

Abstract

The University of Wisconsin Oshkosh's Environmental Research and Innovation Center (ERIC) organizes a private well groundwater monitoring program in Door County every Fall and Spring since 2019. The goal is to provide education about the importance of routinely testing well water quality and build a long-term database of groundwater quality. Multiple public health parameters are tested including Coliform bacteria, *E.coli*, nitrate, arsenic as well as water quality preferences including pH, iron, hardness, and alkalinity.

Introduction

Door County (DC), WI has a unique relationship with Wisconsin's water resources in terms of both surface water and its beaches and the groundwater that supplies vital water to businesses, residents, and visitors. DC's groundwater is very susceptible to contamination from numerous sources due to the Karst geology beneath it. Local policy makers business owners, residents, and the 2.5 million visitors rely on this water resource to help drive a vibrant economy. Because most water wells are not required to be tested there can be large gaps in knowledge that would hinder local policy making. Basic parameters such as coliform/*E.coli* bacteria, nitrate, and arsenic are used as a gauge of groundwater quality for all public facilities in the State of Wisconsin. The wider application of sampling and groundwater data can shed light on current condition and future trends. The overall objective of this partnership is to collect long-term water quality data to help inform water users and policy makers.

Table 1: Thresholds set for public health by the Safe Water Drinking Act

Parameter	Maximum Contaminant Level (MCL)	"Unsafe" Levels*
Total Coliform	0 MPN/100 mL	> 0 MPN/100 mL
<i>E. coli</i>	0 MPN/100 mL	> 0 MPN/100 mL
Nitrate	10 mg/L	> 10 mg/L
Arsenic	10 µg/L	> 10 µg/L

* "Unsafe" Levels refers to samples that exceed the MCL

Methods

Each Fall and Spring Door County residents are encouraged to participate in the Door County Well Monitoring Program through the UWO ERIC Lab. Outreach is done through mail, email, and word of mouth for registration. Each season, drop off dates and locations are provided throughout the county from Washington Island to Sturgeon Bay. Samples are brought back to the UWO ERIC Lab where students and staff follow certified methods to analyze samples. Results are reported to individual participants and summarized at a public forum the following month.

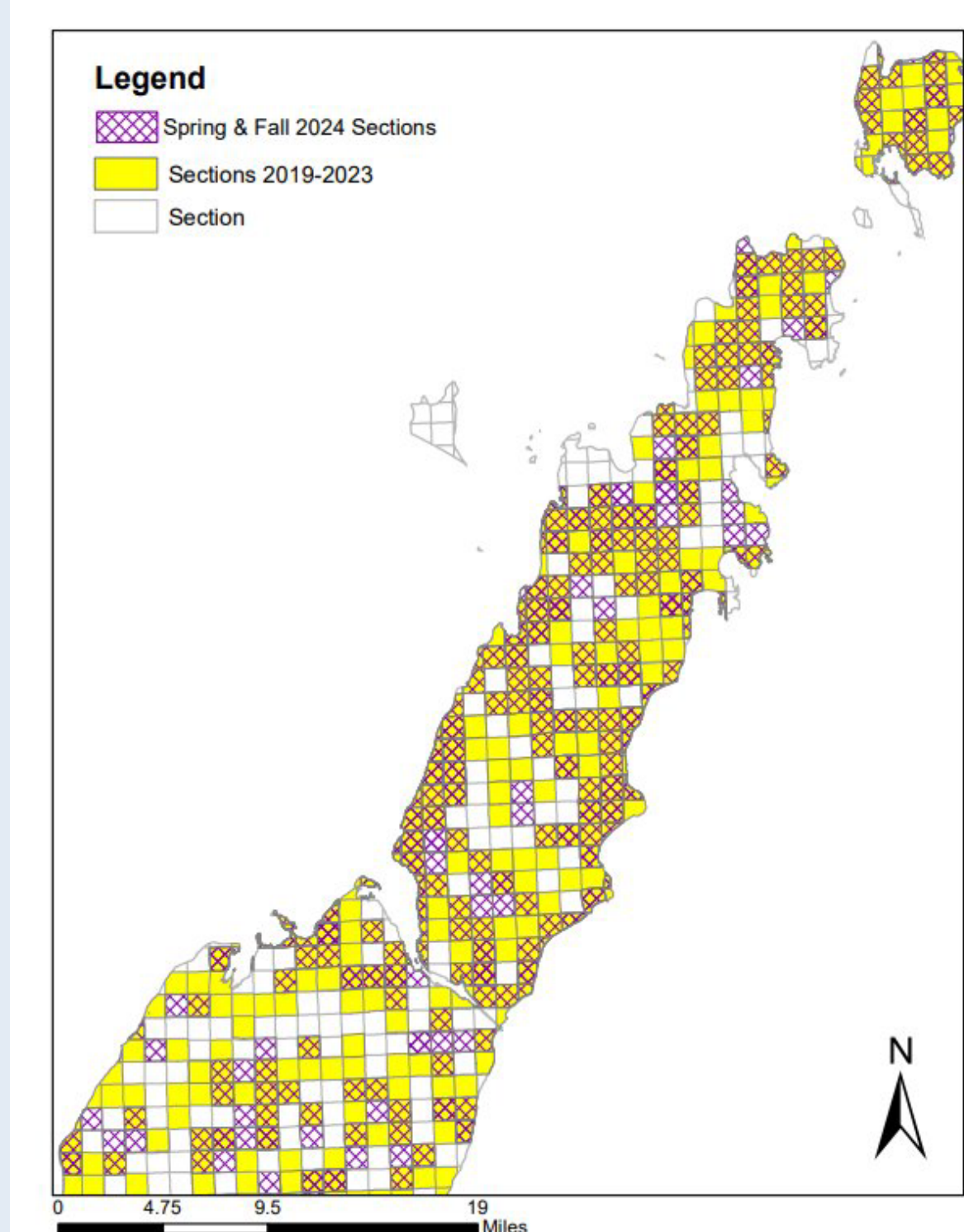


Figure 1: 2019-2024 participating parcels

Results

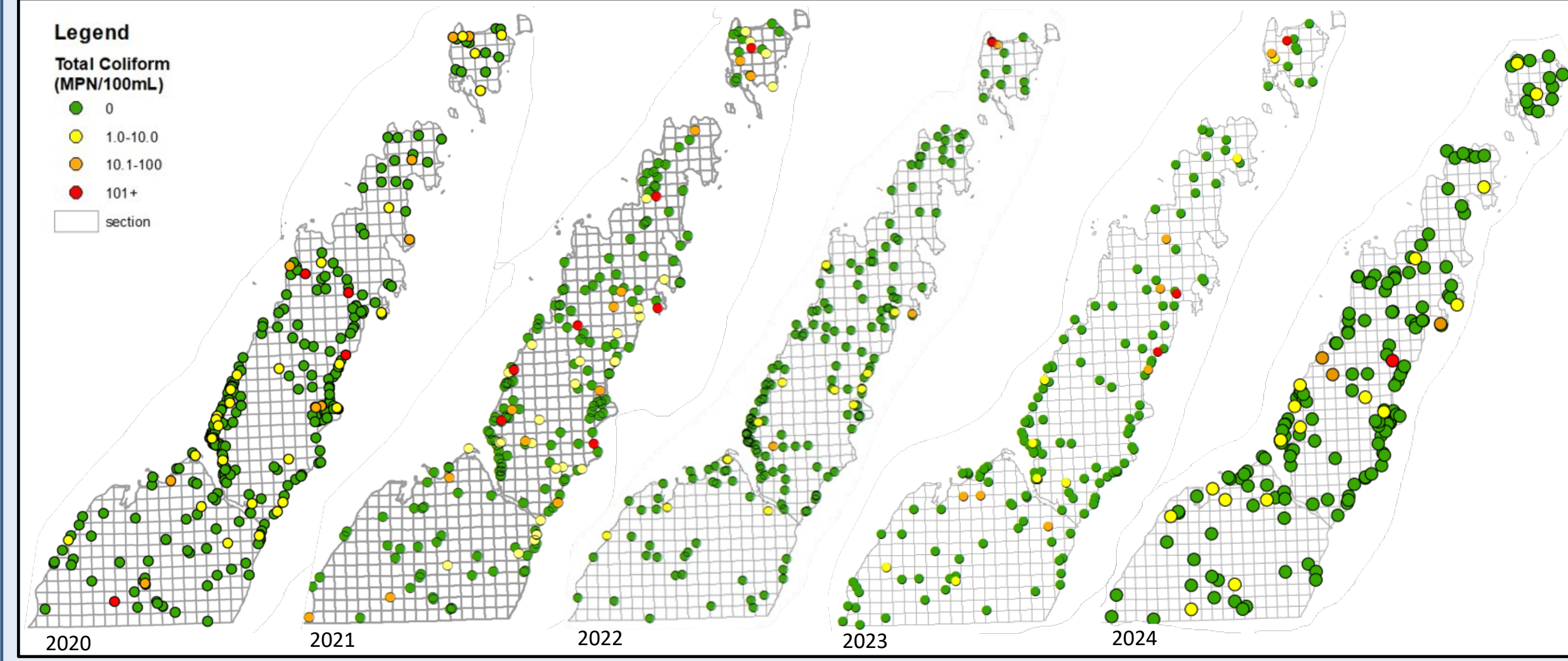


Figure 2: Coliform bacteria results mapped from 2020-2024 in Door County

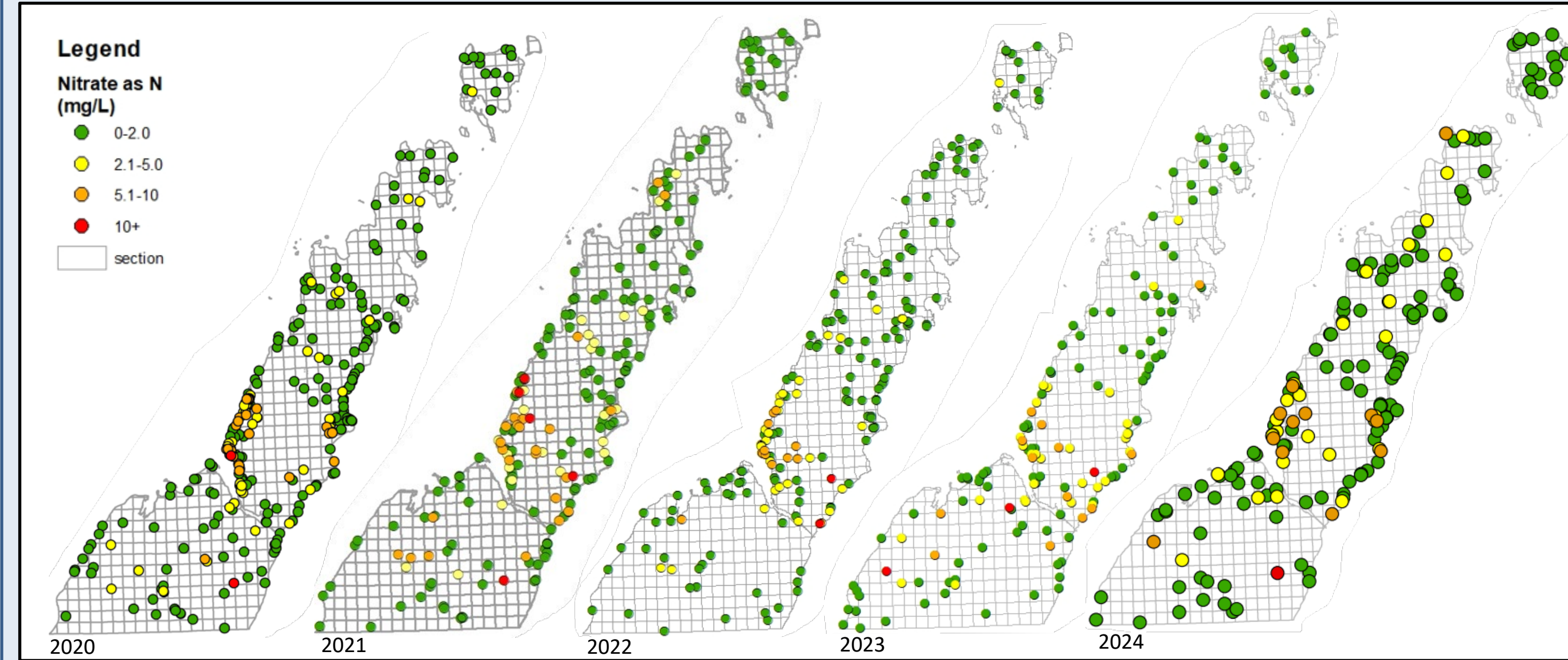


Figure 3: Nitrate results mapped from 2020-2024 in Door County

Table 2: County-wide mean nitrate levels

Sampling Season	Mean Nitrate Level (mg/L)	Number of Samples
Fall 2019	1.70	n = 145
Fall 2020	1.67	n = 288
Fall 2021	1.68	n = 211
Spring 2022	1.06	n = 256
Fall 2022	1.60	n = 194
Spring 2023	1.52	n = 193
Fall 2023	1.60	n = 157
Spring 2024	1.65	n = 217

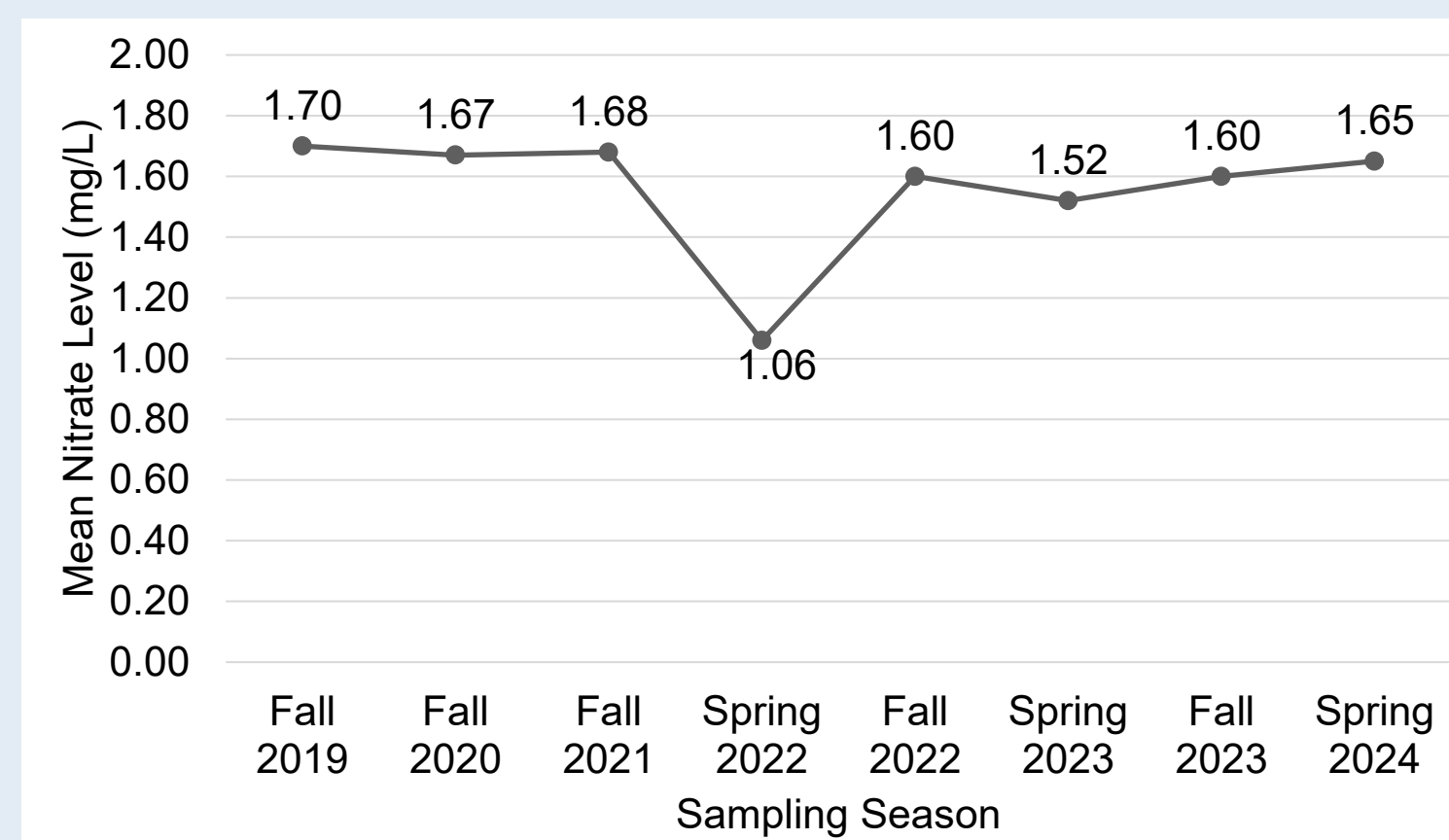


Figure 4: County-wide mean nitrate levels 2019-2024

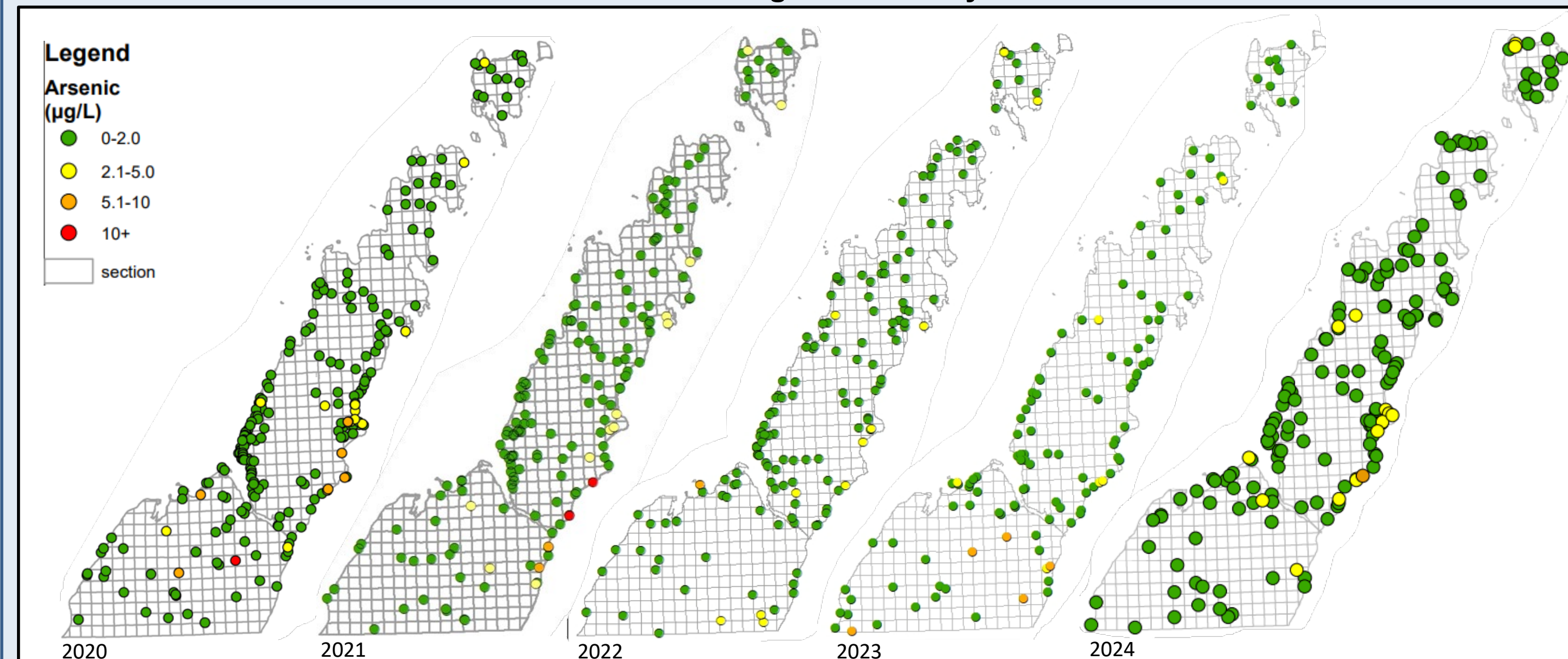


Figure 5: Arsenic results mapped from 2020-2024 in Door County

Table 3: County-wide coliforms results

Year Sampled	Coliforms Results	
	# of Positive Results*	% Samples
2019 (n=148)	23	16
2020 (n=295)	41	14
2021 (n=217)	51	24
2022 (n=456)	41	9
2023 (n=367)	62	17
2024 (n=406)	29	7

*Coliform results >1 MPN/100 mL

Table 4: County-wide *E. coli* results

Year Sampled	<i>E. coli</i> Results	
	# of Positive Results*	% Samples
2019 (n=148)	0	0
2020 (n=295)	2	0.7
2021 (n=217)	4	1.8
2022 (n=456)	2	0.4
2023 (n=367)	3	0.8
2024 (n=406)	2	0.5

**E. coli* results >1 MPN/100 mL

Table 5: County-wide nitrate results

Year Sampled	Nitrate Results			
	# of Results > 10 mg/L	% Samples	# of Results 5-10 mg/L	% Samples
2019 (n=146)	3	1.3	16	11
2020 (n=288)	2	0.7	34	12
2021 (n=210)	5	2.4	25	12
2022 (n=450)	2	0.4	25	6
2023 (n=350)	8	2.3	23	7
2024 (n=399)	1	0.3	29	8

Table 6: County-wide arsenic results

Year Sampled	Arsenic Results			
	# of Results > 10 µg/L	% Samples	# of Results 5-10 µg/L	% Samples
2019 (n=71)	0	0.0	0	0
2020 (n=237)	1	0.4	7	3
2021 (n=168)	2	1.2	2	1
2022 (n=366)	1	0.3	4	1
2023 (n=261)	1	0.4	5	2
2024 (n=314)	0	0.0	5	2

Future Plans

- Continuation the long-term data collection (annual program)
- Conduct a septic tracer study to identify well water connection to human wastes discharged from septic systems.
- Continue to recruit participants so at least one well per section (square mile) of Door County participates in this program.

Acknowledgements

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Environmental Research and Information Center Contact Information

Website: <https://www.uwosh.edu/eric/>
 Email: eric@uwosh.edu
 Phone: 920-424-3148
 Greg Kleinheinz (Lab Director)
 – Email: kleinhei@uwosh.edu
 Jackie Behrens (Associate Lab Director)
 – Email: behrensj@uwosh.edu
 Brittany Dupree (Laboratory Manager)
 – Email: dupreeb@uwosh.edu