BACK RIVER PROJECT

B2GOLD NUNAVUT – AEMP UPDATE COMMENT RESPONSES DOCUMENT-ROUND 2_CIRNAC-R-01

DATE
[13 June 2025]

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ACRONYMS AND ABBREVIATIONS

B2Gold	B2Gold Back River Corp.
NU	Nunavut

1. B2GOLD RESPONSES TO ROUND 2 REVIEWER COMMENTS ON THE AQUATIC EFFECTS MANAGEMENT PLAN

1.1 CROWN-INDIGENOUS RELATIONS AND NORTHERN AFFAIRS CANADA

1.1.1 ROUND 2_CIRNAC-R-01

Review Comment Number	Round 2_CIRNAC-R-01
Subject/Topic	Removal of Stream Sampling Locations
References	B2Gold Nunavut Back River Project AEMP Update Comment Responses Document (21 May 2025)
Comment	CIRNAC requested that B2Gold Nunavut conduct a comparative analysis to assess the representativeness of lake and stream water quality data, including the provision of graphical representations and statistical comparisons, to determine whether continued stream monitoring is warranted. B2Gold Nunavut provided two aggregate plots showing field-specific conductivity and total dissolved solid concentrations in Goose Lake Central Basin, Goose Lake Tail, and Goose Lake Outlet from 2011 to 2023. B2Gold Nunavut concluded that water quality is similar between the lake and streams during the open-water season. CIRNAC is of the view that B2Gold Nunavut has not sufficiently addressed its original comment or demonstrated that water quality is comparable between lake and streams for the following reasons: 1. Statistical Analysis B2Gold Nunavut did not address CIRNAC's request to conduct a statistical analysis comparing lake and stream water quality parameters. CIRNAC notes that there is a lack of quantitative evidence that supports the conclusion provided by B2Gold Nunavut to discontinue stream sampling. CIRNAC also notes that relying on qualitative descriptions is not sufficient. 2. Representativeness of Water Quality Parameters It is unclear to CIRNAC how other water quality parameters compare between lake and stream water (e.g., metals, turbidity). CIRNAC is of the view that a comprehensive analysis of other water quality parameters is necessary to understand any variability that exists between lake and stream water quality. 3. Data Presentation CIRNAC notes that presenting pooled monitoring data in this manner does not

	provide a clear indication of the temporal variability between lake and stream water, particularly for any paired sampling during the same year.
Recommendation	(R-01) CIRNAC recommends that B2Gold Nunavut: • Conduct a statistical analysis on water quality data between lake and stream water; • Assess the representativeness of other water quality parameters in lake and stream water; and • Provide graphical representations that demonstrate paired sampling for lake and stream water events during the same year.
B2Gold Nunavut Response	Statistical analysis and plots of paired chemistry data for lake and stream samples collected during the same year show that water quality is similar and supports the rationale for removing stream monitoring from the AEMP. Further discussion is provided below. 1. Conduct a statistical analysis on water quality data between lake and stream water: Paired t-tests were carried out on water quality data to assess whether concentrations differed between the Goose Lake Central Basin (lake) and Goose Lake outlet (stream) when samples were collected concurrently (i.e., sampled in the same month). Parameters were excluded from analyses if concentrations were generally below the detection limit (i.e., 80% of paired data were below the detection limit) or when fewer than five paired samples were available from the baseline dataset. There were no statistically significant differences between concentrations measured in the lake and the stream for most parameters (i.e., 79 out of 86 parameters analyzed; Table CIRNAC-R-01-1). Plots are presented for each parameter in Appendix A. Seven parameters had concentrations at the outlet that differed significantly from those in the lake. Each is discussed below: • For total nickel and dissolved barium, copper, and nickel, there was less than a 20% relative percent difference between stream and lake mean concentrations[1], which is within the range of variability between field duplicates[2]. In addition, the concentration in the stream sample was often within the variability among lake samples/replicates (i.e., 2018, 2023, and 2024[3]) and dissolved copper concentrations in 2011 and 2012 were within five times the detection limit for those years (i.e., 0.5 µg/L).

[1] Relative percent difference was calculated as the absolute difference of stream and lake means, divided by the stream and lake mean average.

[2] For example, a difference of 20% between field duplicates is generally considered acceptable.

[3] When sampled, one water sample was collected from the Goose Lake outlet at each sampling event. From 2018 onwards, three to five samples were collected from Goose Lake Central Basin (i.e., one sample from three to five stations).

	• Total and dissolved iron concentrations were generally consistently greater in stream samples compared to those in the lake. In 2023, there was high variability in total and dissolved iron concentrations among lake stations within the Goose Lake Central Basin sampling area. Concentrations were within the range measured in other sampling events, which suggests that total and dissolved iron concentrations may vary naturally in these surface waters. • Total manganese and dissolved cobalt concentrations were generally greater in stream samples compared to those in the lake. However, in 2024, the concentration in the stream sample was within the variability among lake samples/replicates, which suggests that total manganese and dissolved cobalt concentrations may vary naturally in these surface waters, especially in streams. Overall, most parameters did not suggest that concentrations differed between the lake and stream samples. Of the few parameters that differed significantly, most had some concentrations similar or within the variability observed among lake samples collected from replicate stations within the sampling area. Differences between lake and stream data for these parameters may represent natural variability during the baseline period; this variability may not have been adequately quantified using the single replicate samples collected in the stream. 2. Assess the representativeness of other water quality parameters in lake and stream water: A comprehensive analysis of all water quality parameters was carried out in (1). 3. Provide graphical representations that demonstrate paired sampling for lake and stream water events during the same year: Appendix A provides temporal plots for paired lake and stream data collected between 2011 and 2024.

Table CIRNAC-R-01-1: **Statistical Results Comparing Parameter Concentrations in Paired Samples** in Goose Lake Central Basin (Lake) and Goose Lake Outlet (Stream), 2011 to 2024

Parameter	Unit	Stream Mean	Lake Mean	Number of Paired Samples	*P*-value	Relative Percent Difference (%)
Field pH	-	6.8	6.7	7	0.388	n/a
Field specific conductivity	µS/cm	43	40	7	0.435	n/a
Field temperature	°C	14	12	10	0.265	n/a
Field dissolved oxygen	mg/L	10	10	10	0.527	n/a
Lab pH	-	6.8	6.8	9	0.277	n/a
Lab specific conductivity	µS/cm	39	40	9	0.628	n/a
Hardness, as $CaCO_3$	mg/L	15	15	9	0.818	n/a
Total alkalinity, as $CaCO_3$	mg/L	4.7	4.5	10	0.055	n/a
Total dissolved solids	mg/L	29	28	8	0.195	n/a
Lab turbidity	NTU	0.47	0.46	7	0.838	n/a
Bicarbonate, as $CaCO_3$	mg/L	4.9	4.6	8	0.065	n/a
Calcium	mg/L	3.1	3.1	10	0.244	n/a
Chloride	mg/L	3.4	3.5	10	0.076	n/a
Fluoride	mg/L	0.028	0.025	5	0.225	n/a
Magnesium	mg/L	1.7	1.7	10	0.838	n/a
Potassium	mg/L	0.40	0.40	10	0.753	n/a
Sodium	mg/L	0.69	0.68	10	0.537	n/a
Sulphate	mg/L	6.6	6.5	10	0.702	n/a
Total Kjeldahl nitrogen	mg-N/L	0.23	0.20	8	0.087	n/a
Total phosphorus	mg-P/L	0.0042	0.0042	9	0.983	n/a
Dissolved phosphorus	mg-P/L	0.0022	0.0022	6	0.907	n/a
Total aluminum	µg/L	12	14	9	0.212	n/a
Total arsenic	µg/L	0.23	0.22	9	0.176	n/a
Total barium	µg/L	5.8	6.0	9	0.172	n/a
Total chromium	µg/L	0.094	0.088	7	0.692	n/a
Total cobalt	µg/L	0.29	0.15	6	0.052	n/a
Total copper	µg/L	1.3	1.3	9	0.610	n/a
Total iron	µg/L	97	33	9	0.006	98
Total lithium	µg/L	0.79	0.80	5	0.796	n/a
Total manganese	µg/L	7.7	3.1	9	0.035	84

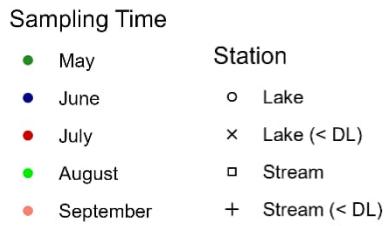
Parameter	Unit	Stream Mean	Lake Mean	Number of Paired Samples	*P*-value	Relative Percent Difference (%)
Total mercury	µg/L	0.00097	0.00098	5	0.924	n/a
Total nickel	µg/L	2.7	3.1	9	0.009	15
Total silicon	µg/L	191	165	9	0.302	n/a
Total strontium	µg/L	17	17	9	0.062	n/a
Total sulphur	µg/L	2,642	2,790	6	0.053	n/a
Total vanadium	µg/L	0.088	0.067	5	0.105	n/a
Dissolved aluminum	µg/L	6.2	8.9	9	0.127	n/a
Dissolved arsenic	µg/L	0.21	0.21	9	0.500	n/a
Dissolved barium	µg/L	5.5	6.0	9	0.025	8.7
Dissolved chromium	µg/L	0.066	0.076	5	0.651	n/a
Dissolved cobalt	µg/L	0.21	0.10	6	0.043	68
Dissolved copper	µg/L	1.1	1.2	9	0.049	4.6
Dissolved iron	µg/L	48	14	6	0.017	108
Dissolved lithium	µg/L	0.77	0.83	6	0.170	n/a
Dissolved manganese	µg/L	5.2	1.6	9	0.051	n/a
Dissolved nickel	µg/L	2.5	3.1	9	0.001	20
Dissolved silicon	µg/L	188	159	9	0.346	n/a
Dissolved strontium	µg/L	17	17	9	0.053	n/a
Dissolved sulphur	µg/L	2,852	2,835	6	0.786	n/a
Dissolved zinc	µg/L	0.76	1.0	5	0.300	n/a

Notes: Analyses were carried out for parameters that had five or more paired results and at least 80% of results were above the detection limit. Bolded *P*-values identify statistically significant results ($P<0.05$). Relative percent differences were calculated for statistically significant results as the absolute difference of stream and lake means, divided by the stream and lake mean average.

n/a = not applicable; *P* = probability.

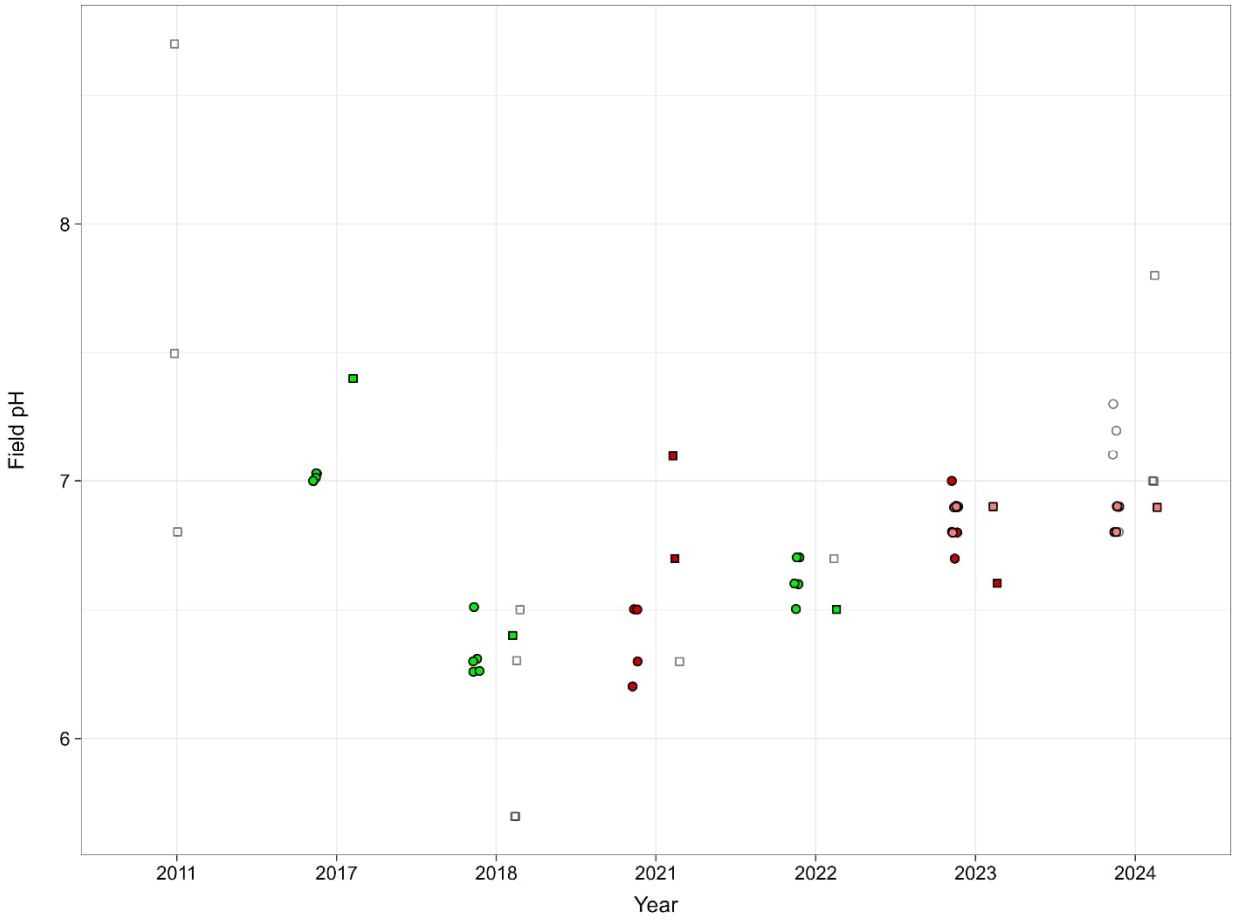
APPENDIX A TEMPORAL PLOTS FOR PARAMETER CONCENTRATIONS IN GOOSE LAKE CENTRAL BASIN (LAKE) AND GOOSE LAKE OUTLET (STREAM), 2011 TO 2024

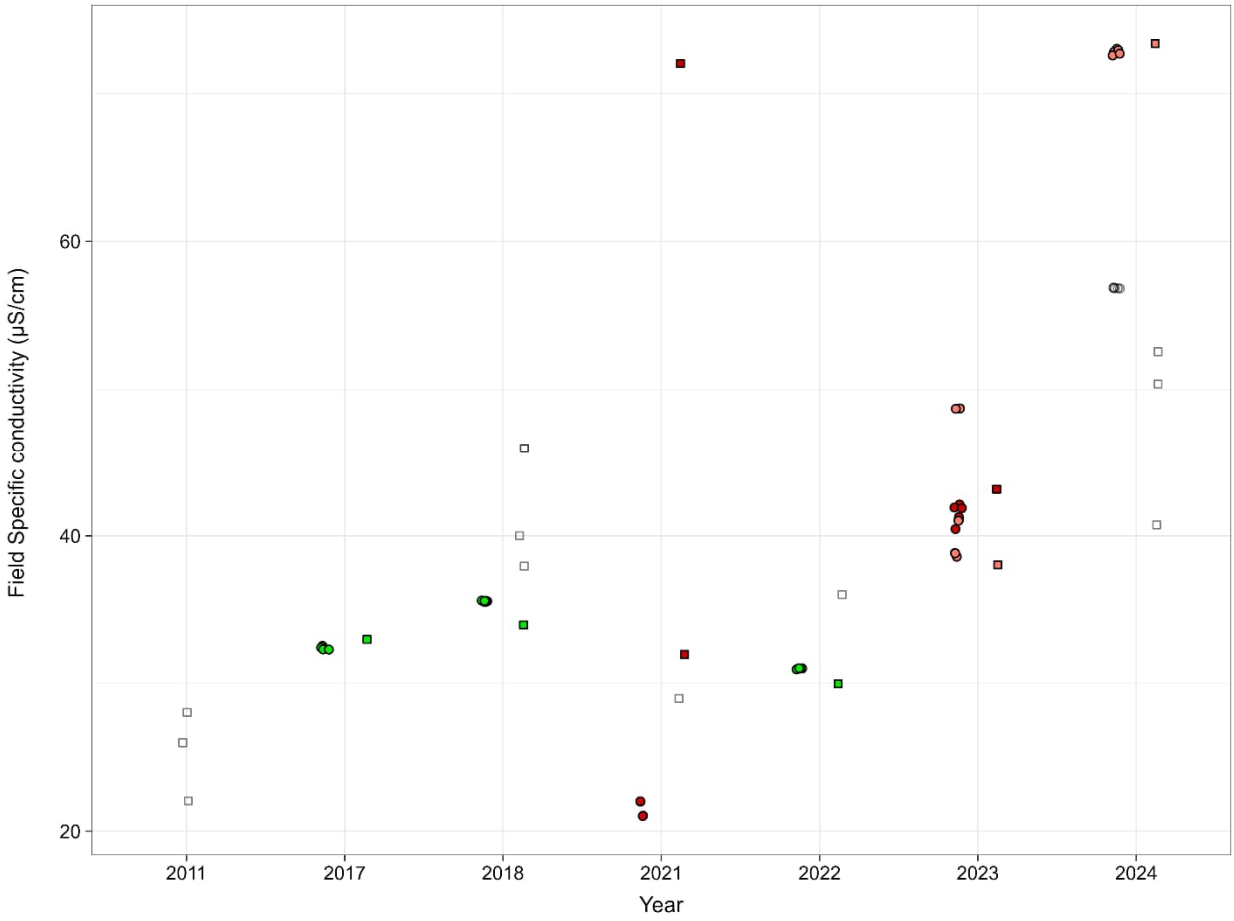
The following legend applies to the plots in this appendix:

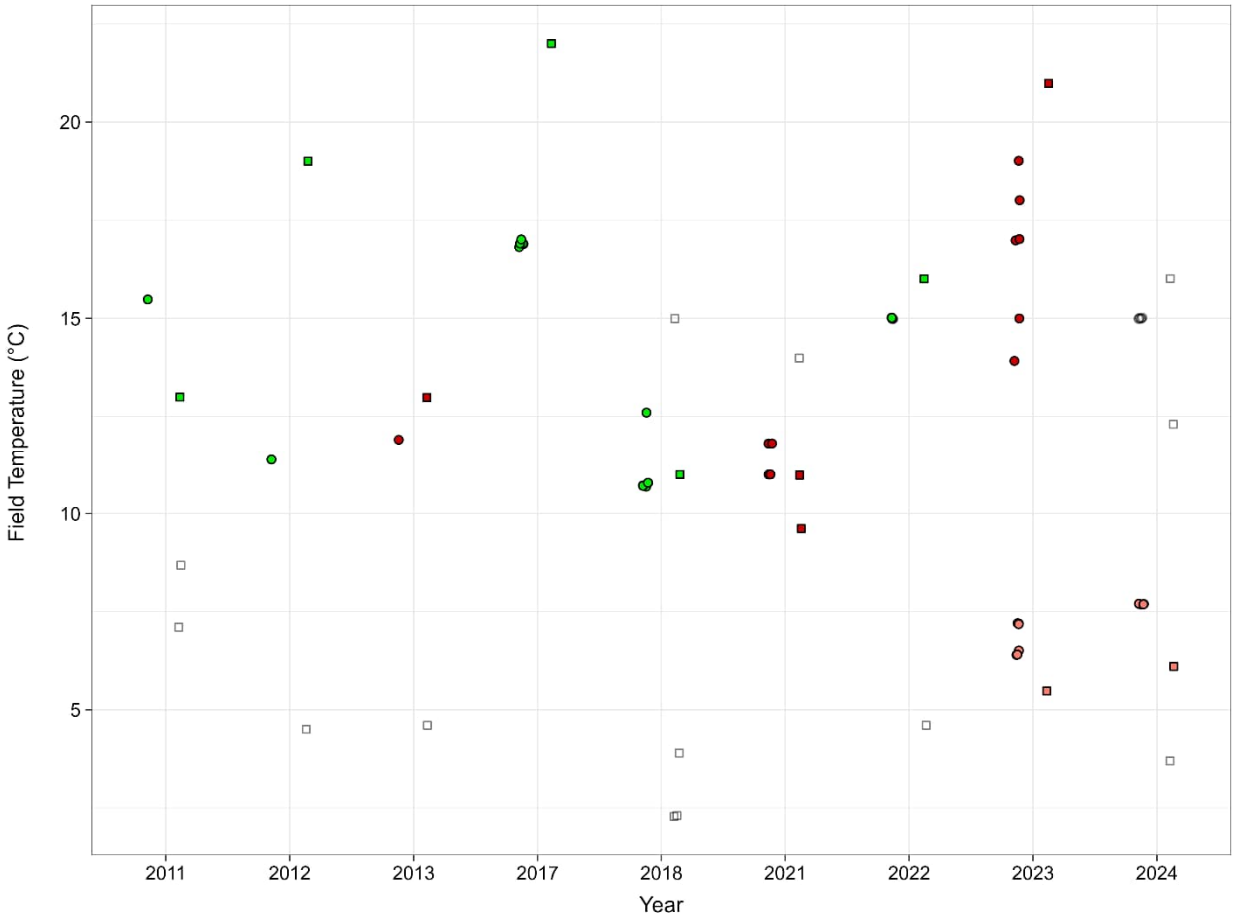


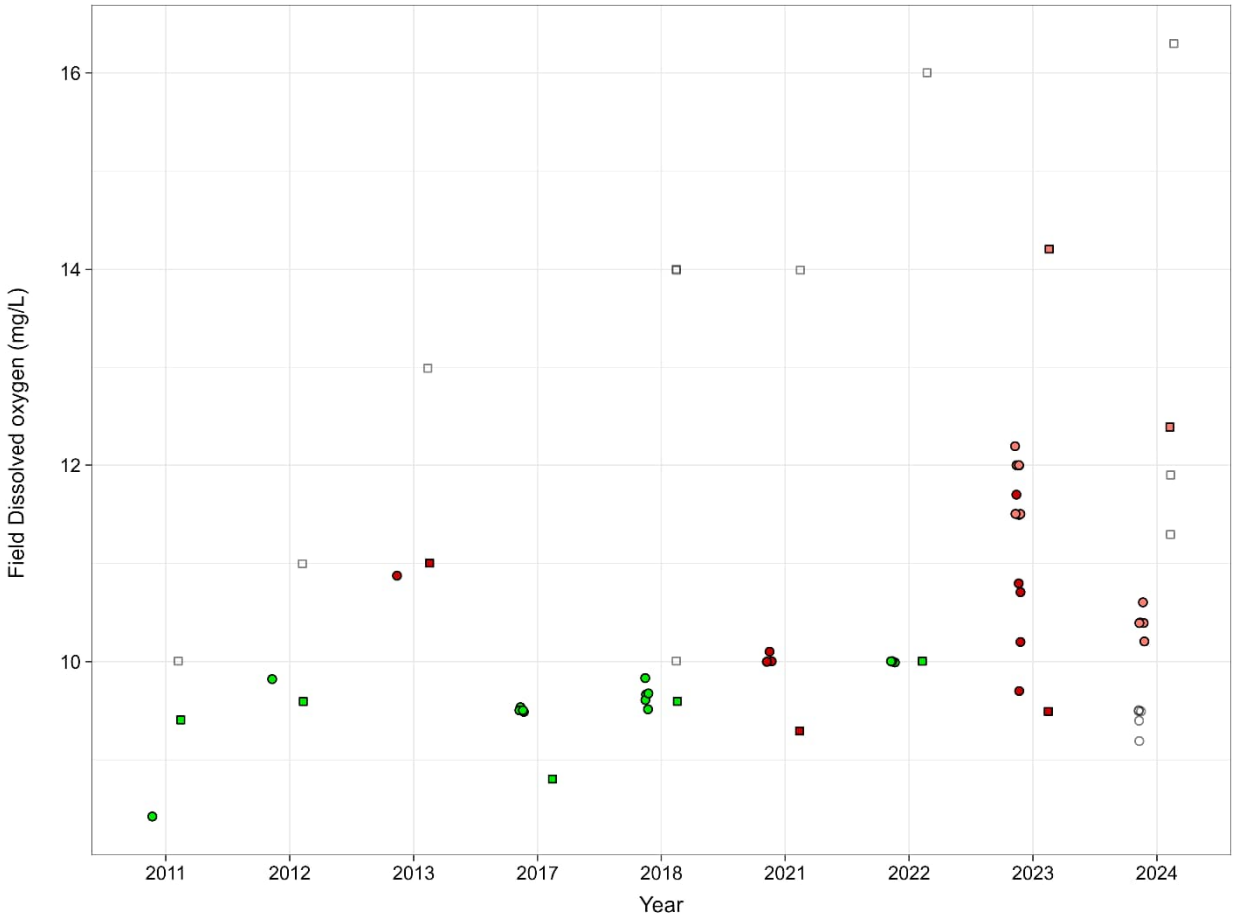
The following note applies to the plots in this appendix:

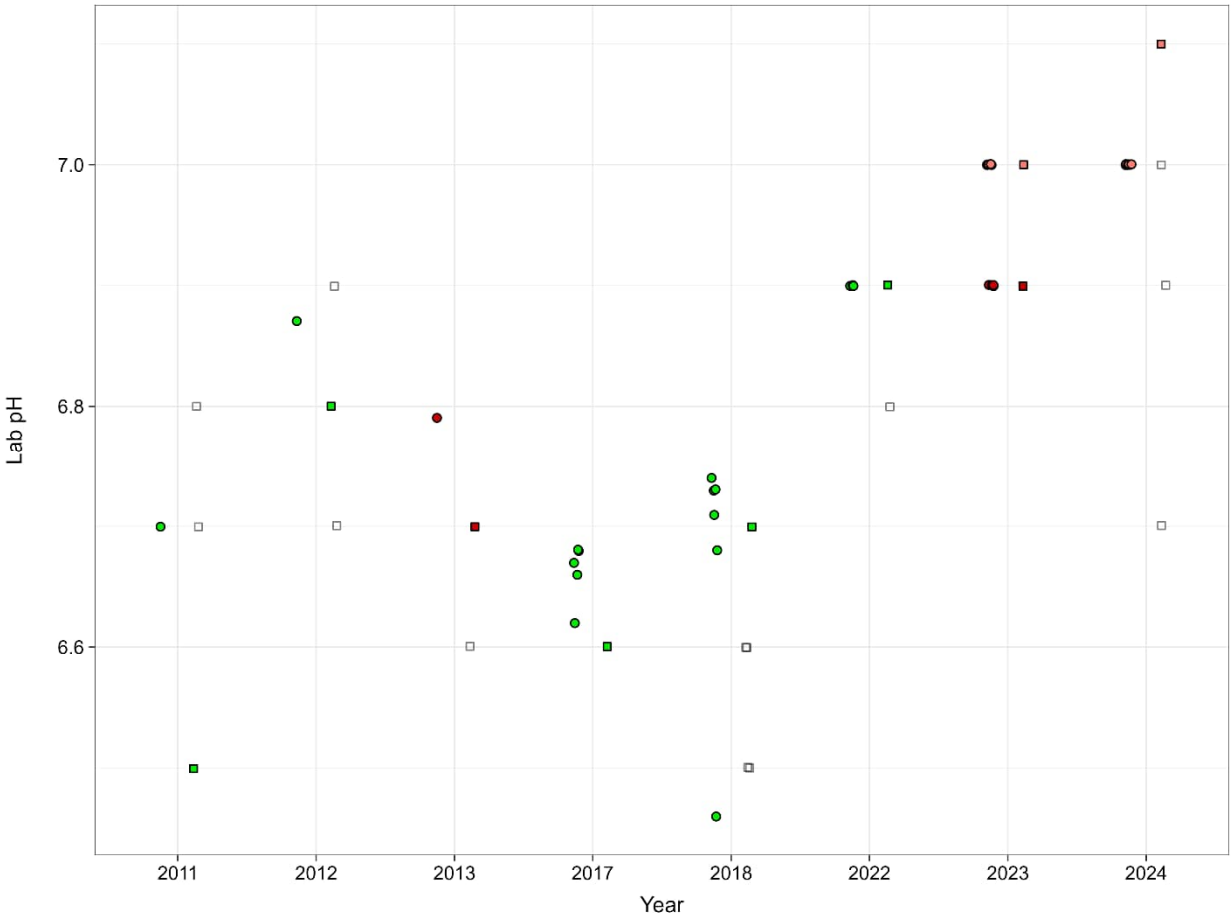
Samples used in statistical comparisons are shown as coloured symbols that identify the sampling month from Goose Lake Central Basin (i.e., coloured circles to the left of the vertical year line) and the Goose Lake outlet (coloured squares to the right of the vertical year line). Other data for Goose Lake Central Basin and Goose Lake outlet that were not collected concurrently are provided for context and are shown on the plots as grey symbols. Concentrations below the detection limit are shown as "x" or cross symbols.

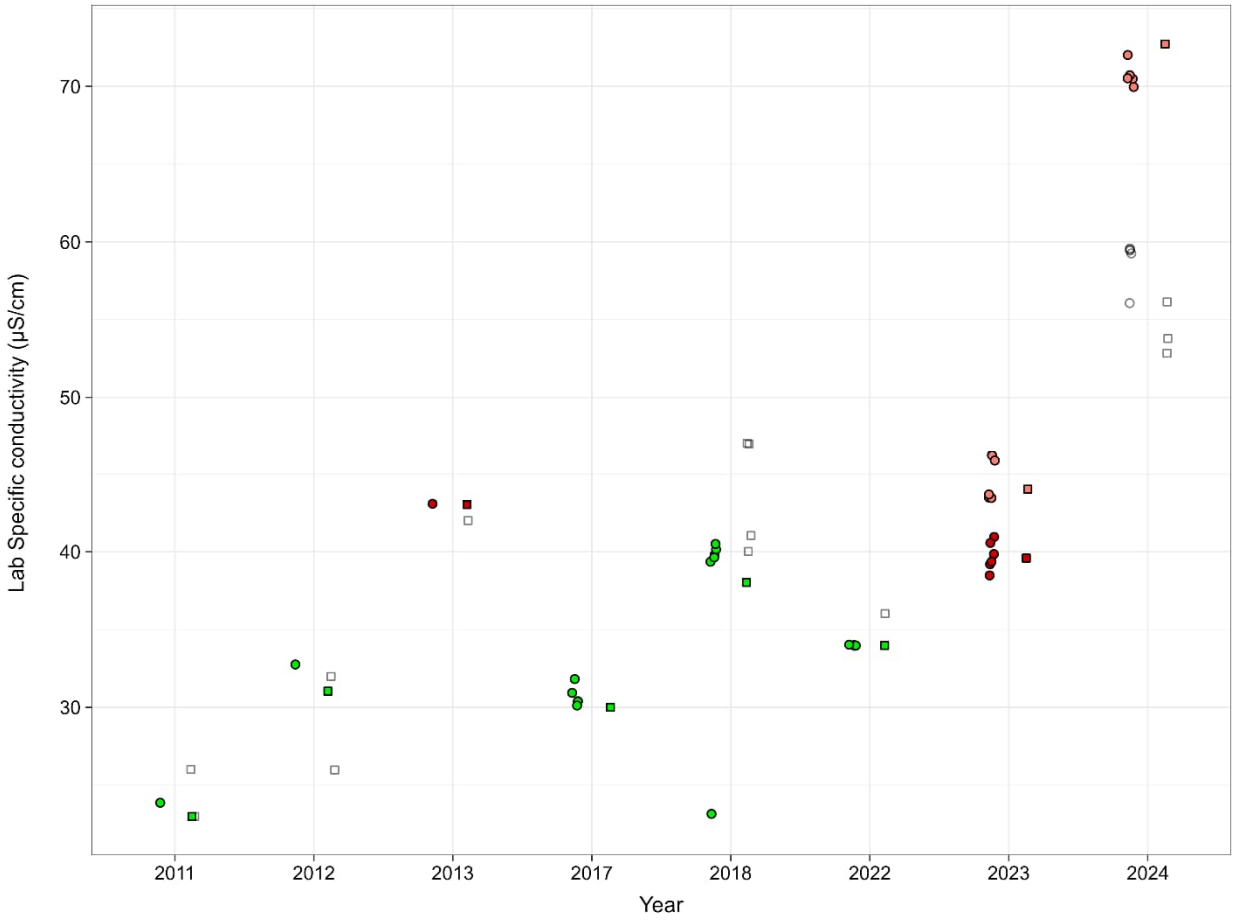

Field pH
8
7
6
2011
2017
2018
2021
2022
2023
2024
Year

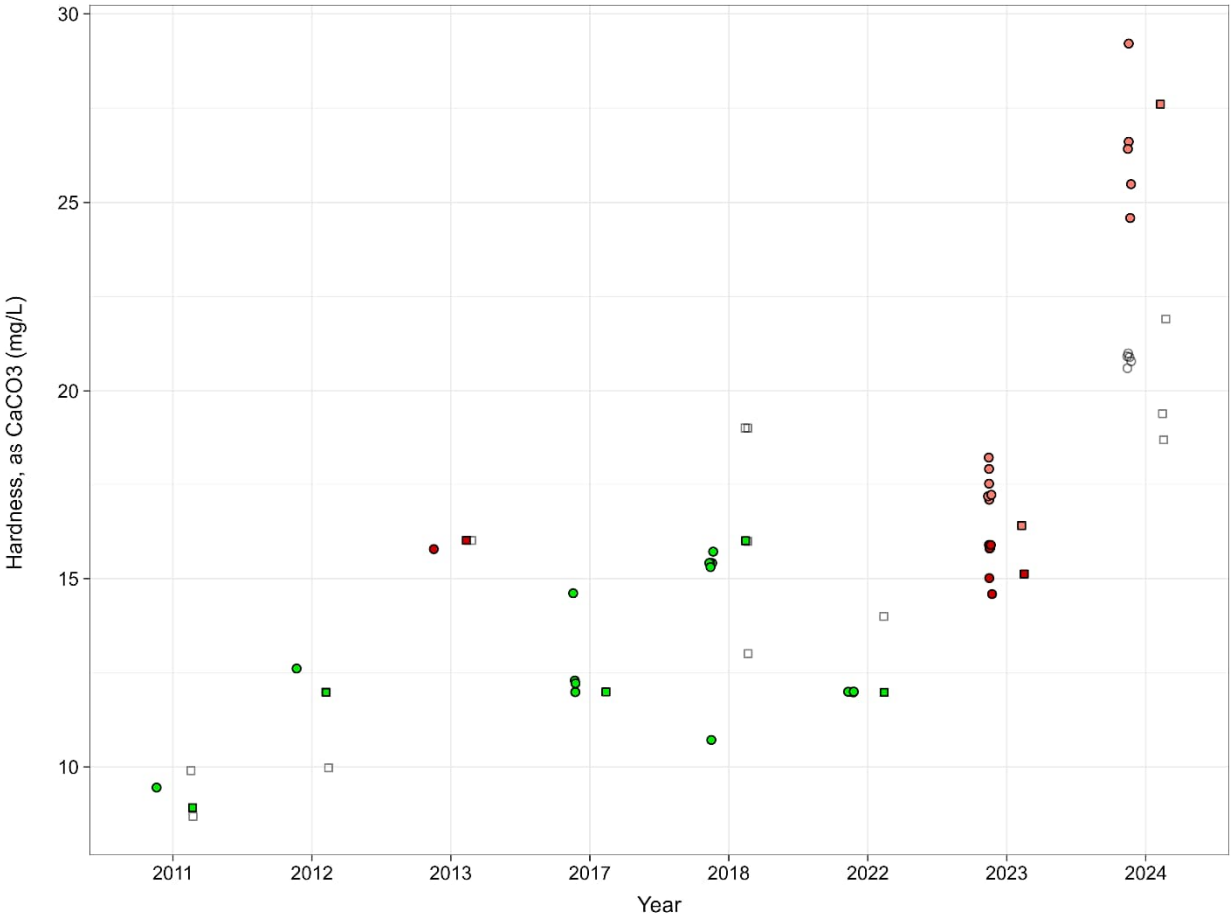

Field Specific conductivity (µS/cm)
60
40
20
2011
2017
2018
2021
2022
2023
2024
Year

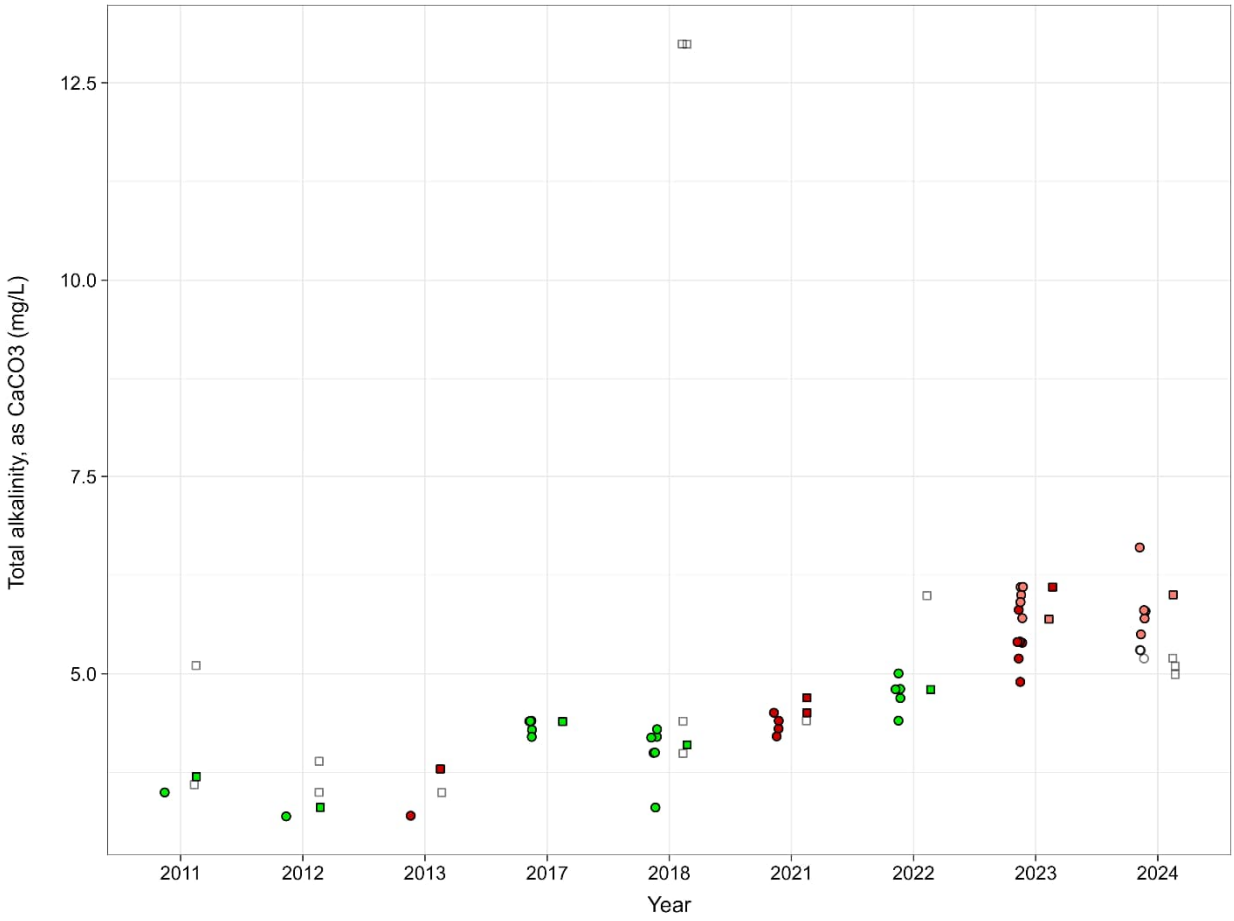

Field Temperature (°C)
20
15
10
5
2011
2012
2013
2017
2018
2021
2022
2023
2024
Year

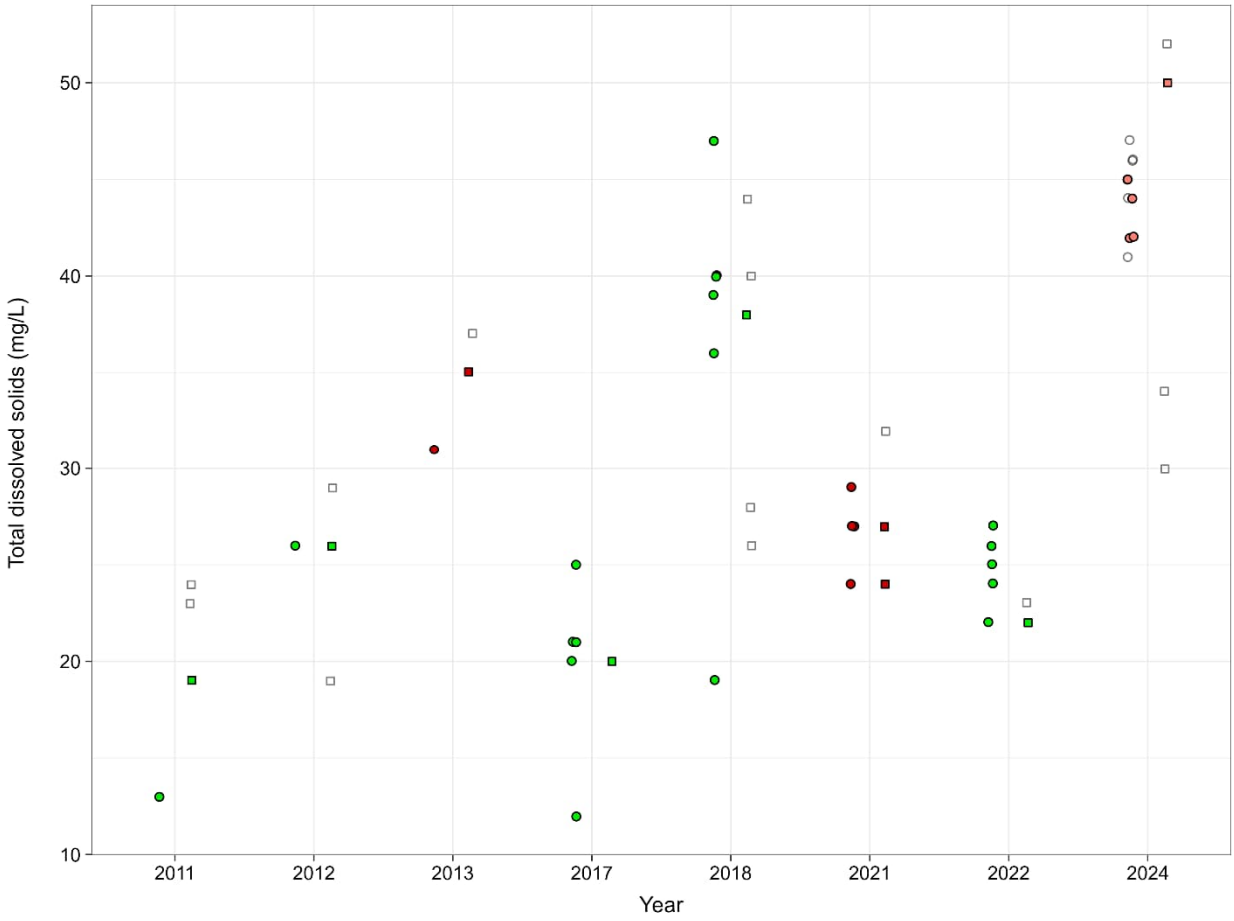

Field Dissolved oxygen (mg/L)
16
14
12
10
2011
2012
2013
2017
2018
2021
2022
2023
2024
Year

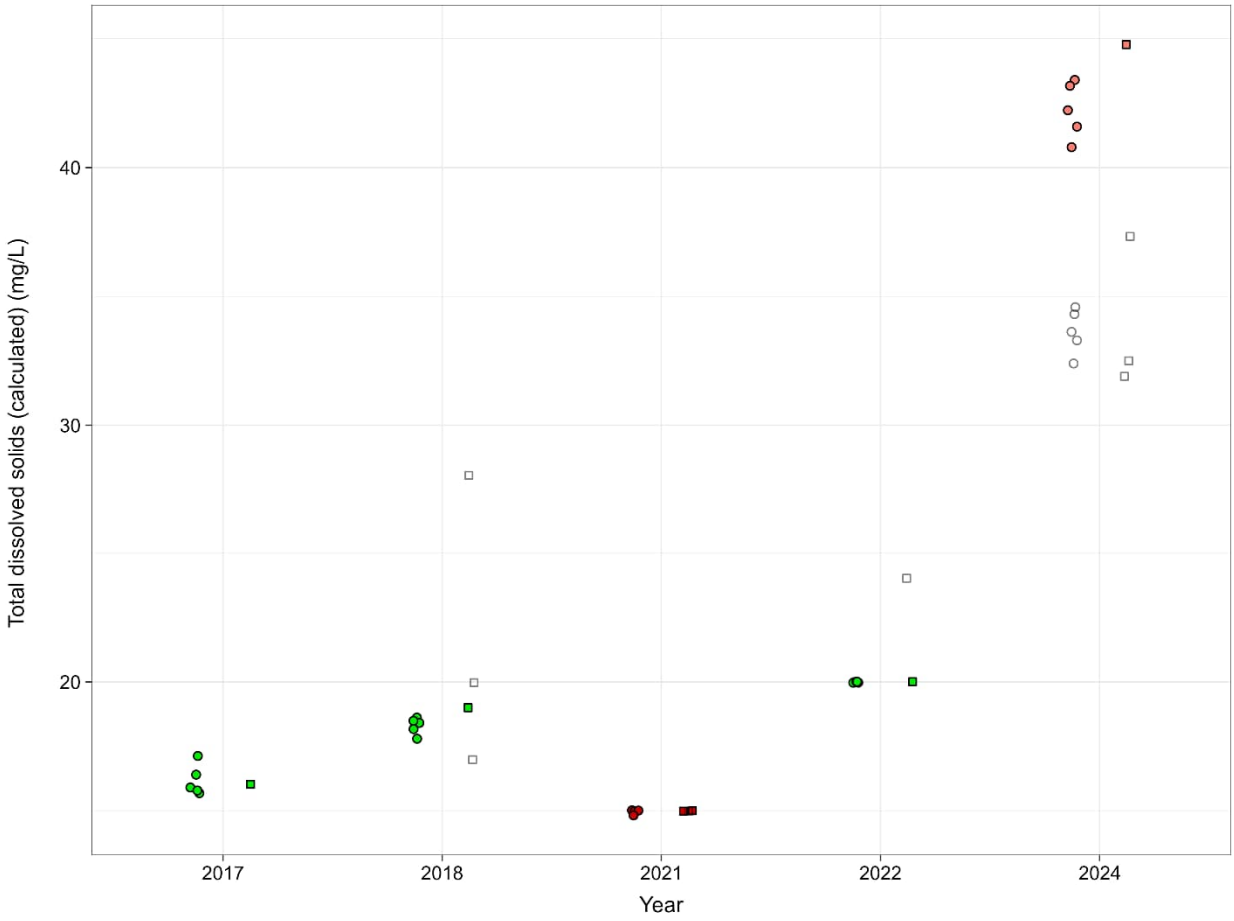

Lab pH
7.0
6.8
6.6
2011
2012
2013
2017
2018
2022
2023
2024
Year

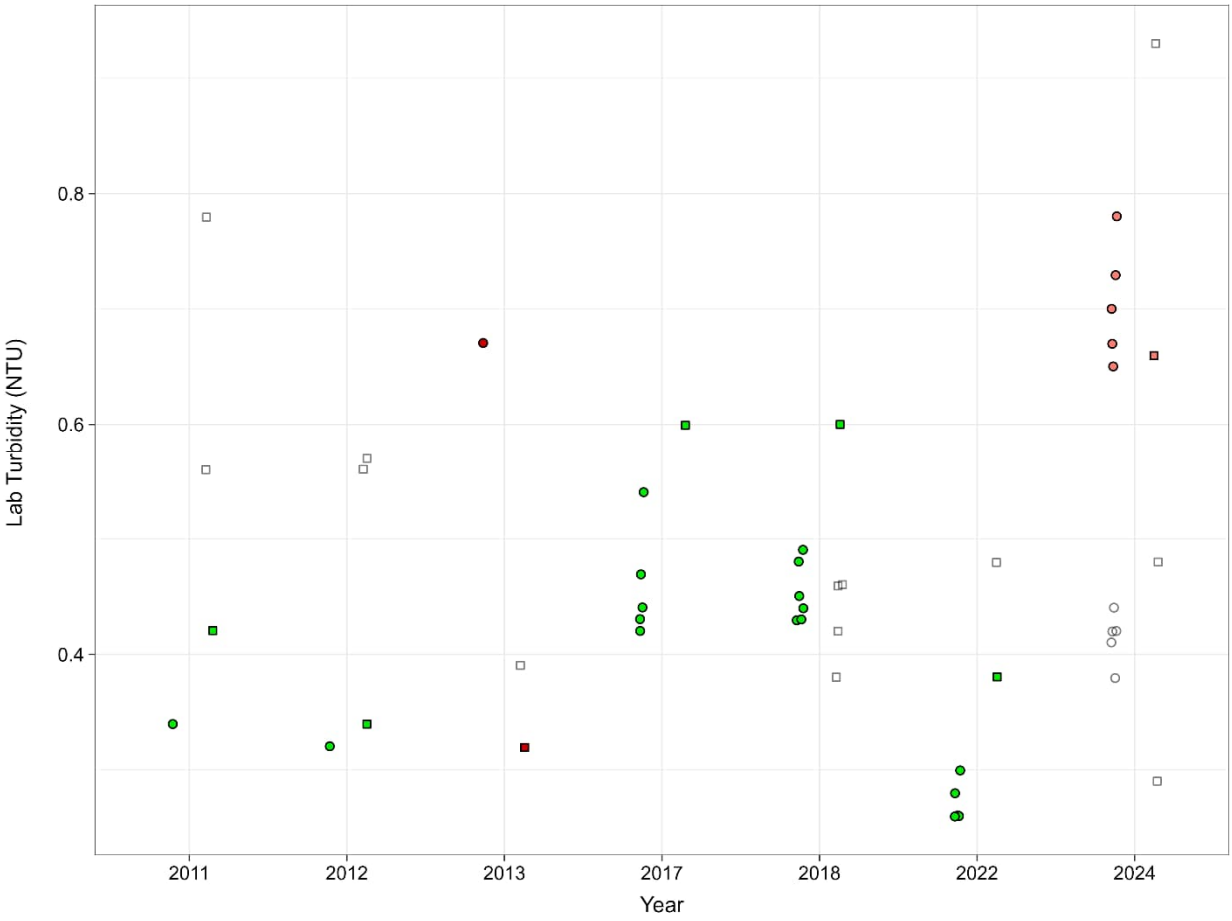

Lab Specific conductivity (µS/cm)
70
60
50
40
30
2011
2012
2013
2017
2018
2022
2023
2024
Year

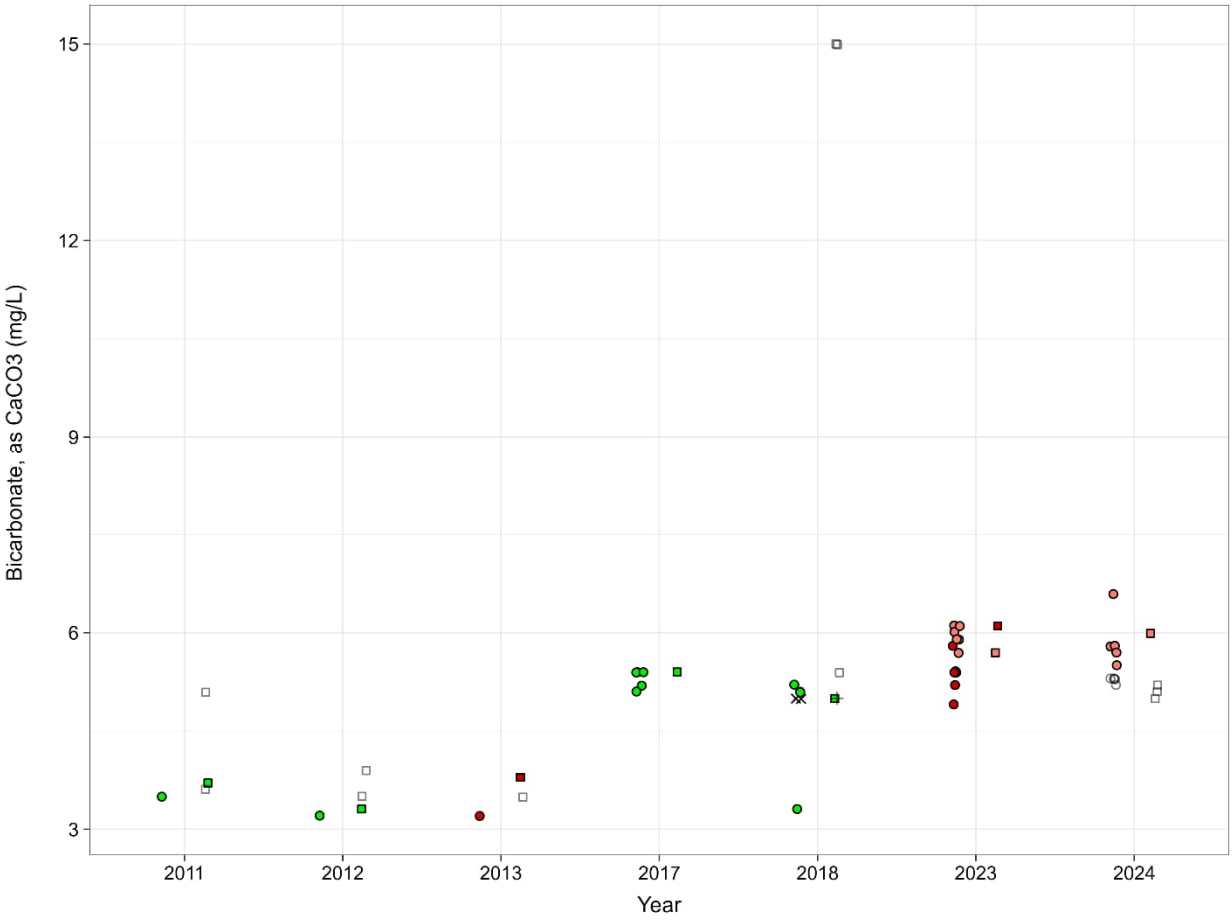

Hardness, as CaCO3 (mg/L)
30
25
20
15
10
2011
2012
2013
2017
2018
2022
2023
2024
Year

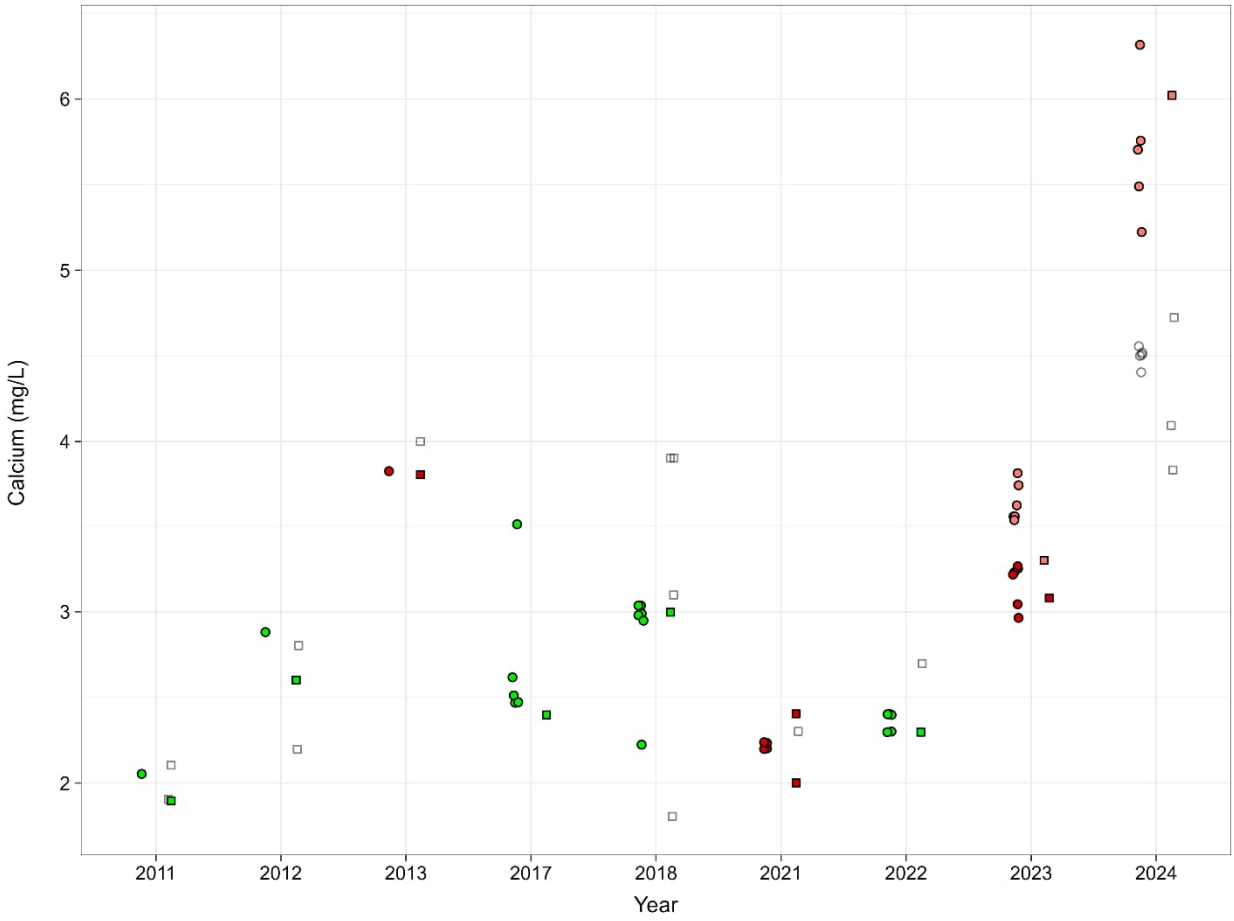

Total alkalinity, as CaCO3 (mg/L)
12.5
10.0
7.5
5.0
2011
2012
2013
2017
2018
2021
2022
2023
2024
Year

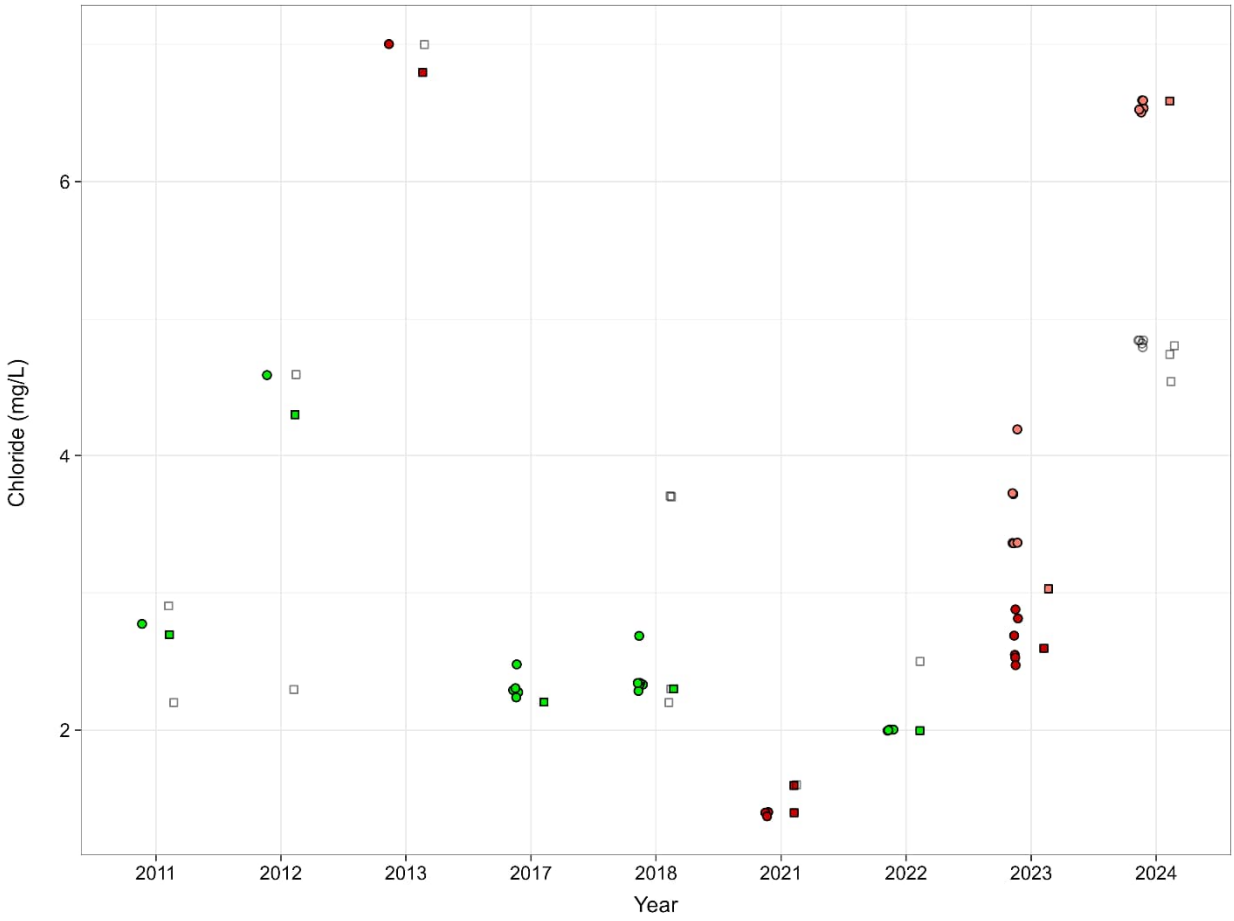

Total dissolved solids (mg/L)
50
40
30
20
10
2011
2012
2013
2017
2018
2021
2022
2024
Year

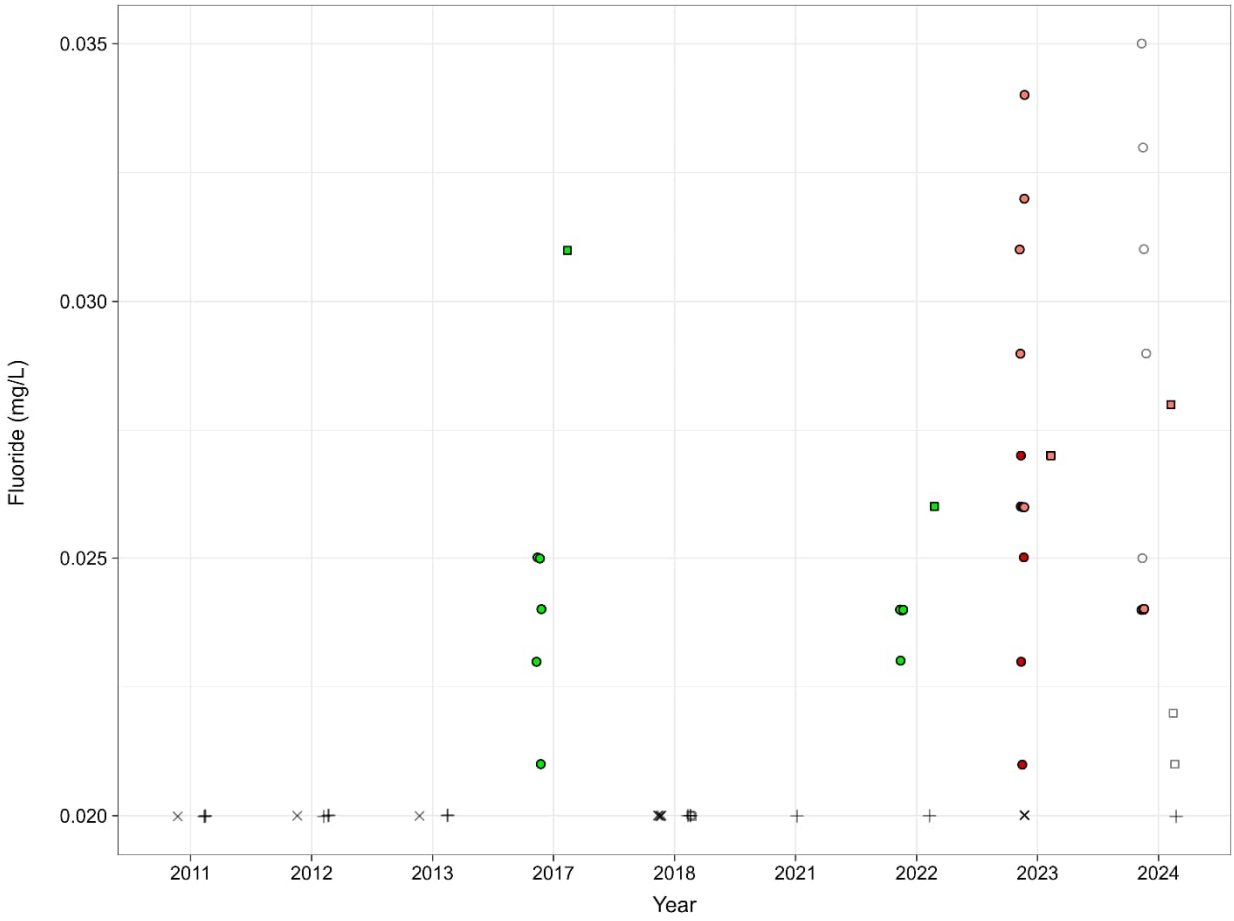

Total dissolved solids (calculated) (mg/L)
40
30
20
2017
2018
2021
2022
2024
Year

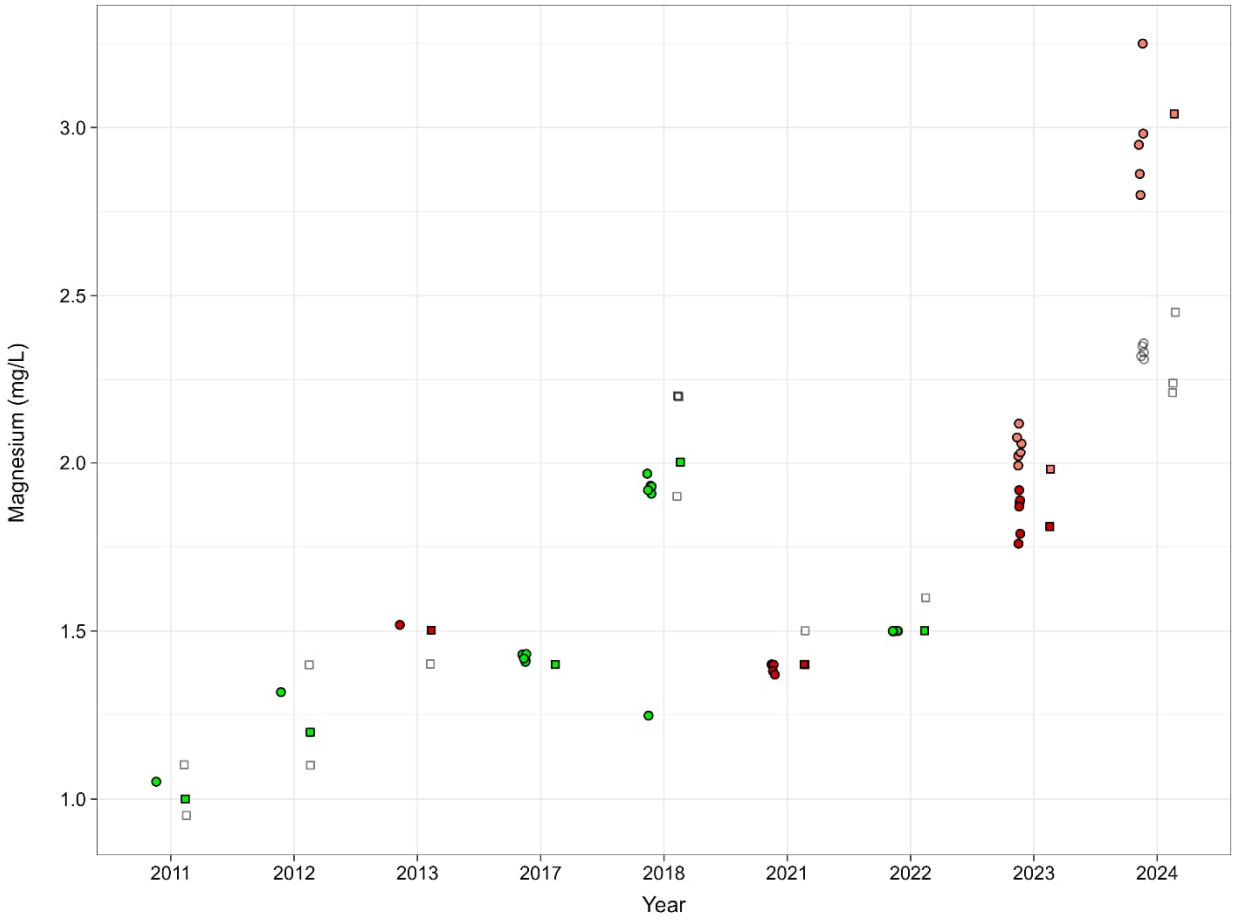

Lab Turbidity (NTU)
0.8
0.6
0.4
2011
2012
2013
2017
2018
2022
2024
Year

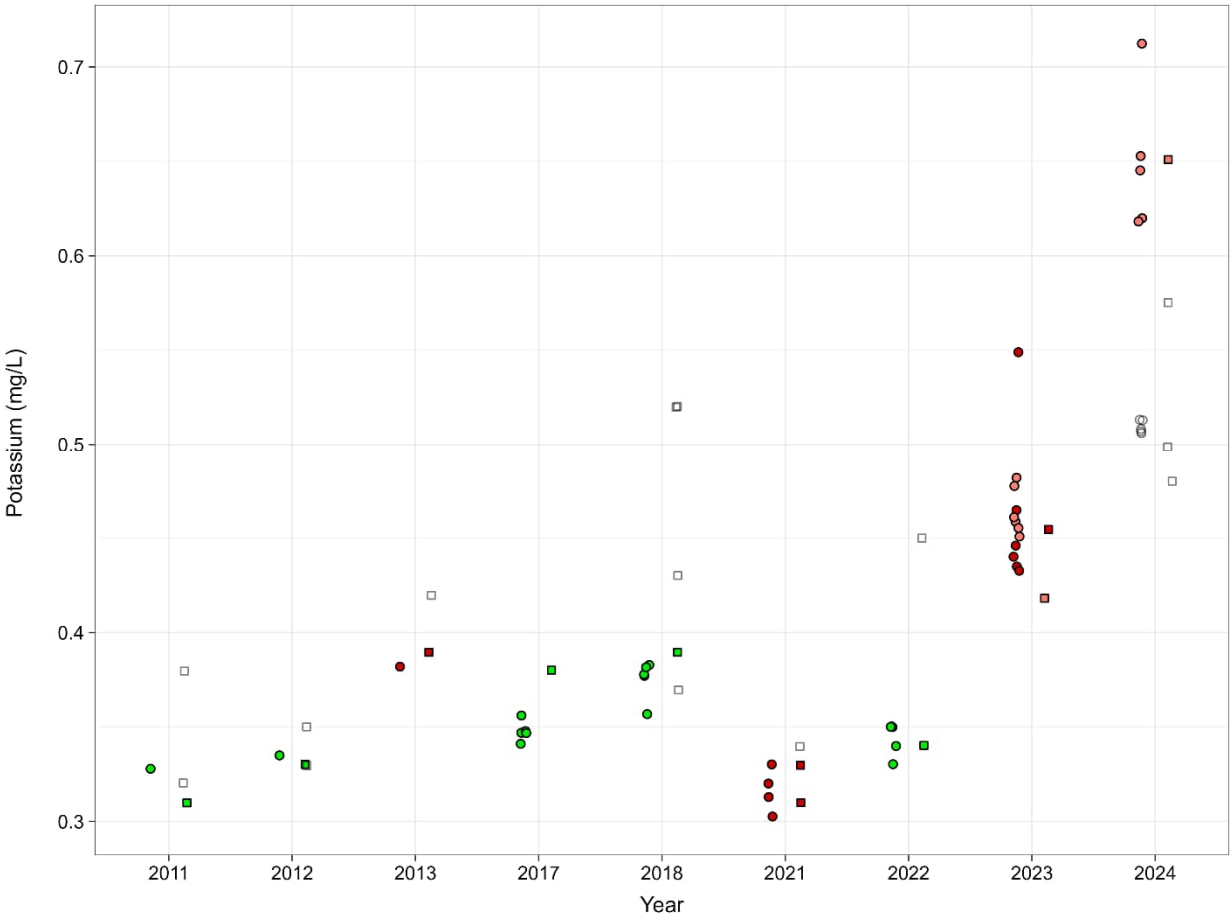

Bicarbonate, as CaCO3 (mg/L)
15
12
9
6
3
2011
2012
2013
2017
2018
2023
2024
Year

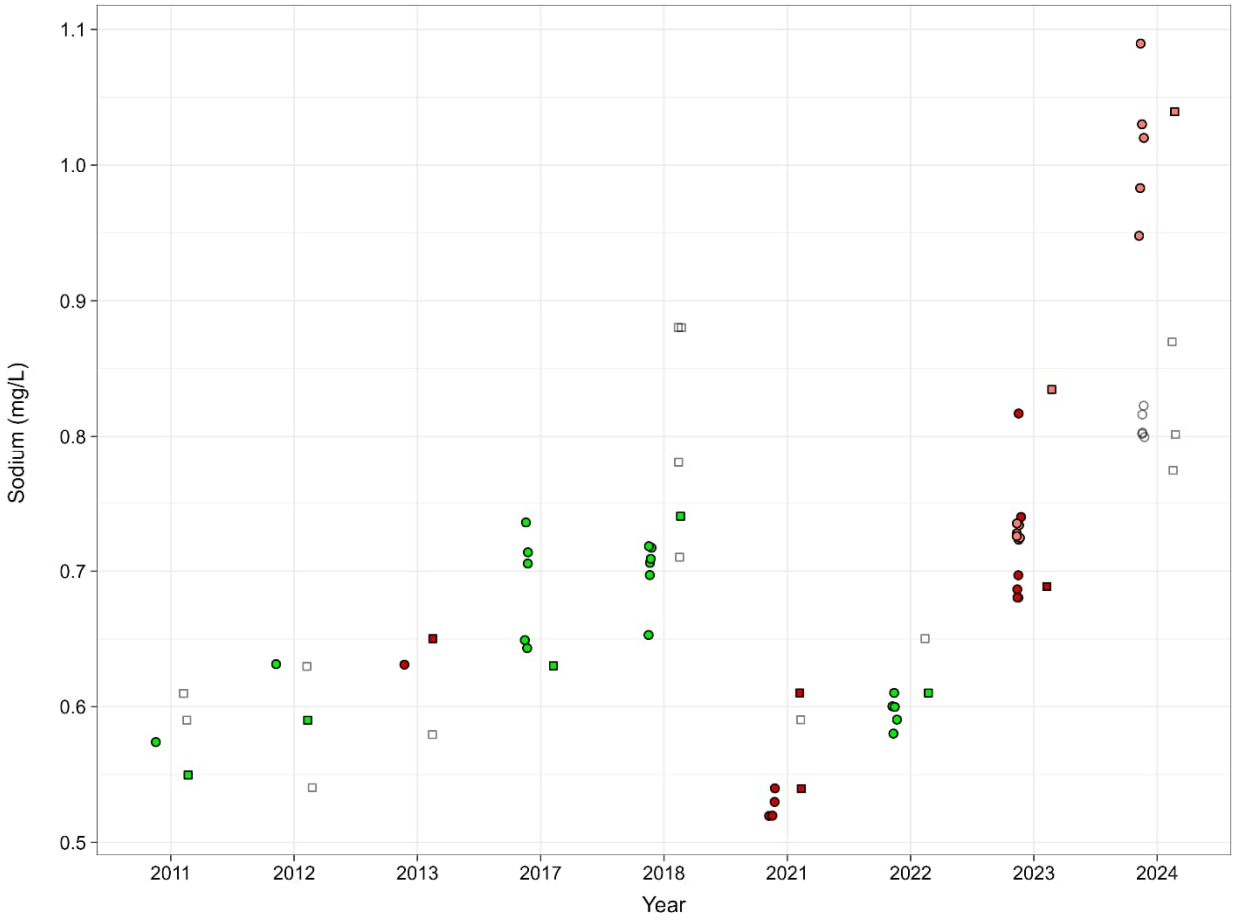

Calcium (mg/L)
6
5
4
3
2
2011
2012
2013
2017
2018
2021
2022
2023
2024
Year

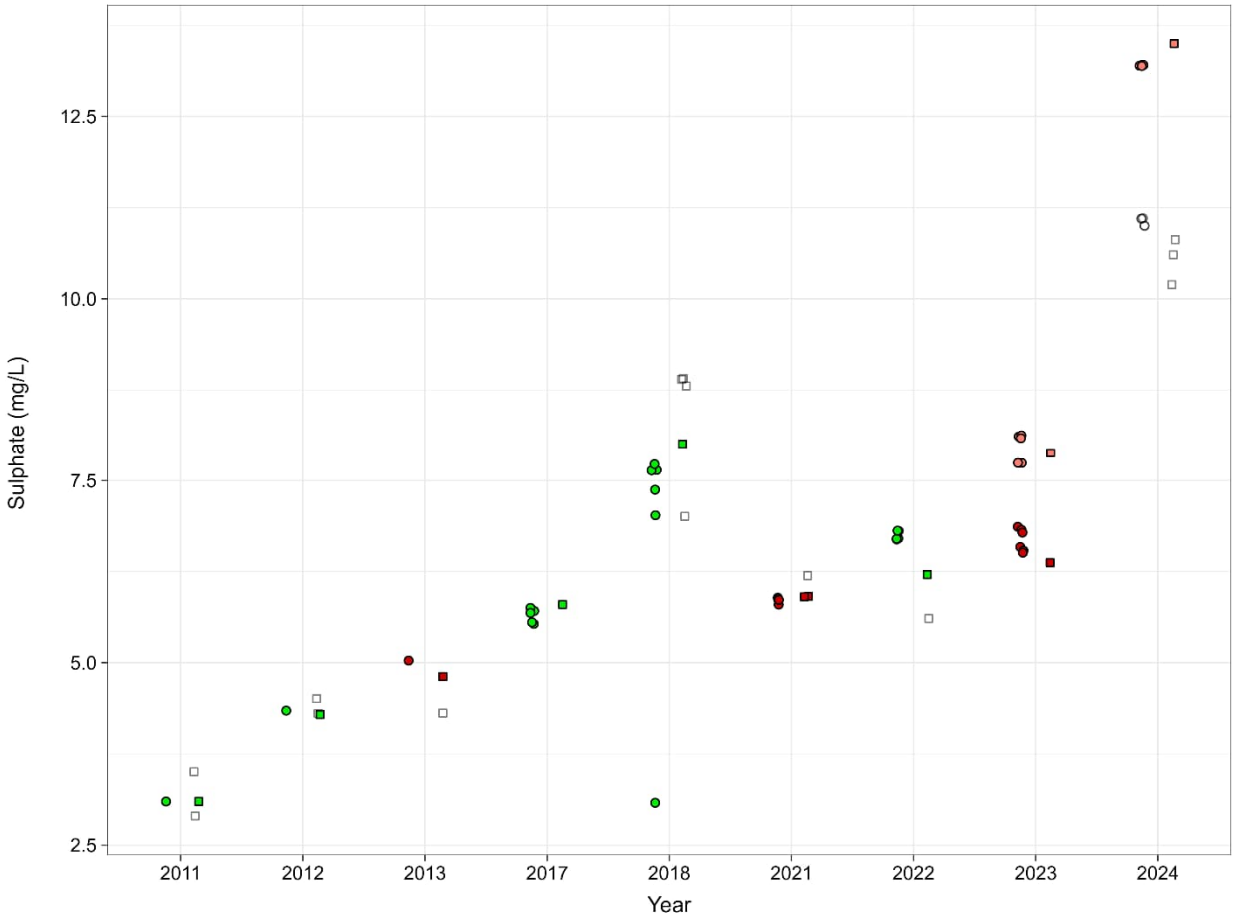

Chloride (mg/L)
6
4
2
2011
2012
2013
2017
2018
2021
2022
2023
2024
Year

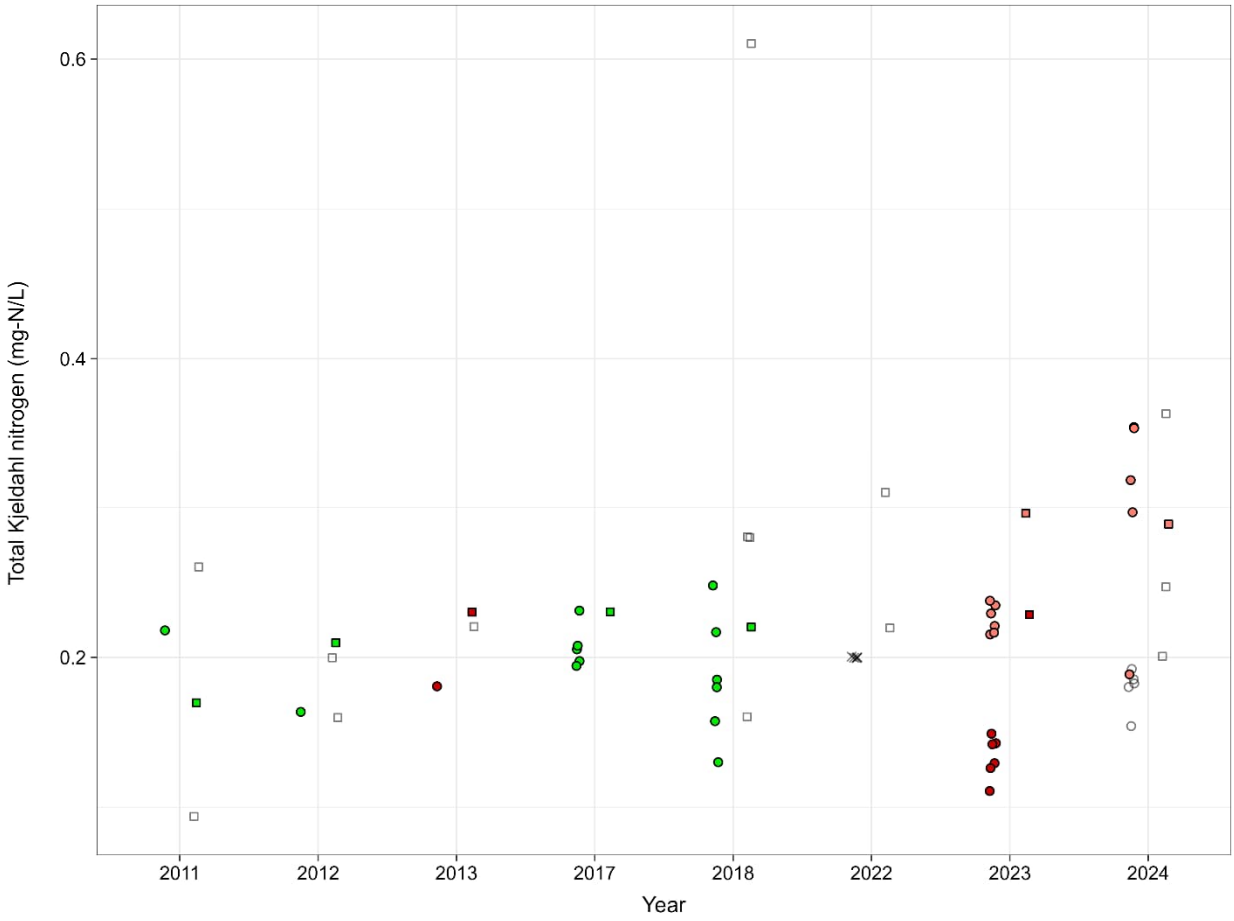

0.035
0.030
0.025
0.020
Fluoride (mg/L)
2011
2012
2013
2017
2018
2021
2022
2023
2024
Year

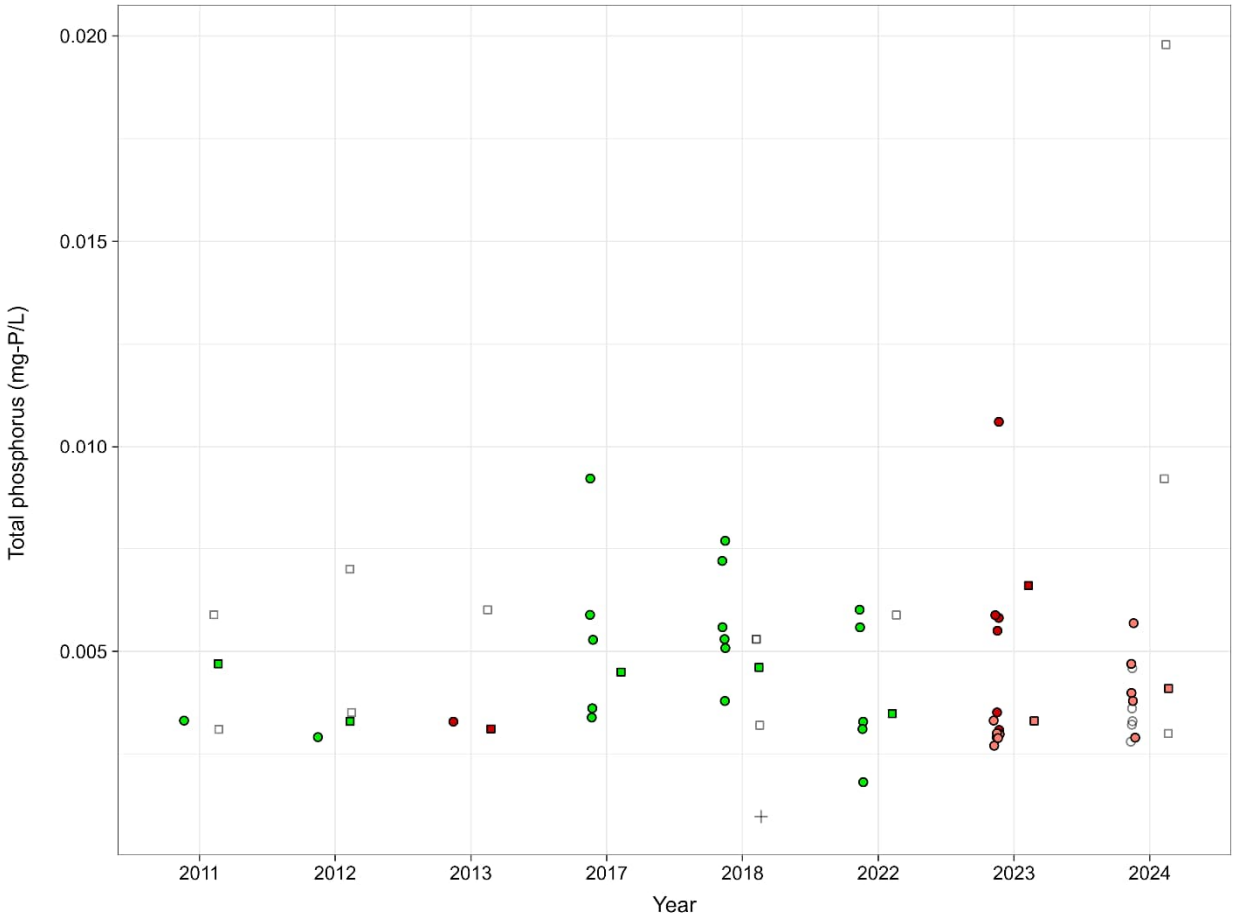

Magnesium (mg/L)
3.0
2.5
2.0
1.5
1.0
2011
2012
2013
2017
2018
2021
2022
2023
2024
Year

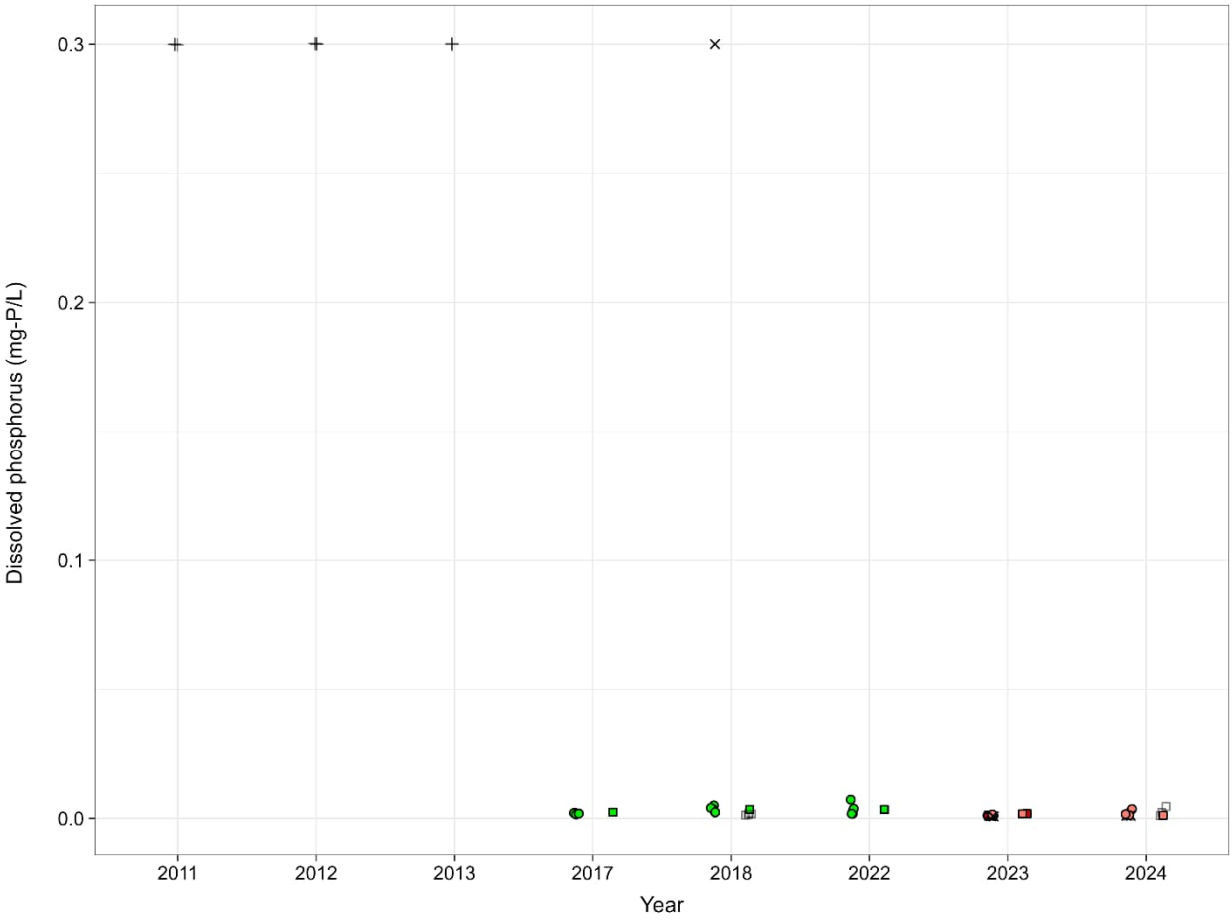

Potassium (mg/L)
0.7
0.6
0.5
0.4
0.3
2011
2012
2013
2017
2018
2021
2022
2023
2024
Year

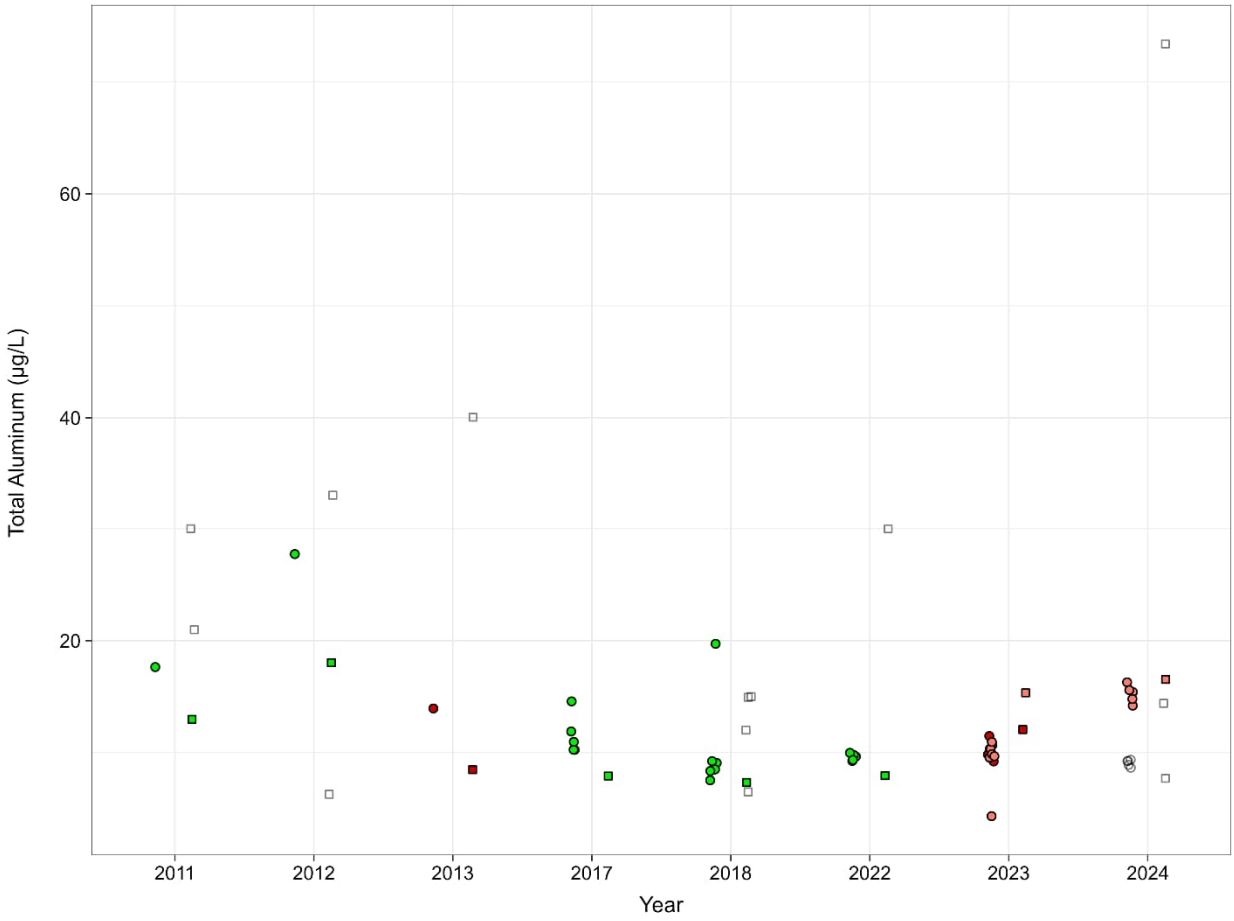

Sodium (mg/L)
1.1
1.0
0.9
0.8
0.7
0.6
0.5
2011
2012
2013
2017
2018
2021
2022
2023
2024
Year

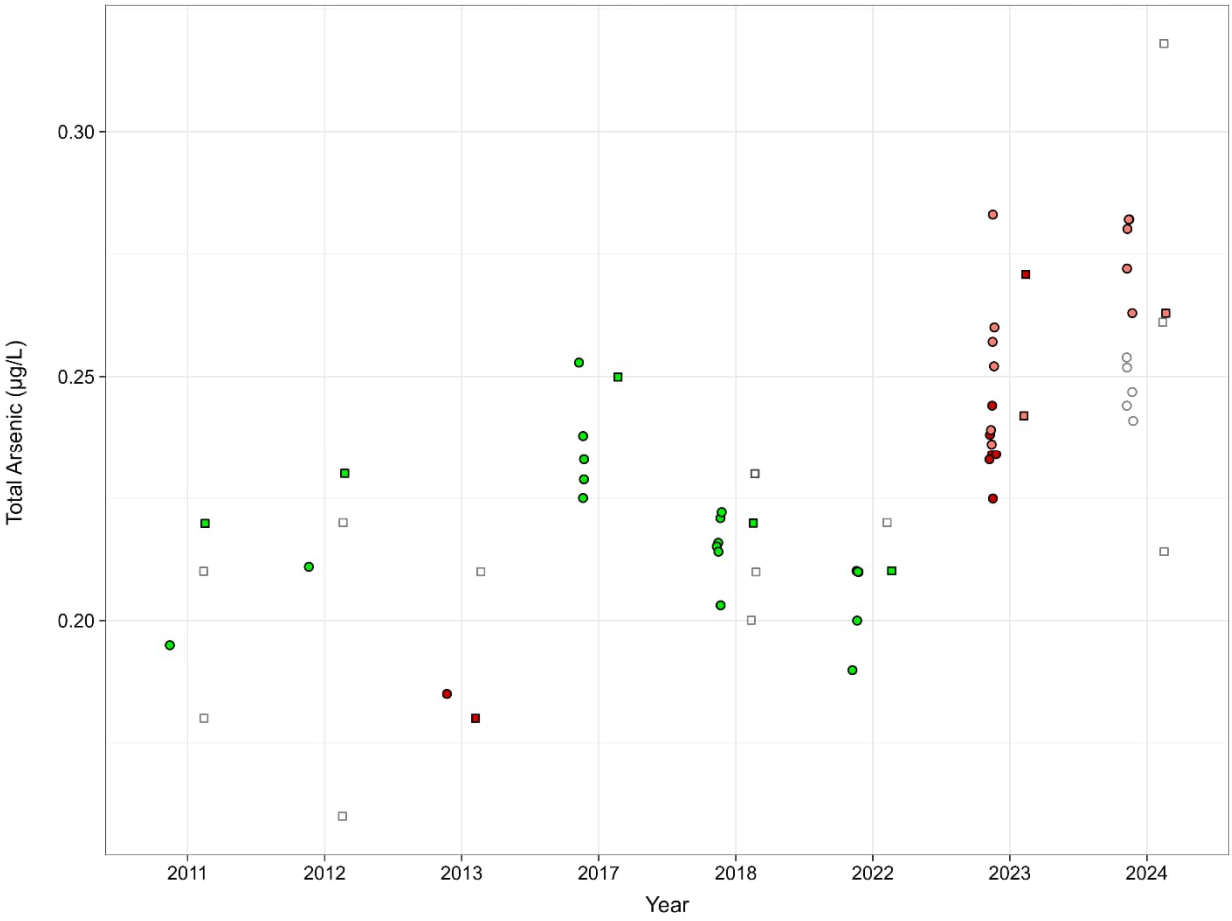

Sulphate (mg/L)
12.5
10.0
7.5
5.0
2.5
2011
2012
2013
2017
2018
2021
2022
2023
2024
Year

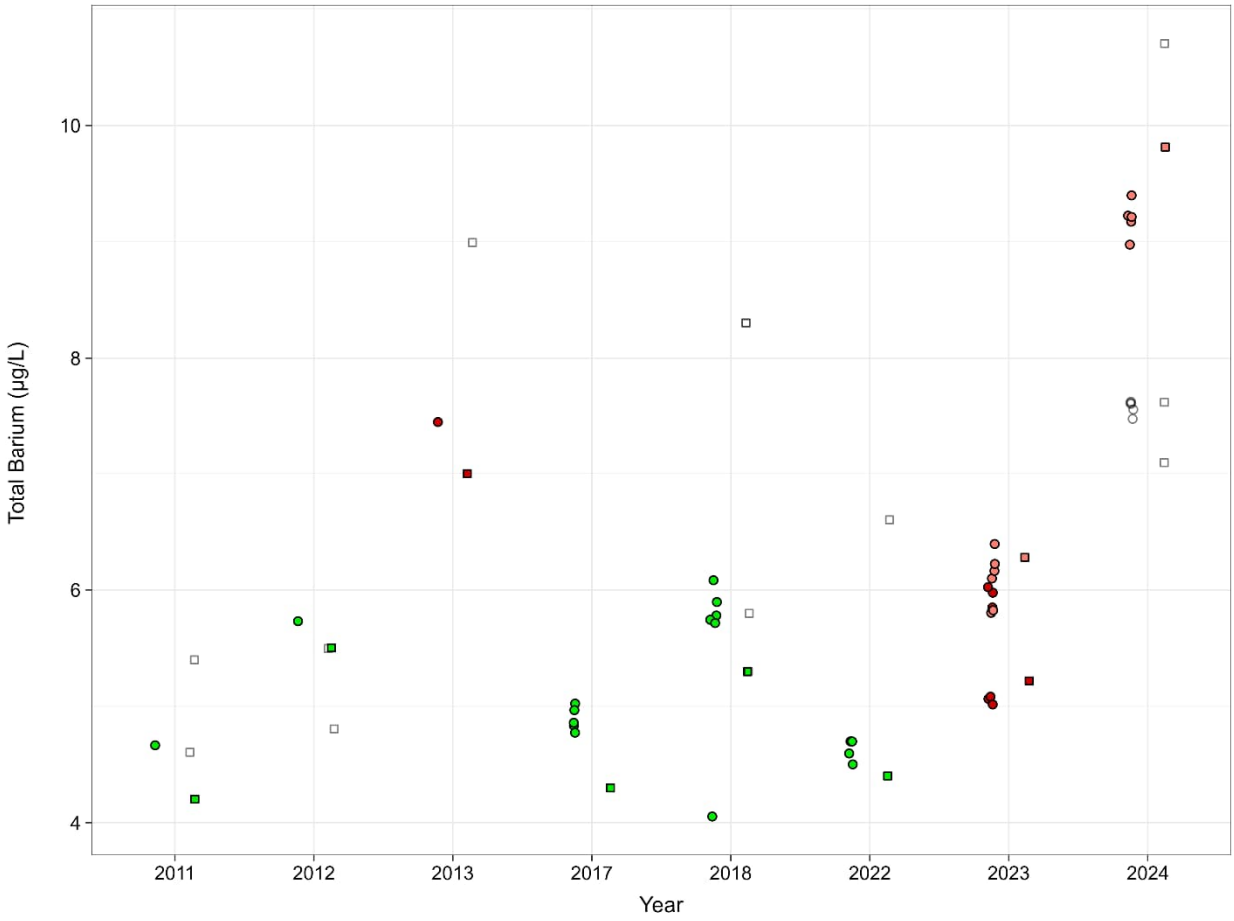

Total Kjeldahl nitrogen (mg-N/L)
0.6
0.4
0.2
2011
2012
2013
2017
2018
2022
2023
2024
Year

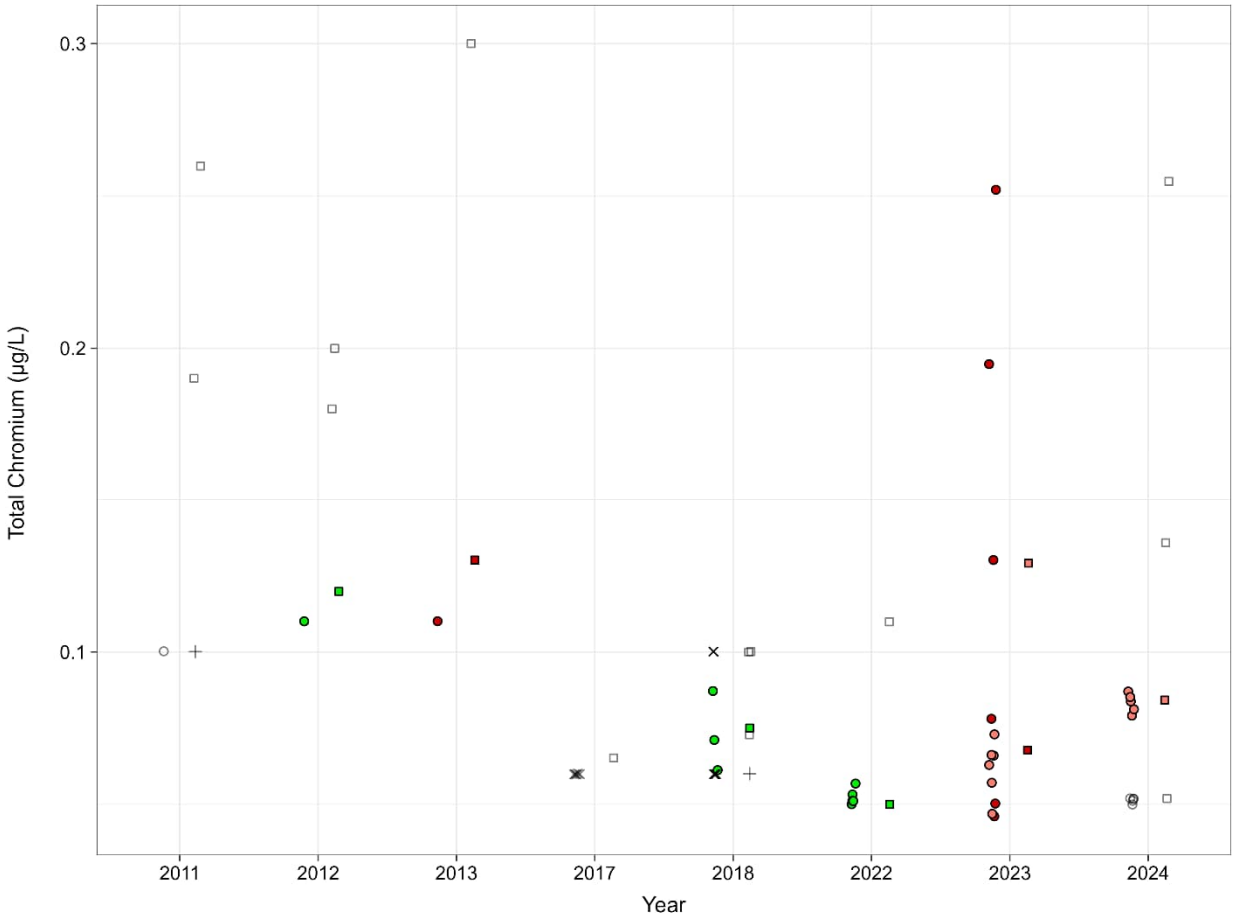

0.020
0.015
0.010
0.005
Total phosphorus (mg-P/L)
2011
2012
2013
2017
2018
2022
2023
2024
Year

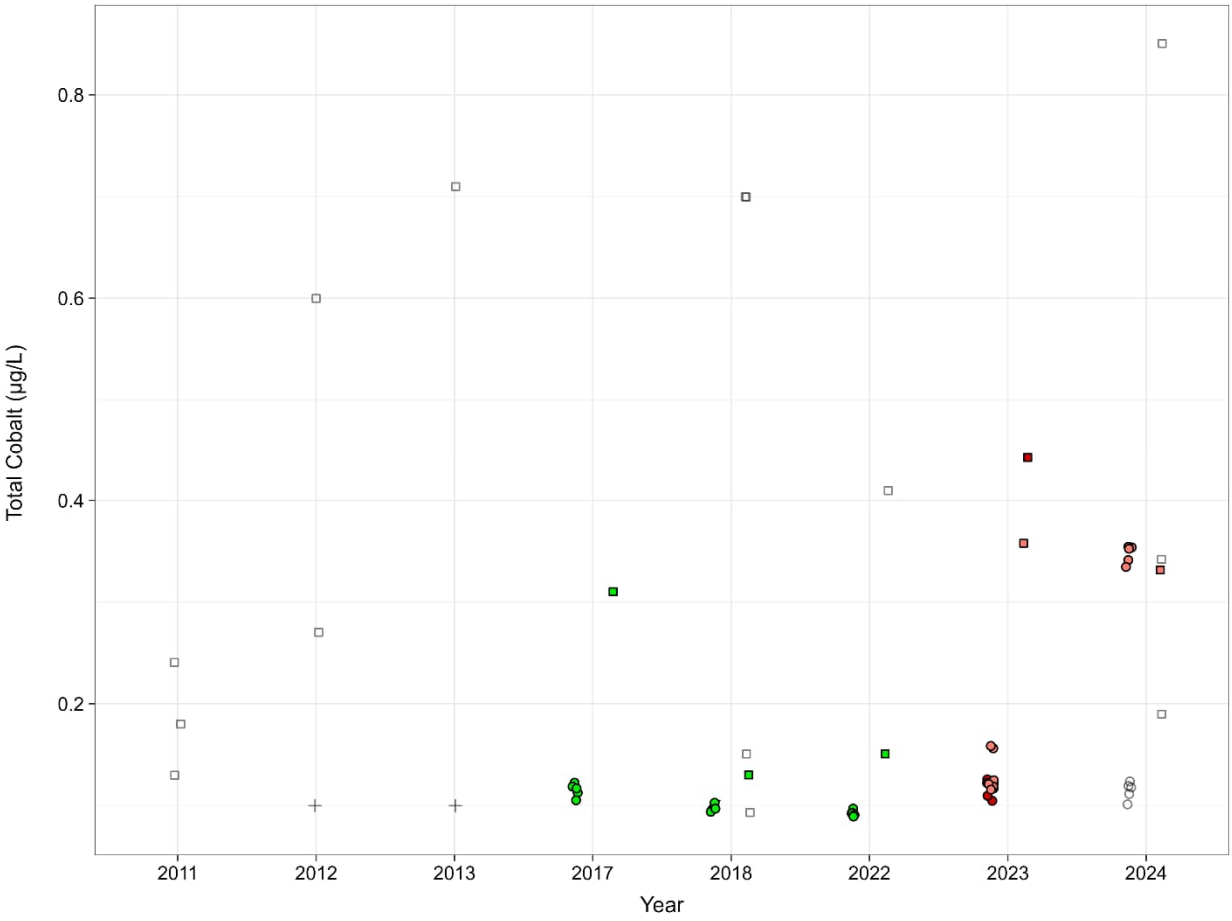

Dissolved phosphorus (mg-P/L)
0.3
0.2
0.1
0.0
2011
2012
2013
2017
2018
2022
2023
2024
Year

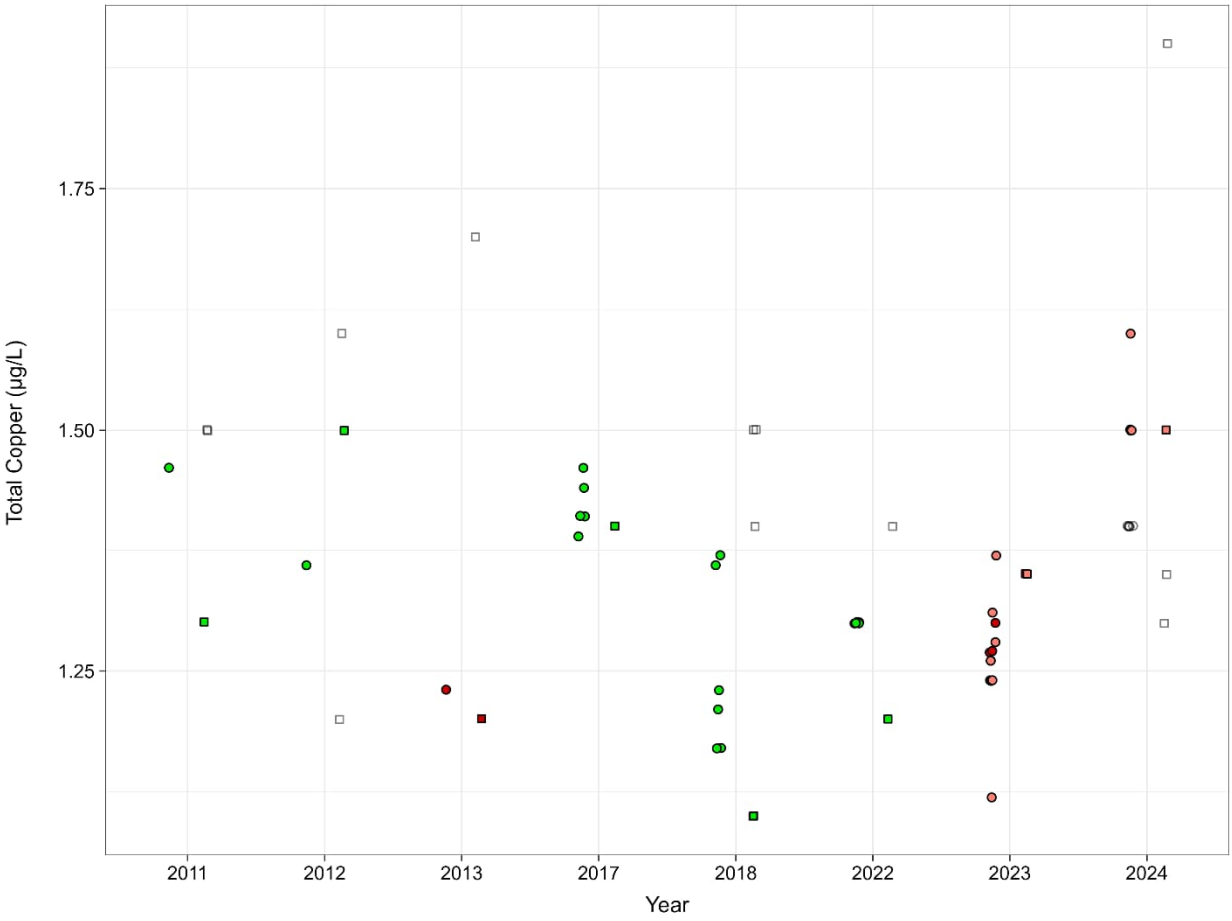

Total Aluminum (µg/L)
60
40
20
2011
2012
2013
2017
2018
2022
2023
2024
Year

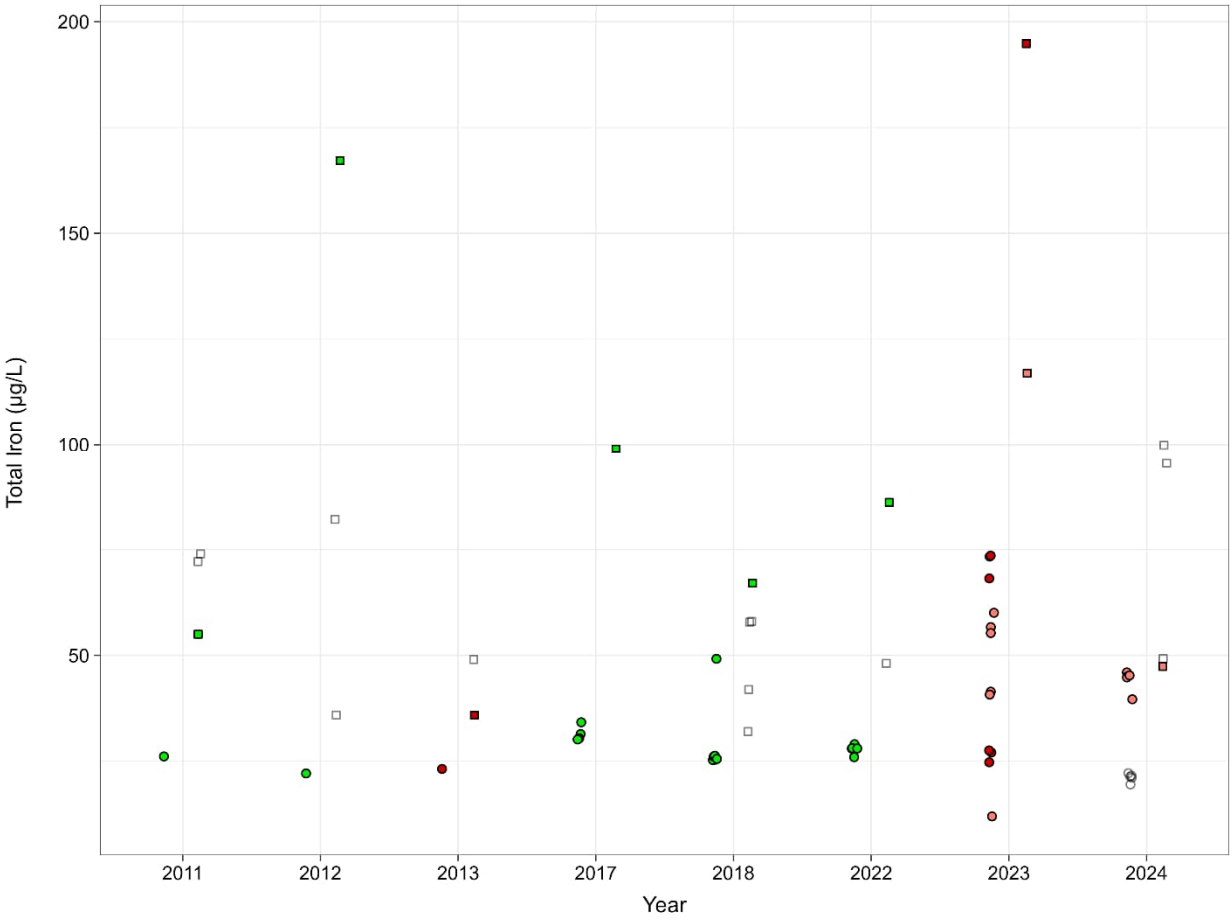

Total Arsenic (µg/L)
0.30
0.25
0.20
2011
2012
2013
2017
2018
2022
2023
2024
Year

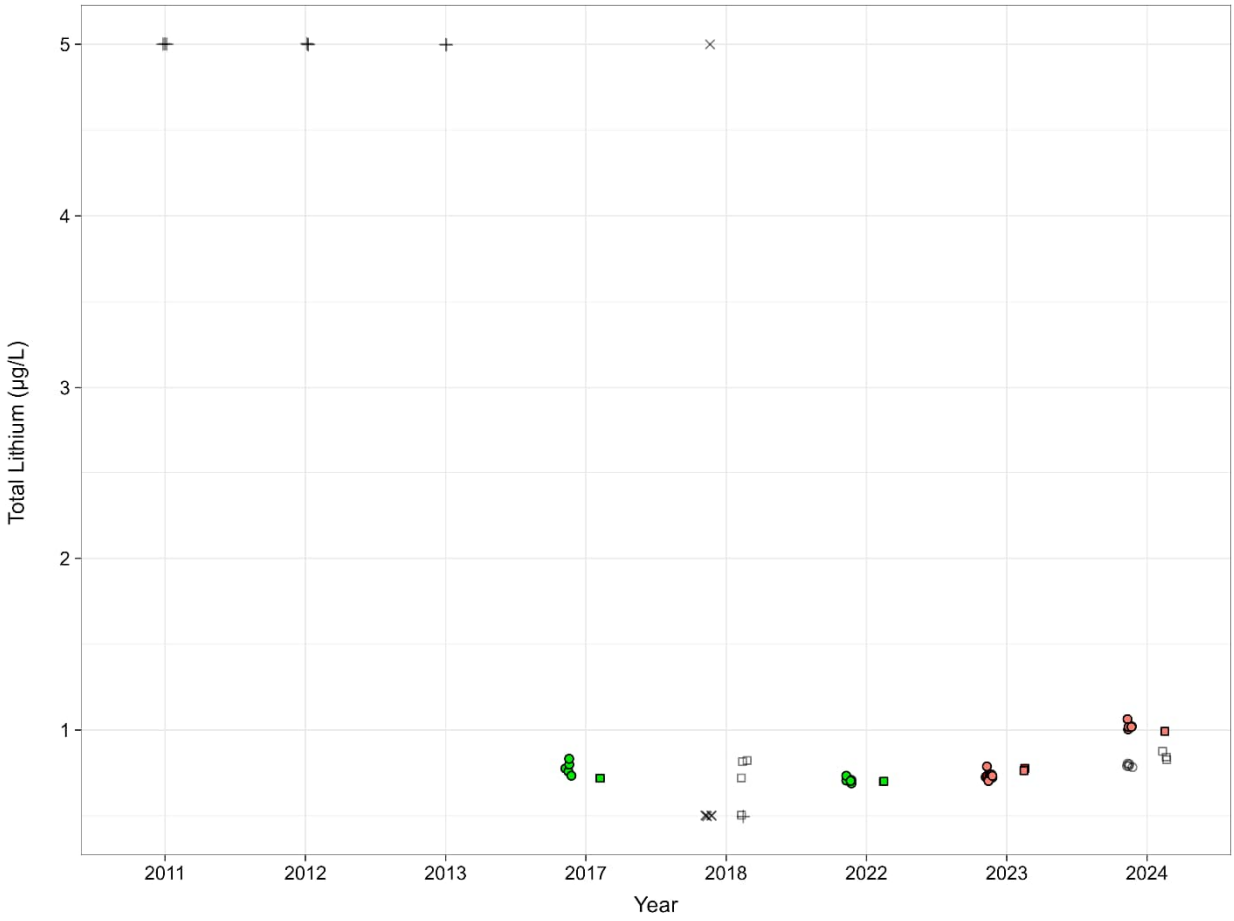

Total Barium (µg/L)
10
8
6
4
2011
2012
2013
2017
2018
2022
2023
2024
Year

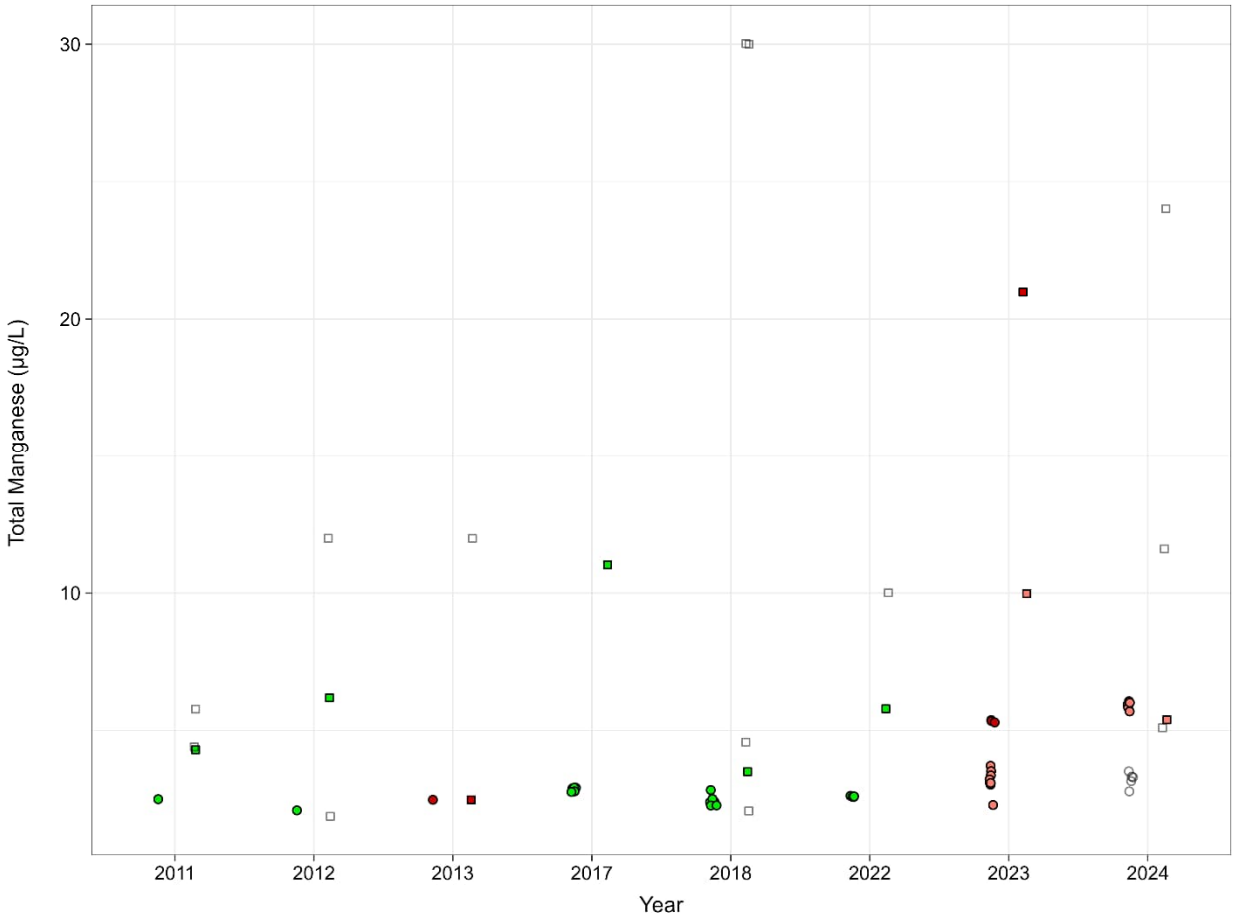

Total Chromium (µg/L)
0.3
0.2
0.1
2011
2012
2013
2017
2018
2022
2023
2024
Year

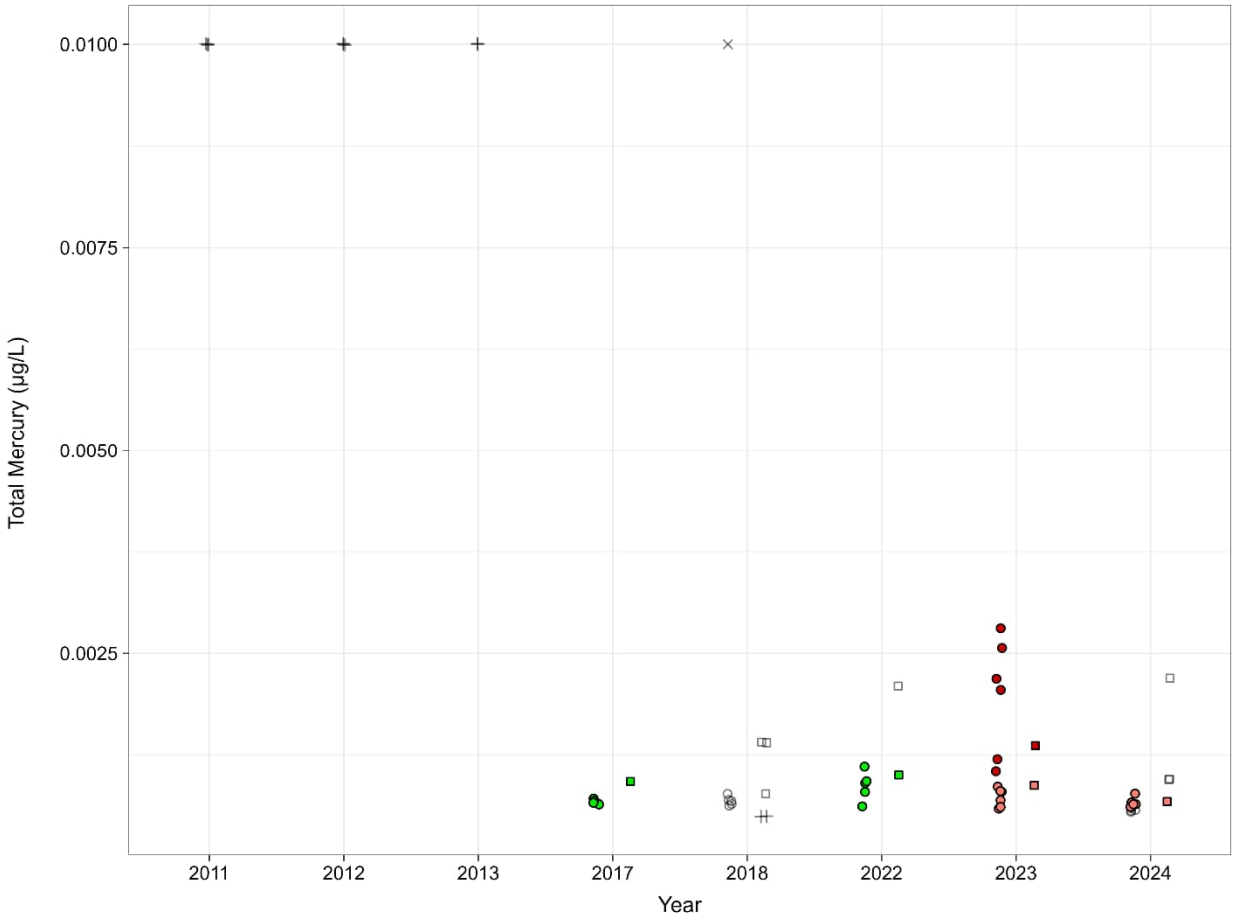

Total Cobalt (µg/L)
0.8
0.6
0.4
0.2
2011
2012
2013
2017
2018
2022
2023
2024
Year

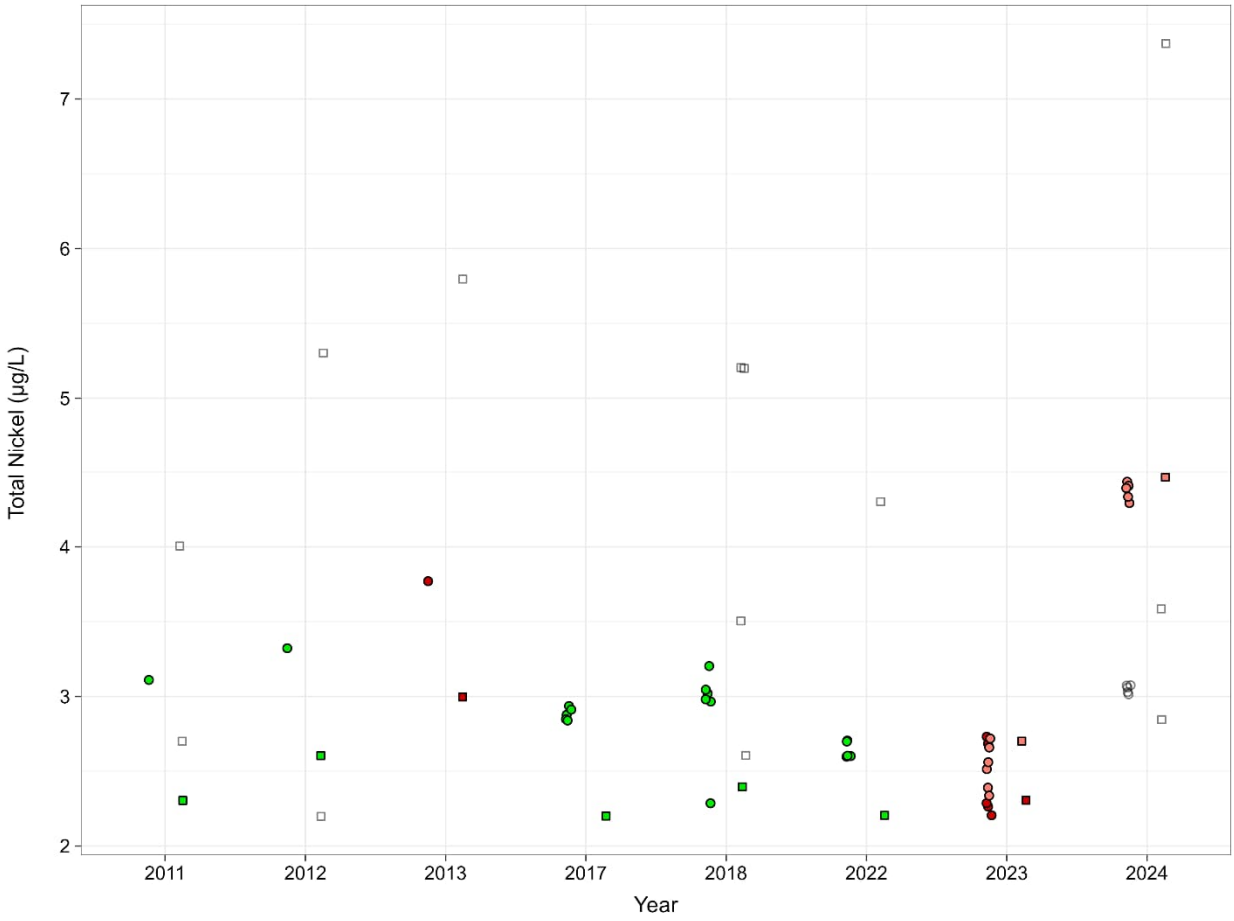

Total Copper (µg/L)
1.75
1.50
1.25
2011
2012
2013
2017
2018
2022
2023
2024
Year

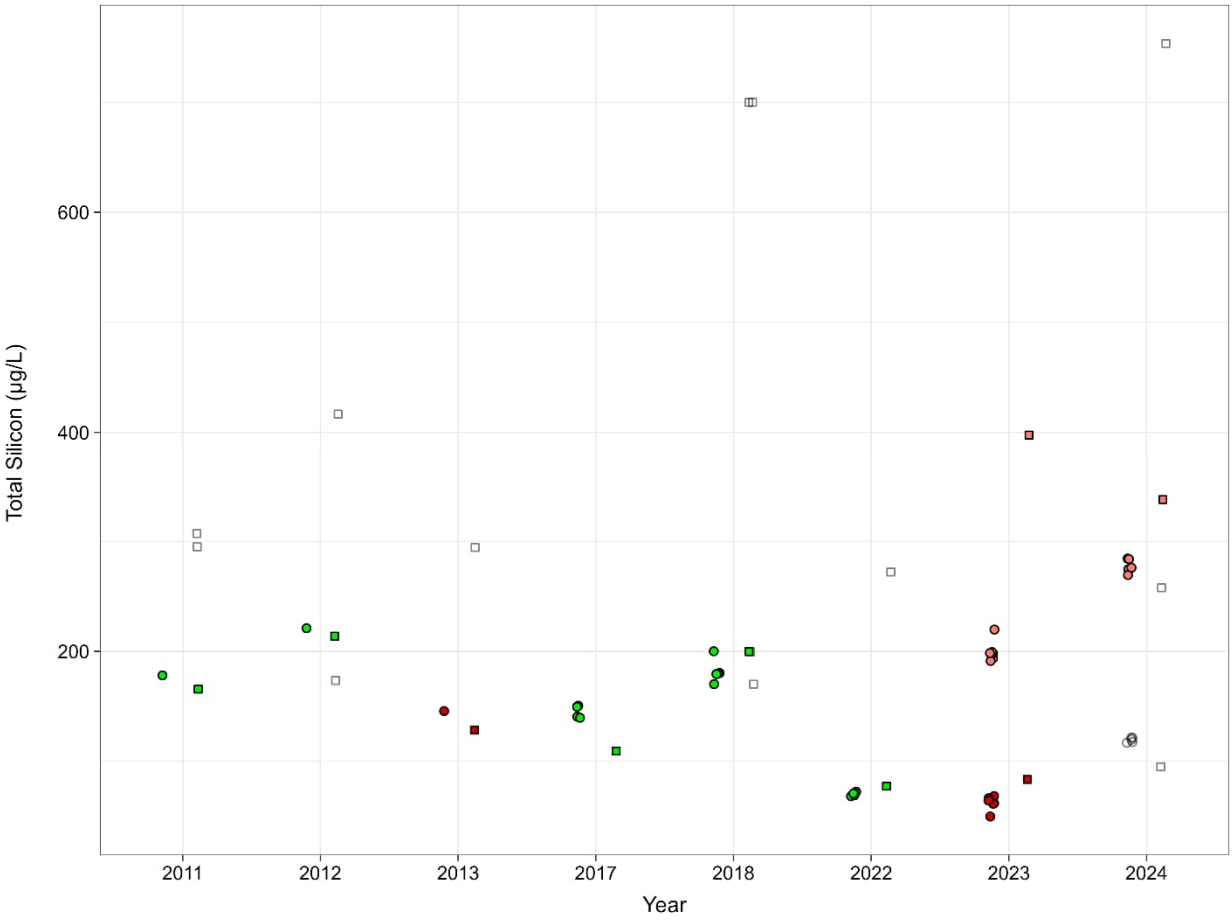

Total Iron (µg/L)
200
150
100
50
2011
2012
2013
2017
2018
2022
2023
2024
Year

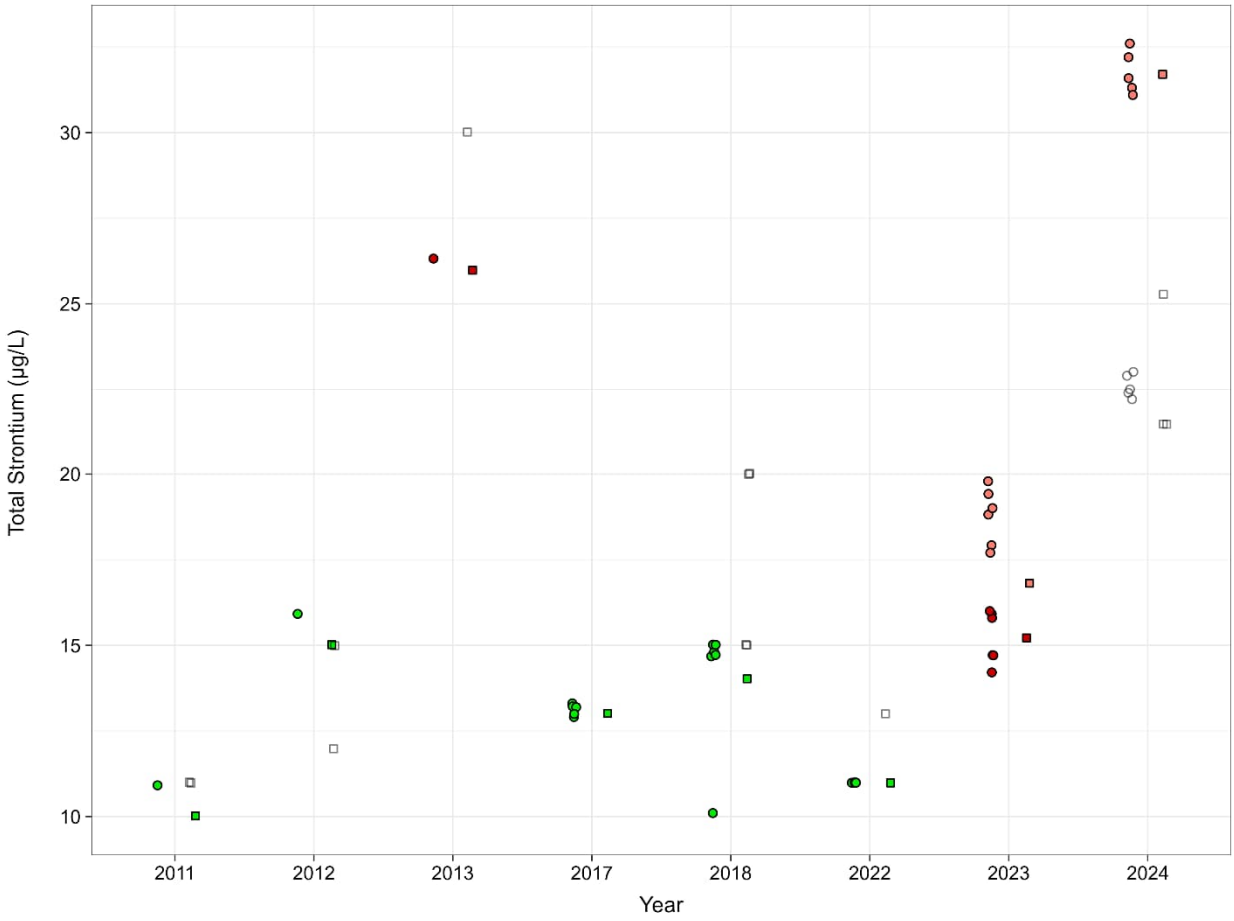

Total Lithium (µg/L)
5
4
3
2
1
2011
2012
2013
2017
2018
2022
2023
2024
Year

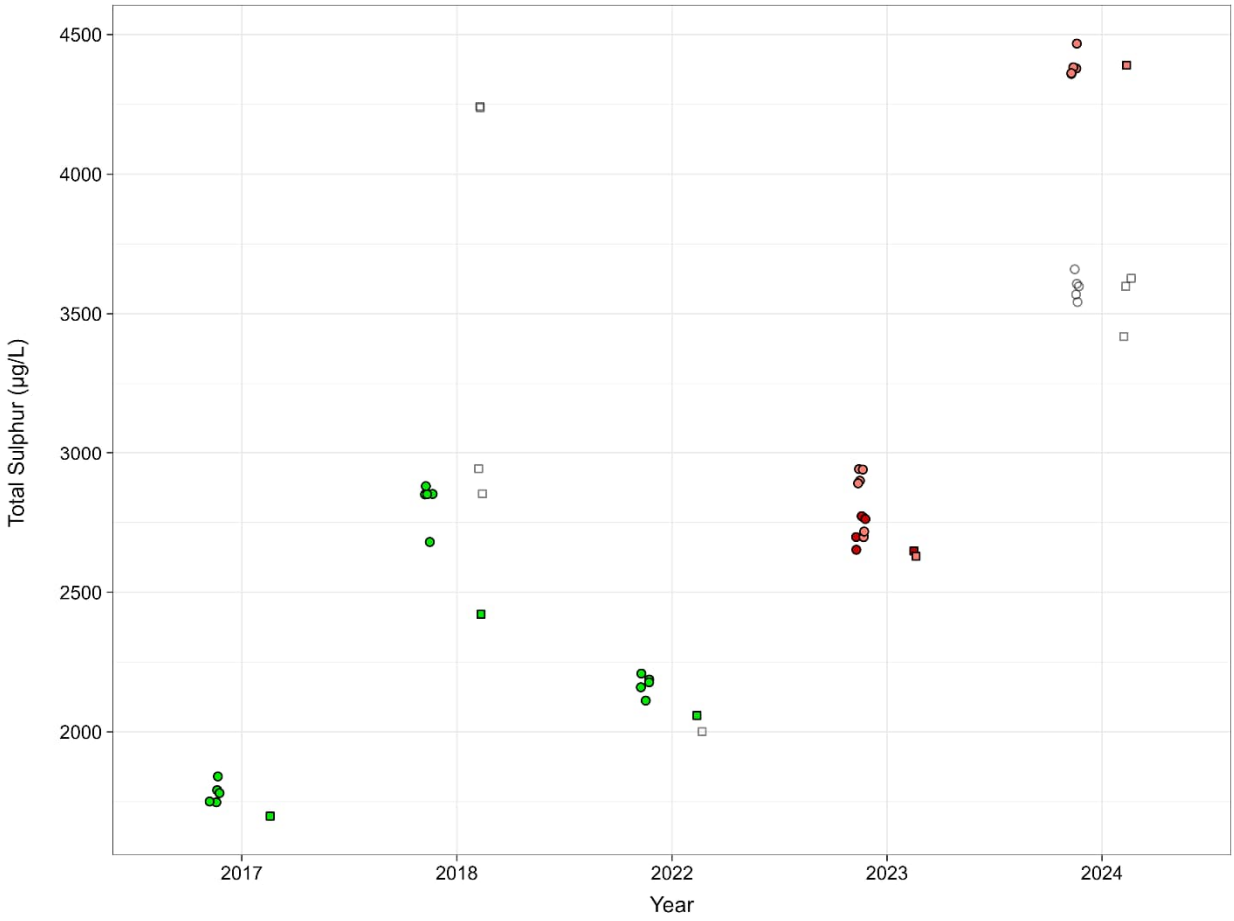

Total Manganese (µg/L)
30
20
10
2011
2012
2013
2017
2018
2022
2023
2024
Year

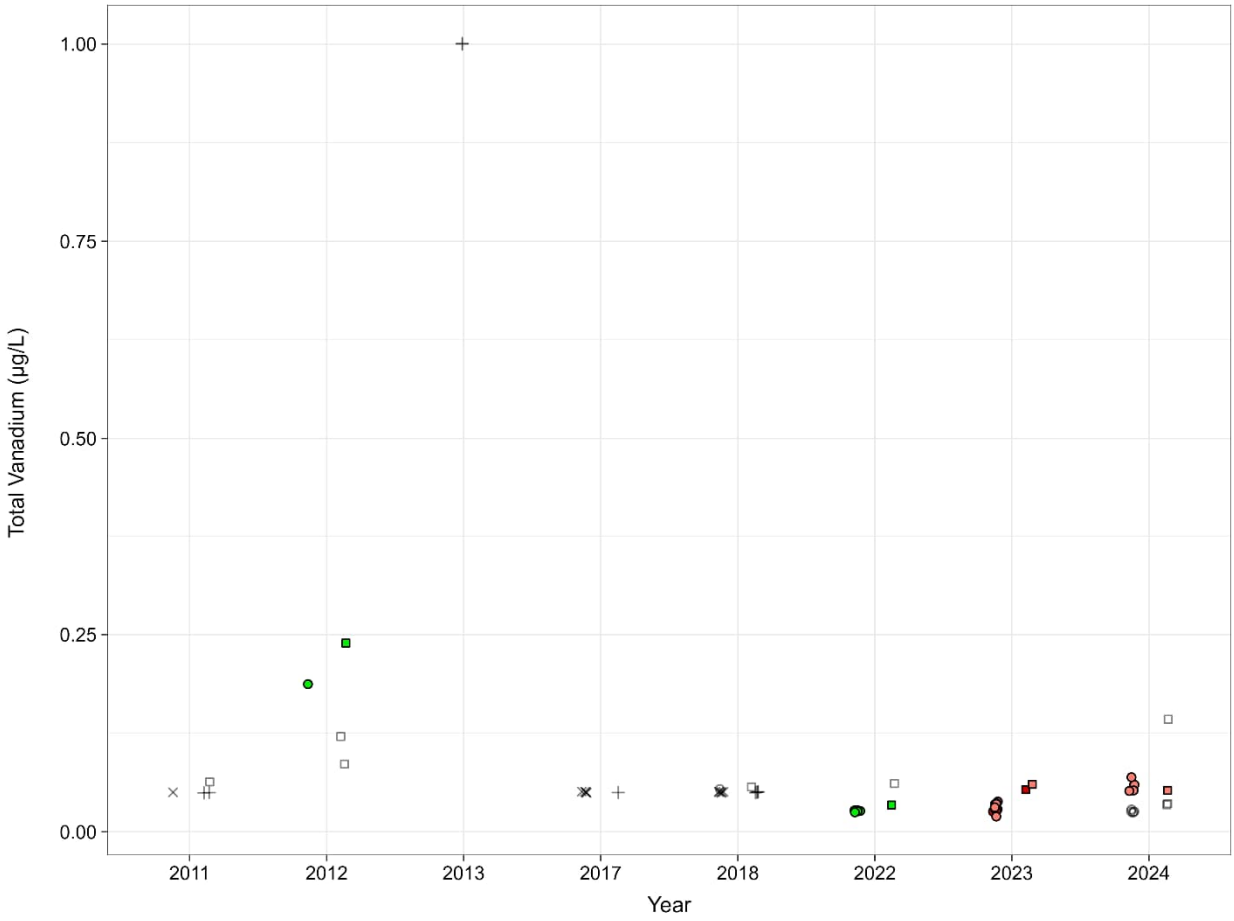

0.0100
0.0075
0.0050
0.0025
Total Mercury (µg/L)
2011
2012
2013
2017
2018
2022
2023
2024
Year

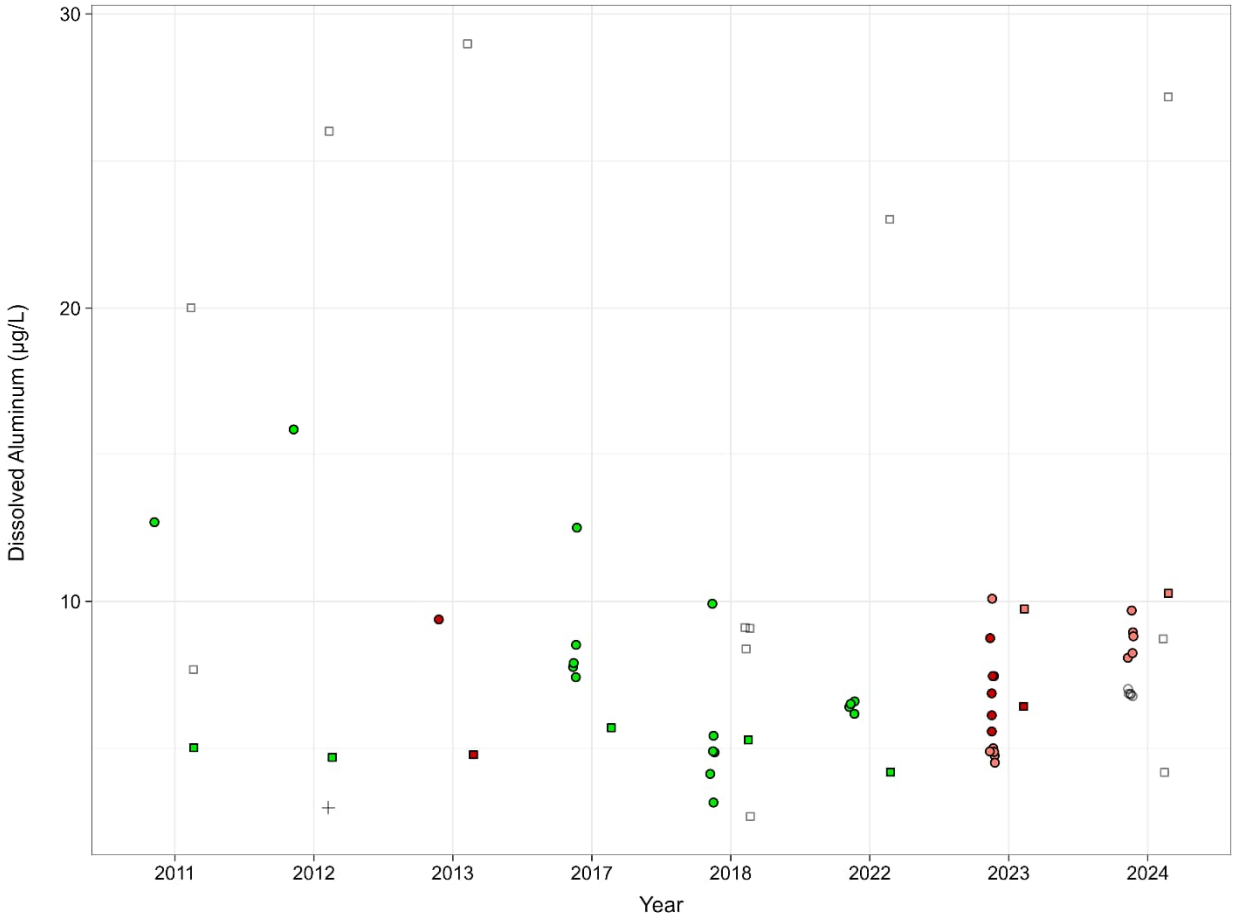

Total Nickel (µg/L)
7
6
5
4
3
2
2011
2012
2013
2017
2018
2022
2023
2024
Year

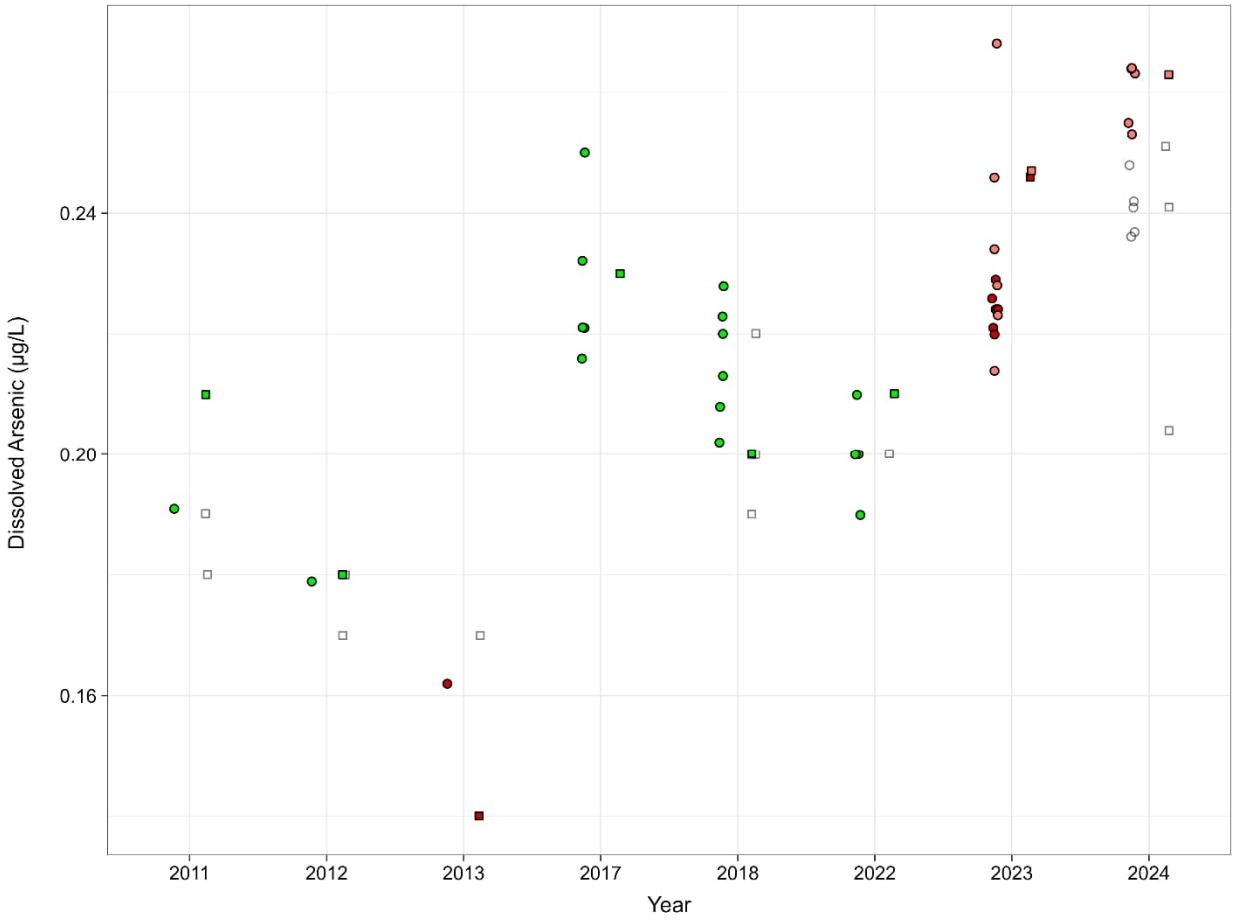

Total Silicon (µg/L)
600
400
200
2011
2012
2013
2017
2018
2022
2023
2024
Year

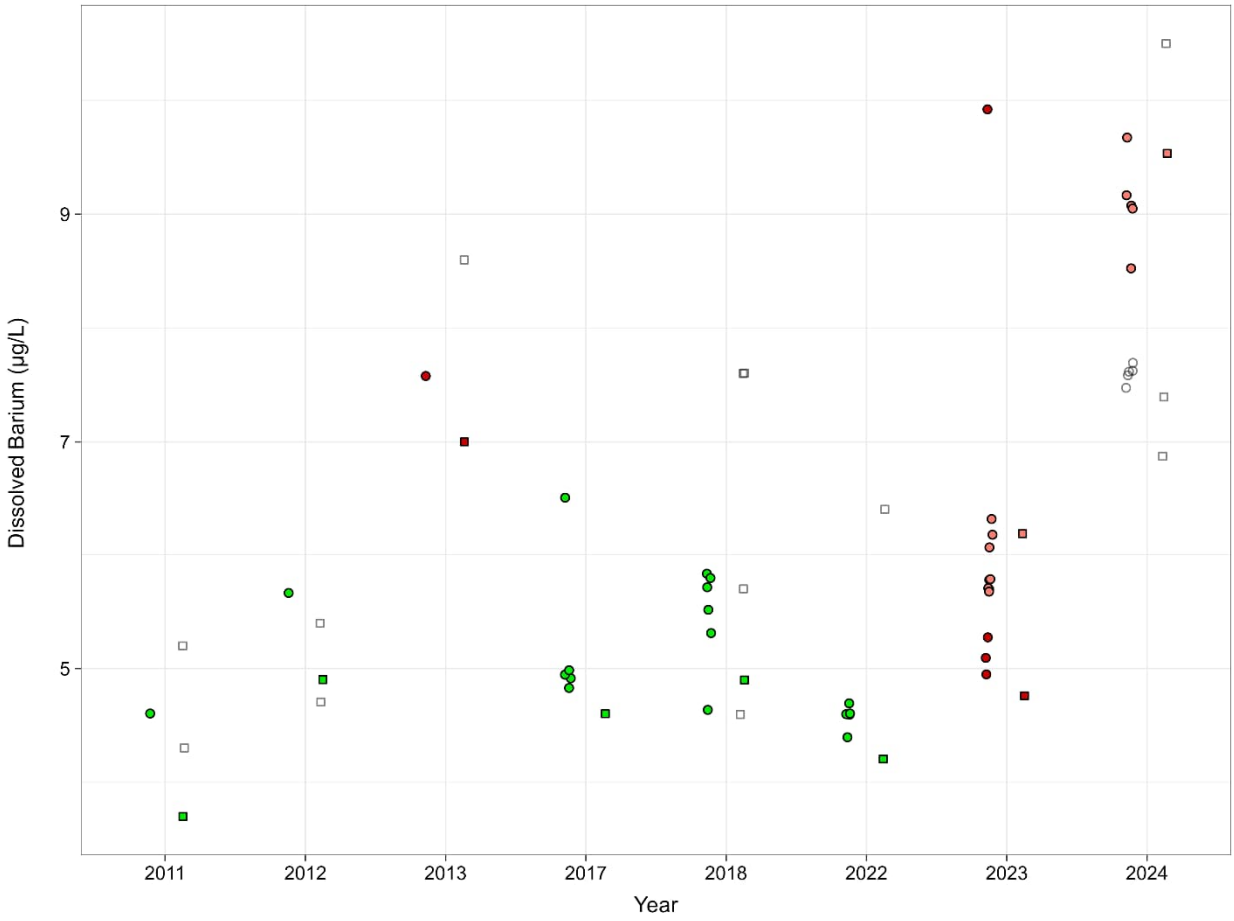

Total Strontium (µg/L)
30
25
20
15
10
2011
2012
2013
2017
2018
2022
2023
2024
Year

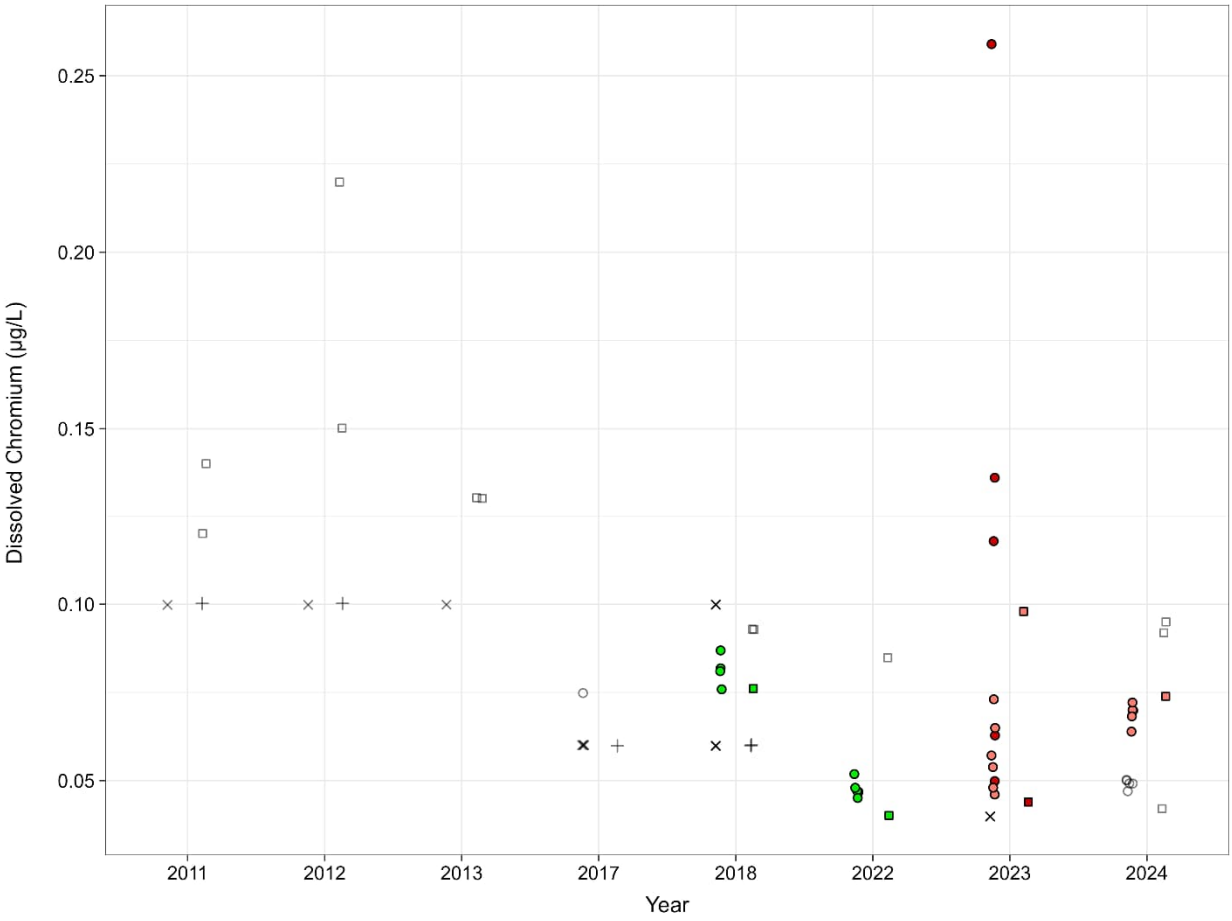

Total Sulphur (µg/L)
4500
4000
3500
3000
2500
2000
2017
2018
2022
2023
2024
Year

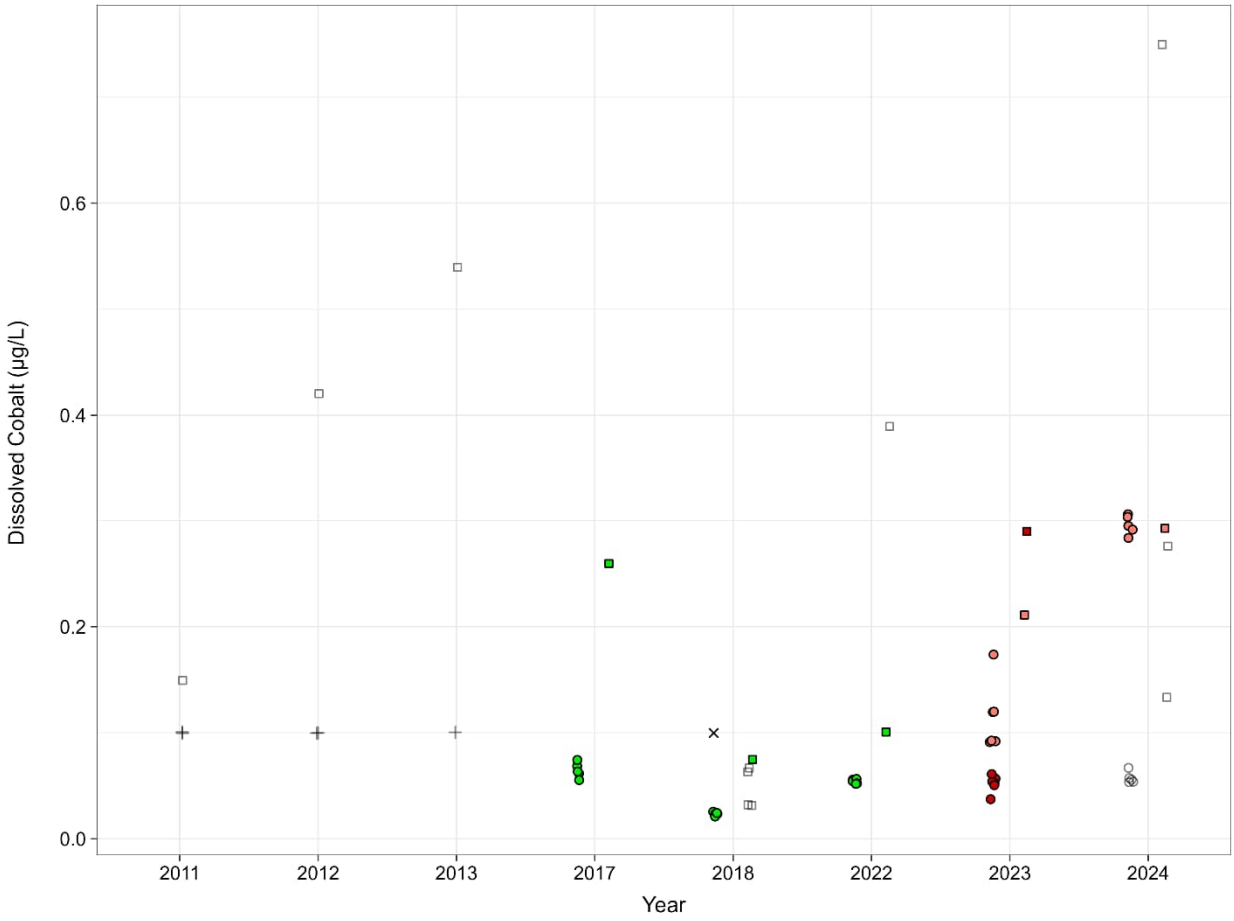

Total Vanadium (µg/L)
1.00
0.75
0.50
0.25
0.00
2011
2012
2013
2017
2018
2022
2023
2024
Year

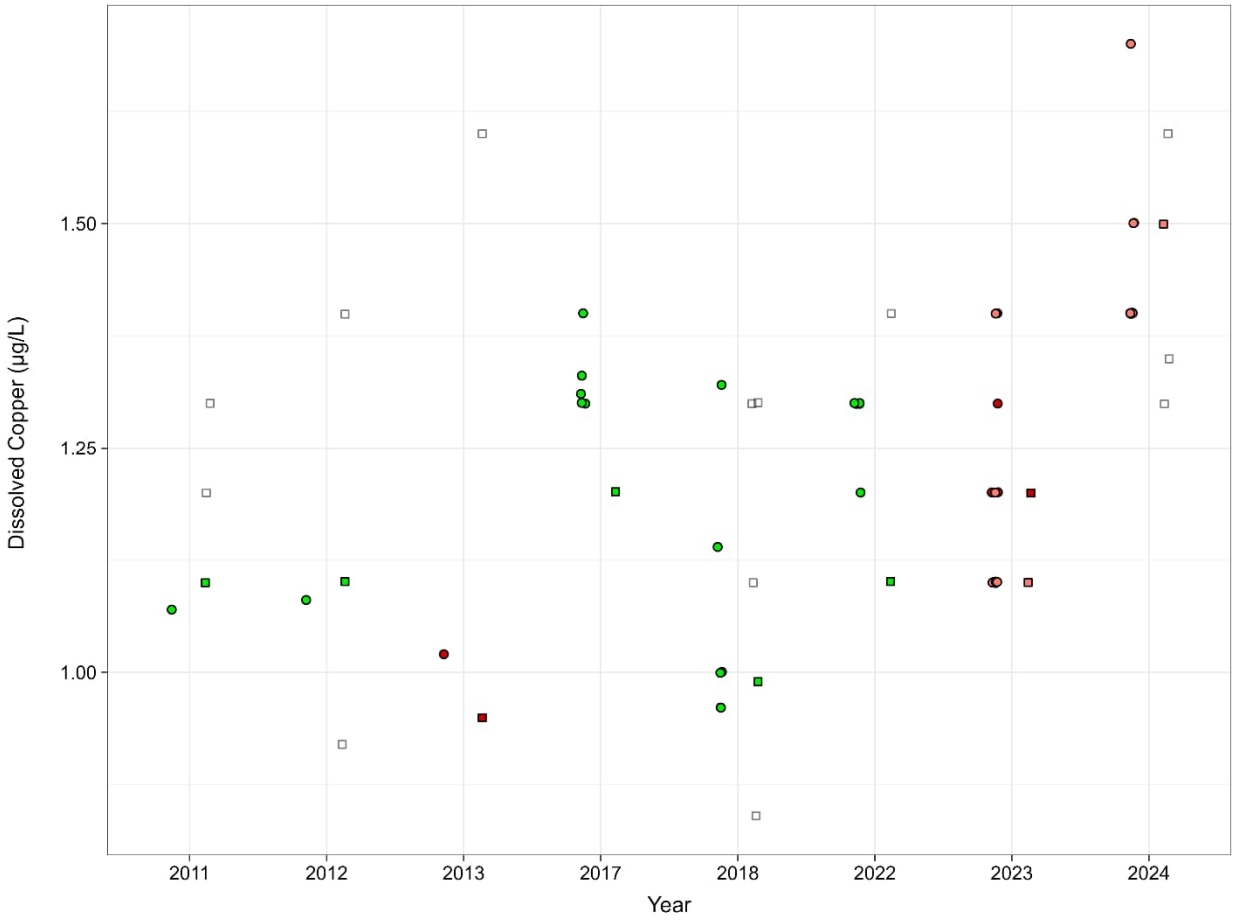

Dissolved Aluminum (µg/L)
30
20
10
2011
2012
2013
2017
2018
2022
2023
2024
Year

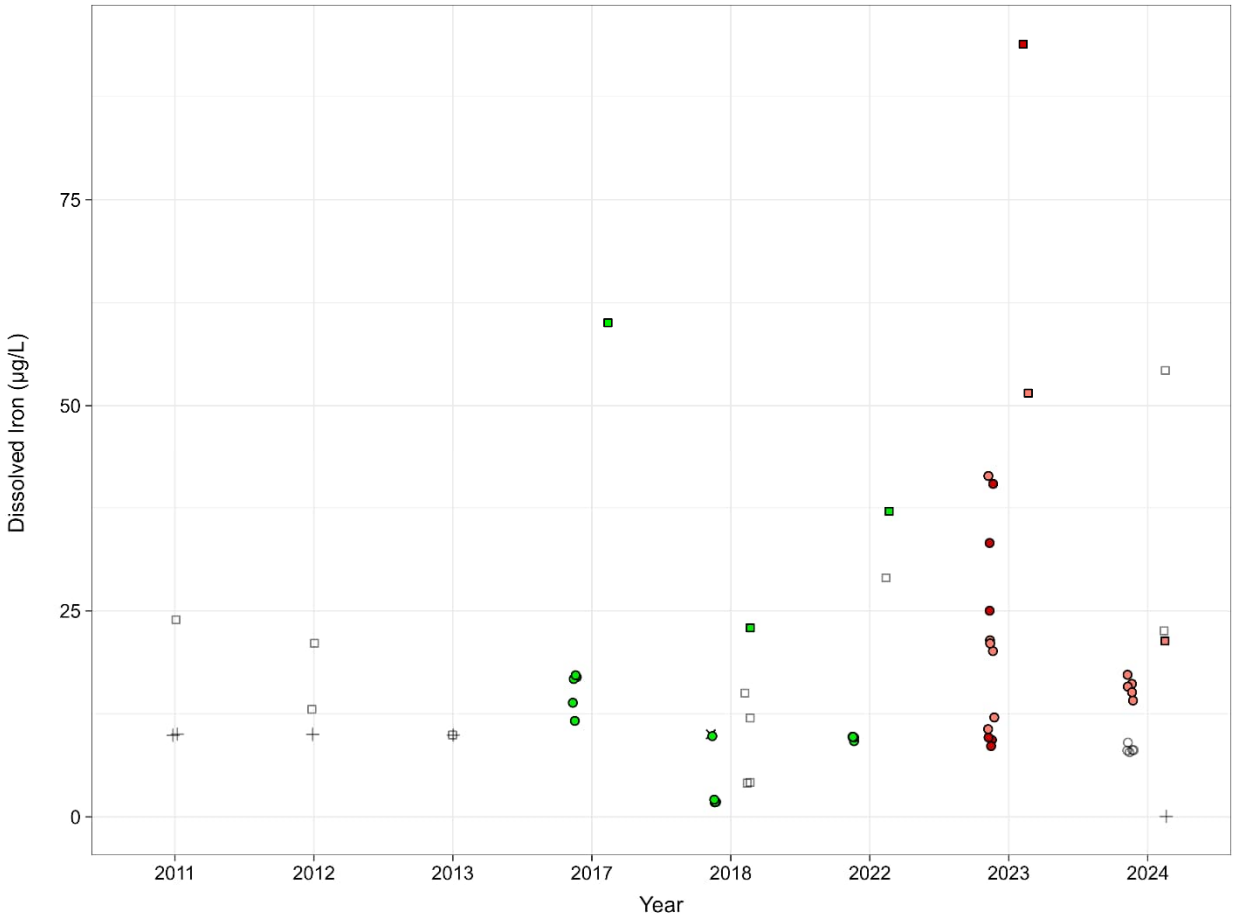

Dissolved Arsenic (µg/L)
0.24
0.20
0.16
2011
2012
2013
2017
2018
2022
2023
2024
Year

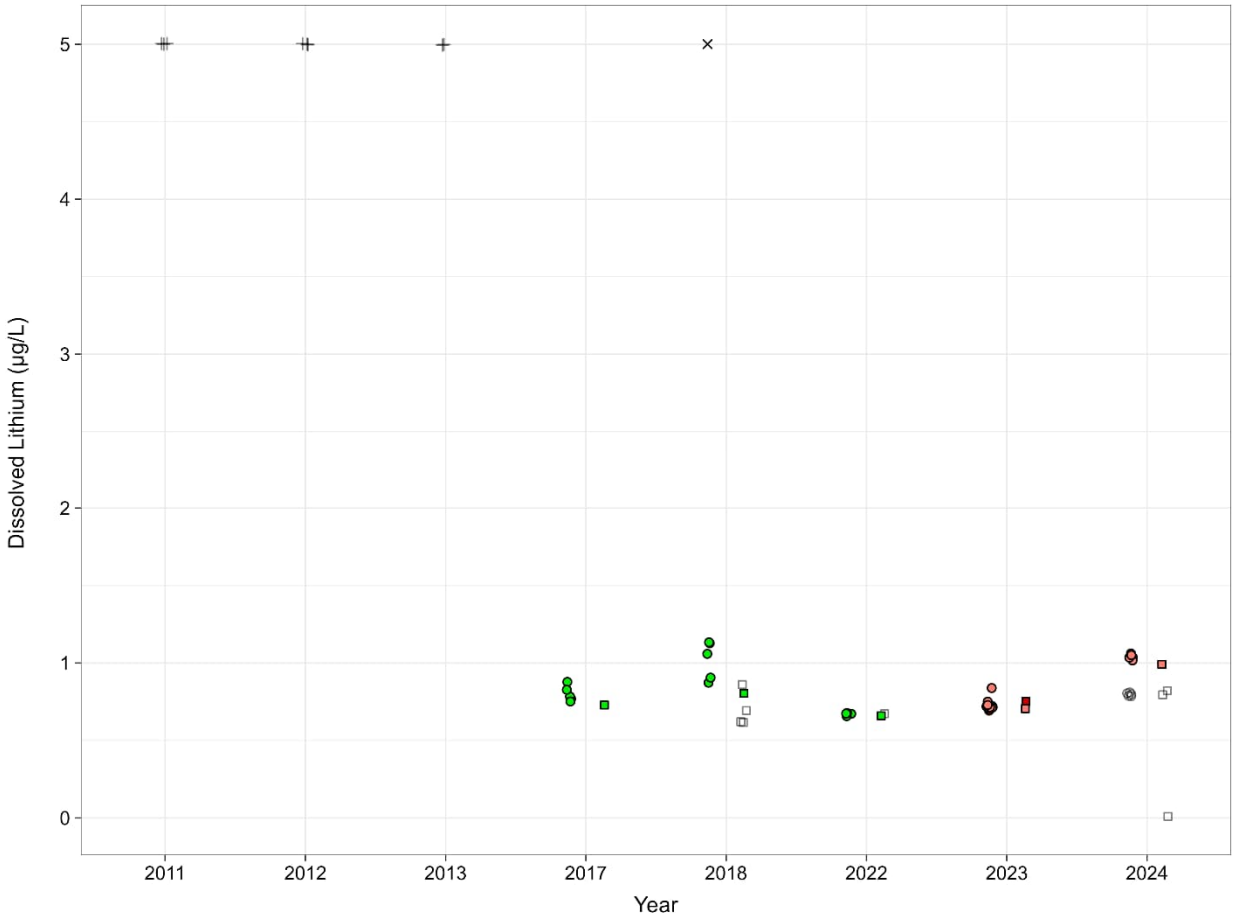

Dissolved Barium (µg/L)
9
7
5
2011
2012
2013
2017
2018
2022
2023
2024
Year

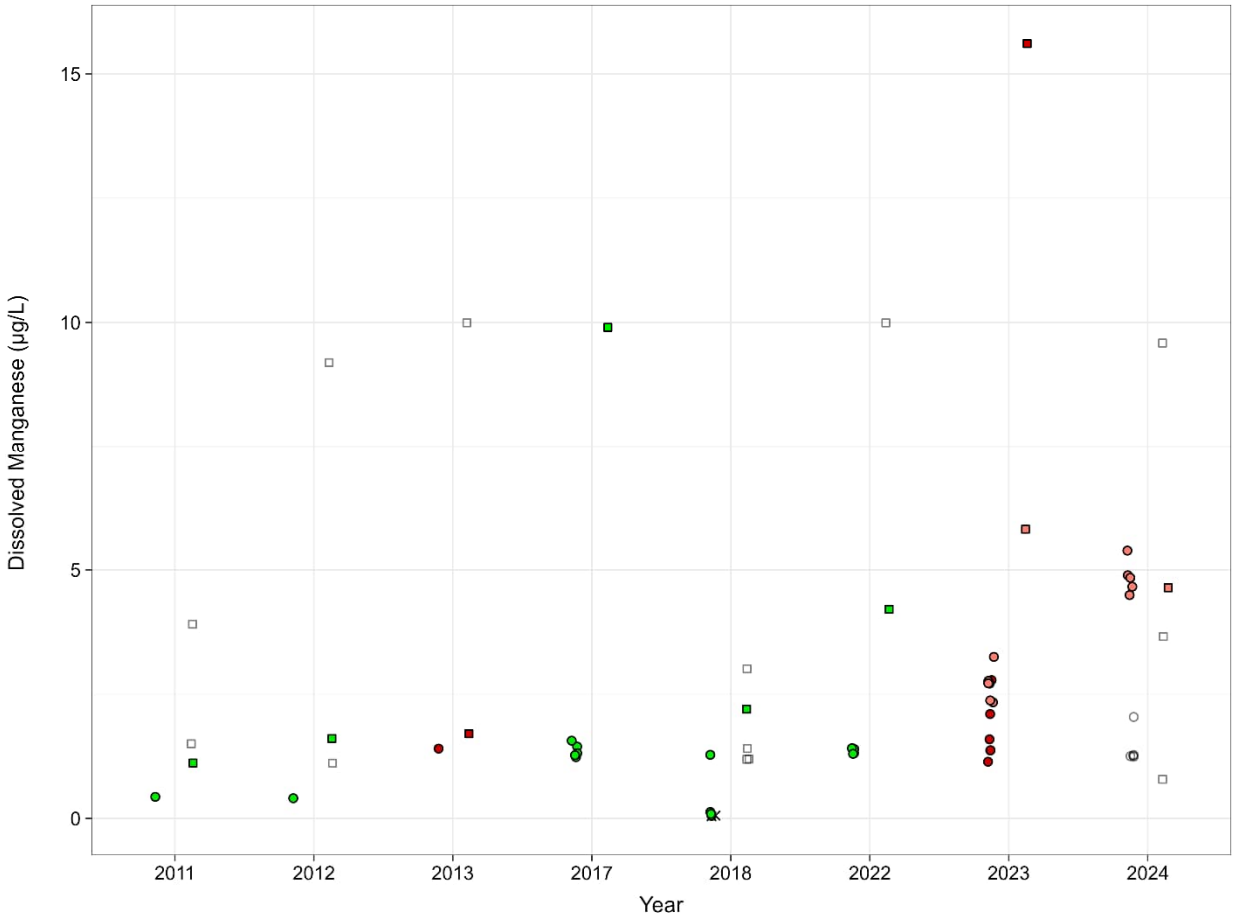

Dissolved Chromium (µg/L)
0.25
0.20
0.15
0.10
0.05
2011
2012
2013
2017
2018
2022
2023
2024
Year

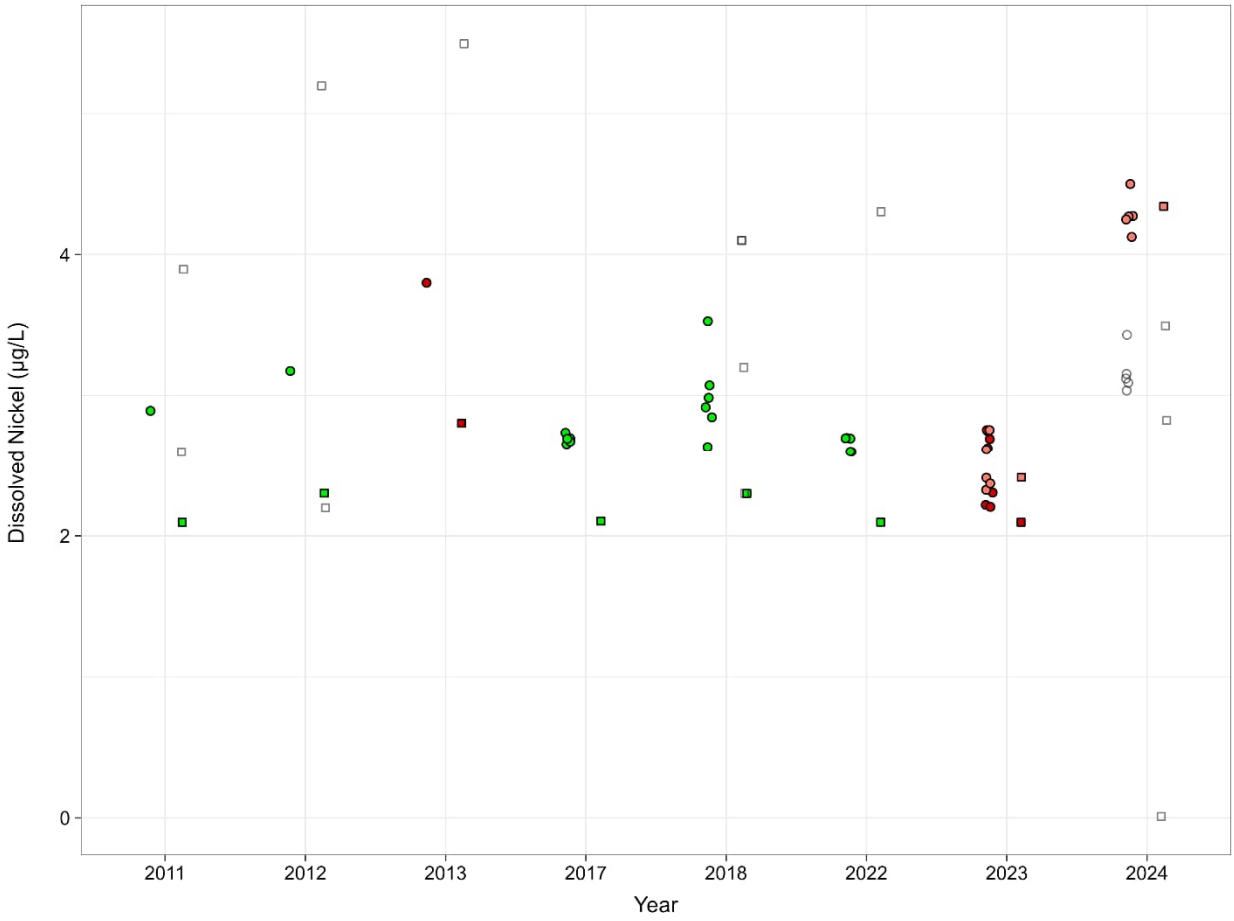

Dissolved Cobalt (µg/L)
0.0
0.2
0.4
0.6
2011
2012
2013
2017
2018
2022
2023
2024
Year

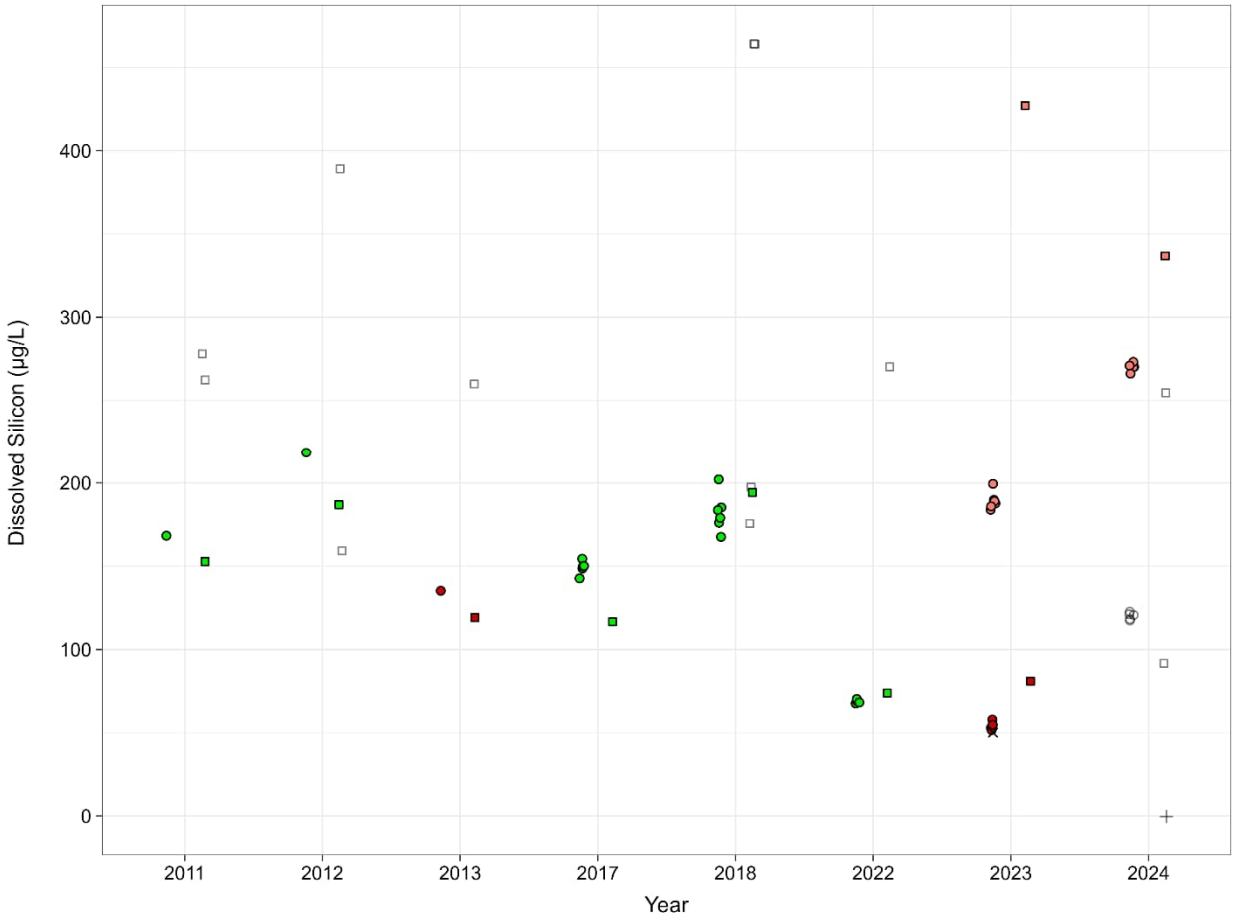

Dissolved Copper (µg/L)
1.50
1.25
1.00
2011
2012
2013
2017
2018
2022
2023
2024
Year

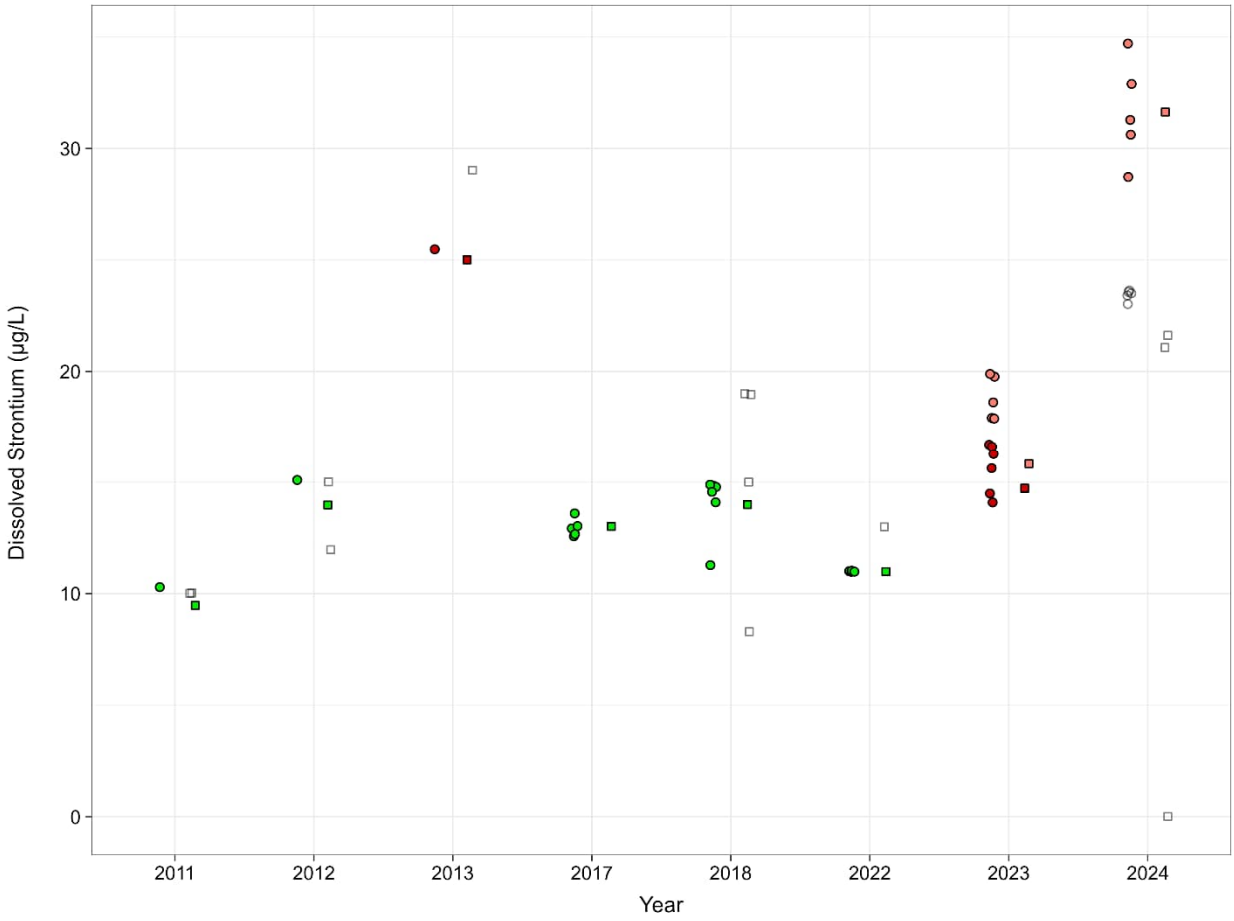

Dissolved Iron (µg/L)
75
50
25
0
2011
2012
2013
2017
2018
2022
2023
2024
Year

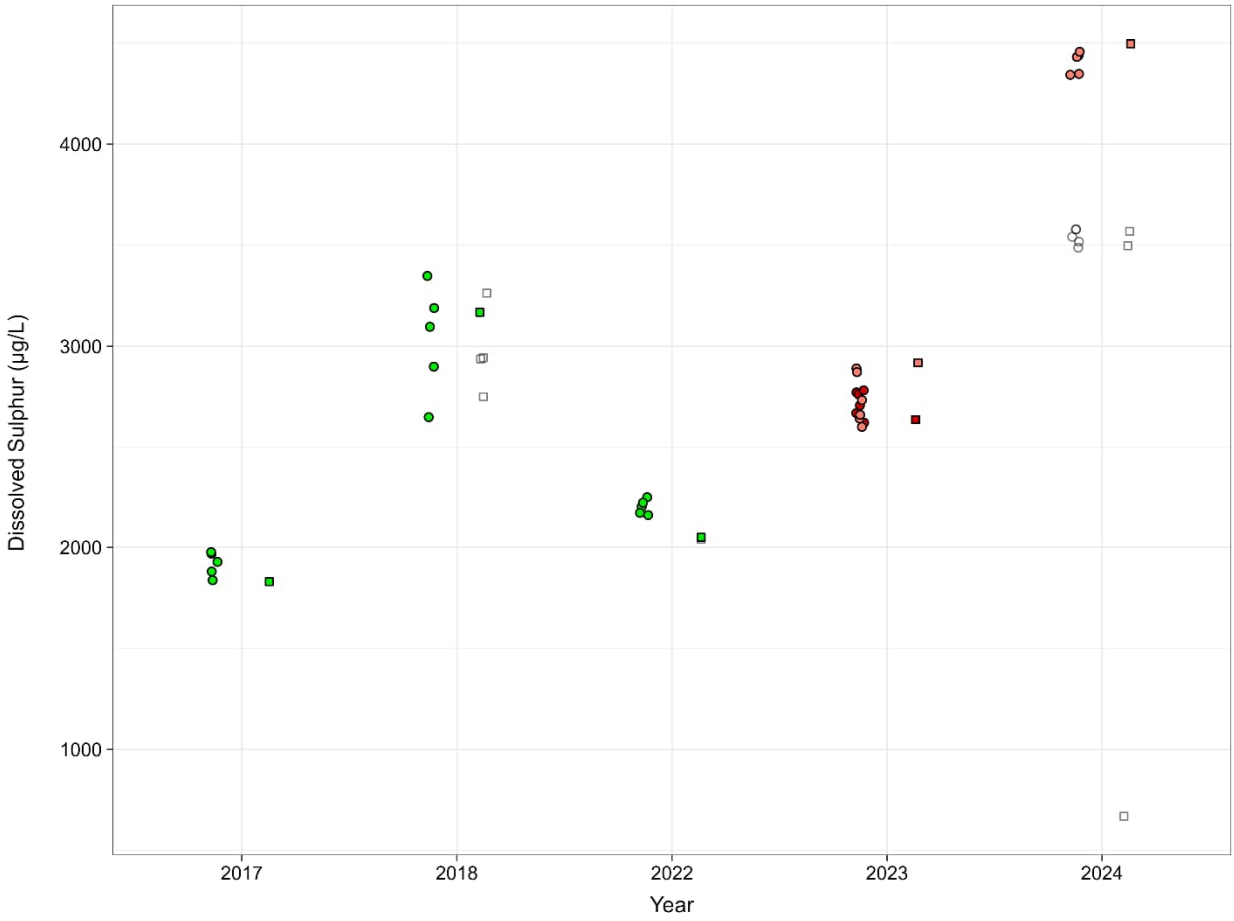

Dissolved Lithium (µg/L)
5
4
3
2
1
0
2011
2012
2013
2017
2018
2022
2023
2024
Year

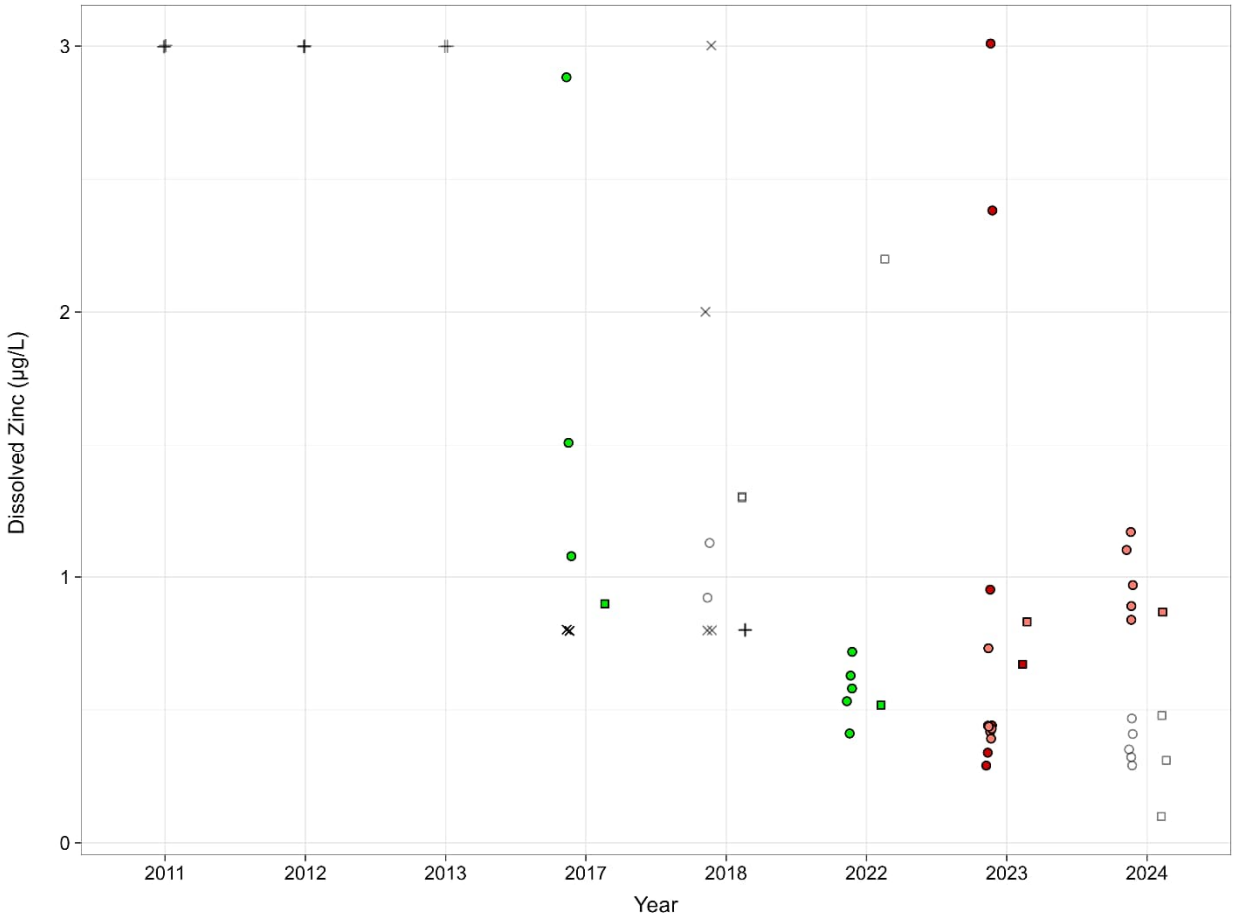

Dissolved Manganese (µg/L)
15
10
5
0
2011
2012
2013
2017
2018
2022
2023
2024
Year


Dissolved Nickel (µg/L)
0
2
4
2011
2012
2013
2017
2018
2022
2023
2024
Year


Dissolved Silicon (µg/L)
400
300
200
100
0
2011
2012
2013
2017
2018
2022
2023
2024
Year


Dissolved Strontium (µg/L)
0
10
20
30
2011
2012
2013
2017
2018
2022
2023
2024
Year


Dissolved Sulphur (µg/L)
4000
3000
2000
1000
2017
2018
2022
2023
2024
Year


Dissolved Zinc (µg/L)
3
2
1
0
2011
2012
2013
2017
2018
2022
2023
2024
Year