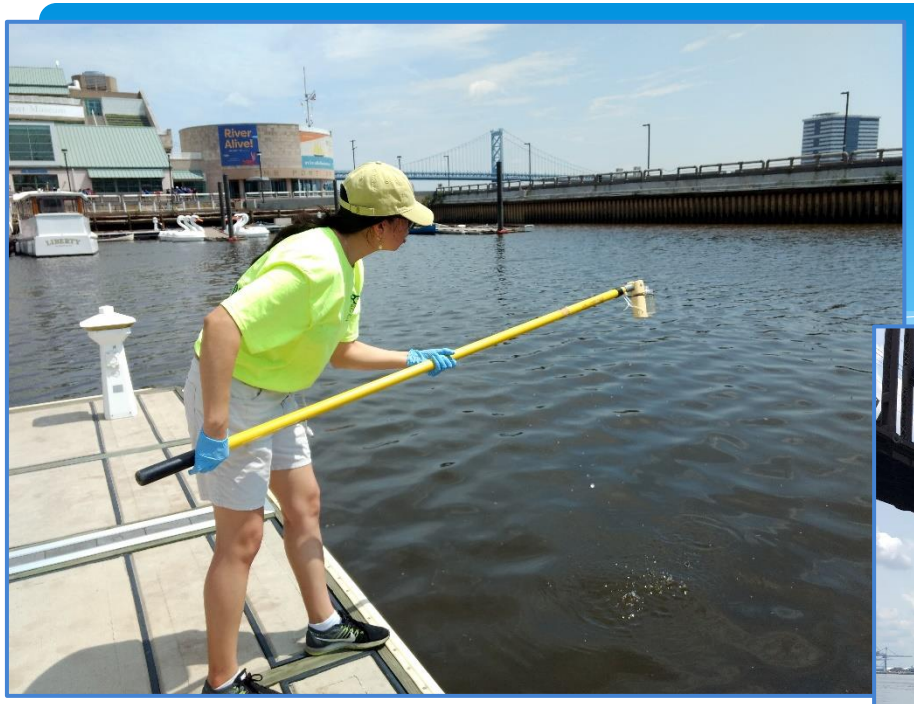

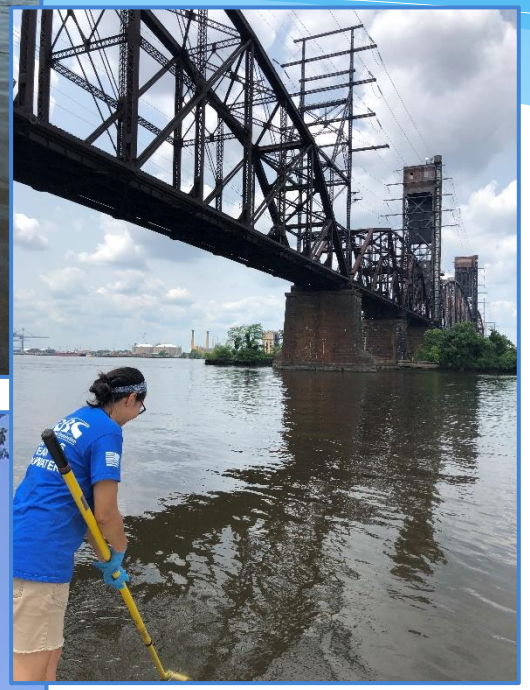

Shore-based, where recreation more likely
15 sampling events, May - September
Fecal coliform, enterococcus, E. coli

- Riverton Yacht Club
- Palmyra Cove Nature Center
- Pennsauken Access
- Pyne Poynt Park
- National Park

NJ

- Washington Ave. Green
- Penns Landing Lagoon
- Frankford Arsenal Boat Ramp
- Penn Treaty Park (2020)

PA

2022 Bacteria Monitoring

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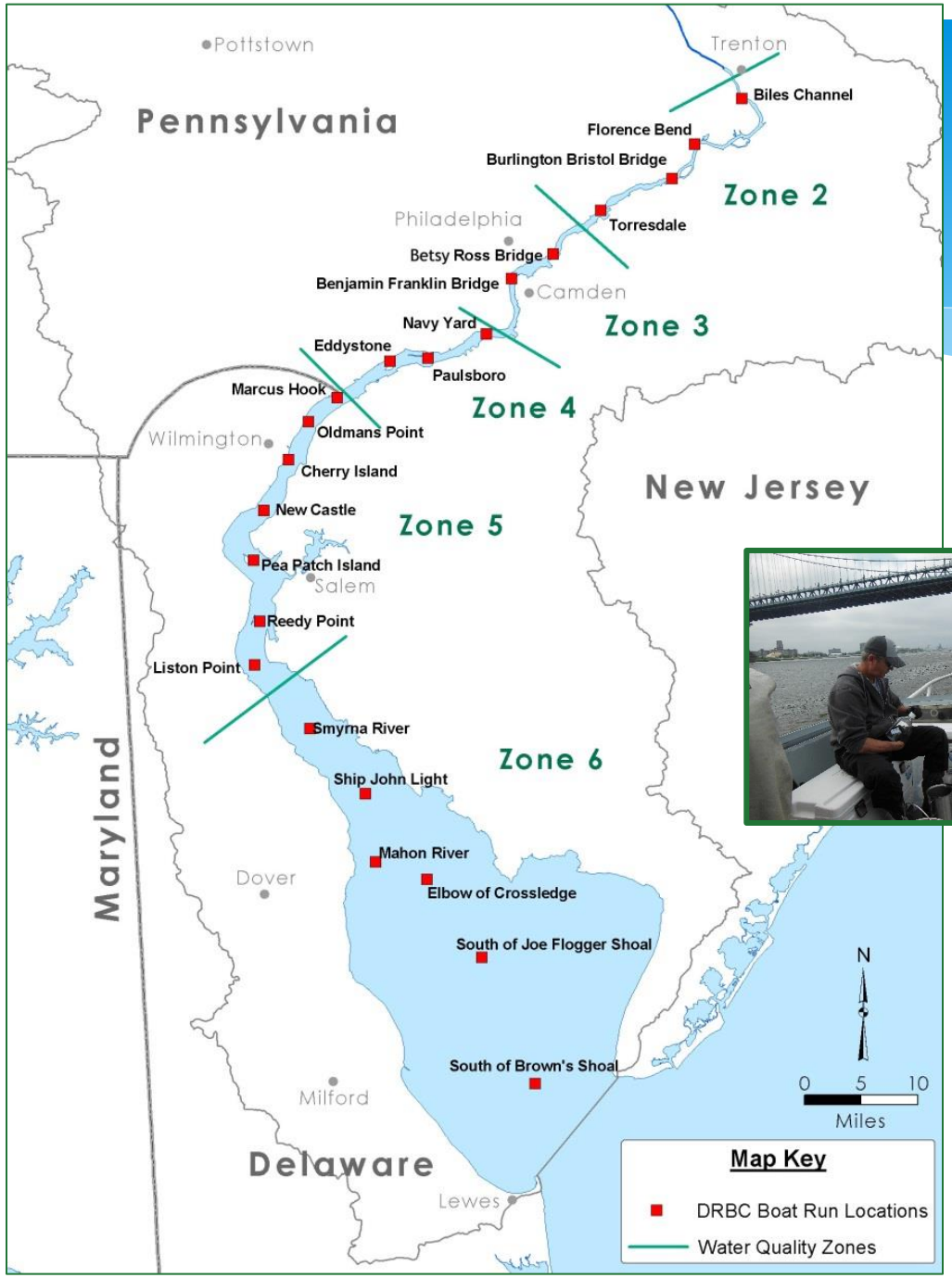
- Microbial source tracking to differentiate bacteria derived from humans, cows, horses, Canada geese, deer, and dogs
- 3 wet weather & 3 dry weather events
- 9 sites
- NJ Center for Water Science & Technology, Montclair State University
- Planned May start

Target	Primers/Probes	Sequence	Amplicon	Reference
Universal	AllBacF	GAGAGGAAGGTCCCCCAC	106	Layton et al. 2006
	AllBacR	CGCTACTTGGCTGGTTCAG		
	AllBacP	[6-FAM]-CCATTGACCAATATTCCTCACTGCTGCCT-[BHQ]		
Human	HF183	ATCATGAGTTCACATGTCCG	126	USEPA Method 1696
	BacR287	CTTCCTCTCAGAACCCCTATCC		
	BacP234MGB	[6-FAM]- CTAATGGAACGCATCCC – [MGB]		
Cow	CF128F	CCAACYTTCCCGWTACTC	177	Kildare et al. 2007
	BacCow-305R	GGACCGTGTCTCAGTTCCAGTG		
	BacCow-257P	[6-FAM]-TAGGGGTTCTGAGAGGAAGGTCCCCC-[BHQ]		
Horse	Hof597F	CCAGCCGTAAAATAGTCGG	129	Dick et al.2005
	Bac708R	CAATCGGAGTTCTTCGTG		
Canada goose	CanadaGooseFor	CTAACATCCAAATCCCTCGACCCA	77	Caldwell and Levine, 2009
	CanadaGooseRev	TCCTATTCAGCCTCCTAGTGCTCT		
	CanadaGoosePro	[6-FAM]-TACTCACCGCCATAGCCCTAGCCT-[BHQ]		
Deer	Deer Forward	TAACCCGATTCTTCGCCTTCCTC	122	Caldwell and Levine, 2009
	Deer Reverse	GTCTGCGTCTGATGGAATTCCTGAT		
	DeerProbe	[6-FAM]-CCTCCCATTTATCATCGCAGCACTTGCT-[BHQ]		
Dog	BacCanF	GGAGCGCAGACGGGTTTT	145	Kildare et al. 2007
	BacUni690R	CAATCGGAGTTCTTCGTGATATCTA		
	BacUni656P	[6-FAM]-TGGTGTAGCGGTGAAA-[BHQ]		

Delaware Estuary Water Quality Monitoring (Boat Run)



- Since mid-1960's
- 22 Sites, once per month
- Parameter Groups
  - Dissolved Oxygen, pH, temperature, specific conductance, turbidity, secchi depth, PAR
  - Nutrients (ammonia, nitrate + nitrite, phosphorus)
  - Sodium, chloride, Chlorophyll a
  - Bacteria
  - Metals
  - 1,4-dioxane

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10384304.hobo

STANDARD OPERATING PROCEDURE FOR SOLID PHASE ADSORPTION TOXIN TESTING (SPATT) ASSEMBLAGE AND EXTRACTION OF HAB TOXINS

August 2018

SCCWRP Established 1969

Kudela Lab Biological Oceanography

CARON LAB Protistan Aquatic Microbial Ecology

Cyanotoxin Monitoring Late summer 2022

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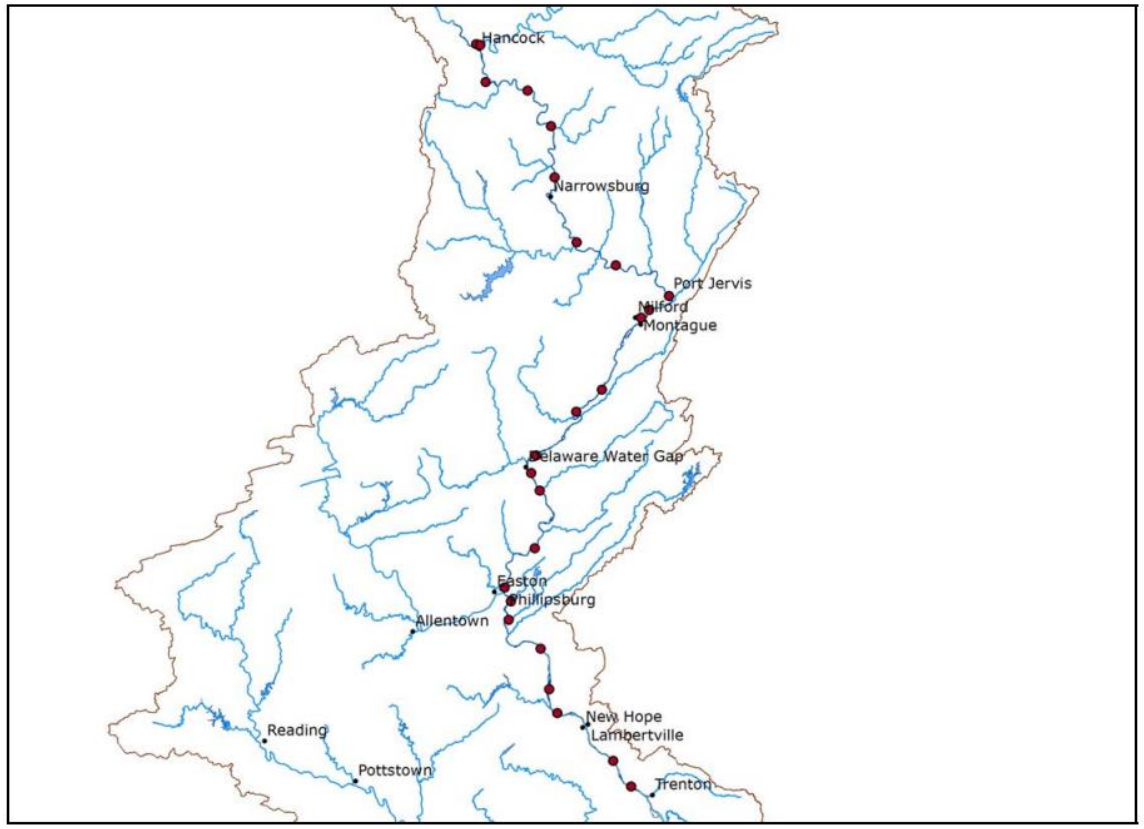
- Anatoxin
- Microcystins
- Cylindrospermopsin

- Extraction followed by immunoassay
- DNREC lab

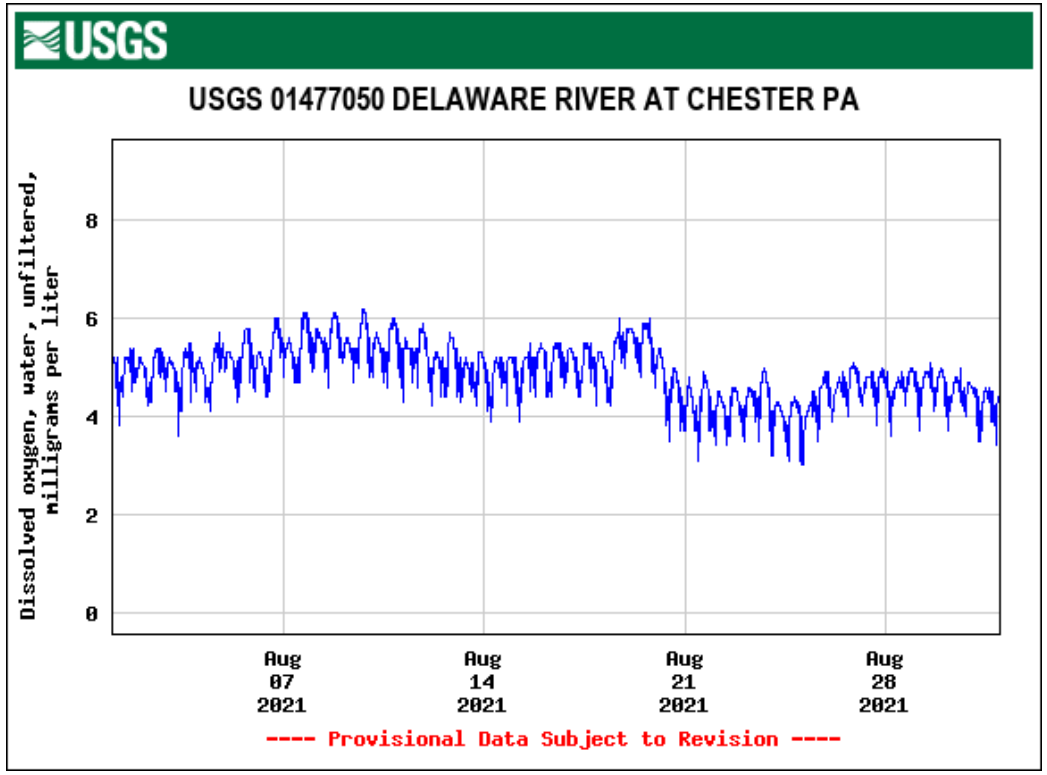
- 15 deployment sites in flowing mainstem Delaware River
- 3 rounds
- Early planning stages - Still refining the scope

Biological Monitoring



- 25 Stations from Trenton to Hancock
- August and September Index Period
- High Flows Interrupted Sampling

Dissolved Oxygen Monitoring



- Current USGS logger at Chester is several miles upstream of important sturgeon nursery grounds
- Collect enhanced spatial resolution DO data in portion of the estuary important to young-of-year Atlantic sturgeon
- Deploy several top/bottom DO loggers at multiple locations
- Target low DO time of year (July-September)

Canopy Shading Study

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Non-tidal Chloride Monitoring

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Lower Delaware River SPW Assessment of Measurable Changes to Existing Water Quality

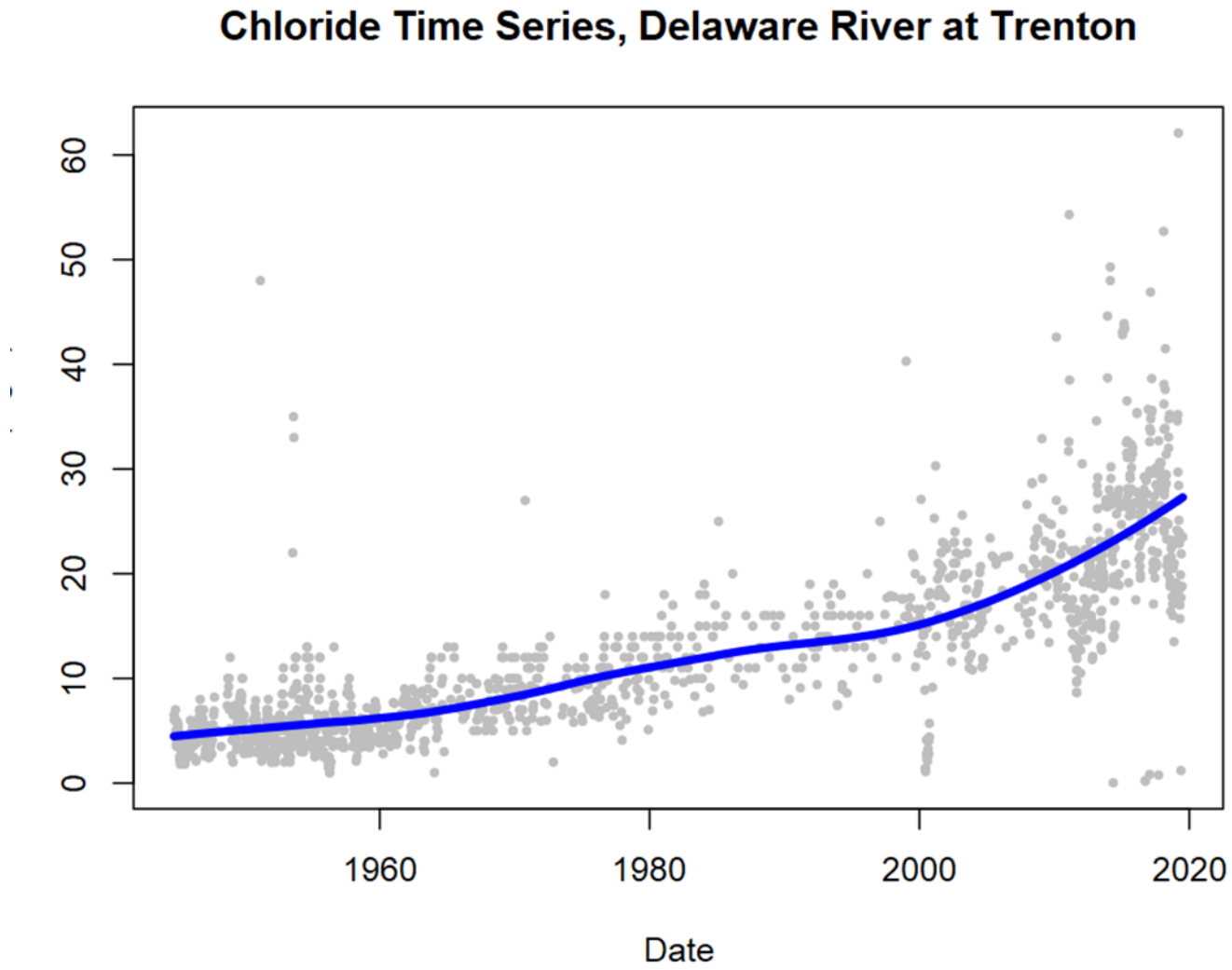
Summary Matrix of Water Quality Changes at Lower Delaware Control Points: 2000-2004 Baseline vs. 2009-2011 Assessment Round 1

Site Color Key: Dark Blue = Interstate Control Point (ICP); Dark Red = Pennsylvania Tributary Boundary Control Point (BCP); Dark Green = New Jersey Tributary Boundary Control Point (BCP)

	Parameter / Site--->	Del. River at Trenton	Del. River at Washngtn Crossing	Pidcock Creek, PA	Delaware River at Lambrtville	Wicke-cheoke Creek, NJ	Lockatong Creek, NJ	Delaware River at Bulls Island	Pauna-cussing Creek, PA	Tohickon Creek, PA	Tinicum Creek, PA	Nishi-sakawick Creek, NJ	Del. River at Milford	Cooks Creek, PA	Musco-netcong River, NJ	Del. River at Rieglsvll	Pohat-cong Creek, NJ	Lehigh River, PA	Del. River at Easton	Bushkill Creek, PA	Martins Creek, PA	Pequest River, NJ	Del. River at Belvidere	Paulins Kill River, NJ	Del. River at Portland
	Site Number--->	1343 ICP	1418 ICP	1463 BCP	1487 ICP	1525 BCP	1540 BCP	1554 ICP	1556 BCP	1570 BCP	1616 BCP	1641 BCP	1677 ICP	1737 BCP	1746 BCP	1748 ICP	1774 BCP	1837 BCP	1838 ICP	1841 BCP	1907 BCP	1978 BCP	1978 ICP	2070 BCP	2074 ICP
Field	Dissolved Oxygen (DO) mg/l											~													
	Dissolved Oxygen Saturation %											~													
	pH, units																								
	Water Temperature, degrees C																								
Nutrients	Ammonia Nitrogen as N, Total mg/l																								
	Nitrate + Nitrite as N, Total mg/l																**								
	Nitrogen as N, Total (TN) mg/l																**								
	Nitrogen, Kjeldahl, Total (TKN) mg/l																								
	Orthophosphate as P, Total mg/l																								
	Phosphorus as P, Total (TP) mg/l																								
Bacteria	Enterococcus colonies/100 ml	~			~																				
	Escherichia coli colonies/100 ml	**	**	**	**	**	**			**	**	**													
	Fecal coliform colonies/100 ml																								
Conventionals	Alkalinity as CaCO3, Total mg/l																								
	Hardness as CaCO3, Total mg/l											~													
	Chloride, Total mg/l			**		**	**	**	**	**		**	**	**	**	**	**	**	~	**	**	**	**		**
	Specific Conductance µmho/cm			**		**	**	~	**	**	**	**	**	**	**	~	**	**	~	~	~	**	~		
	Total Dissolved Solids (TDS) mg/l																								
	Total Suspended Solids (TSS) mg/l																								
	Turbidity NTU																								

KEY: = No indication of measurable change to EWQ; ** = Indication of measurable water quality change toward more degraded status; ~ = Weak indication of measurable water quality change toward more degraded status

Chloride data trend for Delaware at Trenton



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Freshwater Salinization Syndrome

- **Many recent articles & more public awareness**
- **Complex interactions & "chemical cocktails"**

Road salts and freshwater salinization syndrome

S. Himmelstein | April 26, 2021

The application of deicing salt reduces the potential for weather-related travel accidents on roads and walkways during winter but increases the potential for freshwater quality degradation as these chemicals are washed into waterways. Researchers from the University of Maryland and University of Connecticut have labeled the cascading effects of introduced salts Freshwater Salinization Syndrome (FSS), which exerts detrimental impacts on drinking water quality, human health, agriculture, infrastructure and wildlife.

LETTER • OPEN ACCESS

Trends and legacy of freshwater salinization: untangling over 50 years of stream chloride monitoring

Bhaswati Mazumder[3,1], Christopher Wellen[1], Georgina Kaltenecker[2], Ryan J Sorichetti[2] and Claire J Oswald[3,1]

Published 12 August 2021 • © 2021 The Author(s). Published by IOP Publishing Ltd

Open Access | Published: 12 April 2021

Freshwater salinization syndrome: from emerging global problem to managing risks

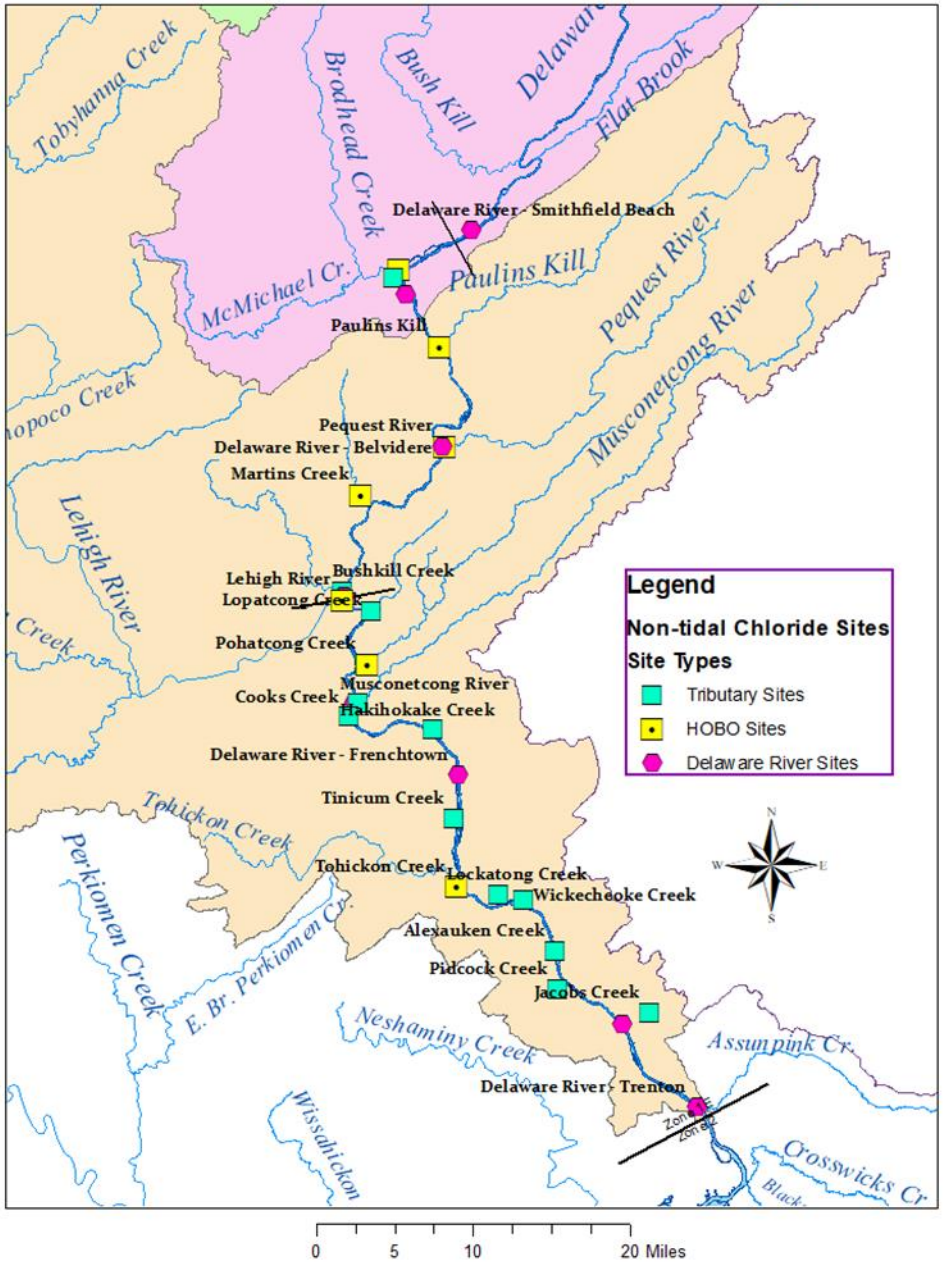
Sujay S. Kaushal, Gene E. Likens, ... Seyram A. Woglo + Show authors

Biogeochemistry **154**, 255–292 (2021) | Cite this article

Links (top to bottom):

- https://insights.globalspec.com/article/16424/road-salts-and-freshwater-salinization-syndrome
- https://iopscience.iop.org/article/10.1088/1748-9326/ac1817
- https://link.springer.com/article/10.1007/s10533-021-00784-w

Non-tidal Chloride Monitoring Sites



Non-tidal Chloride Monitoring Program 2021

- 27 sites (19 tributaries & 8 mainstem Delaware River)
- Once per month monitoring
- Twice per month continuous conductivity logger maintenance
- Chloride is a good tracer as it is conservative in the environment

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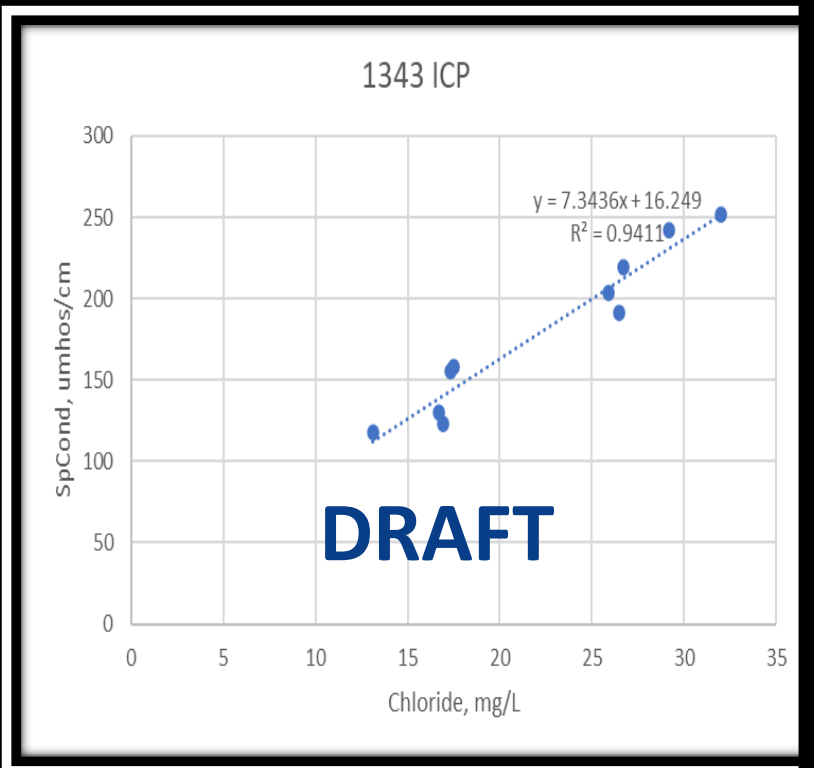
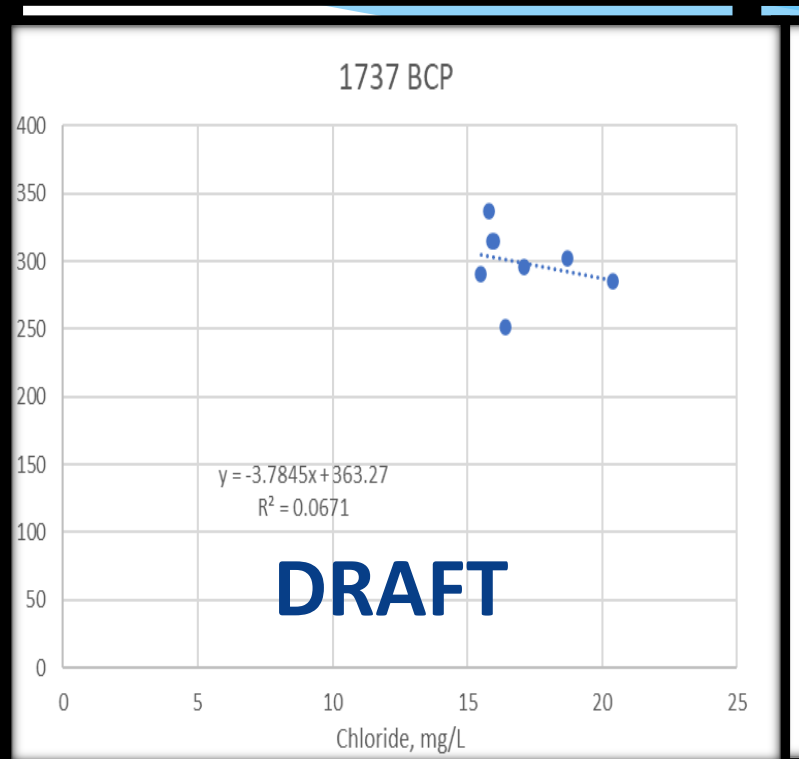
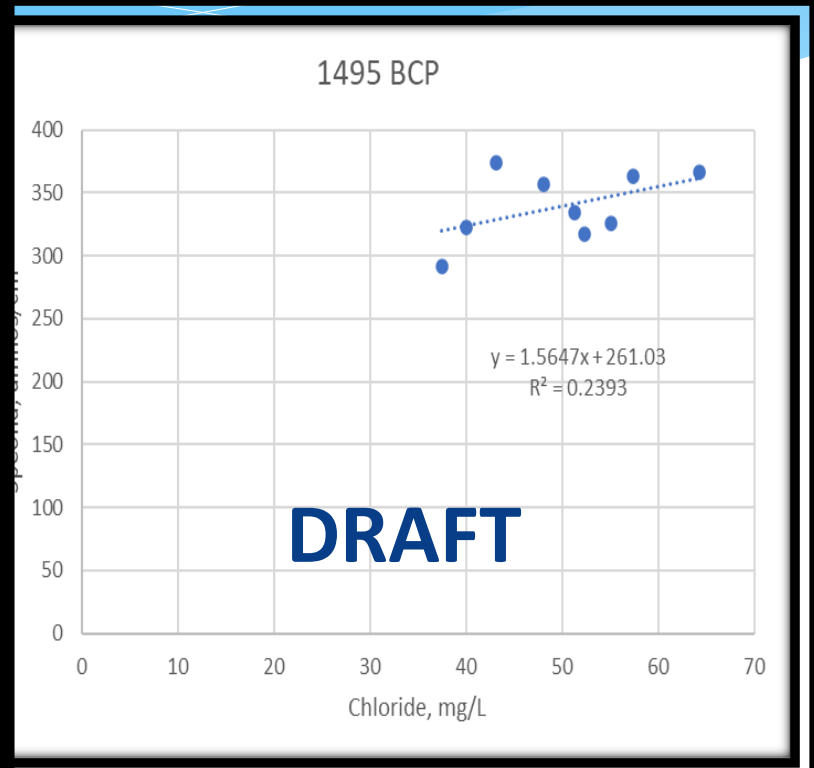
Continuous Conductivity Loggers

- Deployed continuous conductivity loggers in 7 tributaries (Brodhead Creek, Paulins Kill, Pequest River, Martins Creek, Lehigh River, Pohatcong Creek, and Tohickon Creek)
- Continuous deployment since April 2021
- Lost 1 logger at Paulins Kill during flood events (hurricanes in early September 2021); deployed a new logger in December 2021
- Another logger stopped working at Brodhead Creek and was serviced by manufacturer and deployed in December 2021
- In March 2022, the cable tethering the logger apparatus to a tree was snapped in Martins Creek and is currently lost

Chloride Results May 2021 – March 2022







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Non-tidal Chloride Monitoring in 2022

- **Starting this week, monitoring for expanded parameter list**
- **Added:**
  - **Nitrate, calcium, magnesium, sodium, potassium, sulfate, total silica, total alkalinity, total suspended solids, and total phosphorus**
- **Will utilize collected data to characterize ionic compositions on a site-specific basis**

Future Work

- Chloride/Freshwater Salinization monitoring workgroup (received feedback from interested parties in March)
- Assess relationships of various ions to conductivity in streams and mainstem river
  - Characterize ionic compositions
- Chloride mass-balance model of SPW mainstem and tributaries
- Identify sites that indicate evidence of improvements and/or degradation
  - Trackdown areas of concern

Chloride/Freshwater Salinization Workgroup

- Received feedback from 6 individuals (from different agencies/organizations)
  - These folks (and myself) will be the core members of the workgroup
- Currently seeking out other interested parties to join future meetings/calls (please email Elaine.Panuccio@drbc.gov) .
- Following this joint meeting, an email will be sent to the 6 core members to initiate a first meeting (virtual).
- Goal: Increasing chlorides and salinization are a nationwide problem and individual agencies, and organizations, operate mostly standalone monitoring programs to approach the issue(s). A more collaborative approach, in addition to a space for knowledge and information sharing, will be beneficial to the overall goal of understanding the effects and mitigating increasing trends.
- Note: individuals who are outside of the Basin and interested in joining may do so!

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Joint meeting of the Science and Technical Advisory Committee (STAC) and Monitoring Advisory and Coordination Committee (MACC)

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Delaware River PFAS Monitoring

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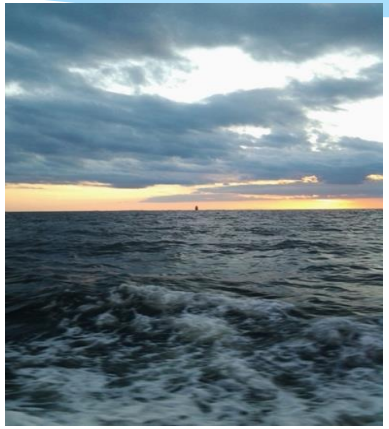

Why are PFAS of Concern?

Occurrence, Persistence, Bioaccumulation and Toxicity (Legacy and Novel PFAS)

What are the risks to source water, fish consumption, maintenance and propagation of fish, other aquatic life, and aquatic dependent wildlife?

Effects on Human Health

Association with liver damage, increased cholesterol, thyroid disease, decreased response to vaccines, asthma, decreased fertility and birth weight, pregnancy–induced hypertension

Effects on Aquatic Life

Impaired survival, growth, and reproduction, other sublethal affects observed.

Direct exposure (water column)

Indirect exposure (bioconcentrated by producers and bioaccumulated by consumers in higher trophic levels)

Delaware River Sampling Sites and Years

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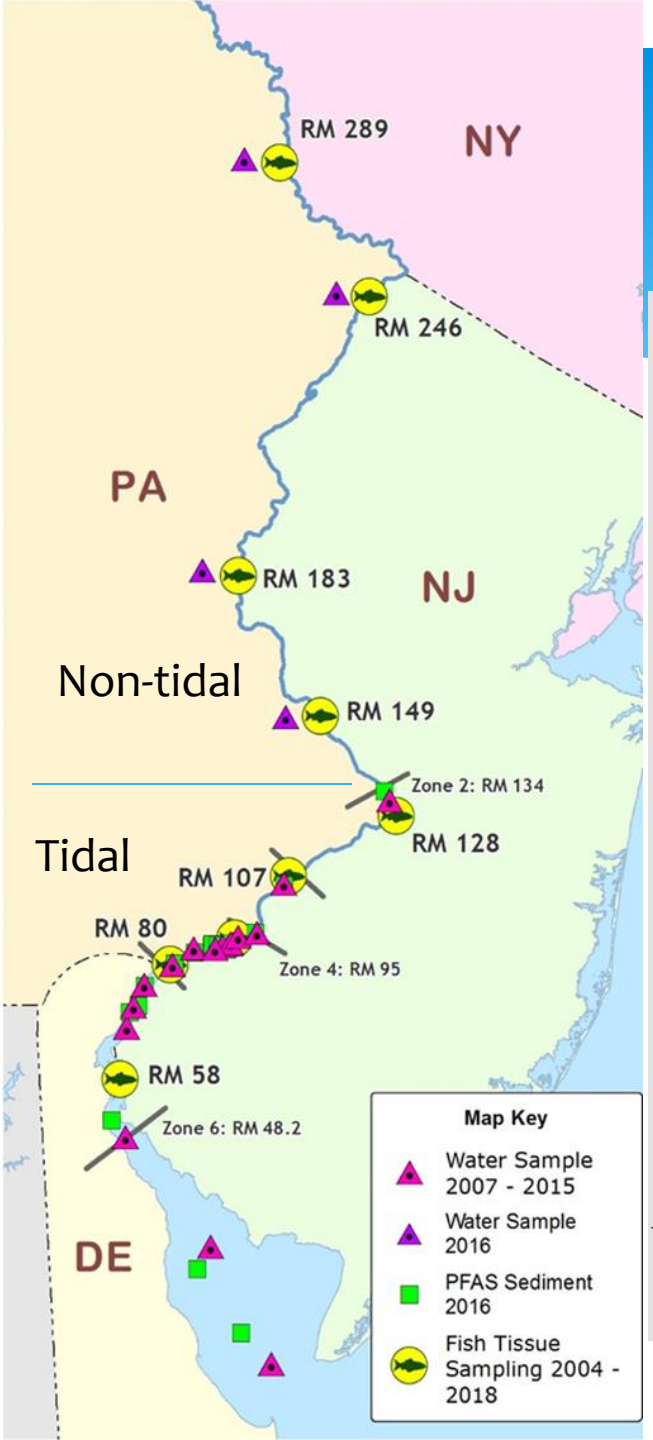

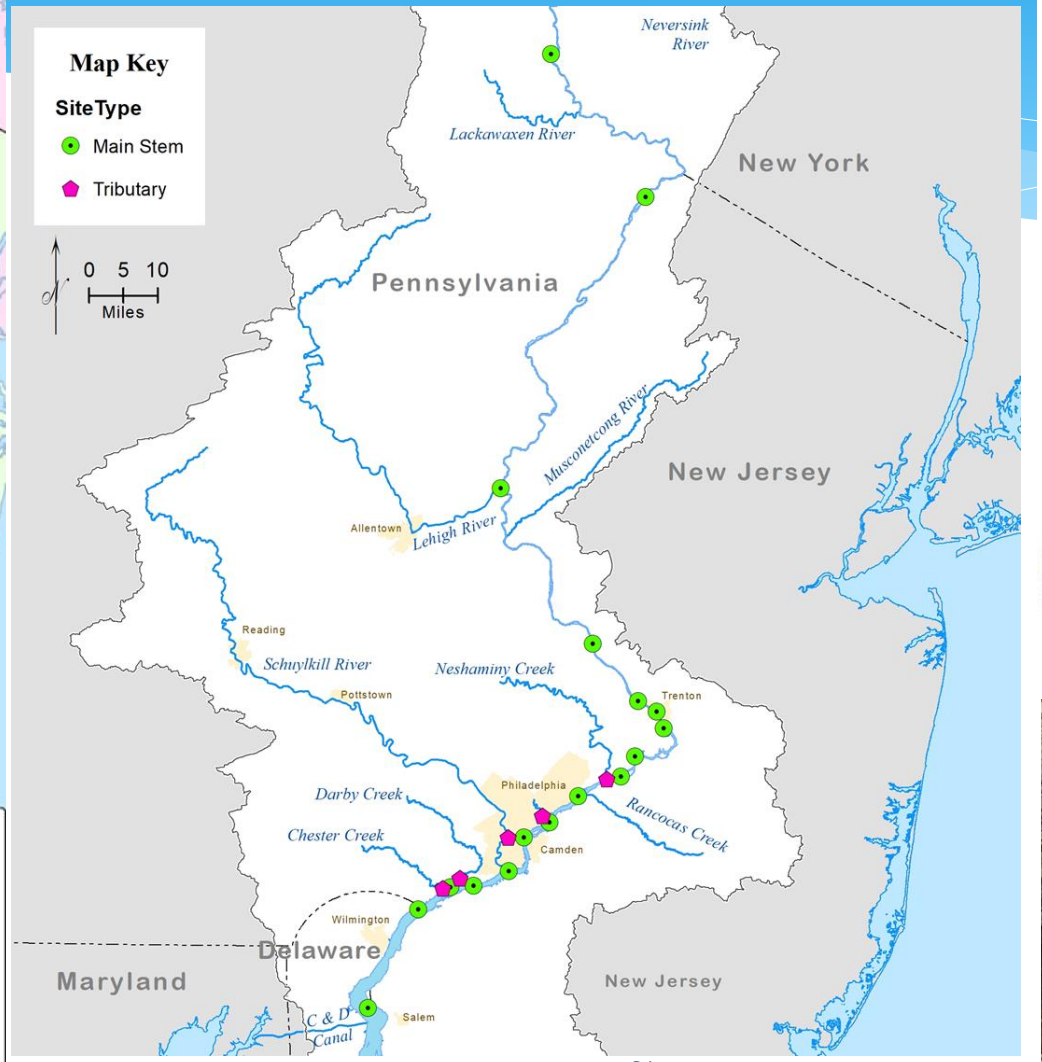

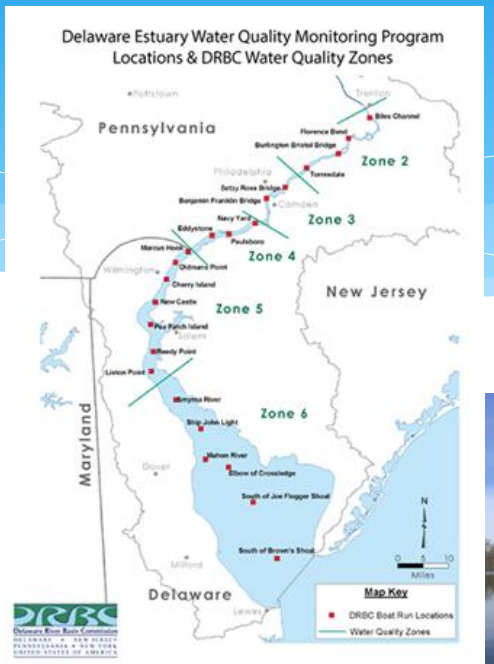

April & Sept '21 & '22

2021 sampling sites with a subset to be collected in 2022