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Environmental Monitoring Report – Water Management and Monitoring 2022/23

Mt Piper Power Station Brine Conditioned
Fly Ash Co-Placement Project

27 September 2023

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Application Number: DA80/10060

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27 September 2023

Environmental Monitoring Report – Water Management and Monitoring 2022/23

Mt Piper Power Station Brine Conditioned Fly Ash Co-Placement Project



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Acronyms and Abbreviations

| Name | Description |
|-----------------|--|
| EMR | Environmental Monitoring Report |
| AHD | Australian Height Datum |
| ANZECC | Australia and New Zealand Environment Conservation Council |
| ANZG | Australia and New Zealand Guidelines |
| BCA | Brine conditioned ash |
| CSP | Coal Settling Pond |
| DPE | NSW Department of Planning and Environment |
| EC | Electrical conductivity |
| EnergyAustralia | EnergyAustralia NSW Pty Limited |
| EPA | Environment Protection Authority |
| EP&A Act | Environmental Planning and Assessment Act 1979 |
| EPL | Environment Protection Licence |
| ERM | Environmental Resources Management Australia Pty Ltd |
| FHP | Final Holding Pond |
| ha | Hectares |
| LCC | Lithgow City Council |
| LDP | Licensed Discharge Point |
| LMP | Licensed Monitoring Point |
| LNAR | Lamberts North Ash Repository |
| LOR | Limit of Reporting |
| m AHD | metres Australia Height Datum (m AHD). |
| MF | Micro Filtration |
| mg/L | milligrams per litre |
| ML | Mega litre |
| MPAR | Mt Piper Ash Repository |
| MPPS | Mt Piper Power Station |
| Nalco | Nalco Water – Ecolab |
| NFR | Non-filterable Residue, also referred to as Turbidity. |

| Name | Description |
|----------|---|
| NSW | New South Wales |
| OEMP | Operational Environmental Management Plan |
| POEO Act | Protection of the Environment Operations Act (NSW) 1997 |
| QA/QC | Quality Assurance and Quality Control |
| QC | Quality Control |
| RL | Relative Level |
| RO | Reverse Osmosis |
| SWTP | Springvale Water Treatment Plant |
| TARPs | Trigger Action Response Plans |
| TDS | Total Dissolved Solids |
| TKN | Total Kjeldahl Nitrogen |
| TSS | Total Suspended Solids |
| WCA | Water Conditioned Ash |
| WMP | Water Management and Monitoring Plan |
| µg/L | micrograms per litre |
| µS/cm | microSiemens per centimetre |

Report Terminology

The Project - the Mt Piper Brine Conditioned Fly Ash Co-Placement Project approved under the conditions of development consent DA80/10060 (Mt Piper Consent).

The Mt Piper Consent – originally granted under the Environmental Planning and Assessment Act 1979 (NSW) (EP&A Act) on 1 April 1982 and has since been modified on eight occasions. The Mt Piper Consent, as currently modified (Modification 8, dated 24 July 2019), authorises the MPPS and ancillary activities, including the Mt Piper Ash Repository (MPAR).

The WMP – the Water Management and Monitoring Plan approved for the Project, prepared by ERM and dated 28 February 2020 (the WMP).

The EMR – this report which has been developed in relation to water management and monitoring aspects of the Project in order to satisfy Conditions 44 and 45 of the Mt Piper Consent, and the relevant reporting requirements of the Water Management and Monitoring Plan approved for the Project (the WMP).

The Ash Repositories – the MPAR and the LNAR are together referred to as the Ash Repositories.

1. INTRODUCTION

Environmental Resources Management Australia Pty Ltd (ERM) was engaged by EnergyAustralia NSW Pty Limited (EnergyAustralia) to prepare an annual Environmental Monitoring Report (EMR) for the Mt Piper Brine Conditioned Fly Ash Co-Placement Project (the Project). The Project is located at the Mount Piper Power Station (MPPS), 350 Boulder Road, Portland, New South Wales (NSW) (the site). Refer to Figure 1 showing the location of the site.

The Project is operated under the conditions of development consent DA80/10060 (Mt Piper Consent). The Mt Piper Consent was originally granted under the Environmental Planning and Assessment Act 1979 (NSW) (EP&A Act) on 1 April 1982 and has since been modified on eight occasions. The Mt Piper Consent, as currently modified (Modification 8, dated 24 July 2019), authorises the MPPS and ancillary activities, including the Mt Piper Ash Repository (MPAR).

This EMR has been developed in relation to water management and monitoring aspects of the Project in order to satisfy Conditions 44 and 45 of the Mt Piper Consent, and the relevant reporting requirements of the Water Management and Monitoring Plan approved for the Project (the WMP). It has been developed in general accordance with the requirements of the NSW Department of Planning and Environment (DPE), formerly the NSW Department of Planning, Industry and Environment (DPIE) post approval compliance reporting requirements (DPIE, 2020). Appendix A presents a summary of the requirements of the Mt Piper Consent and the WMP, and where they are addressed in this EMR. Consistent with feedback from the DPE on the 2021/22 EMR, Table 1 provides a statement of compliance as at the end of the reporting period and based on the information in this EMR.

Table 1: Statement of Compliance

| Were all conditions of the relevant approval complied with? | | |
|---|--|-----|
| DC DA80/10060 (Mt Piper Consent) | Conditions 44 and 45, the annual Environmental Monitoring Report (EMR) | YES |

This EMR reports on the water monitoring carried out for the Project from July 2022 to June 2023 (the reporting period) in accordance with the conditions of the Mt Piper Consent. It will be provided to the Secretary, the NSW Environment Protection Authority (EPA), the Water Division within the NSW DPE, WaterNSW, and Lithgow City Council (LCC).

This report should be read in conjunction with the Statement of Limitations presented in Section 10.

1.1 Project Background

The MPPS is located in the western coalfields of NSW about 18 kilometres north-west of Lithgow. The MPPS is owned and operated by EnergyAustralia. The MPPS is regulated by a number of separate development consents and planning approvals under the EP&A Act, including the Mt Piper Consent. The MPPS is also regulated under the conditions of Environment Protection Licence 13007 (EPL) granted under the Protection of the Environment Operations Act 1997 (NSW) (the POEO Act). Table 2 lists the approvals that apply to the Project and form the subject of this EMR.

Table 2: Summary of Approvals

| Approval/ Licence | Details/Comments |
|-------------------|---|
| Mt Piper Consent | Granted by Minister for Planning under the EP&A Act as currently modified. The WMP was approved under the conditions of the Mt Piper Consent. |
| EPL No. 13007 | EPL held by EnergyAustralia for the MPPS, including the Project. |

The Project incorporates brine management and storage facilities on the footprint of the MPPS and the ash emplacement area within the former Western Main Open Cut void adjacent to the operational power generation area.

The ash placement area is comprised of the MPAR, which is authorised under the Mt Piper Consent, and the separately approved Lamberts North Ash Repository (LNAR). The MPAR and the LNAR are together referred to as the Ash Repositories. However, this EMR is limited to the MPAR which was approved under the Mt Piper Consent.

The separately approved Springvale Water Treatment Project (SWTP) is also located on the MPPS footprint but outside of the EPL premises. Both the SWTP and the MPPS contribute brine to the MPAR. The SWTP also contributes solid mixed salts to the MPAR. Key features of the Project area are presented in Figure 2.

The Mt Piper Consent was modified on 3 April 2000 to authorise the co-placement of brine conditioned ash (BCA) in the existing MPAR placement area. This Stage 1 BCA co-placement activity was approved as Modification 4 to the Mt Piper Consent. As required by the conditions imposed as part of Modification 4, an early Water Management Plan was developed and implemented. Due to space limitations in the Stage 1 approval area and to provide for increased brine production due to the upgrade of generating capacity (authorised as Modification 6 to the Mt Piper Consent), a Stage 2 extension to the BCA co-placement area at the MPAR was approved on 23 March 2008 (authorised as Modification 7 to the Mt Piper Consent). A Water Management Plan (Mt Piper Power Station Brine Conditioned Flyash Co-Placement Extension Water Management and Monitoring Plan prepared by Connell Wagner and dated 26 September 2008) was prepared and implemented under the conditions of the Mt Piper Consent for the MPAR. This is referred to in this report as the “Prior WMP.”

Following the approval of Modification 8 to the Mt Piper Consent (Condition 43A), the Prior WMP was updated to account for construction and operation of a new 60 Mega Litres (ML) pond (Settling Pond D) at the MPPS. The current WMP was prepared by ERM and is dated 28 February 2020 (ERM, 2020) (the WMP).

It is noted that a separate and broader investigation of surface and groundwater conditions in the vicinity of the Ash Repositories, including the Mt Piper Brine in Ash Co-Placement area has recently been completed in line with the contingency measures identified in the WMP (the independent groundwater investigation). Based on findings from the independent groundwater investigation, a modification application for the Mt Piper Consent is pending. The proposed modification to the Mt Piper Consent is intended to enable a mitigation strategy, as the MPAR transitions to a decommissioned facility.

1.1.1 Relationship to Other Approvals and Plans

While the MPAR is approved under the Mt Piper Consent, the LNAR is separately approved by Project approval 09_0186 granted under Part 3A of the EP&A Act on 16 February 2012 (LNAR Project Approval). The conditions of the LNAR Project Approval require:

- Implementation of a separately approved Operational Environmental Management Plan. The currently approved plan is the Lamberts North Ash Placement Project Operational Environmental Management Plan (Revision 6) originally prepared by CDM Smith in 2013 and last revised by EnergyAustralia in May 2022 (LNAR Operations Environment Management Plan (OEMP)). The LNAR OEMP includes a Groundwater Management Plan and a Surface Water Management Plan; and
- The carrying out of groundwater and surface water monitoring programs as specified in the LNAR OEMP. The results of the LNAR monitoring are reported in a separate EMR prepared in accordance with the conditions of the LNAR Project Approval.

As the LNAR is operated in accordance with the separately approved LNAR OEMP under the conditions of the LNAR Project Approval, this EMR does not cover water management, monitoring and reporting aspects required under the LNAR OEMP.

In addition, the SWTP was separately approved under development consent number SSD-7592 (SWTP Consent) granted under the EP&A Act in 2017.

1.2 Objectives

The objectives of the EMR are to meet the reporting requirements of the Mt Piper Consent and the WMP for the reporting period (July 2022 to June 2023).

This includes the requirements of Condition 45 of the Mt Piper Consent which requires that the EMR include:

- A summary and discussion of all available results and analyses from Water Monitoring Programs (i.e., those contained in the WMP);
- A discussion of the aims of the WMP and to what degree these aims have been attained in the context of results and analyses of the Water Monitoring Programs; and
- Actions taken, or intended to be taken, if any, to mitigate any adverse environmental impacts and to meet the reasonable requirements of the Secretary, EPA, DPE Water, WaterNSW or the LCC.

The WMP requires that the EMR is to involve the following scope of works:

- Review of surface water and groundwater quality data;
- Review of long-term trends in surface water and groundwater concentrations, with reference to statistical assessment of concentration trends and triggers;
- Assessment of the data to evaluate potential interactions with Wangcol Creek water quality;
- Reporting when the Environmental Goals have not been achieved;
- An interpretation and discussion of results;
- Update on the contingency measures currently being implemented in accordance with the WMP; and
- Preparation of this report in accordance with the WMP and the Mt Piper Consent.

It is noted that other reporting requirements, including provision of water quality data, form part of the EPL annual return reporting process; the data presented in this EMR will also be published online as required by regulation. The reporting requirements under the EPL will be provided separately to this EMR.

1.3 Contact

The contact details for the key personnel responsible for the environmental management of the Project are listed in Table 3.

Table 3: Contact Details

| Contact Person | Organisation | Position | Telephone |
|-----------------|-----------------|------------------------|----------------|
| Mr Ben Eastwood | EnergyAustralia | NSW Environment Leader | (02) 6354 8111 |

1.4 Scope of Works

In order to meet the objectives of the EMR, the following works have been implemented:

- Import of environmental monitoring data provided by EnergyAustralia to the existing database for the site;
- Export of summary tables for available water quality and weather data collected by EnergyAustralia from the monitoring conducted in accordance with the WMP;
- Preparation of selected graphs of environmental monitoring data collected by EnergyAustralia from the monitoring conducted in accordance with the WMP;
- Review of surface water (seven locations), groundwater (25 locations) and leak detection (two locations) monitoring data at the Project area for the reporting period;

- Review of changes in water quality data including long-term trends in surface water and groundwater concentrations and water levels;
- Assessment of the groundwater data to evaluate potential interactions with Wangcol Creek water quality; and
- Preparation of this EMR to
 - Present an overview of Project operations, including ash placement activities,
 - Present findings of the water quality monitoring, including interpretation and discussion of results, in accordance with the WMP,
 - Present outcomes of the statistical assessment of water quality data that exceeded Environmental Goals during the reporting period, including a discussion of trigger, action, response plans (TARPs) where implemented,
 - Provide an update on the contingency measures currently being implemented at the site in accordance with the WMP, and
 - Provide a summary of recommended actions to be taken, if any, to mitigate adverse environmental impacts, and to meet the requirements of the relevant government authorities and the WMP.

This EMR has been developed with consideration of the independent investigation of groundwater and surface water conditions in the vicinity of both the MPAR and the LNAR (the independent investigation). Refer to Section 7.4 for further details.

2. OPERATIONS SUMMARY

All ash placement operations for MPPS, including those within the Project area, are undertaken by the contracted specialist in ash placement. ServiceStream is the current service provider for EnergyAustralia in all aspects of ash and dust management in relation to the Project, which is currently managed under an 'operate and maintain' contract with EnergyAustralia. Refer to Figure 2 for a site layout plan that presents key features of the Project area.

2.1 Site Water Discharge

During the reporting period, water discharged from the Coal Settling Pond (CSP) via the Licenced Discharge Point (LDP12) under EPL 13007 was estimated to be 64.7 ML and complied with the water quality criteria under EPL13007 Condition L3.8.

Following high rainfall and greater than 56mm over five consecutive days, LDP12 was subject to overtopping for three days (on 4/07/2022 and in the period from 09/10/2022 to 10/10/2022) during the reporting period. The discharge of water during these periods complied with EPL13007 condition L3.11. Records of discharge flows at LDP12 during the reporting period are provided in Appendix B.

Discharge from LDP12 enters the Western Drain, which is part of the upstream Wangcol Creek catchment, before flowing into the Final Holding Pond (FHP). The FHP holds stormwater from the clean water diversions from around the MPPS and has gates that can be closed in the event of an environmental incident to limit the likelihood of adverse impacts to the downstream surface water environment. The FHP was constructed within Wangcol Creek, and it operates as the final pollution control structure for surface water associated with the MPPS. Surface water monitoring location LMP01 is the sampling location on Wangcol Creek downstream of the FHP and is representative of instream conditions downstream of the FHP and upstream of the Ash Repositories.

A data summary for water quality in LDP12 (representative of discharge) is presented in this EMR. . Figure 2 presents the locations of the Coal Settling Pond (CSP) and the FHP. Figure 5 presents the locations of LDP12 and monitoring point LMP01. These locations are included as surface water monitoring points in the WMP.

2.2 Ash Placement and Geometry

The MPAR is located within the former Western Main Open Cut mine void in the eastern area of the MPPS facility, which is discussed further in Section 3.2.

The MPPS commenced operations in 1993 and since that time water conditioned ash (WCA) has been placed at the MPAR. WCA and BCA have been placed at the MPAR since 2000, with placement of BCA limited to approved areas, as described below. In accordance with the WMP, the conditioning of the ash occurs at the MPPS, and the conditioned ash is then transferred via conveyors or trucks to the MPAR for placement.

The MPAR has approval for development up to a Relative Level (RL) of 980 m Australian Height Datum (AHD), with the upper surface of the ash to be finished with 1 m of WCA, following the contours of the placement plan approved by the LCC in 1990, as replicated in Figure 3. Further, condition 38A of the Mt Piper Consent requires that the placement of BCA may only occur between the levels of RL 946 metres Australia Height Datum (m AHD) and RL 980 m AHD in approved BCA placement areas (Stage 1 and Stage 2 approval areas). Refer to Figure 2 and Figure 3 for representation of the approved MPAR placement area and schematic of external batter placement.

With reference to the Ash Repository Survey (Appendix C) and Figure 4, BCA continued to be deposited across Stage 1 and Stage 2 approval areas for the Project over the reporting period, with some areas of the MPAR having reached the approved height of 980 m AHD. It is noted that the provided survey was conducted in December 2022 and amended in February 2023. An updated survey is currently being undertaken but will not be completed before submission of this report.

Based on information supplied by EnergyAustralia, a total of 125,900 tonnes (t) of BCA was placed in the MPAR over the reporting period. Refer to Table 4 for a summary of the Project operations for the reporting period, with comparison to the previous reporting period.

Table 4: Operations Summary for the Project

| Activity | Previous Reporting Period (2021-2022) | Current Reporting Period (2022-2023) |
|---|--|---|
| Ash delivered (T) | 460,973 ¹ | 373,247 ¹ |
| WCA placed (T) | 236,573 | 197,483 |
| BCA placed (T) ² | 224,400 | 125,900 |
| Total ash footprint (ha) | 71.2 | 71.2 |
| Area of repository capped (ha) ² | 42.65 | 42.65 |

¹ = Refers to MPAR and LNAR combined

² = Refers to MPAR only

T = tonnes, ha = hectares

2.3 Brine Composition

Brine from MPPS is derived from the evaporative cooling process in the cooling towers. As water evaporates from the cooling towers, the concentration of salts contained in the circulating water increases, which would eventually impact upon the operation of the cooling system. A portion of the salty water is therefore regularly blown down and replaced with fresh “make up” water.

In addition, the separately approved SWTP produces brine from the treatment of mine water from dewatering facilities related to mining operations in the region (Figure 1). The separately approved brine and solid mixed salts from the SWTP are integrated with the MPPS water management system, and brine from the SWTP is transferred to the MPPS for use in conditioning ash prior to its placement in the MPAR.

During the reporting period, blow down water from the cooling towers was transferred to the Mine Water Buffer Pond for treatment by the SWTP or to the EnergyAustralia Reverse Osmosis (RO) brine concentrators and micro filtration (MF) infrastructure. The EnergyAustralia RO and MF system removes salts from the cooling water system and recycles distillate back into the cooling water cycle. The SWTP brine crystalliser system produces a mixed salt and a dewatered lime salt. Both the EnergyAustralia RO and MF system and the SWTP transfer the brine stream to Brine Waste Pond A and Brine Waste Pond B for temporary storage. This brine is used to condition the ash that is placed in approved BCA placement areas.

Brine from the EnergyAustralia brine concentrators is typically transferred to Brine Waste Pond A, while brine from the SWTP is typically transferred to Brine Waste Pond B. Brine in Waste Pond B can overtop to Brine Waste Pond A in order to manage stored brine volumes between the ponds. The brine composition depends on the source of water being treated (e.g., inputs from the SWTP and EnergyAustralia RO and MF system). Additionally, ERM understands that further treatment of the brine has been occurring through the EnergyAustralia RO and MF system. This has been implemented as a means of minimising the volume of brine requiring co-placement at the MPAR. Brine composition data has been used to inform the discussion of surface water and groundwater results below.

An average of the historical brine composition reported from Brine Waste Pond A and Brine Waste Pond B are provided in Appendix D.

The sample frequency for Brine Waste Pond A is monthly and Brine Waste Pond B is weekly. It is noted that during the current reporting period there was no sample collected on 22 July due to construction work on the boat ramp into the Brine Waste Pond.

During the reporting period the average concentrations of key parameters in brine stored in Brine Waste Pond A and Brine Waste Pond B were reported as follows:

- Alkalinity concentrations reported from Brine Waste Pond A averaged 14,243 mg/L while those in Brine Waste Pond B averaged 19,708 mg/L;
- Silver concentrations from Brine Waste Pond A and Brine Waste Pond B were generally reported as below the LOR; however, the LOR varied from 1 to 21 µg/L;
- Chromium concentrations reported from Brine Waste Pond A averaged 26 µg/L while concentrations from Brine Waste Pond B averaged 53 µg/L;
- Iron concentrations reported from Brine Waste Pond A averaged 172 µg/L while concentrations from Brine Waste Pond B averaged 234 µg/L;
- Barium concentrations reported from Brine Waste Pond A averaged 136 µg/L while concentrations from Brine Waste Pond B averaged 11 µg/L;
- Boron concentrations reported from Brine Waste Pond A averaged 6.90 mg/L while concentrations from Brine Waste Pond B averaged 3.61 mg/L;
- Manganese concentrations reported from Brine Waste Pond A averaged 639 µg/L while concentrations from Brine Waste Pond B averaged 20 µg/L; and
- Nickel concentrations reported from Brine Waste Pond A averaged 808 µg/L while concentrations from Brine Waste Pond B averaged 455 µg/L.

Note, metals are reported as total (unfiltered) concentrations.

3. ENVIRONMENTAL SETTING

Details of the environmental site setting are presented in the following sections to provide context to the surface water and groundwater assessments presented below.

3.1 Climate

The climate data below was provided by EnergyAustralia and is sourced from a weather station on site at MPPS (see Figure 2). A summary of the climate data is presented in Table 5 and a copy of the data is presented in Appendix E. Rainfall data is graphed in the hydrographs included in Appendix F.

Table 5: Local Climate Data for 2022/2023

| Month | Rainfall Total (mm) | Min. Temperature (°C) | Max. Temperature (°C) |
|--------------------------|---------------------|-----------------------|-----------------------|
| July 2022 | 106.4 | 1.5 | 9.4 |
| August 2022 | 83.7 | 1.9 | 11.1 |
| September 2022 | 131.0 | 4.4 | 13.0 |
| October 2022 | 157.8 | 7.8 | 16.0 |
| November 2022 | 110.0 | 6.2 | 17.7 |
| December 2022 | 15.6 | 8.0 | 21.8 |
| January 2023 | 108.6 | 12.6 | 24.5 |
| February 2023 | 28.4 | 12.2 | 24.9 |
| March 2023 | 83.6 | 11.0 | 23.0 |
| April 2023 | 70.2 | 6.5 | 16.2 |
| May 2023 | 5.2 | 0.8 | 12.5 |
| June 2023 | 30.0 | 1.5 | 10.6 |
| TOTAL / MIN / MAX | 930.5 | 0.8 | 24.9 |

Data from MPPS Weather Station provided by EnergyAustralia

The total rainfall for the reporting period was 930.5 mm. This is lower than the total reported rainfall of 1,191.4 mm for the 2021/22 reporting period, but higher than the 607.0 mm recorded during the 2020/21 reporting period and the 513.1 mm recorded for 2019/20 reporting period.

The total rainfall for the reporting period, 930.5 mm, is slightly higher than the average annual rainfall between 2012 and 2017, which was reported by Aurecon (2017) to be 756.5 mm/year. However, slightly lower than the higher-than-average periods of rain from December 2020 and March 2021, which broke the period of relative drought experienced at the site, and more broadly within NSW, between 2017 and 2020.

The 2022/23 reporting period was characterised by slightly higher than average rainfall, although the monthly rainfall data shows fluctuations throughout the reporting period. November 2022 was the month that recorded the highest rainfall (110.0 mm), and May 2023 recorded the lowest rainfall (5.2 mm).

3.2 Geology and Hydrogeology

The site is located on the western margin of the Sydney Basin, and the geology is characterised by eastward dipping sedimentary deposits. The sedimentary deposits extend approximately 130 km east towards the NSW coast. Structurally, the western margin of the Sydney Basin is not complex, and no significant faulting or folding structures are present in the region surrounding the site (CDM Smith, 2012).

The site is located at an outcrop of the Illawarra Coal Measures, which have been mined throughout the region. The Narrabeen Group, comprised of sandstones, overlies the Illawarra Coal Measures in the vicinity of the site, forming the surrounding hillsides. The Illawarra Coal Measures host the coal seams that were previously mined out in the vicinity of the site and overlie the Shoalhaven Group. Some characteristics of these units are listed in Table 6

Table 6: Local Geological Units

| Narrabeen Group | Illawarra Coal Measures | Shoalhaven Group |
|--|---|---|
| <ul style="list-style-type: none"> ■ Sandstones, shale and claystone. ■ Up to approximately 800 m thick in parts, although generally absent in the immediate vicinity of the Ash Repositories. ■ Deposition in estuarine/alluvial, fluvial, and fluvial-deltaic environments. ■ Unconformably overlies Illawarra Coal Measures (Danis et al., 2011). | <ul style="list-style-type: none"> ■ Interbedded shale, sandstone, conglomerate, and coal. ■ Dips 1-2 degrees to the east. ■ Outcrops extensively just east of Portland, exposing the Lidsdale and Lithgow coal seams close to the surface with approximately 15-20 m of sandstone overburden (CDM Smith, 2012). | <ul style="list-style-type: none"> ■ Siltstones, lithic sandstones and conglomerate. ■ Marine sediments. ■ Berry Siltstone / Formation (earlier) & Snapper Point Formation (later). ■ Contains sulfide-bearing material and is acid generating in places where exposed via rock cuttings (SKM, 2010). |

Groundwater beneath the site is present within the Illawarra Coal Measures, with a regional groundwater flow direction generally to the east / south-east in the vicinity of the site (Figure 6a to Figure 6b). The natural stratigraphy of the Illawarra Coal Measures in the vicinity of the site is generally as follows:

- Bunnyong Sandstone (Long Swamp Formation) – massive sandstone;
- Lidsdale Coal Seam – interbedded high ash coal and shale;
- Blackmans Flat Conglomerate – coarse sandstone and conglomerate;
- Lithgow Coal Seam; and
- Marrangaroo Conglomerate – massive sandstone and conglomerate.

Prior to the placement of ash in the former Western Main Open Cut mine void (now occupied by the MPAR), the bottom of the mine void was covered with mine spoil to a minimum level of 908 m AHD. This was to facilitate groundwater flow from the adjacent areas of the unmined Lithgow coal seam aquifer and mine goaf areas surrounding the Western Main Open Cut mine void (Connell Wagner, 2007). The background groundwater level (water table elevation) prior to the filling of the mine voids and placement of ash was reported to be approximately 910 m AHD.

Historically, groundwater seepage from beneath the MPAR was collected in the Groundwater Collection Basin that was previously located to the east of MPAR (SKM, 2010). In 2012, this basin was filled in with mine spoil and compacted as part of the construction of the adjacent LNAR; the footprint of the former Groundwater Collection Basin is located beneath the LNAR (refer to Figure 2).

The area surrounding the Ash Repositories is characterised by former open cut and below ground coal mining. The below ground mined out areas are variably filled in with goaf, or in some areas remain as voids. Former open cut mines remain as ponds, including within the alignment of Wangcol Creek to the north of MPAR, or have been filled in.

Long term groundwater monitoring at the site indicates that the water table occurs variably in the former below ground mined out areas and open cuts and, away from the Ash Repositories, predominantly in the overlying Bunnyong Sandstone. Over the monitoring period, the water table elevation ranged from approximately 903.4 m AHD (D2) in the south-east up to 918.7 m AHD (MPGM/D4) in the north-east of the Ash Repositories (refer to Figure 6a and 6b). Perched water is present in the southern part of the MPAR.

3.3 Hydrology

The Project site is within the catchment of Wangcol Creek, a tributary of the Cocks River. The site itself sits on the eastern edge of the Great Dividing Range and includes the headwaters of Wangcol Creek.

Locally, Wangcol Creek is present to the north and north-east of the MPPS, approximately 250 m from the active ash placement area at its closest point. Wangcol Creek flows to the east and south-east and joins the Cocks River approximately 3.2 km east of the site.

Clean water diversion structures divert surface waters around the operational areas of the MPPS, where possible (see Figure 2). Stormwater within the operational area of the MPPS is directed to water management and storage infrastructure for use at the Project site.

4. WATER MONITORING AND MANAGEMENT PLAN

The aim of the WMP is to minimise the effect of ash placement at the MPAR on local natural surface waters and groundwater. The WMP addresses water cycle management associated with the Project. It includes a surface water and groundwater monitoring program, a requirement for an annual water quality report, and associated TARPs, contingency and strategies for brine reduction as appropriate for the reporting period.

The WMP approved under the Mt Piper Consent outlines the following key elements:

- Water cycle management plan describing the management of surface water run off at the ash repository;
- Brine cycle management including brine minimisation strategies and future mine disposal strategies;
- Water cycle management including the potential uses of multipurpose lined water storages present at the MPPS; and
- Water monitoring program, including surface water and groundwater monitoring, and the Environmental Goals to be adopted.

4.1 Environmental Goals

The Environmental Goals for groundwater and surface water monitoring in the WMP are consistent with those applied to monitoring of the LNAR, as approved in the LNAR OEMP. The Environmental Goals were developed by Aurecon (2009) to account for hardness corrected guideline values and were presented by CDM Smith (2013).

The Environmental Goals utilise the 95% ecosystem protection values, stock watering, irrigation water or drinking water values based on the Australian and New Zealand Guidelines (ANZG, 2018) water quality guidelines (formerly Australia and New Zealand Environment Conservation Council, ANZECC, 2000), in combination with 90th percentile pre-brine placement local environmental (groundwater/surface water) data, whichever is greater. The local guideline values incorporated into the Environmental Goals are based upon the 90th percentile pre-ash placement water quality results, as measured at surface water quality point WX22 (for surface water) or the former Groundwater Collection Basin (for groundwater).

It is noted that, where the Environmental Goals for groundwater are based on the ANZG (2018) water quality guidelines, these guidelines are applicable to receiving waters and not to groundwater. However, they form an appropriate basis for undertaking a conservative initial screening assessment.

The Environmental Goals adopted for this assessment are presented with the surface water and groundwater data in Appendix G and Appendix H respectively.

5. SURFACE WATER ASSESSMENT

5.1 Objective

The objective of the surface water monitoring program is to identify water quality changes at an early stage so that potential causes can be investigated and, if necessary, effects mitigated. The surface water data is compared between locations and to the established Environmental Goals to assess changes in water quality and to assess whether the TARPs or contingency measures should be considered and/or implemented.

5.2 Surface Water Monitoring Locations and Frequency

A summary of the surface water monitoring site locations under the WMP is described in Table 7 and the locations are shown on Figure 5.

Table 7: Surface Water Monitoring Locations

| Site ID | Position | Location Description | Frequency | No. of Samples in 2022/23 |
|-------------|------------|---|---|---------------------------|
| CSP | Upstream | Monitor the stormwater in the CSP and discharge from the CSP. Sampling of the CSP is conducted routinely at times when discharge is not occurring. These samples are differentiated as CSP (not discharging) and LDP12 (when discharge is occurring). The data from LDP12 and CSP is not representative of instream surface water conditions. Data from LDP12 is not regulated by the Environmental Goals and is provided in this report for comparison only. | As required during discharge ¹ | 29 (CSP) |
| LDP12 | Upstream | | | 12 (LDP12) |
| LMP01 | Upstream | This monitoring point is located north-west of the MPAR and immediately downstream of the FHP. It is located in an upstream position relative to the Ash Repositories and is the location where water from the headwaters of Wangcol Creek flows out from the MPPS operational area, downstream of the FHP. | Quarterly | 12 |
| NC01 | Mid-stream | Located midstream in the monitored area of Wangcol Creek, upstream to the Ash Repositories. | Monthly | 12 |
| SW_C | Mid-stream | Located within Wangcol Creek, the monitoring location is located midstream of the monitored area of Wangcol Creek and near groundwater monitoring bore D107. | Quarterly | 12 |
| SW_E | Mid-stream | Located within Wangcol Creek, downstream of former open cuts "Area D" and "Area E" between the locations of groundwater monitoring bores D9 and D105. | Quarterly | 12 |
| WX22 / SW_F | Downstream | Located in Wangcol Creek at a stream gauge to the east/downstream of the Ash Repositories. Also serves as WaterNSW monitoring point 212055. | Monthly | 12 |
| SW_G | Downstream | Located within the downstream portion of Wangcol Creek, and downstream of WX22, within a former open cut mine working and in the vicinity of groundwater monitoring bore D103. | Quarterly | 12 |

¹Selected field parameters monitored more regularly

The frequency of sampling conducted during the reporting period is considered adequate to meet the requirements of the WMP.

5.3 Surface Water Monitoring Methodology

Surface water quality monitoring was undertaken by Nalco Water – Ecolab (Nalco) on behalf of EnergyAustralia. Details regarding the Nalco sampling method and quality assurance and quality control (QA/QC) program are presented in Appendix I.

5.4 Surface Water Quality Dataset

Surface water samples were obtained by Nalco for field and/or laboratory analysis for the following parameters, in accordance with the monitoring and analysis schedule outlined within the WMP:

- Electrical conductivity (EC - $\mu\text{S}/\text{cm}$, field measured);
- pH (field measured);
- Total Dissolved Solids (TDS);
- Cations and anions (calcium, chloride, fluoride, magnesium, potassium, sodium, sulfate) i.e., major and minor ions;
- Alkalinity (total alkalinity, bicarbonate alkalinity, phenolphthalein alkalinity);
- Total and dissolved metals (aluminium, arsenic, boron, copper, iron, manganese, nickel, vanadium, and zinc) – field filtered at $0.45\ \mu\text{m}$ for dissolved analysis;
- Non-filterable residue (NFR, turbidity or TSS);
- Total phosphorus; and
- Nitrogen, nitrate, nitrite, total Kjeldahl nitrogen (TKN).

The trace metals in surface water samples were reported as both total (unfiltered) and dissolved (filtered) samples, except for antimony, arsenic, barium, beryllium, cadmium, chromium, speciated chromium, cobalt, lead, magnesium, mercury, molybdenum, selenium, silver and strontium, which were reported as total sample concentrations only.

Evidence of the collection of field quality control (QC) samples (i.e., rinsate, trip blanks or trip spikes) during the field-based programs was not provided. Results of laboratory QC measures including laboratory duplicate, triplicate, internal duplicates, method blanks or spike data were also not presented for review during compilation of this EMR.

5.5 Surface Water Results

The surface water field and analytical results obtained for the reporting period are presented alongside the Environmental Goals for surface water in Appendix G and Figure 7. Graphs of concentrations over the last 10 years for selected analytes (boron, chloride, manganese, nickel, sulfate and TDS), considered to be indicators of potential changing conditions resulting from the Project, are provided in Appendix J.

5.5.1 Upstream Monitoring Results

LDP12 is the licenced discharge point for the MPPS under EPL 13007. The licenced discharge point is located at the CSP, which is a sediment basin for the coal stockpile area. Samples from the CSP are routinely collected monthly and prior to planned discharge events however are presented in this report (in accordance with the WMP).

Discharge via LDP12 occurs as required following confirmation by laboratory analysis that the water quality is within the approved EPL discharge limits. Samples of the discharge are collected from the discharge point, and these are presented as LDP12. Location LDP12 is not considered to be representative of upstream conditions relative to the MPAR in the monitored area of Wangcol Creek.

Discharge from LDP12 enters the western stormwater drain, which is part of the upstream Wangcol Creek catchment, before flowing into the FHP. The FHP holds stormwater from the clean water diversions from around the MPPS and can be closed in the event of an environmental incident to limit the likelihood of adverse impacts to the downstream surface water environment. The FHP was constructed within Wangcol Creek, and it operates as a pollution control structure downstream from the operational areas of the MPPS. LMP01 is the sampling location within Wangcol Creek downstream of the FHP.

LDP12 and LMP01 are located upstream of the MPAR and water quality at these locations is not considered to be influenced by activities at the Ash Repositories. However, other aspects of the Project (e.g., brine transfer pipelines and brine waste holding ponds) are located within the catchment upstream of these sampling locations.

Data for LDP12 (discharging) is presented in the following written sections of this report, in Figure 7, and in Table 2, Appendix G; however, assessment of trends and statistical assessment of LDP12 has not been conducted as this location is not considered to be representative of in-stream conditions. Assessment of trends at LMP01, which receives flow from LDP12 and other upstream portions of the Wangcol Creek catchment, has been conducted as it is considered most appropriate for assessment of potential impacts from the Project on the upstream section of Wangcol Creek. Graphs showing the concentrations of key analytes over time are presented in Appendix J.

5.5.1.1 Field Parameters

Field parameters monitored at LDP12 and LMP01 for the reporting period are summarised as follows:

- pH values (field measured) of surface water samples from LMP01 ranged from 6.8 to 8.5. The pH at LMP01 was marginally outside of the range (more alkaline) of the Environmental Goal (6.5 to 8.0) during a single sampling event in June 2023 (8.5) of the reporting period. LDP12 pH values ranged from 7.3 to 7.8, all within the range of the Environmental Goal;
- Field EC values obtained from LMP01 ranged from 130 $\mu\text{S}/\text{cm}$ to 505 $\mu\text{S}/\text{cm}$. Field EC measured at LDP12 ranged from 127 $\mu\text{S}/\text{cm}$ to 361 $\mu\text{S}/\text{cm}$. The reported field EC values were consistent with the laboratory TDS concentrations (where analysed). Reported EC and TDS values throughout the reporting period were below the Environmental Goals for surface water; (2,200 $\mu\text{S}/\text{cm}$ for EC and 1,500 mg/L for TDS); and
- Graphs of concentrations over the last 10 years show TDS concentrations at LMP01 have fluctuated, peaking in 2019 (Appendix J). Concentrations during the current reporting period remained within historical ranges and below the Environmental Goal and showed a slightly decreasing trend towards the end of the reporting period until an increase in June 2023.

5.5.1.2 Major and Minor Ions

Throughout the reporting period, concentrations of major and minor ions for which there are Environmental Goals (chloride, sulfate and fluoride) at LDP12 and LMP01 were below the relevant Environmental Goals for surface water.

Graphs of concentrations over the last 10 years for LMP01 (Appendix J) show fluctuations of sulfate and chloride over time, however, the concentrations in the current reporting period appeared generally steady, within the historical range and below the Environmental Goals for surface water. High sulfate and chloride results relative to the historical dataset were reported intermittently from July 2019 to January 2020. The spikes in concentrations were attributed to a brine leak event that occurred in 2019 (ERM, 2020a); these were notified to the EPA and the liner was repaired in 2019.

5.5.1.3 Metals

Throughout the reporting period copper, iron, and lead were identified on one or more occasions at concentrations above the relevant Environmental Goals for surface water at LMP01, as presented in Appendix G and summarised in Figure 7.

Speciated chromium (hexavalent and trivalent), selenium, and silver had LORs above the Environmental Goals on one or more occasions.

The LOR of total chromium was below the Environmental Goal. LMP01 reported chromium concentrations above the Environmental Goal for one event (July 2022) during the reporting period. Lowering the LOR for speciated chromium would help assess if Environmental Goals are met for trivalent and hexavalent chromium impacts related to MPAR.

Selenium was reported marginally above the 0.2 µg/L LOR for most monitoring events. However, surface water samples collected from LMP01 during the July, August, and September events had a laboratory LOR of 10 µg/L, which exceeded the Environmental Goal of 5 µg/L. The raised laboratory LOR above the Environmental Goal was related to sample matrix interference, as confirmed by EnergyAustralia.

ERM understands that a laboratory LOR that is lower than the Environmental Goal for silver (0.05 µg/L) is unachievable by the laboratory. Based on the results of previous monitoring, including concentrations of silver in brine (<10 µg/L for most samples during 2021/22 and below the LOR for most samples for the current reporting period), and <1 µg/L in groundwater, silver is not considered to represent a primary constituent of concern for monitoring in accordance with the WMP.

Graphs of concentrations over the last 10 years for LMP01 (Appendix J) show fluctuations of manganese and nickel over time, however the concentrations measured during the current reporting period were below the Environmental Goals and were generally consistent and within the historical ranges. Concentrations of boron show a spike in concentrations in June 2023 (70 µg/L), the highest concentrations since September 2020; however, this concentration is within the historic range and is below the Environmental Goal.

5.5.2 Midstream Monitoring Results

Locations NC01, SW_C and SW_E are considered to represent midstream conditions relative to the MPAR in the monitored area of Wangcol Creek.

Locations NC01 and SW_C are located north of the MPAR along an area of Wangcol Creek that is not known to have been subject to open cut mining operations. SW_E is located further downstream of NC01 and SW_C, to the east of the MPAR and immediately downstream from an area of Wangcol Creek that was historically subject to open cut mining activities.

The surface water field and analytical results obtained from sample points NC01, SW_C and SW_E, for the reporting period are presented in Table 1, Appendix G and summarised in Figure 7. Graphs showing the concentrations of key analytes over time are presented in Appendix J.

A brief discussion of results is presented in the following subsections.

5.5.2.1 Field Parameters

Field parameters monitored at NC01, SW_C and SW_E for the reporting period are summarised as follows:

- pH (field) values were 6.3 to 7.6, with one result (SW_C, September 2022) reported outside of the Environmental Goal range (6.5 to 8.0) for surface water;
- Field EC values reported at NC01, SW_C and SW_E ranged from 101 µS/cm to 1,440 µS/cm. Field EC values were generally consistent with laboratory TDS results, and results were not reported outside of the Environmental Goals for either EC or TDS (2,200 µS/cm for EC and 1,500 mg/L for TDS);
- Graphs of concentrations over the last 10 years show TDS concentrations at NC01 and SW_C have remained low and stable. TDS at SW_E showed a spike in concentrations during the 2019/20 reporting period, but TDS concentrations have subsequently returned to within the historical range and have not been reported above the Environmental Goals since January 2020; and

- EC and TDS values at SW_E were generally higher compared to those further upstream at NC01 and SW_C.

5.5.2.2 Major and Minor Ions

Throughout the reporting period, major and minor ions including chloride, sulfate, and fluoride were reported at NC01, SW_C and SW_E at concentrations below the Environmental Goals for surface water.

Graphs of concentrations over the last 10 years for chloride and sulfate are consistent with the trends identified for TDS concentrations and show chloride and sulfate concentrations at NC01 and SW_C have remained low and stable. Consistent with the trend of increased TDS and EC values, concentrations of chloride and sulfate in SW_E spiked during 2019/20 but returned to concentrations below the Environmental Goals during the 2020/21 reporting period; concentrations remained below the Environmental Goal for the current reporting period, although chloride and sulfate concentrations at SW_E increased from October 2022, but remained within historic ranges and below the Environmental Goals.

Consistent with trends identified from EC and TDS, chloride and sulfate concentrations at SW_E were elevated compared to those further upstream at NC01 and SW_C.

5.5.2.3 Metals

Throughout the reporting period cadmium, chromium, copper, iron, lead, manganese, mercury and nickel were identified on one or more occasions at concentrations above the relevant Environmental Goals for surface water at NC01, SW_C and/or SW_E, as presented in Appendix G and summarised in Figure 7.

Speciated chromium (hexavalent and trivalent), selenium, and silver had LORs above the Environmental Goals for one or more sample events.

For surface water monitoring locations NC01, SW_C and SW_E, the selenium laboratory LOR was <10 µg/L for the July, August and September (only SW_E) sampling events, which exceeded the Environmental Goal (5.0 µg/L). Selenium was reported at/or above the Environmental Goal for SW_C and NC01 in September.

For all samples throughout the reporting period silver concentrations were reported below the laboratory LOR (<1 µg/L) which exceeded the Environmental Goal for silver (0.05 µg/L). The LOR for speciated chromium was also above the Environmental Goal for both hexavalent (1.0 µg/L) and trivalent (3.3 µg/L) chromium. No results were reported above the LORs for speciated chromium. Total chromium concentrations were at (NC01 and SW_E) or above (NC01) the Environmental Goal (2.0 µg/L) in a total of five sampling events.

Refer to Section 5.5.1.3 for commentary relating to the laboratory LORs versus the Environmental Goals for silver and speciated chromium in surface water.

Iron (total) was reported at concentrations above the Environmental Goal for all sampling events except SW_C in August. Filtered iron concentrations were reported above the Environmental Goal on fewer occasions, with the majority of exceedances reported from SW_E (eight out of 12 events).

Graphs of concentrations over the last 10 years for boron, manganese and nickel (Appendix J) show trends consistent with TDS, specifically that concentrations of these selected metals at NC01 and SW_C have remained low and stable. Boron, manganese and nickel concentrations at SW_E spiked during the 2019/20 reporting period but decreased to within the historical range during the 2020/21 reporting period and remained low and stable during the 2021/22 reporting period. Graphs of boron, manganese and nickel (Appendix J) show that concentrations in SW_E have increased since January 2022.

Concentrations of boron (both total and filtered) remained below the relevant Environmental Goals throughout the current reporting period, although concentrations at SW_E show a slight increase from January, slightly decreasing and stabilising between the March and April events then continuing to increase and peaking in June. The maximum concentration recorded during this reporting period is consistent with the concentrations in 2019.

Similar to the trend seen with boron, manganese concentrations also increased during this reporting period. Although concentrations remained below the historical concentrations reported in the 2019/20 reporting period, concentrations at SW_E exceeded the Environmental Goal from February to June 2023 for total manganese and March to June 2023 for filtered manganese. Historically, total manganese and filtered manganese have not exceeded the Environmental Goal since November 2019.

Similar to the trends identified from major ion concentrations (TDS and EC values) nickel concentrations (total and filtered) were higher at SW_E than at NC01 and SW_C, with most events reporting nickel concentrations above the Environmental Goal at SW_E. Nickel concentrations at SW_E were reported above the Environmental Goal for nine out of the 12 sampling events. Both total and filtered nickel concentrations increased slightly from January, decreased and stabilised slightly between March and April and continued to increase to June, consistent with the other selected metals. Nickel concentrations at NC01 and SW_C remained below the Environmental Goals throughout the current reporting period.

The increase in metal concentrations is considered to be due to the drier conditions experienced during this reporting period, after the period of heavy rain experienced over the last reporting period (2021/22).

5.5.3 Downstream Monitoring Results

Locations WX22 (SW_F) and SW_G are considered to represent downstream conditions relative to the MPAR in the monitored area of Wangcol Creek.

Both WX22 and SW_G are located east of the MPAR along an area of Wangcol Creek that is downstream of and, in the case of SW_G, has been subject to open cut mining operations.

The surface water field and analytical results obtained from sample points WX22 (SW_F) and SW_G for the reporting period are presented in Table 1, Appendix G, and summarised in Figure 7. Graphs showing the concentrations of key analytes over time are presented in Appendix J.

A brief discussion of results is presented in the following subsections.

5.5.3.1 Field Parameters

Field parameters monitored at WX22 and SW_G for the reporting period are summarised as follows:

- Field pH values ranged from 6.7 to 7.6 and were within the Environmental Goal range (6.5 to 8.0) for pH in surface water;
- Field measured EC values ranged from 167 $\mu\text{S}/\text{cm}$ to 1,930 $\mu\text{S}/\text{cm}$ and were generally consistent with the laboratory determined TDS values. EC and TDS were reported below the respective Environmental Goals for surface water (2,200 $\mu\text{S}/\text{cm}$ for EC and 1,500 mg/L for TDS) at both locations during the reporting period; and
- Graphs of concentrations over the last 10 years (Appendix J) for WX22 and SW_G show TDS has fluctuated over time. Concentrations of TDS have typically increased during summer months, but only exceeded the Environmental Goal once at SW_G during July 2018. The trends at SW_G are similar to those described for WX22; however, monitoring data at SW_G has only been collected since May 2018. TDS has remained below the Environmental Goal for surface water since January 2020. For WX22 and SW_G in the current reporting period, the typical summer peak was observed later than historically observed, with concentrations increasing from December 2022 and peaking in June 2023 at concentrations below the Environmental Goal.

5.5.3.2 Major and Minor Ions

Throughout the reporting period, concentrations of major and minor ions including chloride, sulfate and fluoride were reported below the relevant Environmental Goals at WX22 and SW_G.

Graphs of concentrations over the last 10 years for WX22 and SW_G (Appendix I) show chloride and sulfate concentrations have fluctuated over time and are generally consistent with TDS trends (i.e., typically increase during and following summer months). Similar to historic TDS concentrations, chloride and sulfate concentrations were highest during February 2014, February 2018 and January 2020. For the current reporting period, concentrations of sulfate and chloride increased from January to the June sampling event, during which the peak concentrations for the reporting period were recorded. Concentrations for chloride and sulfate remained below the Environmental Goals throughout the reporting period.

5.5.3.3 Metals

Throughout the reporting period, chromium, copper, iron, lead, manganese, and nickel were identified on one or more occasions at concentrations above the Environmental Goal for surface water at WX22 and/or SW_G, as presented in Appendix G, and summarised in Figure 7.

Speciated chromium (hexavalent and trivalent), selenium, and silver had LORs above the Environmental Goals for one or more sample events. No detections (concentrations above the LOR) were reported for these analytes during the reporting period. Refer to Section 5.5.1.3 for commentary relating to the laboratory LORs versus the Environmental Goals for speciated chromium, selenium, and silver in surface water.

Graphs of concentrations over the last 10 years for WX22 and SW_G (Appendix J) show boron, manganese and nickel concentrations have fluctuated over time.

Boron concentrations were reported below the Environmental Goal for surface water during the current reporting period, although, similar to TDS concentrations, boron concentrations at both WX22 and SW_G increased above the current reporting period range in March and June (highest) 2023.

Concentrations of nickel fluctuated and exceeded the Environmental Goal for most sampling rounds throughout the reporting period. Similar to TDS, nickel concentrations increased during and following the summer months, peaking in June.

For this reporting period, manganese (both total and filtered) the highest concentrations were reported in March, when concentrations exceeded the Environmental Goal for total manganese at WX22. Manganese concentrations at SW_G remained below the Environmental Goal. Unlike boron and nickel, manganese concentrations did not increase towards the end of the reporting period.

5.5.4 Summary

During the reporting period, LMP01 reported concentrations of pH, chromium, copper, iron, and lead above the Environmental Goals on one or more occasions. Concentrations at LDP12 were below the Environmental Goals throughout the reporting period, noting that the LORs for silver and selenium were above the Environmental Goals.

Results from midstream monitoring locations NC01, SW_C and SW_E were typically below the Environmental Goals for surface water, except for iron which consistently exceeded the Environment Goal for surface water throughout the monitoring period at NC01, SW_C and SW_E. pH, cadmium, chromium, copper, lead, mercury, and selenium were reported above the Environmental Goals on one or more occasions from at least one of these locations. Manganese and nickel concentrations at SW_E exceeded the Environmental Goals consistently throughout the reporting period, but were below the Environmental Goals at NC01 and SW_C, both located upstream of SW_E. Mercury was reported above the Environmental Goal for surface water at SW_E and NC01 on a total of two occasions during the reporting period, however concentrations above the Environmental Goal were not reported in other upstream or downstream samples.

Surface water quality at the midstream locations showed a summer peak in concentrations generally similar to last reporting period (2021/22); however, a second increasing trend towards the end of this reporting period (June 2023) was identified. This is considered to be related to the drier conditions for the months leading up to June compared to last reporting period.

At the downstream monitoring locations (WX22 and SW_G), concentrations of iron and nickel in surface water frequently exceeded the relevant Environmental Goals during the reporting period. The concentrations of iron and nickel were similar at the midstream monitoring location SW_E and downstream locations WX22 and SW_G. Copper was reported above the Environmental Goal for surface water on one occurrence at each downstream monitoring location. Periodic exceedances of chromium, copper, lead, and manganese were identified throughout the reporting period.

The surface water quality at downstream locations WX22 and SW_G generally showed an upward trend in concentrations towards the end of the reporting period, although concentrations did not exceed 2019 peaks or the Environmental Goals, with the exception of nickel at both locations on multiple occasions, and manganese at WX22 in March 2023. This upward trend is consistent with the midstream surface water locations and is likely related to the drier conditions experienced during the months leading up to June.

Iron and nickel concentrations consistently exceeded the Environmental Goals at midstream and downstream monitoring locations. Iron concentrations are related to background conditions in the local environment as a result of the mining history and disturbed geology. Nickel concentrations in surface water are considered to be influenced by interaction between groundwater and the surface water of Wangcol Creek. The periodic exceedances of Environmental Goals for pH in upstream surface water were generally not observed to extend to midstream surface water sample locations, except for one occurrence in September 2022 at SW_C. Overall, surface water quality was comparable to the 2021/22 reporting period until early to mid-2023, after which increasing concentrations were identified at mid-stream and downstream surface water monitoring locations. This is considered to be a reflection of the drier conditions experienced during the months leading up to June, after an extended period of higher-than-average rainfall recorded during the last reporting period.

6. GROUNDWATER

6.1 Objective

The objective of the groundwater monitoring program is to identify water quality changes at an early stage so that potential causes can be investigated and, if necessary, effects mitigated. The groundwater data is compared; between locations, to historical data, and to the established Environmental Goals to assess changes in groundwater quality and the extent to which changes may be related to activities associated with the Project.

6.2 Groundwater Monitoring Locations and Frequency

A summary of the groundwater monitoring locations is presented in Table 8 and Figure 5.

Table 8: Groundwater Monitoring Network

| Bore ID | Location Description | Screened Material | Frequency | No. of Samples in 2022/23 |
|--|---|---------------------------------|-----------|---------------------------|
| Upgradient of MPAR (background) | | | | |
| MPGM4/D4 | Background groundwater monitoring location, north-west (upgradient) of the MPAR | Fill | Quarterly | 4 |
| MPGM4/D5 | Background groundwater monitoring location, north-west (upgradient) of the MPAR | Mudstone/ Sandstone and coal | Quarterly | 4 |
| Within MPAR and the Mine Disturbance Area East of MPAR | | | | |
| B5 | Within the MPAR | Fill | Quarterly | 0 (blocked) |
| SW3-D | Within the south-east portion of the MPAR | Fill – clay/silty clay | Quarterly | 0 (dry) |
| MPGM4/D23 | Adjacent (south) of the MPAR | Sandstone | Quarterly | 0 (destroyed) |
| MPGM4/D10 | East (downgradient) of the MPAR, and adjacent to LN Pond 2 | Fill / mine spoil | Quarterly | 4 |
| MPGM4/D11 | Within the eastern extent of the MPAR (decommissioned Feb 2023) | Fill beneath the ash | Quarterly | 3 |
| MPGM4/D19 | East (downgradient) of the Ash Repositories | Fill / mine spoil | Quarterly | 4 |
| D113 | East (downgradient) of the Ash Repositories. Nested (deeper) with D19 | Siltstone | Quarterly | 4 |
| Within mine disturbance area – south and south-east of MPAR | | | | |
| MPGM4/D15 | South of the Ash Repositories | Sandstone and/or shale | Quarterly | 4 |
| MPGM4/D16 replaced with D16A | South of the Ash Repositories | Sandstone and/or shale | Quarterly | 0 |
| MPGM4/ D16A | South of the Ash Repositories (commissioned in October 2022 to replace D16) | Sandstone and/or shale | Quarterly | 3 |

| Bore ID | Location Description | Screened Material | Frequency | No. of Samples in 2022/23 |
|--|--|----------------------------------|-----------|---------------------------|
| MPGM4/D17 | South of the Ash Repositories | Sandstone and/or shale | Quarterly | 4 |
| MPGM4/D18 | South of the Ash Repositories | Sandstone and/or shale | Quarterly | 4 |
| Adjacent to MPAR – to the north | | | | |
| MPGM4/D3 | Background groundwater monitoring location, north (cross gradient) of the MPAR | Sandstone and/or siltstone | Quarterly | 4 |
| D107 | North (cross gradient) of MPAR and adjacent Wangcol Creek | Siltstone and/or shale | Quarterly | 4 |
| D106 | North (cross gradient) of MPAR and adjacent Wangcol Creek | Weathered sandstone and/or Shale | Quarterly | 4 |
| Adjacent MPAR and Downgradient | | | | |
| MPGM4/D1 | North-east (downgradient) of the MPAR | Mudstone, sandstone and coal | Quarterly | 4 |
| MPGM4/D9 | North-east (downgradient) of the MPAR and adjacent to Wangcol Creek | Alluvial deposits | Quarterly | 4 |
| D102 | North-east (downgradient) of the MPAR and adjacent to Wangcol Creek. Nested (deeper) with D9 | Siltstone | Quarterly | 4 |
| D105 | East (downgradient) of the MPAR and adjacent Wangcol Creek | Coal | Quarterly | 4 |
| MPGM4/D8 | East (downgradient) of the MPAR and adjacent to the northern side of Wangcol Creek | Alluvial deposits | Quarterly | 4 |
| D104 | East (downgradient) of the MPAR and adjacent Wangcol Creek | Sandstone | Quarterly | 4 |
| D103 | East (downgradient) of the MPAR and adjacent Wangcol Creek | Coal and/or siltstone | Quarterly | 4 |
| MPGM4/D2 | East (downgradient) of the MPAR and adjacent Wangcol Creek | Not known | Quarterly | 4 |
| Brine Waste Pond Leak Detection Bores | | | | |
| MPGM5/D5 | Adjacent (downgradient) Brine Waste Pond A | Not known | Quarterly | 6 |
| MPGM5/D6 | Adjacent (downgradient) Brine Waste Pond B | Not known | Quarterly | 7 |
| MPGM/24 and MPGM/25 | Adjacent Settling Pond D (north-west) | Not known | Quarterly | 0 (dry) |
| MPGM/26 and MPGM/27 | Adjacent Settling Pond D (south-east) | Not known | Quarterly | 0 (dry) |

Some bores were sampled and results reported more frequently than the planned quarterly monitoring. In those cases, all available data has been considered in this assessment. Information from EnergyAustralia provided the following clarifications as to why some bores were not sampled as frequently as required. Bores B5, SW3-D and MPGM4/D23 were not sampled during the reporting period because they were blocked (B5), recorded as dry (SW3-D), or damaged and unable to be sampled (MPGM4/D23). Considerations are being made to remove B5 from the WMP. D16 has been decommissioned and bore D16A was installed as its replacement.

6.3 Groundwater Monitoring Methodology

Groundwater quality monitoring was undertaken by Nalco on behalf of EnergyAustralia. Details regarding the Nalco sampling method and QA/QC program are presented in Appendix I.

6.4 Groundwater Quality Dataset

Nalco collected groundwater samples from 23 groundwater monitoring bores throughout the reporting period. Samples were obtained for field and laboratory analysis in accordance with the following monitoring and analysis schedule:

- Depth to water (in m AHD - prior to purging);
- EC ($\mu\text{S}/\text{cm}$, field measured);
- pH (field measured);
- TDS;
- Cations and anions (calcium, chloride, fluoride, potassium, sodium, sulfate);
- Alkalinity (total alkalinity, bicarbonate alkalinity, phenolphthalein alkalinity); and
- Total and dissolved metals (aluminium, arsenic, boron, copper, iron, manganese, nickel, vanadium, zinc) – field filtered at $0.45\ \mu\text{m}$ for dissolved metals.

The trace metals in groundwater samples were reported as both total (unfiltered) and dissolved (filtered) samples except for antimony, barium, beryllium, cadmium, chromium, speciated chromium, cobalt, lead, magnesium, mercury, molybdenum, selenium, silver and strontium, which were reported as total concentrations only.

Evidence of the collection of field QC samples (i.e., rinsate, trip blanks or trip spikes) during the field-based programs was not provided. Results of laboratory QC measures including laboratory duplicate, triplicate, internal duplicates, method blanks or spike data were also not provided for review during compilation of this EMR.

6.5 Groundwater Results

For the purpose of this discussion, the groundwater data review has considered the groundwater monitoring locations (see Figure 5) in five monitoring zones:

- Bores upgradient of MPAR (background): MPGM4/D4, MPGM4/D5;
- Bores within MPAR and the Mine Disturbance Area East of MPAR: MPGM4/D10, MPGM4/D11, D113, MPGM4/D19;
- Bores within the Mine Disturbance Area south and south-east of MPAR: MPGM4/D15, MPGM4/D16A, MPGM4/D17, MPGM4/D18;
- Bores adjacent to MPAR to the north: MPGM4/D3, D107, D106;
- Adjacent to and downgradient of MPAR: MPGM4/D1, D102, D103, D104, D105, MPGM4/D2, MPGM4/D8, MPGM4/D9; and
- Brine Waste Pond Leak Detection Bores: MPGM5/D5, MPGM5/D6).

Graphs of concentrations over the last 10 years for selected analytes (boron, chloride, manganese, nickel, sulfate and TDS) that are considered to be indicators of potential changing conditions resulting from Project activities are provided in Appendix K.

6.5.1 Groundwater Elevations and Inferred Flow Direction

Hydrographs showing groundwater elevations for each bore have been grouped by monitoring zone, as outlined in Section 6.5 (Appendix F). The hydrographs show that groundwater levels were generally stable and decreased slightly (increased depth to groundwater) compared to the last reporting period (2021/22). This is consistent with the decrease in total rainfall this reporting period compared to last reporting period. It is noted that as groundwater elevations were not all measured at the same time, groundwater levels between bores may not be directly comparable.

The decline in groundwater elevations towards the end of the reporting period was relatively consistent throughout the bore network, with a maximum decrease of approximately 2 m, except for bores adjacent to MPAR and downgradient which exhibited lower decreases (maximum of 1 m) towards the end of the reporting period.

The groundwater elevation at D11 differed from the general trend and increased from November 2022 to March 2023, although the remaining bores within the group (within MPAR / mine disturbance area east of MPAR) showed generally decreasing groundwater elevations.

Consistent with 2019/20, 2020/21, 2021/22 monitoring results, the groundwater elevations at bore D18 did not correlate with other nearby groundwater monitoring bores throughout the reporting period, indicating a stable to slightly increasing trend. These observations are considered to indicate that the construction of this bore may be compromised.

No groundwater elevation data was available for B5 (blocked), SW3-D (dry), and D16 (decommissioned). For the current reporting period, only three measurements were provided for D23, which has been noted as destroyed.

Due to previously observed artesian (above ground surface) flow at bore D107, additional casing (stick up) was added, and groundwater elevation was not measured from October 2021 to October 2022. Groundwater elevation measurements from October 2022 onwards were provided and indicated a similar trend as other bores within the same location group except for May 2023 during which groundwater elevation at D107 increased while groundwater elevations in other bores in the location group declined.

Survey data is not available for bores MPGM5-D5 and MPGM5-D6. As such the groundwater levels from these bores are reported as metres below a point of reference (m below top of casing, m btoc), rather than as groundwater elevation (m AHD). The presence of water in these bores is not inferred to reflect the regional groundwater table as these bores are installed to approximately 5 m above the water bearing zone targeted by other nearby monitoring bores. Depth to water measured from MPGM5-D6 generally decreased (indicating shallower water levels) until August 2022 then stabilised, increasing slightly in April 2023). Water levels at MPGM5-D5 have fluctuated but steadily increased from November 2021 until April 2022; since then, groundwater levels at MPGM5-D5 have gradually increased (decreasing depth to water).

While groundwater elevations in most bores, particularly those to the north / north-west of MPAR, decreased slightly towards the end of the reporting period, groundwater elevation contours indicate that regional groundwater flow beneath the MPAR is generally toward the east, consistent with previously inferred groundwater flow directions. Although groundwater elevation fluctuated throughout the reporting period, the inferred groundwater flow directions have remained relatively consistent throughout the reporting period, as indicated in the seasonal groundwater flow contours from in October 2022 and May 2023 presented in Figure 6a and Figure 6b, respectively. Seasonal groundwater flow contours (October 2022 and May 2023) from this current reporting period were generally consistent with the seasonal groundwater flow contours (October 2021 and May 2022) of the previous reporting period, with the bores to the north and east of MPAR indicating an inferred flow to the east while a south-eastern flow is inferred from the bores to the south-east of MPAR.

6.5.2 Groundwater Quality Upgradient of MPAR (background)

Data obtained from bores MPGM4/D4 and MPGM4/D5 located to the north-west and hydraulically upgradient (background) of the MPAR, is outlined below and compared to the Environmental Goals for groundwater. Bores MPGM4/D4 and MPGM4/D5 are considered to represent background groundwater conditions in the area and based on their location up hydraulic gradient of MPAR, are not considered to have been affected by activities at MPAR. Groundwater monitoring data for the current reporting period is presented in Appendix H and summarised in Figure 8a. Graphs of concentrations over the last 10 years are provided in Appendix K.

6.5.2.1 Field Parameters

Field parameters monitored at these bores for the reporting period are summarised as follows:

- pH values for groundwater from MPGM4/D4 and MPGM4/D5 ranged from 3.5 to 6.0. The pH from bore D4 has been consistently acidic, varying from 3.4 to 3.5 during the reporting period, consistent with the 2021/22 reporting period, and prior monitoring events. Throughout the reporting period the measured pH was generally stable from this group of bores, and consistently more acidic than the Environmental Goal range for groundwater (6.5 to 8.0); and
- EC values obtained from field measurements were 710 $\mu\text{S}/\text{cm}$ to 1,220 $\mu\text{S}/\text{cm}$ and were generally stable throughout the reporting period. TDS values were generally consistent with the field EC measurements. EC and TDS values did not exceed the Environmental Goals for groundwater (2,200 $\mu\text{S}/\text{cm}$ for EC and 1,500 mg/L for TDS) during the reporting period.

Graphs of concentrations over the last 10 years for up gradient (background) bores MPGM4/D4 and MPGM4/D5 show concentrations of TDS in groundwater have been stable and below the Environmental Goal for groundwater throughout the historical dataset.

6.5.2.2 Major and Minor Ions

Throughout the reporting period, concentrations of major and minor ions, including chloride, sulfate and fluoride were reported below the relevant Environmental Goals for bores MPGM4/D4 and MPGM4/D5.

Graphs of concentrations over the last 10 years for up gradient (background) bores MPGM4/D4 and MPGM4/D5 show concentrations of chloride and sulfate follow trends consistent with TDS and have been stable and below the Environmental Goals for groundwater throughout the historical dataset.

6.5.2.3 Metals

Throughout the reporting period arsenic, copper, iron, lead, and manganese were identified on one or more occasions at concentrations above the Environmental Goal for groundwater at bores MPGM4/D4 and/or MPGM4/D5, as presented in Appendix H and summarised in Figure 8a.

LORs for speciated chromium (hexavalent and trivalent), selenium, and silver were above the Environmental Goals for one or more sample events.

The LOR of total chromium was below the Environmental Goal. Total chromium concentrations were below the Environmental Goal for MPGM4/D4 and MPGM4/D5 during the reporting period.

Selenium was reported marginally above the 0.2 $\mu\text{g}/\text{L}$ LOR in groundwater samples collected from MPGM4/D4 and MPGM4/D5 on three occasions. July and September monitoring events for both bores had a laboratory LOR of 10 $\mu\text{g}/\text{L}$, exceeding the Environmental Goal of 5 $\mu\text{g}/\text{L}$.

ERM understands that a laboratory LOR lower than the Environmental Goal for silver (0.05 $\mu\text{g}/\text{L}$) is unachievable by the laboratory. Based on the results of previous monitoring, including concentrations of silver in brine (<10 $\mu\text{g}/\text{L}$ for most samples during 2021/22 and below the LOR for most samples for the current reporting period) silver is not considered to represent a primary constituent of concern for groundwater monitoring in accordance with the WMP.

Concentrations of metals were generally higher in groundwater from bore MPGM4/D4 (particularly arsenic, iron and lead) when compared to concentrations in groundwater from bore MPGM4/D5, noting the low pH values in groundwater from bore MPGM4/D4. However, manganese concentrations were higher in groundwater from MPGM4/D5 compared to concentrations from MPGM4/D4 and exceeded the Environmental Goal for manganese throughout the reporting period, consistent with the historic dataset.

Graphs of concentrations over the last 10 years (Appendix K) for up gradient (background) bores MPGM4/D4 and MPGM4/D5 show concentrations of boron and nickel have remained stable and below the Environmental Goal for groundwater throughout the historical dataset.

6.5.3 Groundwater Quality within MPAR and the Mine Disturbance Area East of MPAR

Data obtained from groundwater bores situated within the MPAR or in the mine disturbance area immediately to the east (D10, D11, D19, and D113) are summarised below and compared to the Environmental Goals for groundwater. Bores D23, SW3-D and B5 are located within this area, but have been destroyed (D23), are blocked (B5) or are dry / have insufficient water to sample (SW3-D), and as such no groundwater quality data was available for these bores during this reporting period.

Groundwater monitoring data for the current reporting period is presented in Appendix H, and summarised in Figure 8b. Graphs of concentrations over the last 10 years showing concentrations versus time for key analytes are provided in Appendix K.

6.5.3.1 Field Parameters

Field parameters monitored from bores within MPAR or in the mine disturbance area immediately to the east for the reporting period are summarised as follows:

- pH values of groundwater in this area were slightly acidic, ranging from 5.85 to 6.54 throughout the reporting period. pH values measured during the reporting period remained generally stable and similar to those reported in 2021/22. pH values were consistently more acidic than the Environmental Goal range (6.5 to 8.0) for groundwater, except for D11 on two occasions; and
- EC values obtained from field measurements ranged from 2,070 $\mu\text{S}/\text{cm}$ to 10,460 $\mu\text{S}/\text{cm}$, with values remaining generally consistent with the previous reporting period. TDS concentrations ranged from 1,460 mg/L to 9,030 mg/L. Both EC and TDS values in groundwater from these bores were consistently above the Environmental Goals for groundwater (2,200 $\mu\text{S}/\text{cm}$ for EC and 1,500 mg/L for TDS) during the reporting period, except for D19 on two occasions.

Graphs of concentrations over the last 10 years for data from bores within this area show concentrations of TDS in groundwater have fluctuated over time, with a general increase in concentrations to above the Environmental Goal for groundwater occurring prior to 2013. TDS concentrations within these bores have generally remained above the Environmental Goal since 2013. TDS concentrations in groundwater from bores D10, D19 and D113 generally reported decreasing concentrations since mid-2018, before concentrations spiked in late 2019. Since early 2020, stable to slightly decreasing concentrations have been apparent at D19 and D113. Although concentrations fluctuate, a slight increase in TDS concentrations from late 2020, continuing to mid-2023 is noted in D10, noting that concentrations in groundwater from bore D10 remained within the historic range.

6.5.3.2 Major and Minor Ions

Throughout the reporting period, major and minor ions including chloride, sulfate and fluoride were analysed in groundwater from bores D10, D11, D19, and D113. Sulfate concentrations generally exceeded the Environmental Goal for groundwater throughout the reporting period in groundwater from these four bores, except for D19 on two occasions. Chloride concentrations in groundwater from bore D11 were consistently above the Environmental Goal as were chloride concentration in groundwater from bore D10 in March and June 2023.

During the reporting period, fluoride concentrations were consistently below the Environmental Goal and generally below the LOR in groundwater from the four bores within this area.

Graphs of concentrations over the last 10 years for bores within this area show chloride and sulfate concentrations have fluctuated over time. Chloride and sulfate concentrations increased from approximately 2010 to approximately 2017. Since 2017, chloride concentrations at D19 and D10 generally decreased until concentrations started to increase from March 2023. Concentrations remained within the historical range and were below the Environmental Goal for chloride except for groundwater from bore D10 in March and June 2023. Similarly, sulfate concentrations generally decreased from mid-2019, with a slight increase from mid to late 2022 through to the end of the reporting period. Sulfate concentrations in groundwater from these bores have been consistently above the Environmental Goal except for bore D19 in August, September, and November 2022 when sulfate concentrations were below the Environmental Goal.

6.5.3.3 Metals

Throughout the reporting period boron, chromium (D113, D19), copper (D11), iron, lead (D10, D19), manganese, molybdenum (D10), and nickel (D10, D11) were measured on one or more occasions at concentrations above the Environmental Goals for groundwater from bores D10, D11, D19 and/or D113. These results are presented in Appendix H, and summarised in Figure 8b. The Environmental Goals for groundwater for boron and iron were exceeded in all samples collected during the reporting period.

LORs for speciated chromium (hexavalent and trivalent), selenium, and silver were above the Environmental Goals for one or more sampling events. Commentary about the raised LORs is included in Section 6.5.2.3.

Chromium was reported above the Environmental Goals for three out of the four sampling events in groundwater from bores D113 and D19. Copper (D11) and molybdenum (D10) were reported above the Environmental Goals on one occasion throughout the reporting period. Lead was above the Environmental Goal in groundwater from bores D19 and D10 for one monitoring event each.

Graphs of concentrations over the last 10 years for bores within this area show boron, manganese, and nickel concentrations have fluctuated over time. These selected metals were reported at concentrations above the Environmental Goals for groundwater before 2010. Concentrations have remained consistently above the Environmental Goals for boron in groundwater for all bores within the area, and for manganese and nickel in groundwater from bore D11. Boron, manganese, and nickel concentrations fluctuate but have been generally decreasing in groundwater from other bores in this area since mid-2019. An increase in boron and nickel concentrations was noted at the end of the reporting period in groundwater from bore D10. Concentrations in groundwater from bore D113 were generally stable, and those in groundwater from D11 and D19 decreased slightly towards the end of the current reporting period.

6.5.4 Groundwater Quality within Mine Disturbance Area South and South-east of MPAR

Data obtained from groundwater bores that are considered to be situated within the mine disturbance area to the south and south-east of the MPAR is summarised below and compared to the groundwater Environmental Goals. Bores in this area include D15, D16A, D17 and D18. D16 was replaced by D16A, which was sampled from December 2022; however, the two are considered to represent different data sets, therefore discussion of historical concentrations at D16 relative to D16A is not provided. Groundwater monitoring data for the current reporting period is presented in Appendix H, and summarised in Figure 8c. Graphs of concentrations over the last 10 years showing concentrations versus time for key analytes are provided in Appendix K.

6.5.4.1 Field Parameters

Field parameters monitored at these bores, which are situated within the MPAR and mine spoil disturbance area, are summarised as follows for the reporting period:

- pH values were consistently more acidic than the Environmental Goal range for groundwater at D15 and D17 although values were generally stable ranging between 5.26 and 6.16. pH values at D18 and D16A were generally stable, between 6.68 and 6.81, and within the Environmental Goal range (6.5 to 8.0); and
- EC values obtained from field measurements were 670 $\mu\text{S}/\text{cm}$ to 2,790 $\mu\text{S}/\text{cm}$, and generally consistent with laboratory TDS concentrations of 343 mg/L to 2,220 mg/L. EC and TDS were above the Environmental Goals for groundwater (2,200 $\mu\text{S}/\text{cm}$ for EC and 1,500 mg/L for TDS) from bore D17 for two out of the four monitoring events for the reporting period. Values in groundwater from the other bores within this area were below the Environmental Goals.

Graphs of concentrations over the last 10 years for bores within this area show concentrations of TDS in groundwater from bores D15 and D17 increased over time and were above the groundwater Environmental Goal from at least mid-2013. However, since mid-2021, TDS concentrations in these bores have declined, with concentrations in groundwater from D15 decreasing below the Environmental Goal from late 2022. Concentrations of TDS in groundwater from bore D18 appear stable and remained below the Environmental Goals for groundwater. During the current reporting period, TDS concentrations in groundwater from bore D16A were relatively stable and consistently below the Environmental Goal.

6.5.4.2 Major and Minor Ions

Throughout the reporting period, concentrations of major and minor ions including chloride, sulfate and fluoride were reported for groundwater from bores D15, D17, D16A and D18. Fluoride was consistently below the Environmental Goals in groundwater from all four bores. Concentrations of sulfate were generally higher in groundwater from bores D15 and D17; however, only sulfate concentrations in groundwater from bore D17 were above the Environmental Goal in this reporting period. For this reporting period, chloride concentrations were below the Environmental Goal in groundwater from all the bores in this area.

Graphs of concentrations over the last 10 years for bores within this area show concentrations of chloride and sulfate in groundwater that are consistent with the trends observed from TDS concentrations. Concentrations of chloride and sulfate increased in groundwater from bores D15 and D17 from about 2013 to 2019 followed by a decreasing trend, which continued throughout the current reporting period. Chloride and sulfate concentrations at D18 have remained stable and low. During the current reporting period, chloride and sulfate concentrations in groundwater from bore D16A were consistently below the Environmental Goals.

6.5.4.3 Metals

Throughout the reporting period arsenic, barium, chromium, copper, iron, and lead were identified on one or more occasions at concentrations above the Environmental Goals in groundwater from bores D15, D16A, D17 and/or D18. Results are presented in Appendix H, and summarised in Figure 8c. Bore D15 accounts for the majority of exceedances in this area, consistent with the previous reporting periods.

LORs for speciated chromium (hexavalent and trivalent), selenium, and silver were above the Environmental Goals for one or more sample events. Commentary about the raised LORs is included in Section 6.5.2.3.

Graphs of concentrations over the last 10 years for bores within this area show that the concentration trends for manganese and nickel generally follow similar decreasing trends to those noted for TDS, chloride and sulfate.

Boron concentrations appear to have remained relatively stable throughout the last 10 years, fluctuating within a similar concentration range at each monitoring bore in this area. The exception is for intermittent spikes in boron concentrations at D15 throughout the early historical dataset (before 2018). Concentrations of boron in groundwater from D15 and the other bores in this area remained below the Environmental Goal for groundwater throughout the reporting period.

Concentrations of manganese in several bores in this area have varied although indicate consistent trends since 2019. The highest manganese concentrations were reported in groundwater from D15 and D17. These were similar in magnitude to each other, and higher than concentrations reported in groundwater from bore D18 and D16A. Manganese concentrations in groundwater from bores D15 and D17 have, overall, declined since approximately mid-2019. This trend is seen to continue into the current reporting period. Manganese concentrations in groundwater from all bores in this area remained below the Environmental Goal for groundwater throughout the historical dataset and the reporting period.

Concentrations of nickel appear stable, except in groundwater from bore D15, since at least 2014. Concentrations in groundwater from bore D15 were higher than the other bores in this area and were above the Environmental Goal from late 2017 until early 2022. However, nickel concentrations in groundwater from D15 have, overall, decreased since 2019 and continued to decrease during the current reporting period. Throughout the reporting period, nickel concentrations in groundwater from bore D15 were below the Environmental Goal for groundwater. Concentrations of nickel in groundwater from D17 and D18 appear generally stable since at least 2014 and have remained below the Environmental Goal for groundwater throughout the historical dataset and the reporting period. Nickel concentrations in groundwater from bore D16A have remained below the Environmental Goal for this reporting period.

6.5.5 Groundwater Quality Adjacent to MPAR – to the North

Groundwater data obtained from groundwater bores MPGM4/D3, D106 and D107 adjacent and to the north of the MPAR (cross gradient) are summarised with reference to the Environmental Goals for groundwater below. Groundwater monitoring data for the current reporting period is presented in Appendix H and summarised in Figure 8a. Graphs of concentrations over the last 10 years are provided in Appendix K.

6.5.5.1 Field Parameters

Field parameters monitored at bores adjacent and to the north of the MPAR (cross gradient) for the reporting period are summarised as follows:

- pH values measured from the bores in this area were between 5.47 and 6.2, indicating slightly acidic groundwater conditions, and were consistently more acidic than the Environmental Goal range for groundwater (6.5 to 8.0) throughout the reporting period; and
- EC values obtained from field measurements ranged from 269 $\mu\text{S}/\text{cm}$ to 15,560 $\mu\text{S}/\text{cm}$ and were generally consistent with laboratory TDS values reported between 134 mg/L and 13,600 mg/L. EC and TDS values were consistently above the Environmental Goals for groundwater (2,200 $\mu\text{S}/\text{cm}$ for EC and 1,500 mg/L for TDS) in groundwater from bores D106 and D107, however values in groundwater from bore MPGM4/D3 remained below the Environmental Goals throughout the reporting period.

Graphs of TDS concentrations over the last 10 years show concentrations from bore MPGM4/D3 have been stable and below the Environmental Goal for groundwater throughout the historical dataset, including the reporting period. This is consistent with data from up gradient (background) bores MPGM4/D4 and MPGM4/D5.

Graphs of concentrations since 2018 for bores D106 and D107 show higher and more variable concentrations of TDS in groundwater and concentrations have remained above the Environmental Goal since September 2018, when these bores were first sampled.

6.5.5.2 Major and Minor Ions

Throughout the reporting period, concentrations of major and minor ions, including chloride, sulfate, and fluoride were reported for groundwater from MPGM4/D3, D106 and D107. Concentrations of these ions were higher in groundwater from bores D106 and D107 when compared to data from bore MPGM4/D3. Sulfate and chloride concentrations have consistently been above the Environmental Goals for groundwater from bores D106 and D107 since they were first sampled in 2018, while concentrations in groundwater from bore MPGM4/D3 have remained below the Environmental Goals for groundwater. Fluoride concentrations in groundwater from each of these bores were below the Environmental Goal for groundwater, noting that the LOR was raised to <2 mg/L, which is above the Environmental Goal of 1.5 mg/L, during November, January, and May events.

Consistent with the trends identified from TDS, graphs of concentrations over the last 10 years of chloride and sulfate concentrations in groundwater from bore MPGM4/D3 indicate that concentrations have been stable and below the Environmental Goals throughout the historical dataset. This is consistent with up gradient (background) bores MPGM4/D4 and MPGM4/D5.

Also consistent with trends identified from TDS, chloride and sulfate concentrations in groundwater from bores D107 and D106 have been higher than MPGM4/D3 and have remained above the Environmental Goals for groundwater since September 2018 when these bores were first sampled. Concentrations of sulfate and chloride measured at D106 and D107 fluctuate between monitoring events.

6.5.5.3 Metals

Throughout the reporting period boron, copper, iron, lead, manganese, mercury, nickel and silver were identified on one or more occasions at concentrations above the Environmental Goals in groundwater from bores MPGM4/D3, D106 and/or D107. Results are presented in Appendix H, and summarised in Figure 8a.

LORs for speciated chromium (hexavalent and trivalent), selenium, and silver were above the Environmental Goals for one or more sampling events. Commentary about the raised LORs is included in Section 6.5.2.3.

Similar to TDS and major and minor ions, concentrations in groundwater from bore MPGM4/D3, located further upstream, were generally lower than concentrations in groundwater from bores D106 and D107. Bores D106 and D107 accounted for the majority of monitoring events recording concentrations above the Environmental Goals.

Graphs of concentrations over the last 10 years for bores MPGM4/D3, D106 and D107 (installed in 2018) show that trends in concentrations of boron, manganese and nickel are generally consistent with trends exhibited by the TDS concentrations. Concentrations in groundwater from bore MPGM4/D3 were stable and consistently below the Environmental Goals whereas concentrations of boron, nickel and manganese in groundwater from bores D106 and D107 were above the Environmental Goals. Graphs of concentrations over the last 10 years for bore MPGM4/D3 show concentrations of these selected metals have been stable and below the Environmental Goals for groundwater through the historical dataset. This is consistent with upgradient (background) bores MPGM4/D4 and MPGM4/D5.

Graphs of concentrations for bores D107 and D106 since their installation in 2018 show concentrations of boron, manganese, and nickel in groundwater are higher than MPGM4/D3 and have been above the Environmental Goals for groundwater since the bores were first sampled. During the current reporting period, concentrations in groundwater from bores D106 and D107 period fluctuated but were generally within the historical range for the selected metals, except for nickel in groundwater from bore D106 in October.

6.5.6 Groundwater Quality Adjacent to MPAR and Downgradient

Groundwater data obtained from groundwater bores MPGM4/D1, MPGM4/D9, D102, D105, MPGM4/D8, D104, D103, MPGM4/D2 located adjacent to and hydraulically downgradient of the MPAR is summarised below, with reference to the Environmental Goals for groundwater. Groundwater monitoring data for the current reporting period is presented in Appendix H, and summarised in Figure 8d. Graphs of concentrations over the last 10 years are provided in Appendix K.

6.5.6.1 Field Parameters

Field parameters monitored at bores located adjacent to and hydraulically downgradient of the MPAR for the reporting period are summarised as follows:

- pH values in groundwater from these bores ranged from 5.06 to 8.61, with most results indicating slightly acidic groundwater conditions throughout the reporting period. pH levels remained generally stable; however, most values were more acidic 5.06 to 6.49 than the Environmental Goal range (6.5 to 8.0), except for one occurrence at D102 (8.61); and
- EC values obtained from field measurements were 206 $\mu\text{S}/\text{cm}$ to 12,370 $\mu\text{S}/\text{cm}$. The EC results were comparable to laboratory TDS values reported at 163 mg/L to 11,000 mg/L. Over the reporting period, EC and TDS values were consistently above the Environmental Goals (2,200 $\mu\text{S}/\text{cm}$ for EC and 1,500 mg/L for TDS) in groundwater from bores MPGM4/D1, MPGM4/D9, D102, D103 and D105. No exceedances of the EC and TDS Environmental Goals for groundwater were reported in groundwater from bores MPGM4/D2, D104 and MPGM4/D8.

Concentrations graphs for the last 10 years show that TDS concentrations in groundwater from most of these bores have increased over time, with concentrations from MPGM4/D1, MPGM4/D9 and MPGM4/D2 reported above the Environmental Goal since before 2013. TDS concentrations in groundwater from MPGM4/D1 increased consistently from before 2013 to 2018, and again from 2019 to 2021; since 2021 they have been relatively stable but remain above the Environmental Goal for groundwater. TDS concentrations in groundwater from MPGM4/D9 increased from 2018 through 2020; since then, concentrations have been relatively stable but remain above the Environmental Goal.

Concentrations graphs for bores D102, D103 and D105 show the concentrations of TDS in groundwater from these bores have remained above the Environmental Goal for groundwater since September 2018 when these bores were first sampled. Concentrations have fluctuated over time, but a slight decreasing trend is noted for TDS in groundwater from D102, D103 and D105. Concentration graphs for groundwater from bores D104 and MPGM4/D8 show fluctuating TDS concentrations over time, although concentrations have been consistently below the Environmental Goal throughout the historical dataset and the current reporting period.

The previously increasing TDS concentrations at MPGM4/D1, MPGM4/D2, D102, D103 and D105 have become generally stable to decreasing over the current reporting period. MPGM4/D9 shows a slight increase towards the end of the current reporting period, but concentrations remain within the historical range.

6.5.6.2 Major and Minor Ions

Throughout the reporting period, concentrations of major and minor ions, including chloride, sulfate and fluoride were reported in groundwater from bores MPGM4/D1, MPGM4/D2, MPGM4/D8, MPGM4/D9, D102, D103, D104 and D105, with concentrations of chloride and sulfate exceeding the Environmental Goals for groundwater throughout the reporting period for groundwater from bores MPGM4/D1, D102, and MPGM4/D9 (chloride), and from bores MPGM4/D1, D102, MPGM4/D9, D103, and D105 (sulfate). Except for one occasion (MPGM4/D1 in November, raised LOR), fluoride concentrations in groundwater from these bores were consistently below the Environmental Goal for groundwater.

Concentrations of major and minor ions were lower and below the Environmental Goals in groundwater from bores MPGM4/D2, MPGM4/D8 and D104 when compared to concentrations in groundwater from bores MPGM4/D1, MPGM4/D9, D102, D103 and D105. The difference in groundwater quality between these locations is considered likely to be due to the spatial distribution of these locations relative to the MPAR and related groundwater flow paths.

Sulfate was reported at concentrations above the Environmental Goal consistently throughout the reporting period from bores MPGM4/D1, D102, MPGM4/D9, D103 and D105. No exceedances of the sulfate Environmental Goal for groundwater were reported at bores MPGM4/D2, MPGM4/D8 and D104 during the reporting period.

Chloride was reported at concentrations that were consistently above the Environmental Goal in groundwater from bores MPGM4/D1, D102 and MPGM4/D9. No exceedances of the chloride Environmental Goal were reported in groundwater from bores MPGM4/D2, MPGM4/D8, D103, D104 and D105.

Graphs of concentrations over the last 10 years for bores within this area show concentrations of chloride and sulfate in groundwater are consistent with the trends exhibited by TDS concentrations. Concentrations of selected major and minor ions have increased. Sulfate has consistently been reported above the Environmental Goals in groundwater from MPGM4/D1 and MPGM4/D9 since before 2013, while chloride has consistently been reported at concentrations above the Environmental Goals for groundwater from MPGM4/D1 since early 2015 and MPGM4/D9 since August 2018. During the current reporting period sulfate and chloride concentrations fluctuated at MPGM4/D1 with the historical maximum for sulfate recorded in November 2022.

Chloride concentrations in groundwater from MPGM4/D2 generally increased, although concentrations fluctuated, until January 2020 when concentrations started to decline. Similar trends are apparent in sulfate concentrations in groundwater from MPGM4/D2 although sulfate concentrations increased above the Environmental Goal in 2013 and started to decrease below the Environmental Goal from January 2020. Sulfate and chloride concentrations have been stable in groundwater from MPGM4/D2 since decreasing in early 2020 and remained below the Environmental Goals for groundwater throughout the reporting period.

Graphs of concentrations over the last 10 years for bore D103 show the concentration of sulfate has generally declined, although remaining above the Environmental Goal, since September 2018 when the bore was first sampled. Concentrations of chloride in groundwater from D103 have declined since monitoring commenced and have remained below the Environmental Goal for groundwater since October 2019.

Sulfate concentrations in groundwater from D105 appear to be relatively stable and have remained above the Environmental Goal for groundwater. Chloride concentrations in groundwater from D105 also appear to be relatively stable and have remained below the Environmental Goal for groundwater.

Graphs of concentrations over the last 10 years for bores D104 and MPGM4/D8 show generally stable chloride and sulfate concentrations over time, with concentrations of these analytes consistently remaining below the Environmental Goals for groundwater throughout the historical dataset and current reporting period.

6.5.6.3 Metals

Throughout the reporting period boron, chromium, copper, iron, lead, manganese, mercury, and nickel were identified on one or more occasions at concentrations above the relevant Environmental Goals for groundwater at the bores located downgradient of MPAR. Results are presented in Appendix H and summarised in Figure 8d.

LORs for speciated chromium (hexavalent and trivalent), selenium, and silver were above the Environmental Goals for one or more sampling events. Commentary about the raised LORs is included in Section 6.5.2.3.

Concentrations of metals were generally lower in groundwater from bores MPGM4/D2, MPGM4/D8, D104, and D105 with concentrations higher in groundwater from bores MPGM4/D1, MPGM4/D9, D102, and D103.

Graphs of concentrations over the last 10 years show concentrations of boron, manganese and nickel are generally consistent with the trends exhibited by the TDS values. Concentrations of nickel, manganese and boron have remained generally stable and below the Environmental Goals in groundwater from MPGM4/D8 and D104. In groundwater from MPGM4/D2, concentrations previously fluctuated near the Environmental Goal for groundwater but have decreased since early 2020 and have since been stable and below the Environmental Goals for boron, manganese, and nickel.

Graphs of concentrations over the last 10 years show that concentrations of boron, manganese and nickel in groundwater have increased over time at MPGM4/D1 and MPGM4/D9 to concentrations that remain above the Environmental Goals for groundwater. Concentrations decreased towards the end of last reporting period, increased from September to November 2022 of this reporting period, then decreased through to the end of this reporting period, except for D9 which increased towards the end of the reporting period.

Graphs of concentrations in groundwater from bores D102, D103 and D105 show relatively stable concentrations of boron, manganese, and nickel that have generally been above the Environmental Goals for groundwater since September 2018, when these bores were first sampled. Nickel concentrations for bore D105 in 2023 were below the Environmental Goal for groundwater for the first time since it was first sampled. For boron, concentrations appear to be stable with no identifiable trend throughout the reporting period except for a slight decrease in groundwater from D102.

6.5.7 Brine Waste Pond Leak Detection Bores

Water quality results from monitoring bores MPGM5/D5 and MPGM5/D6, adjacent to the Brine Waste Holding Ponds (to the west and upgradient of the MPAR, but downgradient of the Brine Waste Holding Ponds) are summarised with reference to the Environmental Goals for groundwater in the sections below. These bores are installed to approximately 10 m below ground level and were constructed for the purpose of leak detection from the Brine Waste Holding Ponds. Therefore, the presence of water at these locations is not inferred to reflect the regional groundwater table. Water monitoring data for the current reporting period is presented in Appendix H and summarised in Figure 8e. Graphs of concentration vs time for available data over the last ten years are provided in Appendix K.

6.5.7.1 Field Parameters

Field parameters monitored at bores adjacent to the Brine Waste Holding Ponds for the reporting period are summarised as follows:

- pH values were 6.41 to 8.0, with most values indicating slightly acidic groundwater conditions throughout the reporting period except for one value of a pH of 8.0 in water from MPGM5/D6. The majority of the pH values were within the Environmental Goal range (6.5 to 8.0). For MPGM5/D5 three out of six values were more acidic than the Environmental Goal and for MPGM5/D6 two were outside of the range, with one more acidic and one more basic than the Environmental Goal range; and
- EC values obtained from field measurements at MPGM5/D5 and MPGM5/D6 were between 200 $\mu\text{S}/\text{cm}$ and 36,390 $\mu\text{S}/\text{cm}$, and this was generally consistent with laboratory TDS values reported at 5,860 mg/L to 37,400 mg/L, though TDS was not analysed for five of the monitoring events. EC and TDS values consistently exceeded the Environmental Goals (2,200 $\mu\text{S}/\text{cm}$ for EC and 1,500 mg/L for TDS) for groundwater at bores MPGM5/D5 and MPGM5/D6, except for EC on one occasion for MPGM5/D6 in July 2022 (200 $\mu\text{S}/\text{cm}$). Given the discrepancy between the July 2022 event, the previous result (also July 2022) and the rest of the results from this current reporting period, this measurement is considered to be erroneous. Laboratory TDS and major ions were not reported for this monitoring event.

Graphs of concentrations over the last 10 years show that TDS had remained below or within the range of the Environmental Goals at both bores until approximately October 2019, when a leak was detected in the liner of Brine Waste Bond A, which is closest to MPGM5/D5. The 2019 leak was repaired during the 2019/20 reporting period and notified to the EPA (ERM, 2020a).

Since the repairs, TDS concentrations in water from MPGM5/D5 and MPGM5/D6 had declined, with concentrations at MPGM5/D6 below the Environmental Goal. However, TDS concentrations at MPGM5/D5 have been increasing since February 2021 and MPGM5/D6 since January 2023, with concentrations above the Environmental Goal in water from both bores throughout the reporting period. The recently increasing TDS concentrations are considered to be related to the rising groundwater elevations remobilising residual impact related to the 2019 leak. This is discussed further in Section 6.6.6.

6.5.7.2 Major and Minor Ions

Concentrations of major and minor ions, including chloride, sulfate and fluoride were reported at concentrations above the Environmental Goals in water from bores MPGM5/D5 and MPGM5/D6 throughout the reporting period. Chloride and sulfate concentrations were generally within the historic range for MPGM5/D5; however, concentrations in water from MPGM5/D6, increased to concentrations above the Environmental Goals from early 2022. For chloride in MPGM5/D6, concentrations increased from May 2022 to the end of the reporting period, with the maximum recorded concentrations reported in January 2023. Sulfate concentrations increased from May 2022, but remained within the historic range. Similar to TDS, the recently increasing sulfate and chloride concentrations are considered to be related to the rising water levels remobilising residual impact related to the 2019 leak. This is discussed further in Section 6.6.6.

The LOR (between <2 mg/L and <5 mg/L) for fluoride was above the Environmental Goal (1.5 mg/L) at both MPGM5/D5 and MPGM5/D6 for all events during the reporting period, except for one occasion for MPGM5/D6 in July 2022 when the LOR was below the Environmental Goal. Fluoride was also not recorded for two events for MPGM5/D5 and three events for MPGM5/D6.

6.5.7.3 Metals

Throughout the reporting period boron, cadmium, copper, iron, lead, manganese, mercury, molybdenum, nickel, selenium and zinc were identified on one or more occasions at concentrations above the relevant Environmental Goals for groundwater from bores MPGM5/D5 and MPGM5/D6. Results are presented in Appendix H and summarised in Figure 8e.

Chromium, speciated chromium (hexavalent and trivalent), copper, lead, selenium, and silver had LORs above the Environmental Goals for one or more sample events. Commentary about the raised LORs is included in Section 6.5.2.3.

Bore MPGM5/D5 accounts for the majority of exceedances from the leak detection bores, with concentrations generally higher than MPGM5/D6, apart from iron which had higher concentrations from MPGM5/D6 during the reporting period.

Graphs of concentrations over the last 10 years show a similar trend for boron, manganese and nickel as for TDS, i.e., a spike in concentrations in 2019 at both bores, with subsequently decreasing concentrations toward pre-tear levels or below the Environmental Goals (mostly for MPGM5/D6) until early 2021. Concentrations of these analytes have fluctuated and appeared to have been slightly increasing at MPGM5/D5 and MPGM5/D6 until mid to late 2021 but seem to have generally stabilised in the current reporting period, apart from nickel. The recently increasing concentrations of select metals is considered to be related to the rising groundwater elevations remobilising residual impact related to the 2019 leak. This is discussed further in Section 6.6.6.

6.6 Summary

6.6.1 Groundwater Quality Upgradient of MPAR (background)

Acidic groundwater and concentrations of metals including arsenic, copper, iron, lead and manganese elevated above the Environmental Goals were identified in groundwater from background bores MPGM4/D4 and MPGM4/D5. As these bores are located up hydraulic gradient, and away from the MPAR, the reported results are not considered to be related to the Project activities.

The area surrounding the MPAR has been highly disturbed by historical mining activities, and the low pH in this area is reported to have resulted from the oxidation of iron sulfide (Connell Wagner, 2007). The elevated metals concentrations are likely associated with this oxidation and acidification mobilising metals into groundwater. Graphs of concentrations over the last 10 years presented in Appendix K for key analytes in groundwater including TDS, chloride, sulfate, boron, manganese and nickel show that the concentrations of these analytes have remained relatively stable in this area historically, as well as over the reporting period, consistent with the representation of background conditions.

6.6.2 Groundwater Quality within MPAR and the Mine Disturbance Area East of MPAR

pH values in groundwater both within and east of the MPAR were typically below (more acidic than) the Environmental Goal for groundwater. The lower pH values are considered to be consistent with background conditions in the area and may be a result of historical mine disturbance and/or be related to the regional groundwater quality. On this basis, the pH of groundwater in this area will continue to be monitored, consistent with the WMP, but is not discussed further.

Elevated EC and TDS values as well as concentrations of sulfate, chloride (D10 and D11) and metals including boron, chromium (D11 and D113), iron, lead (D10 and D19), manganese, molybdenum (D1) and nickel (D10 and D11) were identified at concentrations at or above the Environmental Goals in groundwater from bores within the MPAR and the mine disturbance area to the east (D10, D11, D19 and D113).

Concentrations of iron, lead and manganese in groundwater from the bores at and downgradient of the MPAR were a similar order of magnitude to those in groundwater from the background monitoring bores (MPGM4/D4 and MPGM4/D5). These concentrations are considered to be related to background groundwater conditions.

The reported TDS, EC, sulfate, chloride, boron, chromium and nickel concentrations in groundwater from bores in this area are considered elevated relative to upgradient locations. Connell Wagner (2007) reported elevated levels of sulfate, boron, nickel, zinc, manganese and iron previously in this area based on pre-placement ash data from bore B904 (operational between 1997 and 2000), which may have been influenced by goaf underground mine workings to the south of this area. However, concentrations of sulfate, chloride, boron, nickel and zinc and potentially the other metals indicate a different composition relative to the background bores and pre-placement groundwater data from historical bore B904 (from Aurecon, 2017).

In consideration of the brine composition (refer to Section 2.3 and Appendix D), which also contains elevated concentrations of these constituents, groundwater in this area has been influenced by leaching of BCA placed in the MPAR to the underlying water table. The leaching of constituents from the BCA placement area to the underlying groundwater formed part of the recently completed independent investigation.

During this reporting period a slight increase was noted for TDS, chloride, sulfate, boron, manganese and nickel in groundwater from D10, D19 and D113 towards the end of the reporting period (June 2023). This is thought to be related to the drier conditions experienced in the months leading up to June after a period of higher-than-average rainfall experienced during the previous reporting period (2021/22).

6.6.3 Groundwater Quality within Mine Disturbance Area South and Southeast of MPAR

Concentrations of analytes including sulfate, chloride and metals were typically lower in groundwater from D18 than in the surrounding bores in this area (D15, D16A and D17). D18 results were also lower than when compared to background concentrations in groundwater from bores MPGM4/D4 and MPGM4/D5. D18 also had barium concentrations an order of magnitude above the surrounding bores in the area.

Based on this information, the integrity of bore D18 may have been compromised, allowing fresh water to enter the bore from the surface or may be directly connected through a mine void or fill to surface water. Groundwater elevations in bore D18 have historically been more variable than in nearby bores, with more rapid responses to rainfall. During this reporting period, the groundwater elevation measured from D18 were not consistent with trends in the surrounding bores. Based on this information, water quality in bore D18 is not considered to represent groundwater quality in the area.

Elevated concentrations of iron were consistent in groundwater from bores within this area, except at D18, and were comparable to or slightly lower than those reported in groundwater from background bores MPGM4/D4 and MPGM4/D5. These iron concentrations, which exceeded the Environmental Goal, are considered to be consistent with background groundwater conditions.

EC, TDS and sulfate concentrations were higher in groundwater from bores D15 and D17, and TDS for D16A, than in the background bores MPGM4/D4 and MPGM4/D5. Concentrations of EC, TDS and sulfate generally exceeded the Environmental Goals for groundwater from D15 and D17. Metal concentrations recorded above the Environmental Goals, apart from iron, were mostly recorded from D15. Concentrations of chromium, copper, and lead exceeded the Environmental Goals in groundwater from bore D15 on one or more occasions.

Concentrations of target analytes in groundwater from bore D15 that exceed Environmental Goals are considered to be influenced by activities at the MPAR. Bore D15 appears to be located cross-gradient, rather than directly down hydraulic gradient of the MPAR, however the presence of preferential flow paths associated with former mine workings and other water management activities are likely to be factors in the apparent distribution of the analytes in groundwater. The seepage of constituents from the BCA placement area to underlying and adjacent groundwater has been assessed as part of the independent investigation.

6.6.4 Groundwater Quality Adjacent to MPAR – to the North

Groundwater quality at bore D3, which is the furthest up hydraulic gradient of the bores adjacent to MPAR was similar to the background groundwater conditions identified at background bores MPGM4/D4 and MPGM4/D5. Iron concentrations were within an order of magnitude of concentrations in the background bores, and the low pH values were also comparable to those in groundwater from MPGM4/D5.

Concentrations of EC, TDS, chloride, sulfate, boron, copper (D107), iron, lead, manganese, mercury, and nickel exceeded the Environmental Goals in groundwater from bores D106 and D107, located to the north-east of the MPAR. The iron and a component of the manganese concentrations are considered to be related to background water quality in the area, based on concentrations in groundwater from the background bores MPGM4/D4 and MPGM4/D5, in which concentrations were a similar order of magnitude. However, the EC, TDS, chloride, sulfate, boron and nickel concentrations in groundwater from bores D106 and D107 are considered to represent changes to water quality and are not primarily related to background and pre-ash placement conditions. These analytes are present at elevated concentrations in the brine and in groundwater beneath and immediately downgradient of the MPAR. Therefore, concentrations of analytes in groundwater from bores D106 and D107 are considered to be related to BCA placement activities at the MPAR. The seepage of constituents from the BCA placement area to underlying and adjacent groundwater has been assessed as part of the independent investigation.

6.6.5 Groundwater Quality Adjacent to MPAR and Downgradient

Some exceedances of the Environmental Goals for iron were reported in groundwater from bores D2 and D104. These concentrations are considered likely to be related to the background water quality in the area, based on concentrations in groundwater from the background bores MPGM4/D4 and MPGM4/D5, which were higher.

Concentrations of TDS, EC, sulfate, chloride, boron, iron, nickel and/or manganese that exceeded the Environmental Goals were reported in groundwater from bores MPGM4/D1, MPGM4/D9, D102, D103, and D105, located down hydraulic gradient of the MPAR.

pH values were also generally more acidic than the Environmental Goal range for groundwater. The elevated iron and manganese concentrations and the acidic pH values are considered to represent background groundwater conditions in the area.

The concentrations of EC and TDS, chloride, sulfate, boron and nickel that were above the Environmental Goals are considered to represent changes to water quality and are not primarily related to background and pre-ash placement conditions. These analytes are present at elevated concentrations in the brine used to condition the BCA, and in groundwater beneath and immediately downgradient of the MPAR. Concentrations of these analytes in groundwater from bores MPGM4/D1, MPGM4/D9, D102, D103 and D105 are considered to be related to BCA placement activities at the MPAR. This was considered as part of the independent investigation.

The concentrations of these key analytes (TDS, chloride, sulfate, boron, manganese, and nickel) in groundwater from MPGM4/D2 during the current reporting period have been generally stable apart from a slight increasing trend seen in October 2022, but then decreased towards the end of the current reporting period. This increase is considered to be consistent with the drier conditions experienced during the current reporting period after a higher-than-average period of rainfall experienced from 2021/22.

Except for iron and pH consistently and copper and lead on one occasion, the concentrations of key analytes were at or below the Environmental Goal for MPGM4/D2 during the current reporting period. Given the location and the hydraulic setting of the area, this bore is considered to be representative of background groundwater conditions in the area.

The intermittent and irregular exceedances of the Environmental Goals for chromium, copper, lead and mercury in groundwater from bores D1, D102, D103, D104, D105 and MPGM4/D2 that occurred during the previous reporting periods were noted again during the current reporting period.

6.6.6 Groundwater Quality Adjacent to Brine Waste Holding Ponds

Concentrations of EC, TDS, chloride, boron and nickel have continued to increase slightly in water from MPGM5/D5 for the current reporting period; however, concentrations have remained below historical peak concentrations recorded in 2019 which were associated with the tear in the liner at Brine Waste Pond A. The tear was repaired during the 2019/20 period and notified to the EPA. The suspected reason for the continued increasing trend for these analytes is outlined below. Manganese and sulfate concentrations in MPGM5/D5 have stabilised and have started to slightly decrease towards the end of this reporting period.

The suspected source of increasing concentrations in water from MPGM5/D5 in 2021 and 2022 was subject to review by ERM (2022), and the following conclusions have been made:

- The results do not indicate a new or recent leak that would have led to the changes in water quality observed at bore MPGM5/D5 in 2021 and 2022. The recent composition of water from this bore is generally consistent with the composition and water quality observed from the 2019 leak from Brine Waste Pond A;
- It is likely that the observed increase in concentrations at bore MPGM5/D5 during 2021 and 2022 are associated with residual brine from the 2019 leak that has remained in the ground near the ponds, and that is being mobilised by higher water levels following higher rainfall, particularly in late 2021 and into 2022; and
- The groundwater impacts associated with the original 2019 leak from Brine Waste Pond A are delineated downgradient of bore MPGM5/D5 based on the field survey of EC conducted by ERM in March 2022.

During this reporting period MPGM5/D6 exhibited relatively stable TDS, chloride, sulfate concentrations after a period of increase from early to mid-2022, which was considered to be associated with rising groundwater levels remobilising the elevated concentrations associated with the tear identified in the liner at Brine Waste Pond A.

Boron has remained low and stable, below Environmental Goal. Manganese has fluctuated around the Environmental Goal but appears generally stable. Nickel has increased above Environmental Goal in the current reporting period, which is also considered to be associated with rising groundwater levels remobilising concentrations from the 2019 leak.

7. EARLY WARNING ASSESSMENT

In addition to comparing results with the Environmental Goals for surface water and groundwater, an early warning assessment of the groundwater and surface water monitoring data is required as part of the WMP. This includes assessment of concentration plots through time, as described in Sections 5.5 and 6.5.2, and statistical analysis where appropriate, as described below.

7.1 Trend Assessment Approach

Trends in target analyte concentrations in groundwater and surface water were assessed through a combination of graphical and statistical tools.

Firstly, graphs of concentrations over the last 10 years were created for target analyte concentrations for individual monitoring locations to evaluate temporal trends of solute concentrations. A description of historical concentrations over the last ten years (since 2013) and Environmental Goals are provided in Section 0 (for surface water) and Section 6 (for groundwater). The graphs of concentrations over the last 10 years also include adopted Environmental Goals for comparison. As discussed in Section 5.5 and Section 6.5, graphs of concentrations over the last 10 years from July 2013 to June 2023 are presented for surface water and groundwater in Appendix J and Appendix K respectively.

7.2 Statistical Assessment of Trends

For both groundwater and surface water, the last two years of data (covering the last two reporting periods) was adopted for the statistical assessment. Statistical tools were applied and included the use of the Mann-Kendall method (groundwater data) and linear regressions (surface water data) to evaluate trends in target analyte concentrations in groundwater and surface water from each individual monitoring location. Statistical trend plots from the statistical assessment for surface water and groundwater are presented in Appendix L and Appendix M, respectively. Further details of the ERM Mann-Kendall and the data assessment methodology are provided in Appendix N.

7.2.1 Surface water

Surface water statistical trend plots (linear regression graphs) comparing concentrations in surface water vs time, were generated for each individual monitoring location for selected analytes reported and are included in Appendix L. Where surface water concentrations were reported below the laboratory LOR, a half laboratory LOR concentration value was adopted for the statistical trend assessment.

Due to the seasonal variability within the data set for surface water, linear regression graphs were identified to be the most appropriate statistical assessment tool for the current two-year dataset. The outputs in Appendix L include data from the beginning of the 2021/22 reporting period and the linear regression trend assessment. For the purposes of this assessment a trend was considered a strong positive trend (increasing trend) when the R was reported between 0.5 and 1, and a strong negative trend (decreasing trend) when the R was reported between -0.5 and -1.

For the surface water trends, the R^2 value presented in the surface water statistical trend plots evaluates the scatter of the data points around a fitted regression line (presented as a solid blue line on the trend graphs). The R^2 value is reported between -1 and 1, where a larger R^2 value, or one that is closer to 1 or -1, indicates a stronger trend, with less variability.

Table 9 presents a summary from the statistical assessment of trends assessed for all locations and analytes reported above the relevant Environmental Goal during the reporting period.

7.2.2 Groundwater

Groundwater statistical trend plots (concentrations in groundwater and groundwater elevations vs time) were generated for each individual monitoring location for selected analytes by the ERM Mann Kendall application which was developed by ERM's Data Science and Visualisation Group to facilitate Mann-Kendall trend analysis and reporting. Plots are included in Appendix M.

The outputs include data from the beginning of the 2021/22 reporting period, and the statistical trend assessment. For the groundwater trends, the p-value presented in the trend plots indicates the level of statistical significance that can be attributed to the trend. A p-value of less than 0.05 relates to a statistical significance of 95%, i.e., if a trend has a p-value of less than 0.05 there is a 95% level of confidence that the data presents an actual trend and not a random distribution of data. The 95% confidence level has been adopted by ERM as an indicator of statistical significance in trends, and trends with these characteristics are shown in a solid black line; those that are not statistically significant do not include a solid black line.

Where no p-value is provided on the graphical outputs, a sufficient number of data points were not available to evaluate the significance of trends through the Mann-Kendall test. Concentrations both above and below the LOR and with respect to the relevant adopted background concentration (where available) are shown.

A minimum of four data points above the LOR and a threshold of 50% of data points above the LOR was set for the Mann-Kendall analysis. Parameters of the analysis are detailed in Appendix N.

Further details on the Mann-Kendall procedure are presented in the Western Australia Department of Environment's guidance document entitled *Use of Monitored Natural Attenuation for Groundwater Remediation* (2004).

Table 9: Summary of Statistical Assessment for Target Analytes

| Monitoring Location | As | B | Cd | Cl | Cr | Cu | F | Fe | Pb | Mn | Hg | Mo | Ni | Se | SO ₄ | Zn | TDS | EC |
|--|--|------|----|------|----|----|----|------|------|------|----|------|------|----|-----------------|------|------|------|
| Surface Water | | | | | | | | | | | | | | | | | | |
| LMP01 | NT | NT | NT | NT | NT | NT | NT | NT | NT | NT | NT | NT | NT | ^ | NT | NT | NT | NT |
| NC01 | NT | NT | NT | NT | NT | NT | Up | Up | Up | NT | NT | Up | NT | ^ | NT | NT | Up | NT |
| S_C | NT | NT | NT | NT | NT | NT | NT | NT | NT | NT | NT | NT | NT | ^ | NT | NT | NT | NT |
| SW_E | NT | Up | NT | Up | NT | NT | NT | Up | NT | Up | NT | NT | Up | ^ | Up | NT | Up | Up |
| WX22 | NT | Up | NT | Up | NT | NT | NT | NT | NT | NT | NT | NT | Up | ^ | Up | NT | Up | Up |
| SW_G | NT | Up | NT | Up | NT | NT | NT | NT | NT | NT | NT | NT | Up | ^ | Up | NT | Up | Up |
| Groundwater | | | | | | | | | | | | | | | | | | |
| Within MPAR / mine disturbance area – east of MPAR | | | | | | | | | | | | | | | | | | |
| B5 | Not sampled in current reporting period (blocked) | | | | | | | | | | | | | | | | | |
| SW3-D | Not sampled in current reporting period (dry) | | | | | | | | | | | | | | | | | |
| D23 | Not sampled in current reporting period (destroyed) | | | | | | | | | | | | | | | | | |
| D10 | NT | Up | - | NT | - | - | - | NT | NT | NT | - | NT | Up | ^ | NT | Up | NT | NT |
| D11 | NT | NT | - | NT | - | - | - | NT | - | NT | - | - | NT | ^ | NT | NT | NT | NT |
| D19 | NT | NT | Up | NT | NT | - | - | NT | NT | NT | - | NT | NT | ^ | NT | NT | NT | NT |
| D113 | NT | NT | NT | NT | NT | NT | - | NT | Down | NT | - | - | NT | ^ | NT | Down | NT | NT |
| Within MPAR / mine disturbance area – south / southeast of MPAR | | | | | | | | | | | | | | | | | | |
| D15 | NT | NT | NT | Down | NT | - | - | Down | NT | Down | - | NT | Down | ^ | Down | Down | Down | Down |
| D16A | Insufficient data available to perform statistical assessment (< 8 data points) due to commissioning in October 2022 | | | | | | | | | | | | | | | | | |
| D17 | - | Down | - | Down | - | - | - | NT | - | Down | - | - | Down | ^ | Down | NT | Down | Down |
| D18 | NT | Down | - | NT | - | - | NT | NT | - | Down | - | Down | Down | ^ | Down | NT | NT | Down |

| Monitoring Location | As | B | Cd | Cl | Cr | Cu | F | Fe | Pb | Mn | Hg | Mo | Ni | Se | SO ₄ | Zn | TDS | EC |
|--|----|------|----|------|------|----|----|------|------|------|----|----|------|----|-----------------|------|------|------|
| Background and Adjacent MPAR – north | | | | | | | | | | | | | | | | | | |
| MPGM4/D3 | - | Down | - | Up | - | - | - | Up | - | NT | - | - | Up | ^ | NT | NT | NT | NT |
| MPGM4/D4 | NT | - | NT | NT | NT | Up | - | NT | Down | NT | - | - | NT | ^ | Down | NT | NT | Down |
| MPGM4/D5 | NT | Down | - | NT | - | - | - | NT | - | NT | - | - | Up | ^ | NT | Up | NT | NT |
| D106 | NT | NT | NT | NT | - | - | - | NT | NT | NT | NT | - | NT | ^ | NT | NT | NT | NT |
| D107 | NT | NT | NT | NT | - | - | - | Down | NT | NT | NT | - | NT | ^ | NT | NT | NT | NT |
| Adjacent MPAR – downgradient | | | | | | | | | | | | | | | | | | |
| MPGM4/D1 | NT | NT | - | NT | - | - | - | NT | - | NT | - | - | NT | ^ | NT | NT | NT | NT |
| MPGM4/D2 | - | NT | - | NT | - | NT | NT | NT | NT | NT | - | - | NT | ^ | NT | NT | NT | NT |
| MPGM4/D8 | - | - | - | NT | - | NT | - | NT | - | NT | - | - | Up | ^ | NT | Up | NT | NT |
| MPGM4/D9 | NT | NT | - | NT | NT | - | - | NT | NT | NT | NT | NT | Up | ^ | NT | NT | NT | NT |
| D102 | - | Down | - | NT | Down | - | - | NT | - | NT | - | - | Down | ^ | NT | Down | Down | Down |
| D103 | NT | NT | - | Down | NT | - | - | Down | - | Down | - | - | Down | ^ | Down | Down | Down | Down |
| D104 | Up | NT | - | Down | - | NT | - | NT | - | NT | - | - | Up | ^ | NT | NT | NT | NT |
| D105 | NT | NT | - | Down | - | - | - | Down | - | Down | - | - | Down | ^ | Down | NT | Down | Down |
| Brine waste pond leak detection bores | | | | | | | | | | | | | | | | | | |
| MPGM5/D5 | NT | NT | NT | Up | - | NT | - | NT | NT | Down | NT | - | NT | ^ | NT | NT | NT | NT |
| MPGM5/D6 | NT | - | Up | Up | - | NT | - | Down | NT | NT | - | Up | Up | ^ | Up | Up | Up | Up |

NT = No statistically significant trend apparent

Up = Statistically significant increasing trend (upward black trend line presented on graph)

Down = Statistically significant decreasing trend (downward black trend line presented on graph)

- = Mann Kendall trend analysis not conducted, insufficient data points with concentrations above the LOR (> 50% data points below LOR)

^ = Raised LOR reported, interfering with the trend assessment; therefore, has been excluded from statistical analysis

7.3 Trend Assessment Summary

7.3.1 Surface Water

Last reporting period (2021/22), two increasing trends were identified for boron at SW_E and manganese at SW_C. Decreasing trends were noted for boron, cadmium, chlorine, fluorine, and molybdenum.

Statistically significant decreasing trends were not identified for the surface water dataset during the current reporting period. Increasing trends were reported for boron (SW_E, WX22, SW_G), chloride (SW_E, WX22, SW_G), fluoride (NC01), iron (NC01, SW_E), lead (NC01), manganese (SW_E), molybdenum (NC01), nickel (SW_E, WX22, SW_G), sulfate (SW_E, WX22, SW_G), TDS (NC01, SW_E, WX22, SW_G), and EC (SW_E, WX22, SW_G).

Several increasing trends were identified from the data collected from the last two years; however, it is noted that the last reporting period (2021/22) had higher than average rainfall, which is considered to have resulted in lower concentrations of monitored analytes in surface water. The decrease in rainfall over this reporting period, and particularly towards the months leading up to June, is considered to account for the increasing trends identified by the linear regression trend assessment. Concentrations of the monitored analytes have generally remained below Environmental Goals, except for nickel and manganese towards the end of this reporting period. For nickel and manganese, concentrations remained below the historical peaks recorded in 2020. As such the increasing trends identified in this reporting period are interpreted as a return to historical concentrations after a period of heavy rains.

7.3.2 Groundwater

For bores background to MPAR, nickel and zinc were identified as increasing over the dataset from the past two years in groundwater from MPGM4/D5, together with a decreasing trend in boron. Results for monitored analytes in groundwater from bore MPGM4/D4 did not indicate increasing trends, except for copper. These bores are hydraulically upgradient of MPAR and concentrations are considered to represent background conditions, unrelated to site activities.

Increasing trends were identified for chloride, iron, and nickel in groundwater from MPGM4/D3, adjacent to MPAR to the north; a decreasing trend was identified for boron. Results for monitored analytes in groundwater from bores D106 and D107 did not indicate increasing trends, and the trend for iron in groundwater from bore D107 was decreasing.

Within MPAR / mine disturbance area east of MPAR, increasing trends were reported for boron, nickel and zinc for D10, and cadmium for D19. Decreasing trends were reported for lead and zinc in groundwater from bore D113.

No increasing trends were reported for the bores within MPAR / mine disturbance area south / south-east of the MPAR, with most analytes reporting a decreasing trend and the remaining analytes reporting no trend. This is consistent with the trends identified from this group of bores during the last reporting period. It is noted that D16A did not have sufficient data points to conduct a trend assessment, as monitoring at D16A commenced in December 2022.

Hydraulically downgradient of MPAR, an increasing trend was identified for nickel and zinc in MPGM4/D8, nickel in MPGM4/D9, and nickel and arsenic in D104. For bores D102, D103 and D105, all identified trends were decreasing. No trends were identified for data from MPGM4/D1 and MPGM4/D2. D104 was the only bore in the entire dataset that reported an increasing trend for arsenic.

Generally, for these downgradient bores, the overall trends were similar to those in 2021/22, with the majority of trends identified as decreasing. Two increasing trends were identified during the last reporting period (boron at MPGM4/D9, selenium at MPGM4/D2); however, these trends were not repeated in this reporting period (boron in MPGM4/D9: no trend; selenium in MPGM4/D2: raised LOR).

Within the brine waste pond leak detection bores, two decreasing trends were identified for iron (MPGM4/D6) and manganese (MPGM4/D5). The only increasing trend reported for MPGM4/D5 was chloride. For MPGM4/D6, eight out of the 18 monitored analytes were reported with an increasing trend. Trends identified differed from the last reporting period in which most of the increasing trends were identified from groundwater sampled from MPGM5/D5. Section 6.6.6 includes a discussion of ERM (2022) data review in relation to the brine waste pond leak detection bores.

Elevated levels of the monitored analytes in groundwater from bores adjacent to and downgradient from the MPAR are considered to be from the leaching of the BCA placed in the MPAR, and subsequent transport of solutes within the regional groundwater. The increasing trends identified during the current reporting period are considered to be indicative of concentrations returning to within historical conditions, before the higher-than-average rainfall experienced over the 2021/22 reporting period.

7.4 Implementation of Contingency and Mitigation Measures

Where increasing trends have been identified, these have been recognised as triggers for action in accordance with the TARPs.

In the case of groundwater to the north, east and hydraulically downgradient of the MPAR, the recently completed independent groundwater investigation has identified controls to mitigate further leaching of BCA that is placed in the MPAR.

Based on findings from the independent groundwater investigation, a modification application for the Mt Piper Consent is pending. The proposed modification to the Mt Piper Consent is intended to enable a mitigation strategy as the MPAR transitions to a decommissioned facility.

Planning for implementation of these controls at MPAR is currently underway.

8. CONCLUSIONS

Based on the review of the surface water and groundwater quality data for the Project obtained in accordance with the WMP for the 2022/2023 reporting period, it is considered that the objectives of the EMR have been met, and the following conclusions are drawn:

- Concentrations of target analytes in groundwater have been reported above the Environmental Goal for groundwater at monitoring locations within and immediately downgradient to the east of the MPAR. Elevated levels of key analytes including chloride, sulfate, boron and nickel, are considered to be due to the leaching of these analytes from the BCA placed in MPAR and subsequent transport of solutes with the regional groundwater. During the latter part of the current reporting period concentrations in groundwater from several bores increased, however they remained generally within historical range;
- Impacted groundwater is migrating from the vicinity of the MPAR toward the alignment of Wangcol Creek, as indicated by the groundwater quality results reported to the north at D106 and D107, to the east at MPGM4/D1, MPGM4/D9, D102 and to a lesser extent at D105 and D103. These locations in particular have reported concentrations of target analytes in groundwater above the Environmental Goals for groundwater in areas downgradient of the MPAR. Increasing trends in target analytes were reported for relatively fewer bores within MPAR / mine disturbance east of MPAR and bores adjacent and downgradient of MPAR than in 2021/22; decreasing trends were identified in several bores. These changes in trends are considered to relate to the period of higher-than-average rainfall from 2021 to early 2022, noting that concentrations in groundwater from several bores increased in the latter part of the current reporting period, as drier conditions returned;
- Potential interaction of this impacted groundwater with the surface water of Wangcol Creek was identified during the 2019/20 reporting period (ERM, 2020a). During the current reporting period, several sample events reported values above the Environmental Goals for surface water, particularly for iron and nickel concentrations at SW_E, WX22 and SW_G. Intermittent exceedances were reported for pH, cadmium, chromium, copper, lead, manganese, mercury, and selenium throughout the Wangcol Creek monitoring network. Overall, surface water quality trends identified increasing concentrations of target analytes, with boron, chloride, nickel, sulfate, TDS, and EC all consistently increasing for the mid to downstream monitoring locations (SW_E, WX22 and SW_G). Increasing trends were also identified at NC01 (midstream) for fluoride, iron, lead, molybdenum, and TDS. Concentrations typically remained within historical ranges for each monitoring location. No trends were identified for LMP01 and SW_C. Similar to groundwater quality for this reporting period, the increasing trends identified from the surface water dataset are considered to be reflective of the drier conditions experienced towards the end of the current reporting period and represent the instream concentrations returning to concentrations prior to the period of higher-than-average rainfall (2021/22);
- Concentrations of key target analytes at MPGM5/D5 and MPGM5/D6 increased in 2019. This was related to a leak from Brine Waste Pond A, which was subsequently repaired and reported to the EPA. Groundwater conditions had improved at MPGM5/D5 and MPGM5/D6 toward pre-tear levels or below the Environmental Goals until early 2021. From early 2021, concentrations of key target analytes increased in water from MPGM5/D5. From early 2022, concentrations of key target analytes increased in water from MPGM5/D6. Concentrations from both MPGM5/D5 and MPGM5/D6 appear to have stabilised since early 2023. The suspected source of increasing concentrations in groundwater from MPGM5/D5 in 2021 and 2022 was subject to review by ERM, and the following conclusions have been made:
 - The results do not indicate a new or recent leak that would have led to the changes in water quality observed at bore MPGM5/D5 in 2021 and 2022. The recent composition of water from this bore is generally consistent with the composition and water quality observed from the 2019 leak from Brine Waste Pond A;

- It is likely that the observed increase in concentrations at bore MPGM5/D5 during 2021 and 2022 are associated with residual brine from the 2019 leak that has remained in the ground near the ponds, and that is being mobilised by shallower groundwater levels following higher rainfall, particularly in late 2021 and into 2022;
- The groundwater impacts associated with the original 2019 leak of brine from Waste Pond A are delineated downgradient of bore MPGM5/D5 based on the field survey of EC conducted by ERM in March 2022;
- Since the leak is considered to be associated with historic impacts in groundwater around Brine Waste Pond A and impacts to groundwater are localised (as indicated via the field survey), no further remediation, beyond the repair of the identified liner tear in 2019, is recommended as long as water quality data remains consistent or improves; and
- Monitoring of water levels and water quality in leak detection bore MPGM5/D5 will continue in accordance with the WMP.

Results of the groundwater and surface water monitoring program indicate that groundwater quality in the vicinity of the MPAR and the Brine Waste Ponds is influenced by Project activities. In portions of Wangcol Creek, surface water quality has historically been shown to be affected, primarily through the flow of groundwater into the creek during periods of low rainfall. The increasing trends identified within the downstream surface water monitoring points in mid-2023 are considered to be reflective of the drier conditions experienced towards the end of the reporting period. As such, the concentrations of the monitored analytes are returning to historical range after a period of lower concentrations due to the higher-than-average period of rainfall experienced in 2021/22.

Where increasing trends have been identified, these have been recognised as triggers for action in accordance with the TARP. In the case of groundwater to the north, east and down hydraulic gradient of MPAR, and historically surface water, the independent groundwater investigation informed potential mitigation measures. Based on findings from the independent groundwater investigation, a modification application for the Mt Piper Consent is pending. The proposed modification to the Mt Piper Consent is intended to enable a mitigation strategy, as the MPAR transitions to a decommissioned facility.

Consistent with the 2019/20, 2020/21, and 2021/22 reporting periods, due to bore construction appearing to have been compromised, permanently blocked, or bores repeatedly being dry or inaccessible, it is recommended that monitoring of bores B5, D23 and SW3D be removed from the monitoring program, and these bores be decommissioned if damaged.

As presented in Table 1, and consistent with the information presented in Table A.1, as at the end of the 2022/23 reporting period the operation was compliant with the relevant approval conditions, Conditions 44 and 45, of the Mt Piper Consent (DA80/10060).

9. REFERENCES

9.1 Project

- Aurecon, 2009. Mt Piper Brine Conditioned Fly Ash Co-Placement Environmental Monitoring Report, Annual Environmental Monitoring Report 2008/09, Revision 2, 10 July 2009.
- Aurecon, 2017. Mt Piper Brine Conditioned Fly Ash Co-Placement Environmental Monitoring Report, Annual Environmental Monitoring Report 2016/17, Revision 3, 25 September 2017.
- Connell Wagner, 2007, Statement of Environmental Effects, Mount Piper Power Station, Extension of Brine Conditions Ash Placement Area. Prepared by Environmental Services, Pacific Power International for Delta Electricity, 21 June 2007.
- Connell Wagner, 2008, Mt Piper Power Station Brine Conditioned Fly ash Co-placement Extension Water Management and Monitoring Plan, Delta Electricity Western, Revision 3, 26 September 2008.
- CDM Smith, 2012. Lamberts North Ash Placement Project: Groundwater Modelling Report, prepared for Delta Electricity, 22 November 2012.
- CDM Smith, 2013, Lamberts North Ash Placement Project Operation Environmental Management Plan (OEMP), Delta Electricity – Western May 2013, last revised by EnergyAustralia on 2 September 2019.
- Danis, A., Danis, C., Lackie, M., O’Neil, C., & Twigg, L. (2011) Deep 3D structure of the Sydney Basin using gravity modelling, Australian Journal of Earth Sciences, 58:5, 517-542, DOI: 10.1080/08120099.2011.565802.
- ERM 2020, Water Management and Monitoring Plan – Update for 60 ML Dam, Mt Piper Power Station Brine Conditioned Flyash Co-placement Extension Water Management and Monitoring Plan, EnergyAustralia NSW Pty Ltd, Final, 28 February 2020.
- ERM 2020a, Annual Environmental Monitoring Report – Water Management and Monitoring, Mt Piper Power Station Brine Conditioned Fly Ash Co-Placement Project, 29 September 2020.
- ERM, 2021, Annual Environmental Monitoring Report – Water Management and Monitoring 2020/21, Mt Piper Power Station Brine Conditioned Fly Ash Co-Placement Project, 28 September 2021.
- ERM, 2022, Mt Piper Power Station - response to potential leak at the brine waste ponds, Letter to EnergyAustralia dated 29 August 2022 (DRAFT)
- ERM, 2022a, Annual Environmental Monitoring Report – Water Management and Monitoring 2021/22, Mt Piper Power Station Brine Conditioned Fly Ash Co-Placement Project, 28 September 2022.
- Sinclair Knight Mertz (SKM) (2010) Mt Piper Power Station Ash Placement Project, Appendix D, Hydrology and Water Quality, 2010.

9.2 General

- Australian and New Zealand Environment and Conservation Council (ANZECC) (2000) National Water Quality Management Strategy. Paper No. 4. Australian and New Zealand Guidelines for Fresh and Marine Water Quality, Volume 1: The Guidelines (Chapter 1-7).
- Australian and New Zealand Governments (ANZG) (2018), Australian and New Zealand Guidelines for Fresh and Marine Water Quality, Australian and New Zealand Governments and Australian state and territory governments, Canberra ACT, Australia, available at www.waterquality.gov.au/anz-guidelines
- Western Australia Department of Environment, 2004: Use of Monitored Natural Attenuation for Groundwater Remediation.

10. STATEMENT OF LIMITATIONS

This report is based solely on the scope of work described in our proposal P0533074 dated 20/3/20 and confirmed via email on 24/4/20 (Scope of Work) and performed by Environmental Resources Management Australia Pty Ltd (ERM) for EnergyAustralia NSW Pty Ltd (the Client). The Scope of Work was governed by a contract between ERM and the Client (Contract).

No limitation, qualification or caveat set out below is intended to derogate from the rights and obligations of ERM and the Client under the Contract.

The findings of this report are solely based on, and the information provided in this report is strictly limited to that required by, the Scope of Work. Except to the extent stated otherwise, in preparing this report ERM has not considered any question, nor provides any information, beyond that required by the Scope of Work.

This report was prepared between July 2023 and September 2023 and is based on conditions encountered and information reviewed at the time of preparation. The report does not, and cannot, take into account changes in law, factual circumstances, applicable regulatory instruments or any other future matter. ERM does not, and will not, provide any on-going advice on the impact of any future matters unless it has agreed with the Client to amend the Scope of Work or has entered into a new engagement to provide a further report.

Unless this report expressly states to the contrary, ERM's Scope of Work was limited strictly to identifying typical environmental conditions associated with the subject site(s) and does not evaluate the condition of any structure on the subject site nor any other issues. Although normal standards of professional practice have been applied, the absence of any identified hazardous or toxic materials or any identified impacted soil or groundwater on the site(s) should not be interpreted as a guarantee that such materials or impacts do not exist.

This report is based on one or more site inspections conducted by ERM personnel, the sampling and analyses described in the report, and information provided by the Client or third parties (including regulatory agencies). All conclusions and recommendations made in the report are the professional opinions of the ERM personnel involved. Whilst normal checking of data accuracy was undertaken, except to the extent expressly set out in this report ERM:

- Did not, nor was able to, make further enquiries to assess the reliability of the information or independently verify information provided by;
- Assumes no responsibility or liability for errors in data obtained from; and
- The Client, any third parties or external sources (including regulatory agencies).

Although the data that has been used in compiling this report is generally based on actual circumstances, if the report refers to hypothetical examples those examples may, or may not, represent actual existing circumstances.

Only the environmental conditions and or potential contaminants specifically referred to in this report have been considered. To the extent permitted by law and except as is specifically stated in this report, ERM makes no warranty or representation about:

- The suitability of the site(s) for any purpose or the permissibility of any use;
- The presence, absence or otherwise of any environmental conditions or contaminants at the site(s) or elsewhere; or
- The presence, absence or otherwise of asbestos, asbestos containing materials or any hazardous materials on the site(s).

Use of the site for any purpose may require planning and other approvals and, in some cases, environmental regulator and accredited site auditor approvals. ERM offers no opinion as to the likelihood of obtaining any such approvals, or the conditions and obligations which such approvals may impose, which may include the requirement for additional environment works.

The ongoing use of the site or use of the site for a different purpose may require the management of or remediation of site conditions, such as contamination and other conditions, including but not limited to conditions referred to in this report.

This report should be read in full, and no excerpts are to be taken as representative of the whole report. To ensure its contextual integrity, the report is not to be copied, distributed or referred to in part only. No responsibility or liability is accepted by ERM for use of any part of this report in any other context.

Except to the extent that ERM has agreed otherwise with the Client in the Scope of Work or the Contract, this report:

- Has been prepared and is intended only for the exclusive use of the Client;
- Must not to be relied upon or used by any other party;
- Has not been prepared nor is intended for the purpose of advertising, sales, promoting or endorsing any Client interests including raising investment capital, recommending investment decisions, or other publicity purposes;
- Does not purport to recommend or induce a decision to make (or not make) any purchase, disposal, investment, divestment, financial commitment or otherwise in or in relation to the site(s); and
- Does not purport to provide, nor should be construed as, legal advice.

FIGURES

APPENDIX A MT PIPER CONSENT REQUIREMENTS

Table A1: Summary of Mt Piper Consent and WMP Requirements

| Project Approval Document | Condition | Consent Requirements | How addressed by this EMR | Compliance Status |
|---|-----------|---|---|-------------------|
| Mt Piper Consent (Modification 8, dated 24 July 2019) | 38A | 38A. Notwithstanding the provisions of Condition No. 38, the brine and ash co-placement area may be extended and shall be undertaken generally in accordance with the Statement of Environmental Effects: Mount Piper Power Station Extension of Brine Conditioned Ash Placement Area, prepared by Connell Wagner Pty Ltd and dated June 2007. This includes: (i) The extended area must lie within the existing ash placement area; (ii) Co-placement activities in the proposed extended area must use existing facilities and methods; (iii) The placement of brine conditioned ash may only occur between the levels of RL 946 metres (the endpoint of the water conditioned ash layer) and RL 980 metres. | Refer to Appendix C and Section 2 of this report. | Compliant |
| | 38B | 38B. The groundwater and surface water monitoring programs required by Condition No. 40 and 41 apply to the extension of the brine and ash co-placement area, permitted by Condition 38 A. | Refer to relevant conditions below. | Compliant |
| | 38C | 38C. The Applicant must update the Water Management Plan (WMP) required by Condition No. 43, and obtain the approval of the Secretary for the update, prior to undertaking any works permitted by Condition No. 38 A. In determining whether to grant approval, the Secretary must consult with the BCD, WaterNSW, DPIE Water, and Council. | Condition is met by the WMP dated 28 February 2020, as outlined in Section 1 and Section 4 to Section 8 of this report. | Compliant |
| | 40 | 40. The Applicant shall, at least one month prior to the first placement of brine-conditioned flyash, consult with the EPA, DPIE Water and WaterNSW to establish the requirements for Water Monitoring Programs for groundwater and surface water. The Water Monitoring Programs shall: (i) be based on the monitoring programs presented in the Statement of Environmental Effects for this modification; (ii) include water quality testing at a minimum frequency of every three months; (iii) be at the expense of the Applicant. | Condition is met by the WMP dated 28 February 2020, as outlined in Section 1 and Section 4 to Section 8 of this report. | Compliant |
| | 41 | 41. The Applicant shall expand the groundwater and surface water monitoring programs, including, if so required, the establishment of additional groundwater monitoring bores and surface water sampling points, in accordance with any reasonable requirements of the EPA, DPIE Water or WaterNSW. | Condition is met by the WMP dated 28 February 2020, as outlined in Section 1 | Compliant |

| Project Approval Document | Condition | Consent Requirements | How addressed by this EMR | Compliance Status |
|----------------------------------|------------------|---|---|--------------------------|
| | | | and Section 4 to Section 8 of this report. | |
| Mt Piper Consent | 43 | <p>43. At least one month prior to the placement of brine-conditioned flyash, or within such further period as the Secretary may agree, the Applicant shall prepare and submit for the approval of the EPA, WaterNSW, DPIE Water, Council, and the Secretary, a Water Management Plan (WMP) which shall include, but not be limited to:</p> <p>(a) Details of the monitoring programs for surface water and groundwater required under conditions 40 and 41.</p> <p>(b) Details of measures to be employed to control surface water run-off from the site.</p> <p>(c) Contingency plans for the mitigation of environmental impacts should run-off or leachate from the site be found to be negatively impacting on natural surface water or groundwater.</p> <p>(d) Brine management objectives and strategies, with specific reference to measures aimed at reducing the volume of brine produced at the Mount Piper Power Station.</p> | Condition is met by the WMP dated 28 February 2020, as outlined in Section 1 and Section 4 to Section 8 of this report. | Compliant |
| | 43A | 43A. The Applicant must update the Water Management Plan required by Condition 43 to the satisfaction of the Secretary, prior to commissioning the storage pond associated with Modification 8. The Applicant must implement the approved Water Management Plan. | Condition is met by the WMP dated 28 February 2020, as outlined in Section 1 and Section 4 to Section 8 of this report. | Compliant |
| | 44 | 44. The Applicant shall provide to the Secretary, EPA, DPIE Water, WaterNSW and Council, an Environmental Monitoring Report (EMR) on a yearly basis, with the first EMR to be submitted no later than six months after the first placement of brine-conditioned flyash onsite. The Applicant shall agree to Council making the Environmental Monitoring Reports available on request for public inspection. | Condition is met by the development of this report in its entirety. | Compliant |
| | 45 | <p>45. The Environmental Monitoring Report shall include, but not be limited to:</p> <p>(a) a summary and discussion of all available results and analyses from Water Monitoring Programs;</p> <p>(b) a discussion of the aims of the Water Management Plan and to what degree these aims have been attained in the context of results and analyses of the Water Monitoring Programs;</p> <p>(c) actions taken, or intended to be taken, if any, to mitigate any adverse environmental impacts; and to meet the reasonable requirements of the Secretary, EPA, DPIE Water, WaterNSW or Council.</p> | Refer to Section 4 to Section 8, along with Appendix B to Appendix L of this report. | Compliant |

| Project Approval Document | Condition | Consent Requirements | How addressed by this EMR | Compliance Status |
|----------------------------------|------------------|---|---|---|
| The WMP (ERM, 2020) | | Section 5.1 – Environmental Goals The results of all surface water and groundwater monitoring are intended to be assessed relative to the Environmental Goals | Refer to Section 0 (surface water) and Section 6 (groundwater), along with Appendix F to Appendix J of this report. | Compliant |
| | | Section 5.1.1 – Early Warning Assessment In addition to comparing results with the Environmental Goals for surface water and groundwater an early warning assessment will be conducted. This assessment will include a review of concentration trends through time at each location, including statistical assessment. | Refer to Section 7, along with Appendix H to Appendix L of this report. | Compliant |
| | | Section 6.1 – Monitoring Locations | Refer to Section 5.2 and Section 6.2 of this report. | Compliant |
| | | Section 6.2 – Monitoring Frequency | Refer to Section 5.2 and Section 6.2 of this report. | Compliant |
| | | Section 6.3 – Monitoring Method | Refer to Section 5.3 and Section 6.3 of this report. | Compliant. Minor non-conforming laboratory LORs were reported for silver and selenium as described in Section 6.5 of this report. These non-conforming laboratory LORs do not impact upon the conclusions of this report, as these are not |

| Project Approval Document | Condition | Consent Requirements | How addressed by this EMR | Compliance Status |
|---------------------------|-----------|---|---|--|
| | | | | considered to represent primary constituents of concern for groundwater monitoring in accordance with the WMP. |
| | | Section 6.4 – Monitored Parameters | Refer to Section 1.1 and Section 6.4 of this report. | Compliant |
| | | Section 6.5 – Data Management and Assessment The monitoring data is compared with the existing historical dataset for an assessment of trends related to potential influence of the brine management and BCA placement activities on surface water and groundwater. | Refer to Section 5.5, Section 5.5.4, Section 6.5, Section 6.6 and Section 0 of this report. | Compliant |
| | | Section 6.6 – Reporting Requirements The reporting requirements of the WMP form the objectives of this EMR. | Refer to Section 1.2, Section 0 to Section 8 of this report. | Compliant |
| | | Section 7.1 – Performance Criteria The key aim of TARPs is the mitigation and control of impacts, ideally through early detection. Therefore, TARPs for groundwater and surface water quality are based on the Environmental Goals for the monitoring program. In addition, long-term trends in surface and groundwater concentrations are assessed using the routine monitoring data and with reference to a statistical assessment of water quality data. Should concentrations at a given location indicate a statistically significant increasing concentration trend in groundwater or surface water, or exceed the relevant Environmental Goal, the triggers are considered to have been exceeded and actions are to be implemented. | Refer to Section 7 of this report. | Compliant |

**ENVIRONMENTAL MONITORING REPORT – WATER MANAGEMENT AND
MONITORING 2022/23**

Mt Piper Power Station Brine Conditioned Fly Ash Co-Placement Project

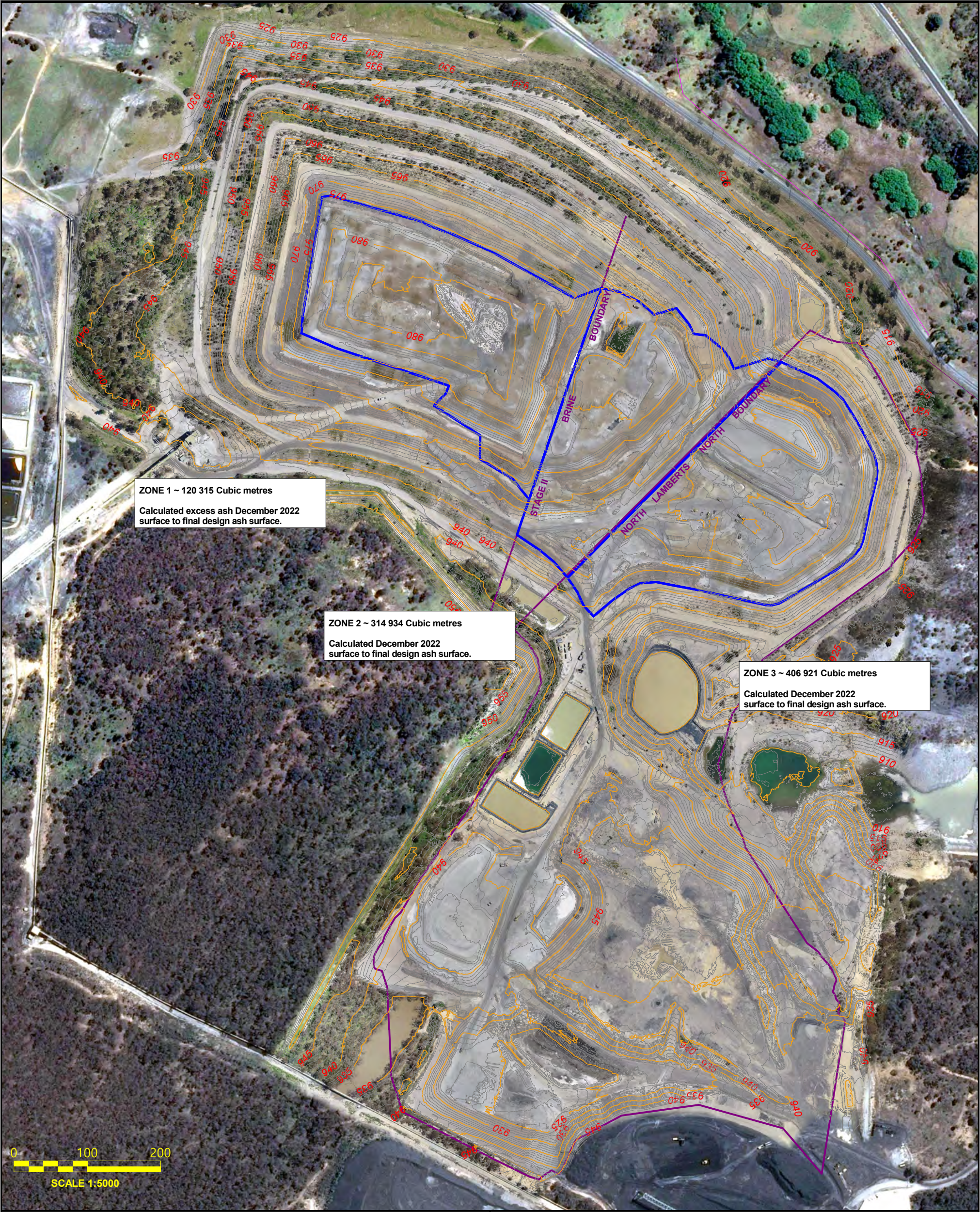
| Project Approval Document | Condition | Consent Requirements | How addressed by this EMR | Compliance Status |
|----------------------------------|------------------|---|--------------------------------------|--------------------------|
| The WMP (ERM, 2020) | | <p>Section 7.2 – Incident Response</p> <p>An impact to groundwater or surface water is considered to be present when concentrations of a monitoring parameter are recorded above the Environmental Goals. In the event of an impact to groundwater or surface water that is considered to be potentially associated with brine management and/or handling/placement of BCA at MPAR, the WMP outlines an incident response procedure.</p> <p>It is noted that the EPL 13007 outlines separate incident response requirements. The reporting requirements of the EPL will be provided to the regulators separately to this EMR.</p> | Refer to Section 7.4 of this report. | Compliant |
| | | <p>Section 7.3 – Contingency Measures</p> <p>Should routine monitoring data suggest that further changes in water quality are being caused by brine management (e.g., brine waste ponds) or other BCA placement and related activities at the MPPS, the WMP outlines contingency items that may be implemented.</p> | Refer to Section 7.4 of this report. | Compliant |

APPENDIX B STORMWATER FLOW VOLUME DATA

Mt Piper Power Station - LDP12 (formerly LDP01) discharge volumes

| Date | Kilolitres / day | Start Pump (hh.mm) | Cease Pumping (hh.mm) | Pump Duration (hrs) | Pump Rate (L/sec) |
|--------------|------------------|--------------------|-----------------------|---------------------|-------------------|
| 1/07/2022 | 2042.40 | 940 | 1330 | 3.8 | 148.0 |
| 4/07/2022 | Overtopping | - | - | - | - |
| 10/08/2022 | 807.18 | 1200 | 1600 | 4.0 | 36.0 |
| 11/08/2022 | 2835.90 | 1015 | 1700 | 6.9 | 115.0 |
| 11/08/2022 | 502.20 | 1045 | 1200 | 1.6 | 90.0 |
| 12/08/2022 | 2901.60 | 905 | 1525 | 6.2 | 130.0 |
| 19/08/2022 | 2394.00 | 845 | 1545 | 7.0 | 95.0 |
| 30/08/2022 | 3113.28 | 935 | 1740 | 8.1 | 110.0 |
| 31/08/2022 | 1391.34 | 730 | 1758 | 10.3 | 70.0 |
| 1/09/2022 | 180.60 | 800 | 842 | 0.4 | 70.0 |
| 14/09/2022 | 232.56 | 940 | 1030 | 0.9 | 76.0 |
| 20/09/2022 | 1707.24 | 1139 | 1725 | 586.0 | 82.0 |
| 21/09/2022 | 2673.60 | 700 | 1616 | 9.2 | 80.0 |
| 26/09/2022 | 2070.54 | 933 | 1742 | 8.1 | 71.0 |
| 27/09/2022 | 2738.40 | 700 | 1721 | 10.2 | 70.0 |
| 5/10/2022 | 2939.28 | 933 | 1503 | 5.7 | 148.0 |
| 9/10/2022 | Overtopping | - | - | | |
| 10/10/2022 | Overtopping | - | - | | |
| 11/10/2022 | 2160.00 | 1500 | 1900 | 4.0 | 150.0 |
| 11/10/2022 | 900.00 | 1530 | 1800 | 2.5 | 100.0 |
| 12/10/2022 | 3578.40 | 600 | 1300 | 7.0 | 142.0 |
| 12/10/2022 | 2880.00 | 600 | 1300 | 7.0 | 100.0 |
| 13/10/2022 | 1268.82 | 903 | 1141 | 2.4 | 133.0 |
| 26/10/2022 | 549.12 | 1137 | 1241 | 1.0 | 143.0 |
| 15/11/2022 | 2530.02 | 1309 | 1751 | 4.4 | 149.0 |
| 16/11/2022 | 6767.58 | 730 | 2007 | 12.8 | 149.0 |
| 17/11/2022 | 926.10 | 735 | 919 | 1.8 | 147.0 |
| 4/04/2023 | 1747.20 | 1047 | 1430 | 3.8 | 130.0 |
| 5/04/2023 | 2316.60 | 1253 | 1749 | 5.0 | 130.0 |
| 6/04/2023 | 2407.92 | 746 | 1301 | 5.6 | 127.0 |
| 18/04/2023 | 2400.00 | 1140 | 1659 | 5.2 | 125.0 |
| 19/04/2023 | 614.88 | 551 | 714 | 1.6 | 122.0 |
| 4/05/2023 | 2647.50 | 1115 | 1707 | 5.9 | 125.0 |
| 5/05/2023 | 2447.76 | 831 | 1359 | 5.3 | 124.0 |
| TOTAL | 64672 | - | - | - | - |

APPENDIX C ASH REPOSITORY SURVEY



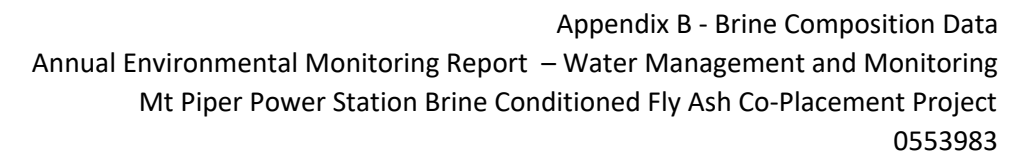
SERVICESTREAM
MOUNT PIPER - ASH PLACEMENT
SURVEY : 6th DECEMBER 2022

SCALE - 1:5000 (A3 SHEET)

DATUM: MGA (ZONE56)

| | | | | | | |
|---|---|---|----------|--|------------|---|
|  |  | <p>CONSULTING LAND, ENGINEERING AND MINING SURVEYORS</p> <p>"Astrolabe" 1 Rutherford Lane, LITHGOW 2790</p> <p>ABN: 68 056 544 551 Office: (02) 6351 2281 Email: survey@ceh.com.au Website: www.ceh.com.au</p> | DATE | | 06-12-2022 | <p>DRAWING No:</p> <p>MPA1222</p> <p>(as surveyed)</p> <p>CCAD6 JOB & DWG: <i>MPA1222 - MPA1222 as survey(b)</i></p> |
| | | | AMENDED | | 16/02/2023 | |
| | | | SURVEYOR | | TH/BN | |
| | | | DRAWN | | TH/GM | |
| | | | CHECKED | | | |
| Liability limited by a scheme approved under Professional Standards Legislation. | | | | | | |

APPENDIX D BRINE COMPOSITION DATA



a. Brine composition data provided by EnergyAustralia on 01 August 2018;
b. Connell Wagner (2007). Statement of Environmental Effects, Mount Piper Power Station, Extension of Brine Conditions Ash Placement Area. Prepared by Environmental Services, Pacific Power International for Delta Electricity, 21 June 2007.
c. data based on Nalco monitoring point reference 1050, EA BC Waste Pond
Notations relate to Average Trace element values, from 1999 Statement of Environmental Effects including:
* mostly 10 – 15 analyses (sources Hodgson, 1999) – AWT, 1996
** EPA (1999a) ^ one analysis ^^ 3 analyses ^^^ 5 analyses + 6 analyses
*** Total chromium reported (CrVI <25ug/l)
d. Brine composition data provided by EnergyAustralia in July 2021 – combined data of BC Waste Pond A & B.
e. Brine composition data provided by EnergyAustralia in August 2022 – averages of data for BC Waste Pond A & BC Pond B.
f. Brine composition data provided by EnergyAustralia on July 2023 – averages of data for BC Waste Pond A & BC Pond B.

APPENDIX E SITE WEATHER DATA

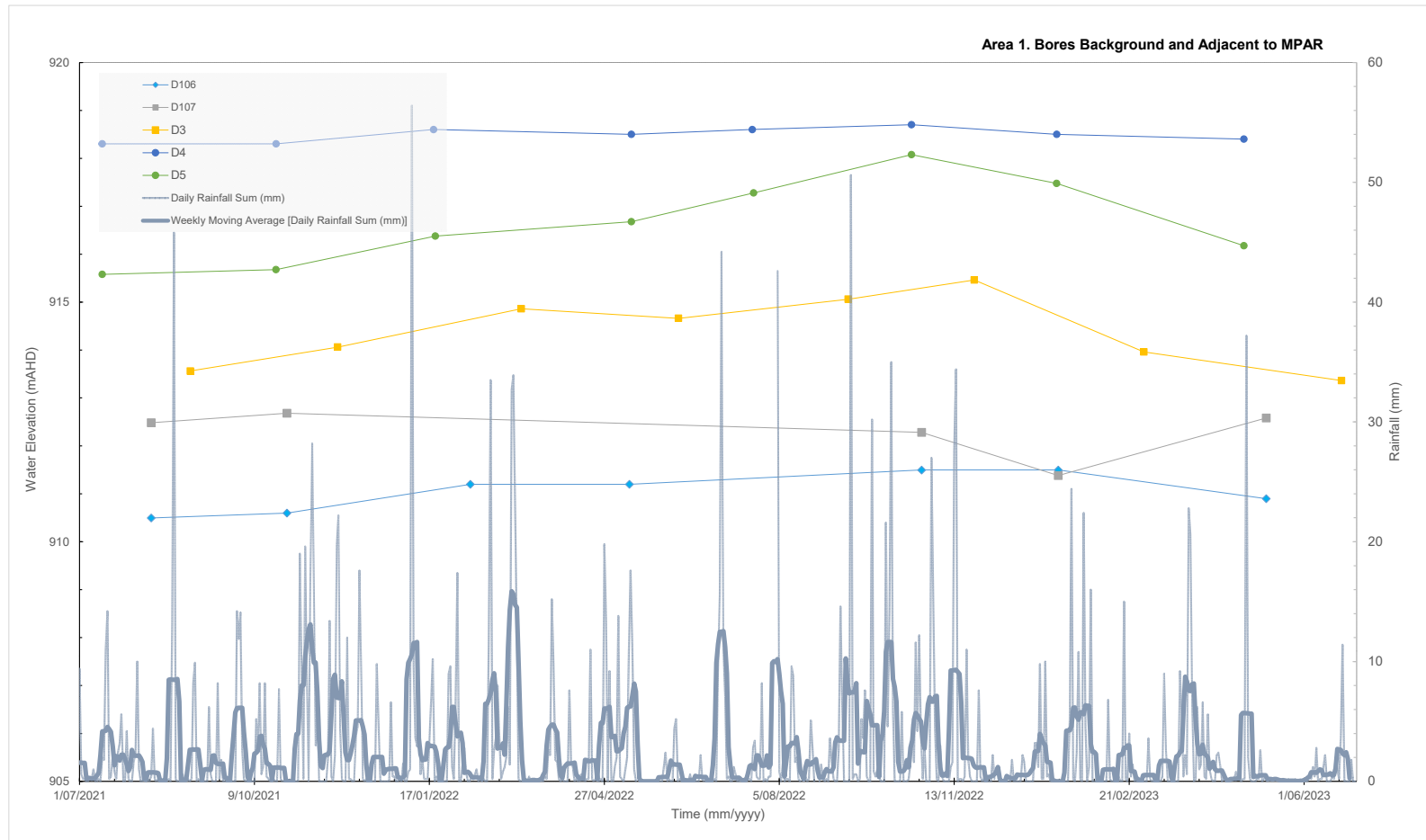
| Month | Jul-22 | | | Aug-22 | | | Sep-22 | | | Oct-22 | | | Nov-22 | | | Dec-22 | | |
|-------------|---------------|---------------|----------|---------------|---------------|----------|---------------|---------------|----------|---------------|---------------|----------|---------------|---------------|----------|---------------|---------------|----------|
| Measurement | AT 2M 1Hr Min | AT 2M 1Hr Max | Rainfall | AT 2M 1Hr Min | AT 2M 1Hr Max | Rainfall | AT 2M 1Hr Min | AT 2M 1Hr Max | Rainfall | AT 2M 1Hr Min | AT 2M 1Hr Max | Rainfall | AT 2M 1Hr Min | AT 2M 1Hr Max | Rainfall | AT 2M 1Hr Min | AT 2M 1Hr Max | Rainfall |
| Date | °C | °C | mm | °C | °C | mm | °C | °C | mm | °C | °C | mm | °C | °C | mm | °C | °C | mm |
| 1 | 4.2 | 6.3 | 9.2 | -0.9 | 10.4 | 6.0 | 3.8 | 15.0 | 0.2 | 5.2 | 11.0 | 0.4 | 3.3 | 16.1 | 15 | 10.1 | 16.0 | 0 |
| 2 | 5.9 | 8.5 | 15.6 | - | - | - | 3.0 | 12.0 | 0 | 2.5 | 14.8 | 0 | 1.4 | 7.7 | 4.4 | 9.4 | 15.9 | 0 |
| 3 | 7.5 | 9.3 | 44.2 | - | - | - | 3.3 | 7.0 | 3.6 | -0.1 | 15.2 | 0 | 4.1 | 12.5 | 0.2 | 5.3 | 22.3 | 0 |
| 4 | 7.1 | 9.3 | 11 | 11.0 | 13.7 | 42.6 | 4.4 | 9.1 | 1.8 | 1.3 | 17.8 | 0 | 5.4 | 14.3 | 0 | 8.2 | 24.2 | 0 |
| 5 | 7.0 | 8.3 | 7.2 | 7.1 | 13.4 | 0.8 | -0.8 | 12.5 | 0.2 | 8.0 | 10.3 | 21.6 | 6.8 | 17.7 | 3 | 7.5 | 25.5 | 2.2 |
| 6 | 6.8 | 9.7 | 0.2 | 4.9 | 9.8 | 0.0 | 3.3 | 11.2 | 0 | 8.9 | 12.4 | 4.6 | 5.7 | 18.4 | 0.4 | 7.1 | 22.6 | 0.2 |
| 7 | 3.5 | 11.5 | 0.4 | -0.4 | 9.4 | 1.6 | 4.8 | 12.7 | 0 | 9.8 | 14.4 | 14.4 | 8.7 | 19.1 | 0 | - | - | - |
| 8 | 2.2 | 4.6 | 0 | -2.9 | 10.7 | 0.0 | 6.9 | 14.1 | 2.6 | 8.7 | 16.0 | 35 | 8.4 | 18.9 | 0 | - | - | - |
| 9 | -1.5 | 8.4 | 0 | -3.8 | 9.2 | 0.2 | 7.3 | 13.0 | 14.6 | 3.4 | 13.6 | 5.8 | 4.6 | 19.4 | 0 | - | - | - |
| 10 | -2.3 | 8.3 | 1.2 | -0.2 | 11.8 | 0.2 | 7.1 | 11.4 | 6.6 | 2.1 | 13.3 | 0 | 7.2 | 20.9 | 0 | - | - | - |
| 11 | 1.7 | 9.4 | 0.6 | 3.2 | 10.9 | 0.0 | 3.1 | 12.1 | 0 | 7.7 | 14.7 | 0 | 6.3 | 17.5 | 1.2 | - | - | - |
| 12 | 2.4 | 10.1 | 0 | 5.6 | 8.9 | 9.6 | 1.9 | 11.5 | 0 | 5.1 | 15.2 | 0 | 6.7 | 23.5 | 1.6 | - | - | - |
| 13 | 1.5 | 6.1 | 0 | 3.0 | 9.9 | 8.8 | 4.4 | 12.7 | 0 | 9.2 | 16.6 | 0 | 12.3 | 19.5 | 27.6 | 3.5 | 18.4 | 0 |
| 14 | -2.2 | 9.4 | 0.2 | 3.0 | 6.6 | 1.6 | 3.4 | 12.2 | 0 | 7.1 | 13.5 | 5.8 | 11.9 | 17.1 | 34.4 | 3.4 | 14.2 | 0 |
| 15 | -6.0 | 11.6 | 0.2 | 3.8 | 8.7 | 2.0 | 6.4 | 9.2 | 50.6 | 4.9 | 17.9 | 0 | 5.2 | 15.5 | 0 | 3.1 | 17.9 | 0 |
| 16 | -5.3 | 11.9 | 0 | 2.2 | 9.0 | 0.2 | 7.1 | 14.7 | 0.2 | 3.2 | 16.7 | 0 | 2.8 | 9.7 | 0.2 | 6.3 | 17.3 | 1.8 |
| 17 | - | - | - | -2.4 | 13.7 | 0.0 | 4.5 | 12.3 | 0.6 | 9.1 | 14.3 | 0 | 1.0 | 15.5 | 0.2 | 4.1 | 18.2 | 0 |
| 18 | - | - | - | - | - | - | 4.1 | 13.2 | 0.6 | 9.1 | 16.3 | 0.2 | 3.1 | 17.7 | 0 | 8.1 | 17.2 | 0 |
| 19 | -5.1 | 7.8 | 0.2 | - | - | - | 0.5 | 12.9 | 0 | 11.5 | 18.7 | 1.6 | 6.2 | 21.5 | 0.4 | 7.5 | 17.3 | 0 |
| 20 | 4.4 | 9.7 | 0 | 2.2 | 9.4 | 0.4 | -2.0 | 16.1 | 0.2 | 12.8 | 16.0 | 4.8 | 9.6 | 16.3 | 11 | 5.0 | 19.2 | 0 |
| 21 | 5.5 | 8.6 | 2.8 | 0.1 | 12.1 | 0.0 | 4.7 | 13.7 | 5.2 | 14.1 | 18.9 | 1.6 | 4.5 | 12.5 | 1.8 | 4.6 | 21.9 | 0 |
| 22 | 6.0 | 9.4 | 3.4 | -1.1 | 11.7 | 0.2 | 10.1 | 12.3 | 3.6 | 12.9 | 19.1 | 11.6 | 3.4 | 11.9 | 0.4 | 6.9 | 18.0 | 2.2 |
| 23 | 4.5 | 11.6 | 0.4 | 0.3 | 12.5 | 5.1 | 9.5 | 15.0 | 7.6 | 12.5 | 18.9 | 4.2 | 6.8 | 17.1 | 0 | 12.0 | 25.9 | 1.6 |
| 24 | -0.4 | 12.7 | 0.2 | -1.0 | 8.5 | 2.8 | 5.4 | 15.0 | 0.4 | 11.6 | 17.0 | 12.2 | 5.8 | 21.0 | 0 | 12.7 | 27.7 | 0 |
| 25 | 0.7 | 13.7 | 0.2 | 1.8 | 10.9 | 0.0 | 1.3 | 16.3 | 0 | 10.1 | 19.1 | 4 | 5.0 | 20.9 | 0 | 11.4 | 28.7 | 0 |
| 26 | 2.9 | 9.0 | 8.2 | - | - | - | 0.6 | 15.1 | 0 | 12.4 | 18.6 | 0.2 | 5.8 | 22.7 | 0 | 10.4 | 29.0 | 0 |
| 27 | 1.4 | 8.7 | 0 | - | - | - | 7.4 | 16.6 | 30.2 | 10.7 | 16.9 | 2.8 | 12.1 | 25.3 | 7.6 | 8.1 | 27.9 | 0 |
| 28 | 3.9 | 10.8 | 0.2 | 2.9 | 15.2 | 0.0 | 4.5 | 13.5 | 0.8 | 8.7 | 14.6 | 0 | 8.4 | 19.5 | 0.4 | 8.0 | 29.4 | 0 |
| 29 | -4.0 | 9.7 | 0 | 2.1 | 11.9 | 1.4 | 4.1 | 14.8 | 0.4 | 8.0 | 15.8 | 0 | 6.2 | 21.3 | 0 | 11.0 | 24.6 | 3.2 |
| 30 | -6.1 | 9.5 | 0.4 | 6.1 | 15.2 | 0.2 | 7.2 | 12.2 | 1 | 3.6 | 18.4 | 0 | 8.5 | 19.0 | 0.2 | 14.3 | 21.4 | 3.2 |
| 31 | -3.6 | 9.8 | 0.4 | 0.1 | 15.1 | 0.0 | | | | 8.4 | 19.1 | 27 | | | | 12.0 | 23.7 | 1.2 |
| Min | -6.1 | 4.6 | 0.0 | -3.8 | 6.6 | 0.0 | -2.0 | 7.0 | 0.0 | -0.1 | 10.3 | 0.0 | 1.0 | 7.7 | 0.0 | 3.1 | 14.2 | 0.0 |
| Max | 7.5 | 13.7 | 44.2 | 11.0 | 15.2 | 42.6 | 10.1 | 16.6 | 50.6 | 14.1 | 19.1 | 35.0 | 12.3 | 25.3 | 34.4 | 14.3 | 29.4 | 3.2 |
| Average | 1.5 | 9.4 | | 1.9 | 11.1 | | 4.4 | 13.0 | | 7.8 | 16.0 | | 6.2 | 17.7 | | 8.0 | 21.8 | |
| Total | | | 106.4 | | | 83.7 | | | 131.0 | | | 157.8 | | | 110.0 | | | 15.6 |

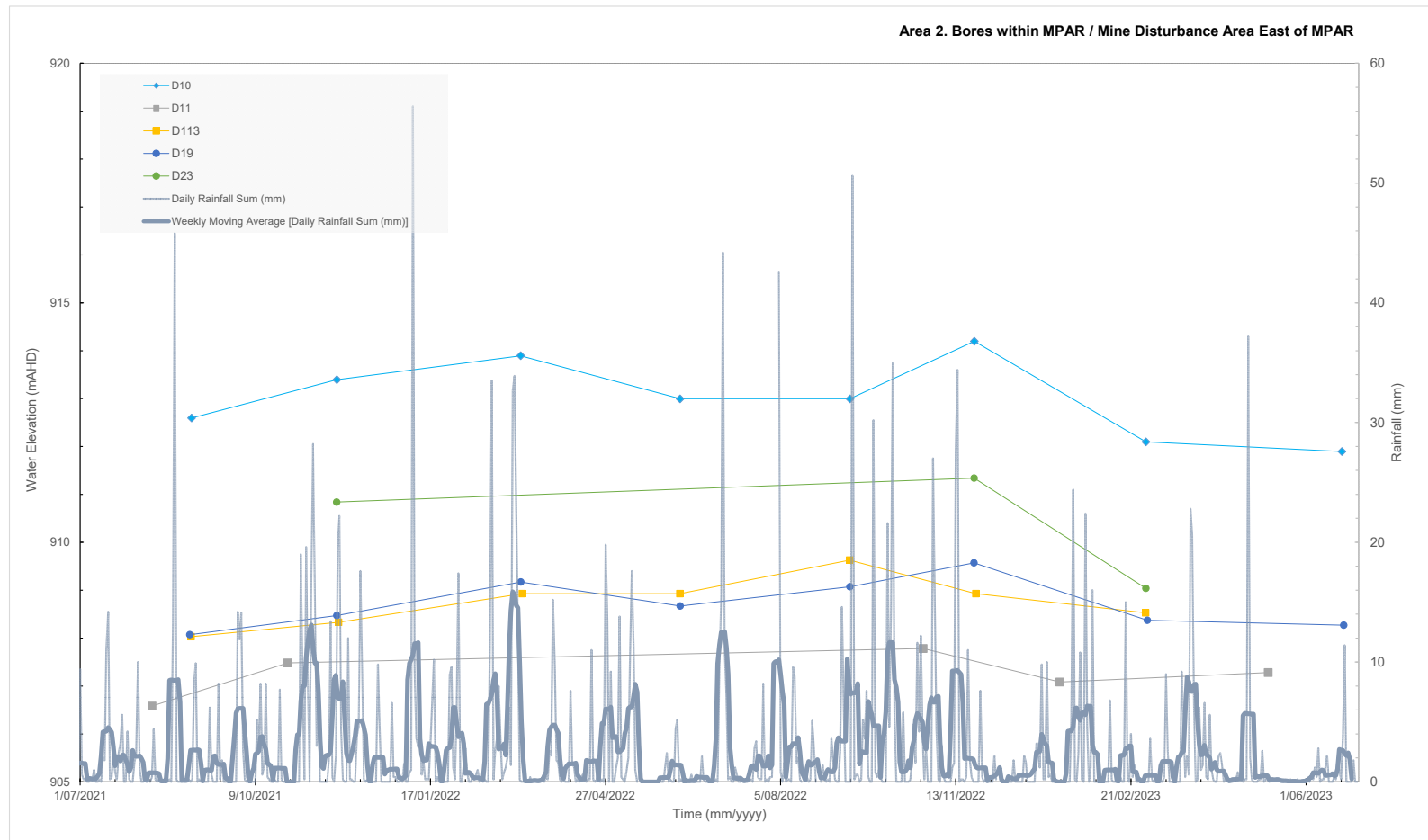
Note:
- signifies data not provided

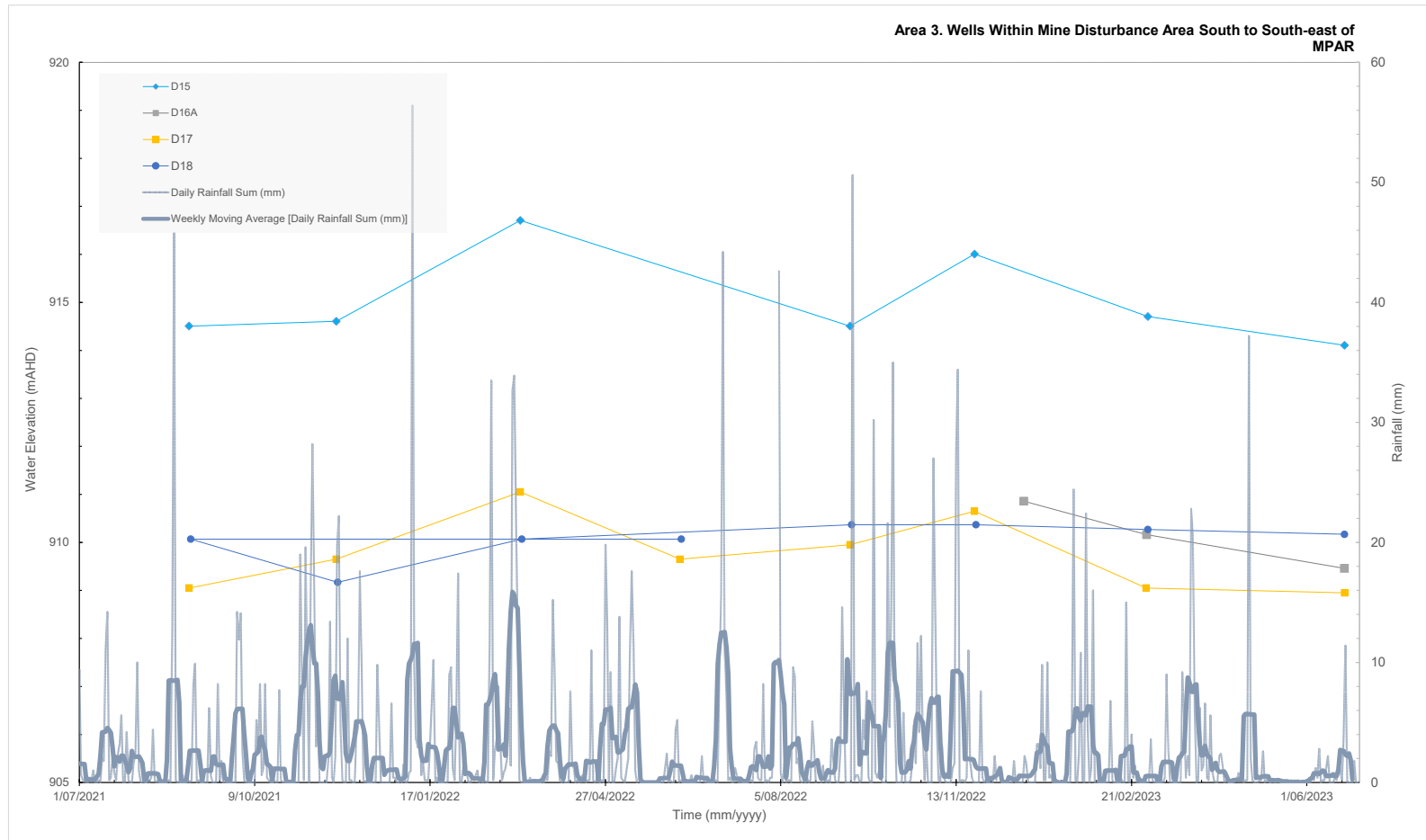
| Month | Jan-23 | | | Feb-23 | | | Mar-23 | | | Apr-23 | | | May-23 | | | Jun-23 | | |
|-------------|---------------|---------------|-------|---------------|---------------|----------|---------------|---------------|----------|---------------|---------------|----------|---------------|---------------|----------|---------------|---------------|----------|
| Measurement | AT 2M 1Hr Min | AT 2M 1Hr Max | Rain | AT 2M 1Hr Min | AT 2M 1Hr Max | Rainfall | AT 2M 1Hr Min | AT 2M 1Hr Max | Rainfall | AT 2M 1Hr Min | AT 2M 1Hr Max | Rainfall | AT 2M 1Hr Min | AT 2M 1Hr Max | Rainfall | AT 2M 1Hr Min | AT 2M 1Hr Max | Rainfall |
| Date | °C | °C | mm | °C | °C | mm | °C | °C | mm | °C | °C | mm | °C | °C | mm | °C | °C | mm |
| 1 | 15.3 | 24.2 | 9.8 | 14.5 | 27.4 | 0 | 9.4 | 25.2 | 0 | 3.6 | 17.1 | 6.2 | 0.8 | 9.9 | 0.2 | 3.2 | 15.7 | 0 |
| 2 | 14.3 | 26.9 | 0.2 | 14.0 | 26.3 | 0 | 15.0 | 24.6 | 0 | 9.2 | 13.9 | 1.0 | 7.6 | 13.4 | 0 | 1.3 | 16.5 | 0.2 |
| 3 | 14.1 | 30.0 | 0.2 | 8.8 | 19.4 | 0 | 10.4 | 23.6 | 0 | 11.1 | 17.7 | 1.4 | 6.8 | 14.0 | 0 | 3.1 | 16.6 | 0 |
| 4 | 13.5 | 25.1 | 10 | 7.3 | 18.6 | 0 | 14.8 | 21.4 | 3.6 | 8.6 | 17.7 | 6.6 | 2.5 | 14.6 | 0 | 7.9 | 10.9 | 0.6 |
| 5 | 10.4 | 14.7 | 0.4 | 9.6 | 27.5 | 0 | 10.8 | 27.8 | 0.2 | 8.4 | 19.9 | 0.4 | -1.3 | 15.2 | 0.2 | 7.0 | 10.5 | 0.2 |
| 6 | 9.1 | 14.5 | 0.6 | 12.5 | 28.8 | 0 | 14.1 | 31.0 | 0 | 7.1 | 18.0 | 0.2 | -1.4 | 13.8 | 0.2 | 6.1 | 14.1 | 1.2 |
| 7 | 10.6 | 18.6 | 0 | 15.6 | 26.3 | 0 | 11.3 | 27.0 | 0 | 8.1 | 18.6 | 5.6 | -0.7 | 7.3 | 2.6 | 5.9 | 15.8 | 0.4 |
| 8 | 10.1 | 25.5 | 0 | 14.6 | 22.8 | 0 | 8.4 | 23.5 | 0 | 10.0 | 13.3 | 1.0 | -0.3 | 7.4 | 0 | 5.5 | 9.9 | 2.8 |
| 9 | 7.0 | 29.4 | 0 | 13.8 | 20.9 | 6.8 | 7.2 | 21.3 | 0 | 7.0 | 10.6 | 0.2 | 0.0 | 11.5 | 0.2 | 2.3 | 9.8 | 0 |
| 10 | 8.0 | 27.9 | 0 | 9.2 | 26.4 | 0.2 | 5.2 | 25.5 | 0 | 3.4 | 10.3 | 0.0 | -2.1 | 15.2 | 0.4 | -2.2 | 10.3 | 0.2 |
| 11 | 13.7 | 27.3 | 0 | 11.5 | 30.0 | 0 | 9.4 | 26.8 | 0 | 4.8 | 16.0 | 0.0 | 0.3 | 15.3 | 0 | -4.7 | 12.6 | 0.2 |
| 12 | 14.5 | 28.9 | 0 | 16.3 | 28.0 | 0 | 13.5 | 25.2 | 0.4 | 3.3 | 15.1 | 2.2 | 0.1 | 15.7 | 0.2 | -2.5 | 11.7 | 1.2 |
| 13 | 15.3 | 24.9 | 0 | 14.0 | 20.5 | 0 | 13.9 | 16.4 | 9 | 8.0 | 16.5 | 2.4 | 0.3 | 15.0 | 0.2 | 3.8 | 12.4 | 2.2 |
| 14 | 14.8 | 25.6 | 0 | 14.0 | 18.5 | 0 | 12.8 | 19.4 | 2.6 | 7.6 | 16.6 | 1.4 | 3.7 | 14.8 | 0.2 | 4.2 | 8.4 | 0 |
| 15 | 11.1 | 30.6 | 0 | 13.2 | 23.7 | 0.4 | 11.6 | 25.0 | 0 | 4.7 | 19.0 | 0.0 | - | - | - | 3.2 | 8.1 | 0 |
| 16 | 15.6 | 23.9 | 0 | 9.1 | 29.0 | 0 | 9.3 | 28.8 | 0 | 7.8 | 17.1 | 0.2 | - | - | - | -2.0 | 11.2 | 0 |
| 17 | 14.1 | 26.2 | 0 | 10.2 | 30.7 | 0 | 8.5 | 28.5 | 0 | 2.4 | 17.8 | 0.2 | - | - | - | -4.4 | 12.0 | 0.4 |
| 18 | 9.9 | 29.3 | 5.2 | 12.8 | 32.7 | 15 | 13.1 | 31.0 | 0 | 6.3 | 17.3 | 0.0 | -0.1 | 10.7 | 0.2 | -3.1 | 9.6 | 0.2 |
| 19 | 11.3 | 16.7 | 24.4 | 11.9 | 25.9 | 0.2 | 9.0 | 34.3 | 0 | 6.5 | 17.9 | 0.0 | -4.0 | 11.4 | 0.2 | 0.5 | 7.4 | 2 |
| 20 | 11.5 | 16.1 | 0.2 | 15.5 | 28.5 | 0 | 11.6 | 22.2 | 0 | 10.4 | 14.0 | 0.0 | 3.4 | 8.2 | 0 | -5.0 | 7.3 | 1 |
| 21 | 9.4 | 20.1 | 0 | 13.6 | 28.4 | 4 | 12.6 | 16.0 | 0 | 3.9 | 15.6 | 0.2 | 5.4 | 8.7 | 0 | -7.5 | 10.8 | 0.2 |
| 22 | 12.0 | 15.5 | 2.4 | 12.0 | 15.0 | 0.4 | 12.4 | 17.8 | 9.2 | 2.8 | 16.0 | 0.2 | -2.8 | 14.8 | 0 | -0.9 | 9.8 | 3.8 |
| 23 | 11.8 | 21.9 | 10.8 | 11.2 | 17.7 | 1.4 | 13.0 | 21.9 | 5.4 | 6.1 | 16.5 | 0.8 | -2.5 | 17.9 | 0.2 | 4.5 | 8.6 | 11.4 |
| 24 | 13.1 | 25.3 | 0.2 | 11.3 | 20.1 | 0 | 9.5 | 20.9 | 0.4 | 6.9 | 16.4 | 0.2 | -4.9 | 16.9 | 0 | 4.2 | 11.1 | 0 |
| 25 | 9.9 | 28.0 | 0 | 7.4 | 24.1 | 0 | 13.4 | 17.2 | 2.2 | 8.3 | 18.6 | 0.2 | -2.3 | 14.7 | 0 | -1.4 | 10.4 | 0 |
| 26 | 12.3 | 31.2 | 22.4 | 8.3 | 27.0 | 0 | 13.5 | 18.5 | 0.6 | 5.6 | 17.1 | 0.0 | -0.1 | 11.3 | 0 | 4.0 | 9.0 | 0 |
| 27 | 14.2 | 26.8 | 4.6 | 13.4 | 28.4 | 0 | 14.1 | 21.0 | 22.8 | 6.0 | 18.3 | 0.2 | -4.6 | 8.8 | 0.2 | 4.6 | 8.4 | 0 |
| 28 | 16.2 | 30.2 | 0 | 14.9 | 25.6 | 0 | 11.9 | 19.2 | 20.6 | 3.5 | 18.9 | 0.2 | 3.0 | 7.8 | 0 | 3.3 | 5.8 | 1.8 |
| 29 | 16.0 | 29.3 | 1.2 | | | | 11.7 | 18.6 | 6.4 | 9.0 | 12.4 | 37.2 | 6.3 | 10.7 | 0 | 1.9 | 6.3 | 0 |
| 30 | 16.1 | 19.2 | 16 | | | | 7.4 | 15.1 | 0 | 4.8 | 11.6 | 2 | 1.7 | 11.9 | 0 | 1.7 | 6.6 | 0 |
| 31 | 14.6 | 24.3 | 0 | | | | 3.7 | 16.8 | 0.2 | | | | 7.8 | 13.5 | 0 | | | |
| Min | 7.0 | 14.5 | 0.0 | 7.3 | 15.0 | 0.0 | 3.7 | 15.1 | 0.0 | 2.4 | 10.3 | 0.0 | -4.9 | 7.3 | 0.0 | -7.5 | 5.8 | 0.0 |
| Max | 16.2 | 31.2 | 24.4 | 16.3 | 32.7 | 15.0 | 15.0 | 34.3 | 22.8 | 11.1 | 19.9 | 37.2 | 7.8 | 17.9 | 2.6 | 7.9 | 16.6 | 11.4 |
| Average | 12.6 | 24.5 | | 12.2 | 24.9 | | 11.0 | 23.0 | | 6.5 | 16.2 | | 0.8 | 12.5 | | 1.5 | 10.6 | |
| Total | | | 108.6 | | | 28.4 | | | 83.6 | | | 70.2 | | | 5.2 | | | 30.0 |

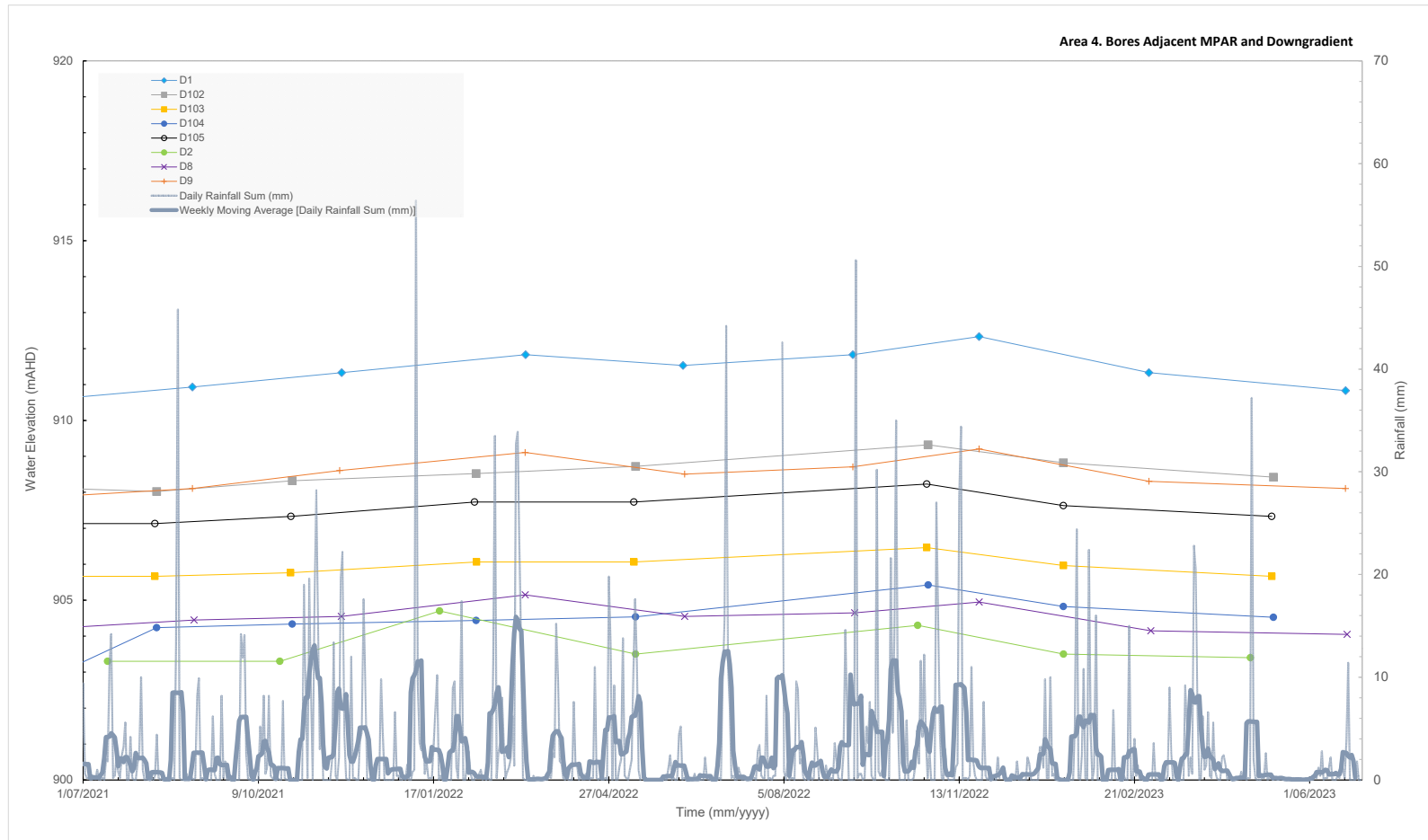
Note:
- signifies data not provided

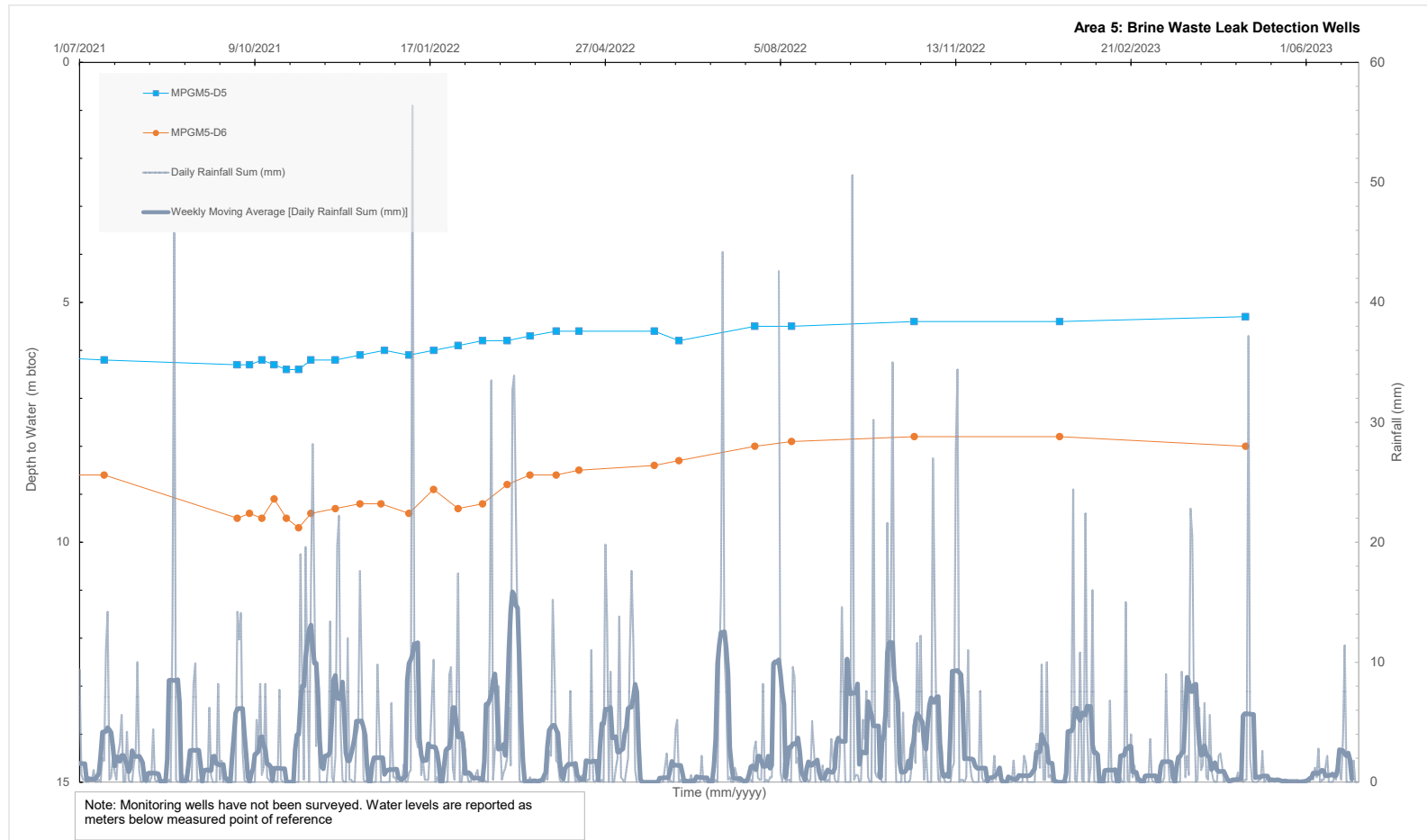
APPENDIX F HYDROGRAPHS











APPENDIX G TABULATED SURFACE WATER DATA

| | | | | Field Parameters | | | | Major Anions and Cations | | | | | | | | | | | | Nutrients | | | | | | | | Physical Parameters | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
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| | | | | Dissolved Oxygen (Field) (Filtered) | Electrical Conductivity (Field) | pH (Field) | Redox (Field) | Carbonate (as CaCO3) | Bicarbonate Alkalinity (as CaCO3) | Calcium | Carbonate Alkalinity (as CaCO3) | Chloride | Hydroxide Alkalinity (as CaCO3) | Fluoride | Magnesium | Phenolphthalein Alkalinity | Potassium | Sodium | Sulfate (as SO4) | Ammonia | Sulfur | Nitrate | Nitrite (as NO2-) | Nitrite + Nitrate (as N) | Nitrogen (N) - Kjeldahl | Nitrogen (N) | Phosphorus | Total Dissolved Solids (TDS) | Total Dissolved Solids (TDS) (Filtered) | Total Suspended Solids (TSS) | Turbidity | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
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| ANZECC (2000) or Local Guidelines - Surface Water | | | | mg/L | uS/cm | pH units | mV | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | µg/L | mg/L | µg/L | µg/L | µg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | 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| | | | | Field Parameters | | | | Major Anions and Cations | | | | | | | | | | | | Nutrients | | | | | | | | | | Physical Parameters | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
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| | | | | Dissolved Oxygen (Field) (Filtered) | Electrical Conductivity (Field) | pH (Field) | Redox (Field) | Carbonate (as CaCO3) | Bicarbonate Alkalinity (as CaCO3) | Calcium | Carbonate Alkalinity (as CaCO3) | Chloride | Hydroxide Alkalinity (as CaCO3) | Fluoride | Magnesium | Phenolphthalein Alkalinity | Potassium | Sodium | Sulfate (as SO4) | Ammonia | Sulfur | Nitrate | Nitrite (as NO2-) | Nitrite + Nitrate (as N) | Nitrogen (N) - Kjeldahl | Nitrogen (N) | Phosphorus | Total Dissolved Solids (TDS) | Total Dissolved Solids (TDS) (Filtered) | Total Suspended Solids (TSS) | Turbidity | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
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| ANZECC (2000) or Local Guidelines - Surface Water | | | | mg/L | uS/cm | pH units | mV | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | µg/L | mg/L | µg/L | µg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L |

| | | | | Metals | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|---|----------------------------|---------|--------------|-----------|----------------------|----------|---------|--------------------|-------------|-----------|--------|-----------|-------|------------------|---------|----------|-----------------------|----------------------|--------|--------|-------------------|------|-----------------|------|-----------|----------------------|---------|------------|--------|-------------------|----------|--------|-----------|----------|---------------------|------|-----------------|
| | | | | Aluminium | Aluminium (Filtered) | Antimony | Arsenic | Arsenic (Filtered) | Arsenic III | Arsenic V | Barium | Beryllium | Boron | Boron (Filtered) | Cadmium | Chromium | Chromium (Hexavalent) | Chromium (Trivalent) | Cobalt | Copper | Copper (Filtered) | Iron | Iron (Filtered) | Lead | Manganese | Manganese (Filtered) | Mercury | Molybdenum | Nickel | Nickel (Filtered) | Selenium | Silver | Strontium | Vanadium | Vanadium (Filtered) | Zinc | Zinc (Filtered) |
| | | | | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | mg/L | µg/L | µg/L | µg/L | µg/L |
| ANZECC (2000) or Local Guidelines - Surface Water | | | | | | | 24 | 24 | 24 | 13 | 700 | 100 | 370 | 370 | 0.85 | 2 | 1 | 3.3 | | 3.5 | 3.5 | 300 | 300 | 5 | 1900 | 1900 | 0.06 | 10 | 17 | 17 | 5 | 0.05 | | | | 116 | 116 |
| Purpose | Field_ID | LocCode | Sampled_Date | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Upstream | Wangcol Creek Weir | LMP01 | 4/07/2022 | 1650 | 50 | <1 | 2 | <1 | <1 | <1 | 23 | <1 | <50 | <50 | 0.2 | 2 | <10 | <10 | 1 | 9 | 3 | 1470 | 170 | 6 | 77 | 24 | <0.04 | 4 | 8 | 5 | <10 | <1 | 0.027 | <10 | <10 | 40 | 13 |
| Upstream | Wangcol Creek Weir | LMP01 | 1/08/2022 | 440 | 10 | <1 | <1 | <1 | <1 | <1 | 23 | <1 | <50 | <50 | <0.1 | <1 | <10 | <10 | <1 | 3 | 2 | 344 | 41 | <1 | 66 | 44 | <0.04 | 3 | 6 | 5 | <10 | <1 | 0.094 | <10 | <10 | 18 | 7 |
| Upstream | Wangcol Creek Weir | LMP01 | 5/09/2022 | 320 | 60 | <1 | <1 | <1 | <1 | <1 | 22 | <1 | <50 | <50 | <0.1 | <1 | <10 | <10 | <1 | 1 | 1 | 280 | <50 | <1 | 56 | 32 | <0.04 | 4 | 3 | 7 | <10 | <1 | 0.084 | <10 | <10 | 16 | 14 |
| Upstream | Wangcol Creek Weir | LMP01 | 4/10/2022 | 240 | 60 | <1 | <1 | <1 | <1 | <1 | 22 | <1 | <50 | <50 | <0.1 | <1 | <10 | <10 | <1 | 3 | 1 | 380 | 90 | <1 | 100 | 57 | <0.04 | 4 | 8 | 7 | 0.5 | <1 | 0.079 | <10 | <10 | 22 | 14 |
| Upstream | Wangcol Creek Weir | LMP01 | 7/11/2022 | 220 | 90 | <1 | <1 | <1 | <1 | <1 | 21 | <1 | <50 | <50 | <0.1 | <1 | <10 | <10 | <1 | 3 | 2 | 280 | 110 | <1 | 73 | 41 | <0.04 | 1 | 9 | 8 | 0.6 | <1 | 0.07 | <10 | <10 | 18 | 13 |
| Upstream | Wangcol Creek Weir | LMP01 | 5/12/2022 | 170 | <10 | <1 | <1 | <1 | <1 | <1 | 23 | <1 | <50 | <50 | <0.1 | <1 | <10 | <10 | <1 | 2 | <1 | 240 | <50 | <1 | 102 | 9 | <0.04 | 2 | 6 | 6 | 0.4 | <1 | 0.09 | <10 | <10 | 14 | <5 |
| Upstream | Wangcol Creek Weir | LMP01 | 3/01/2023 | 180 | <10 | <1 | <1 | <1 | <1 | <1 | 19 | <1 | <50 | <50 | <0.1 | <1 | <10 | <10 | <1 | 4 | 2 | 330 | <50 | <1 | 102 | 4 | <0.04 | 2 | 4 | 4 | 0.3 | <1 | 0.077 | <10 | <10 | 20 | 7 |
| Upstream | Wangcol Creek Weir | LMP01 | 6/02/2023 | 460 | 10 | 1 | <1 | <1 | <1 | <1 | 25 | <1 | <50 | 70 | <0.1 | <1 | <10 | <10 | 1 | 5 | 3 | 570 | <50 | <1 | 413 | 2 | 0.01 | 5 | 7 | 4 | 0.4 | <1 | 0.072 | <10 | <10 | 24 | 5 |
| Upstream | Wangcol Creek Weir | LMP01 | 6/03/2023 | 120 | <10 | <1 | <1 | <1 | <1 | <1 | 24 | <1 | <50 | <50 | <0.1 | <1 | <10 | <10 | <1 | 2 | 1 | 280 | <50 | <1 | 267 | 1 | <0.04 | 3 | 5 | 2 | 0.6 | <1 | 0.091 | <10 | <10 | 11 | <5 |
| Upstream | Wangcol Creek Weir | LMP01 | 3/04/2023 | 540 | 30 | <1 | <1 | <1 | <1 | <1 | 18 | <1 | <50 | <50 | <0.1 | <1 | <10 | <10 | <1 | 2 | <1 | 700 | 90 | <1 | 194 | 39 | <0.04 | 3 | 4 | 4 | 0.3 | <1 | 0.043 | <10 | <10 | 18 | 7 |
| Upstream | Wangcol Creek Weir | LMP01 | 1/05/2023 | 680 | 60 | <1 | <1 | <1 | <1 | <1 | 15 | <1 | <50 | <50 | <0.1 | <1 | <10 | <10 | <1 | 4 | 2 | 620 | 100 | <1 | 38 | 9 | <0.04 | 2 | 4 | 2 | 0.2 | <1 | 0.037 | <10 | <10 | 18 | 6 |
| Upstream | Wangcol Creek Weir | LMP01 | 5/06/2023 | 40 | <10 | <1 | <1 | <1 | <1 | <1 | 26 | <1 | 70 | <50 | <0.1 | <1 | <10 | <10 | <1 | <1 | <1 | 140 | <50 | <1 | 63 | 27 | <0.04 | 9 | 4 | 4 | 0.4 | <1 | 0.094 | <10 | <10 | 7 | 6 |
| | | | Min. | 40 | <10 | <1 | <1 | <1 | <1 | <1 | 15 | <1 | <50 | <50 | <0.1 | <1 | <10 | <10 | <1 | <1 | <1 | 140 | <50 | <1 | 38 | 1 | 0.01 | 1 | 3 | 2 | 0.2 | <1 | 0.027 | <10 | <10 | 7 | <5 |
| | | | Max. | 1650 | 90 | 1 | 2 | <1 | <1 | <1 | 26 | <1 | 70 | 70 | 0.2 | 2 | <10 | <10 | 1 | 9 | 3 | 1470 | 170 | 6 | 413 | 57 | <0.04 | 9 | 9 | 8 | <10 | <1 | 0.094 | <10 | <10 | 40 | 14 |
| | | | Average | 422 | 33 | 0.54 | 0.63 | 0.5 | 0.5 | 0.5 | 22 | 0.5 | 29 | 29 | 0.063 | 0.63 | 5 | 5 | 0.58 | 3.2 | 1.5 | 470 | 63 | 0.96 | 129 | 24 | 0.019 | 3.5 | 5.7 | 4.8 | 1.6 | 0.5 | 0.072 | 5 | 5 | 19 | 8.1 |
| Mid-stream | Wangcol Ck Surface Water_C | C | 27/07/2022 | 290 | 50 | <1 | <1 | <1 | <1 | <1 | 24 | <1 | <50 | <50 | <0.1 | 1 | <10 | <10 | <1 | <1 | 1 | 315 | 81 | <1 | 79 | 65 | <0.04 | 1 | 3 | 2 | <10 | <1 | 0.051 | <10 | <10 | 6 | <5 |
| Mid-stream | Wangcol Ck Surface Water_C | C | 25/08/2022 | 180 | 50 | <1 | <1 | <1 | <1 | <1 | 23 | <1 | <50 | <50 | <0.1 | <1 | <10 | <10 | <1 | <1 | <1 | 260 | 80 | <1 | 62 | 55 | <0.04 | 3 | 2 | 2 | <10 | <1 | 0.048 | <10 | <10 | <5 | <5 |
| Mid-stream | Wangcol Ck Surface Water_C | C | 28/09/2022 | 1960 | 300 | <1 | 4 | <1 | <1 | <1 | 25 | 3 | <50 | <50 | 1.1 | 2 | <10 | <10 | 1 | 6 | 2 | 2130 | 330 | 4 | 101 | 62 | <0.04 | <1 | 7 | 5 | 40 | <1 | 0.027 | <10 | <10 | 27 | 6 |
| Mid-stream | Wangcol Ck Surface Water_C | C | 26/10/2022 | 230 | 160 | <1 | <1 | <1 | <1 | <1 | 21 | <1 | <50 | <50 | <0.1 | <1 | <10 | <10 | <1 | <1 | 2 | 390 | 200 | <1 | 76 | 65 | <0.04 | <1 | 4 | 3 | 0.2 | <1 | 0.043 | <10 | <10 | 6 | 6 |
| Mid-stream | Wangcol Ck Surface Water_C | C | 17/11/2022 | 240 | 90 | <1 | 1 | <1 | <1 | <1 | 20 | <1 | <50 | <50 | <0.1 | <1 | <10 | <10 | <1 | 2 | 1 | 300 | 120 | <1 | 52 | 46 | <0.04 | <1 | 3 | 3 | 0.6 | <1 | 0.04 | <10 | <10 | 8 | 5 |
| Mid-stream | Wangcol Ck Surface Water_C | C | 13/12/2022 | 210 | 30 | <1 | <1 | <1 | <1 | <1 | 26 | <1 | <50 | <50 | <0.1 | <1 | <10 | <10 | <1 | 2 | 1 | 320 | 60 | 1 | 138 | 104 | <0.04 | 2 | 4 | 2 | <0.2 | <1 | 0.055 | <10 | <10 | 10 | <5 |
| Mid-stream | Wangcol Ck Surface Water_C | C | 11/01/2023 | 250 | 80 | <1 | <1 | <1 | <1 | <1 | 26 | <1 | <50 | <50 | <0.1 | <1 | <10 | <10 | <1 | <1 | <1 | 340 | 100 | <1 | 137 | 98 | <0.04 | <1 | 1 | 1 | <0.2 | <1 | 0.035 | <10 | <10 | <5 | <5 |
| Mid-stream | Wangcol Ck Surface Water_C | C | 9/02/2023 | 300 | 70 | <1 | <1 | <1 | <1 | <1 | 25 | <1 | <50 | <50 | <0.1 | <1 | <10 | <10 | <1 | <1 | <1 | 480 | 110 | <1 | 168 | 116 | <0.04 | <1 | 1 | 2 | <0.2 | <1 | 0.034 | <10 | <10 | <5 | <5 |
| Mid-stream | Wangcol Ck Surface Water_C | C | 15/03/2023 | 210 | 60 | <1 | <1 | <1 | <1 | <1 | 29 | <1 | <50 | <50 | <0.1 | <1 | <10 | <10 | <1 | <1 | <1 | 440 | 100 | <1 | 247 | 154 | <0.04 | 1 | 2 | 2 | <0.2 | <1 | 0.051 | <10 | <10 | 7 | <5 |
| Mid-stream | Wangcol Ck Surface Water_C | C | 4/04/2023 | 440 | 30 | <1 | <1 | <1 | <1 | <1 | 24 | <1 | <50 | <50 | <0.1 | <1 | <10 | <10 | <1 | <1 | <1 | 600 | 100 | <1 | 227 | 133 | <0.04 | 1 | 2 | 2 | <0.2 | <1 | 0.041 | <10 | <10 | 6 | <5 |
| Mid-stream | Wangcol Ck Surface Water_C | C | 10/05/2023 | 60 | 30 | <1 | <1 | <1 | <1 | <1 | 18 | <1 | <50 | <50 | <0.1 | <1 | <10 | <10 | <1 | <1 | <1 | 600 | 160 | <1 | 128 | 137 | <0.04 | <1 | 1 | 2 | 0.3 | <1 | 0.034 | <10 | <10 | <5 | <5 |
| Mid-stream | Wangcol Ck Surface Water_C | C | 15/06/2023 | 70 | 20 | <1 | <1 | <1 | <1 | <1 | 25 | <1 | <50 | <50 | <0.1 | <1 | <10 | <10 | <1 | <1 | <1 | 350 | 110 | <1 | 201 | 197 | <0.04 | 1 | 2 | <1 | <0.2 | <1 | 0.056 | <10 | <10 | <5 | <5 |
| | | | Min. | 60 | 20 | <1 | <1 | <1 | <1 | <1 | 18 | <1 | <50 | <50 | <0.1 | <1 | <10 | <10 | <1 | <1 | <1 | 260 | 60 | <1 | 52 | 46 | <0.04 | <1 | 1 | <1 | <0.2 | <1 | 0.027 | <10 | <10 | <5 | <5 |
| | | | Max. | 1960 | 300 | <1 | 4 | <1 | <1 | <1 | 29 | 3 | <50 | <50 | 1.1 | 2 | <10 | <10 | 1 | 6 | 2 | 2130 | 330 | 4 | 247 | 197 | <0.04 | 3 | 7 | 5 | 40 | <1 | 0.056 | <10 | <10 | 27 | 6 |
| | | | Average | 370 | 81 | 0.5 | 0.83 | 0.5 | 0.5 | 0.5 | 24 | 0.71 | 25 | 25 | 0.14 | 0.67 | 5 | 5 | 0.54 | 1.2 | 0.88 | 524 | 129 | 0.83 | 135 | 103 | 0.02 | 1 | 2.7 | 2.2 | 4.3 | 0.5 | 0.043 | 5 | 5 | 6.9 | 3.3 |
| Mid-stream | Wangcol Ck Surface Water_E | E | 27/07/2022 | 80 | 20 | <1 | <1 | <1 | <1 | <1 | 21 | <1 | <50 | <50 | <0.1 | <1 | <10 | <10 | 3 | <1 | <1 | 610 | 379 | <1 | 348 | 325 | <0.04 | <1 | 20 | 18 | <10 | <1 | 0.087 | <10 | <10 | 5 | <5 |
| Mid-stream | Wangcol Ck Surface Water_E | E | 25/08/2022 | 50 | 20 | <1 | <1 | <1 | <1 | <1 | 19 | <1 | <50 | <50 | <0.1 | 1 | <10 | <10 | 2 | <1 | <1 | 600 | 380 | <1 | 285 | 271 | <0.04 | 2 | 19 | 18 | <10 | <1 | 0.084 | <10 | <10 | <5 | <5 |
| Mid-stream | Wangcol Ck Surface Water_E | E | 28/09/2022 | 2000 | 210 | <1 | 1 | <1 | <1 | <1 | 23 | <1 | <50 | <50 | <0.1 | 2 | <10 | <10 | 1 | 6 | 2 | 1630 | 260 | 4 | 119 | 123 | <0.04 | <1 | 8 | 6 | <10 | <1 | 0.033 | <10 | <10 | 22 | 6 |
| Mid-stream | Wangcol Ck Surface Water_E | E | 26/10/2022 | 170 | 80 | <1 | <1 | <1 | <1 | <1 | 18 | <1 | <50 | <50 | <0.1 | <1 | <10 | <10 | <1 | <1 | 2 | 460 | 250 | <1 | 123 | 119 | <0.04 | <1 | 9 | 9 | <0.2 | <1 | 0.055 | <10 | <10 | 6 | <5 |
| Mid-stream | Wangcol Ck Surface Water_E | E | 18/11/2022 | 110 | 50 | <1 | <1 | <1 | <1 | <1 | 20 | <1 | <50 | <50 | <0.1 | <1 | <10 | <10 | 1 | 2 | 1 | 470 | 270 | <1 | 174 | 166 | <0.04 | <1 | 12 | 12 | 0.4 | <1 | 0.067 | <10 | <10 | 10 | 7 |
| Mid-stream | Wangcol Ck Surface Water_E | E | 13/12/2022 | 30 | <10 | <1 | <1 | <1 | <1 | <1 | 24 | <1 | <50 | 70 | <0.1 | <1 | <10 | <10 | 3 | 1 | <1 | 580 | 260 | <1 | 502 | 418 | <0.04 | 1 | 28 | 26 | <0.2 | <1 | 0.116 | <10 | <10 | 13 | <5 |
| Mid-stream | Wangcol Ck Surface Water_E | E | 11/01/2023 | 20 | <10 | <1 | <1 | <1 | <1 | <1 | 26 | <1 | 110 | 140 | <0.1 | <1 | <10 | <10 | 8 | <1 | <1 | 1130 | 550 | <1 | 1380 | 1280 | <0.04 | <1 | 71 | 71 | <0.2 | <1 | 0.188 | <10 | <10 | | |



| | | | Metals | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|---|----------------------------|---------|--------------|----------------------|----------|---------|--------------------|-------------|-----------|--------|-----------|-------|------------------|---------|----------|-----------------------|----------------------|--------|--------|-------------------|------|-----------------|------|-----------|----------------------|---------|------------|--------|-------------------|----------|--------|-----------|----------|---------------------|------|-----------------|-----|-----|--|--|--|--|--|--|--|--|
| | | | Aluminium | Aluminium (Filtered) | Antimony | Arsenic | Arsenic (Filtered) | Arsenic III | Arsenic V | Barium | Beryllium | Boron | Boron (Filtered) | Cadmium | Chromium | Chromium (Hexavalent) | Chromium (Trivalent) | Cobalt | Copper | Copper (Filtered) | Iron | Iron (Filtered) | Lead | Manganese | Manganese (Filtered) | Mercury | Molybdenum | Nickel | Nickel (Filtered) | Selenium | Silver | Strontium | Vanadium | Vanadium (Filtered) | Zinc | Zinc (Filtered) | | | | | | | | | | |
| | | | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | mg/L | µg/L | µg/L | µg/L | µg/L | µg/L | | | | | | | | | | |
| ANZECC (2000) or Local Guidelines - Surface Water | | | | | | 24 | 24 | 24 | 13 | 700 | 100 | 370 | 370 | 0.85 | 2 | 1 | 3.3 | | 3.5 | 3.5 | 300 | 300 | 5 | 1900 | 1900 | 0.06 | 10 | 17 | 17 | 5 | 0.05 | | | | | | 116 | 116 | | | | | | | | |
| Purpose | Field_ID | LocCode | Sampled_Date | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Mid-stream | Wangcol Creek NC01 | NC01 | 27/07/2022 | 380 | 20 | <1 | <1 | <1 | <1 | <1 | 23 | <1 | <50 | <50 | <0.1 | 2 | <10 | <10 | <1 | 1 | 4 | 601 | 157 | <1 | 259 | 243 | <0.04 | 2 | 4 | 4 | <10 | <1 | 0.084 | <10 | <10 | 10 | <5 | | | | | | | | | |
| Mid-stream | Wangcol Creek NC01 | NC01 | 25/08/2022 | 210 | 30 | <1 | <1 | <1 | <1 | <1 | 21 | <1 | <50 | <50 | <0.1 | 1 | <10 | <10 | <1 | 2 | 3 | 610 | 120 | <1 | 306 | 284 | <0.04 | 7 | 4 | 4 | <10 | <1 | 0.084 | <10 | <10 | 8 | 6 | | | | | | | | | |
| Mid-stream | Wangcol Creek NC01 | NC01 | 28/09/2022 | 2370 | 380 | 2 | 3 | <1 | <1 | <1 | 25 | <1 | <50 | <50 | 0.4 | 3 | <10 | <10 | 1 | 8 | 3 | 2170 | 350 | 5 | 114 | 46 | <0.04 | 2 | 8 | 4 | 10 | <1 | 0.028 | <10 | <10 | 34 | 10 | | | | | | | | | |
| Mid-stream | Wangcol Creek NC01 | NC01 | 26/10/2022 | 400 | 120 | <1 | <1 | <1 | <1 | <1 | 20 | <1 | <50 | <50 | <0.1 | <1 | <10 | <10 | <1 | 2 | 3 | 710 | 230 | <1 | 227 | 198 | <0.04 | 1 | 5 | 5 | 0.4 | <1 | 0.062 | <10 | <10 | 10 | 9 | | | | | | | | | |
| Mid-stream | Wangcol Creek NC01 | NC01 | 17/11/2022 | 390 | 80 | <1 | <1 | <1 | <1 | <1 | 19 | <1 | <50 | <50 | <0.1 | 4 | <10 | <10 | <1 | 3 | 2 | 480 | 170 | <1 | 399 | 361 | <0.04 | 1 | 5 | 5 | 0.8 | <1 | 0.069 | <10 | <10 | 16 | 12 | | | | | | | | | |
| Mid-stream | Wangcol Creek NC01 | NC01 | 13/12/2022 | 170 | <10 | <1 | <1 | <1 | <1 | <1 | 25 | <1 | <50 | 60 | <0.1 | <1 | <10 | <10 | <1 | 2 | 2 | 540 | 80 | <1 | 281 | 234 | <0.04 | 4 | 4 | 2 | 0.4 | <1 | 0.097 | <10 | <10 | 10 | <5 | | | | | | | | | |
| Mid-stream | Wangcol Creek NC01 | NC01 | 11/01/2023 | 110 | <10 | <1 | <1 | <1 | <1 | <1 | 33 | <1 | <50 | 60 | <0.1 | <1 | <10 | <10 | <1 | <1 | <1 | 690 | 120 | <1 | 568 | 328 | <0.04 | 3 | 3 | 3 | <0.2 | <1 | 0.091 | <10 | <10 | <5 | <5 | | | | | | | | | |
| Mid-stream | Wangcol Creek NC01 | NC01 | 9/02/2023 | 340 | <10 | 1 | <1 | <1 | <1 | <1 | 33 | <1 | <50 | <50 | <0.1 | <1 | <10 | <10 | <1 | 3 | <1 | 1280 | 100 | <1 | 1160 | 420 | <0.04 | 3 | 3 | 3 | 0.2 | <1 | 0.075 | <10 | <10 | 12 | <5 | | | | | | | | | |
| Mid-stream | Wangcol Creek NC01 | NC01 | 15/03/2023 | 90 | <10 | <1 | <1 | <1 | <1 | <1 | 31 | <1 | <50 | 50 | <0.1 | <1 | <10 | <10 | <1 | <1 | <1 | 630 | 80 | <1 | 510 | 288 | <0.04 | 3 | 3 | 3 | 0.2 | <1 | 0.098 | <10 | <10 | 6 | <5 | | | | | | | | | |
| Mid-stream | Wangcol Creek NC01 | NC01 | 4/04/2023 | 390 | <10 | <1 | <1 | <1 | <1 | <1 | 20 | <1 | <50 | <50 | <0.1 | <1 | <10 | <10 | <1 | <1 | <1 | 850 | 120 | <1 | 363 | 282 | 0.26 | 2 | 2 | 2 | 0.3 | <1 | 0.064 | <10 | <10 | 8 | <5 | | | | | | | | | |
| Mid-stream | Wangcol Creek NC01 | NC01 | 10/05/2023 | 80 | 10 | <1 | <1 | <1 | <1 | <1 | 15 | <1 | <50 | <50 | <0.1 | <1 | <10 | <10 | <1 | 1 | <1 | 490 | 120 | <1 | 119 | 68 | <0.04 | <1 | 2 | 2 | 0.5 | <1 | 0.046 | <10 | <10 | <5 | <5 | | | | | | | | | |
| Mid-stream | Wangcol Creek NC01 | NC01 | 15/06/2023 | 50 | <10 | <1 | <1 | <1 | <1 | <1 | 27 | <1 | <50 | <50 | <0.1 | <1 | <10 | <10 | <1 | <1 | <1 | 560 | 80 | <1 | 137 | 139 | <0.04 | <1 | 2 | 1 | <0.2 | <1 | 0.083 | <10 | <10 | <5 | <5 | | | | | | | | | |
| | | | Min. | 50 | <10 | <1 | <1 | <1 | <1 | <1 | 15 | <1 | <50 | <50 | <0.1 | <1 | <10 | <10 | <1 | <1 | <1 | 480 | 80 | <1 | 114 | 46 | <0.04 | <1 | 2 | 1 | <0.2 | <1 | 0.028 | <10 | <10 | <5 | <5 | | | | | | | | | |
| | | | Max. | 2370 | 380 | 2 | 3 | <1 | <1 | <1 | 33 | <1 | <50 | 60 | 0.4 | 4 | <10 | <10 | 1 | 8 | 4 | 2170 | 350 | 5 | 1160 | 420 | 0.26 | 7 | 8 | 5 | 10 | <1 | 0.098 | <10 | <10 | 34 | 12 | | | | | | | | | |
| | | | Average | 415 | 56 | 0.67 | 0.71 | 0.5 | 0.5 | 0.5 | 24 | 0.5 | 25 | 33 | 0.079 | 1.2 | 5 | 5 | 0.54 | 2 | 1.7 | 801 | 144 | 0.88 | 370 | 241 | 0.04 | 2.4 | 3.8 | 3.2 | 1.9 | 0.5 | 0.073 | 5 | 5 | 10 | 4.8 | | | | | | | | | |
| Downstream | Wangcol Ck Surface Water_G | G | 27/07/2022 | 60 | 20 | <1 | <1 | <1 | <1 | <1 | 17 | <1 | <50 | <50 | <0.1 | <1 | <10 | <10 | <1 | <1 | <1 | 331 | 106 | <1 | 142 | 129 | <0.04 | <1 | 20 | 19 | <10 | <1 | 0.098 | <10 | <10 | 9 | <5 | | | | | | | | | |
| Downstream | Wangcol Ck Surface Water_G | G | 25/08/2022 | 70 | 20 | <1 | <1 | <1 | <1 | <1 | 15 | <1 | <50 | <50 | <0.1 | <1 | <10 | <10 | <1 | <1 | <1 | 320 | 120 | <1 | 105 | 93 | <0.04 | 1 | 18 | 17 | <10 | <1 | 0.094 | <10 | <10 | <5 | <5 | | | | | | | | | |
| Downstream | Wangcol Ck Surface Water_G | G | 28/09/2022 | 2140 | 360 | <1 | 1 | <1 | <1 | <1 | 24 | <1 | <50 | <50 | <0.1 | 2 | <10 | <10 | 2 | 7 | 2 | 2320 | 310 | 4 | 252 | 41 | <0.04 | <1 | 11 | 3 | <10 | <1 | 0.042 | <10 | <10 | 24 | 8 | | | | | | | | | |
| Downstream | Wangcol Ck Surface Water_G | G | 26/10/2022 | 150 | 70 | <1 | <1 | <1 | <1 | <1 | 17 | <1 | <50 | <50 | <0.1 | <1 | <10 | <10 | <1 | <1 | 1 | 510 | 180 | <1 | 97 | 61 | <0.04 | <1 | 12 | 12 | <0.2 | <1 | 0.068 | <10 | <10 | 6 | <5 | | | | | | | | | |
| Downstream | Wangcol Ck Surface Water_G | G | 16/11/2022 | 390 | 160 | <1 | <1 | <1 | <1 | <1 | 19 | <1 | <50 | <50 | <0.1 | <1 | <10 | <10 | <1 | 2 | 1 | 660 | 280 | <1 | 100 | 74 | <0.04 | <1 | 12 | 11 | 0.3 | <1 | 0.067 | <10 | <10 | 8 | <5 | | | | | | | | | |
| Downstream | Wangcol Ck Surface Water_G | G | 13/12/2022 | 20 | <10 | <1 | <1 | <1 | <1 | <1 | 21 | <1 | <50 | 90 | <0.1 | <1 | <10 | <10 | <1 | <1 | 2 | 270 | 80 | <1 | 447 | 350 | <0.04 | 1 | 41 | 36 | <0.2 | <1 | 0.151 | <10 | <10 | 7 | 6 | | | | | | | | | |
| Downstream | Wangcol Ck Surface Water_G | G | 11/01/2023 | 10 | <10 | <1 | <1 | <1 | <1 | <1 | 21 | <1 | 100 | 120 | <0.1 | <1 | <10 | <10 | <1 | <1 | <1 | 200 | 50 | <1 | 509 | 510 | <0.04 | <1 | 59 | 63 | <0.2 | <1 | 0.194 | <10 | <10 | <5 | <5 | | | | | | | | | |
| Downstream | Wangcol Ck Surface Water_G | G | 9/02/2023 | 30 | <10 | <1 | <1 | <1 | <1 | <1 | 21 | <1 | 120 | 120 | <0.1 | <1 | <10 | <10 | <1 | <1 | <1 | 200 | <50 | <1 | 847 | 732 | <0.04 | <1 | 72 | 66 | <0.2 | <1 | 0.228 | <10 | <10 | 9 | 6 | | | | | | | | | |
| Downstream | Wangcol Ck Surface Water_G | G | 15/03/2023 | <10 | <10 | <1 | <1 | <1 | <1 | <1 | 32 | <1 | 220 | 250 | <0.1 | <1 | <10 | <10 | 1 | <1 | <1 | 210 | <50 | <1 | 1770 | 1650 | <0.04 | <1 | 117 | 123 | <0.2 | <1 | 0.353 | <10 | <10 | 5 | <5 | | | | | | | | | |
| Downstream | Wangcol Ck Surface Water_G | G | 4/04/2023 | 30 | <10 | <1 | <1 | <1 | <1 | <1 | 14 | <1 | 80 | 100 | <0.1 | <1 | <10 | <10 | <1 | <1 | <1 | 260 | 100 | <1 | 405 | 374 | <0.04 | <1 | 42 | 42 | <0.2 | <1 | 0.15 | <10 | <10 | <5 | <5 | | | | | | | | | |
| Downstream | Wangcol Ck Surface Water_G | G | 10/05/2023 | <10 | <10 | <1 | <1 | <1 | <1 | <1 | 16 | <1 | 100 | 110 | <0.1 | <1 | <10 | <10 | <1 | <1 | <1 | 190 | 70 | <1 | 381 | 421 | <0.04 | <1 | 50 | 54 | <0.2 | <1 | 0.163 | <10 | <10 | <5 | 8 | | | | | | | | | |
| Downstream | Wangcol Ck Surface Water_G | G | 15/06/2023 | <10 | <10 | <1 | <1 | <1 | <1 | <1 | 34 | <1 | 320 | 320 | <0.1 | <1 | <10 | <10 | 1 | <1 | <1 | 50 | <50 | <1 | 305 | 317 | <0.04 | <1 | 134 | 148 | <0.2 | <1 | 0.383 | <10 | <10 | <5 | <5 | | | | | | | | | |
| | | | Min. | <10 | <10 | <1 | <1 | <1 | <1 | <1 | 14 | <1 | <50 | <50 | <0.1 | <1 | <10 | < | | | | | | | | | | | | | | | | | | | | | | | | | | | | |



| | | | Field Parameters | | | | Major Anions and Cations | | | | | | | | | | | | NA | | Nutrients | | | | | | | | | | | |
|---|---------|-------------------|-------------------------------------|---------------------------------|------------|---------------|--------------------------|-----------------------------------|---------|--------------------|---------------------------------|----------|----------|-----------|----------------------------|-----------|--------|------------------|--|--------------|-----------|--------|---------|-------------------|--------------------------|-------------------------|--------------|-----------------------|----------------------------------|------------|-----------------------|--|
| | | | Dissolved Oxygen (Field) (Filtered) | Electrical Conductivity (Field) | pH (Field) | Redox (Field) | Carbonate (as CaCO3) | Bicarbonate Alkalinity (as CaCO3) | Calcium | Calcium (Filtered) | Carbonate Alkalinity (as CaCO3) | Chloride | Fluoride | Magnesium | Phenolphthalein Alkalinity | Potassium | Sodium | Sulfate (as SO4) | Dissolved Organic Carbon (mg/L) (Filtered) | Oil & Grease | Ammonia | Sulfur | Nitrate | Nitrite (as NO2-) | Nitrite + Nitrate (as N) | Nitrogen (N) - Kjeldahl | Nitrogen (N) | Total Phosphate (PO4) | Total Phosphate (PO4) (Filtered) | Phosphorus | Phosphorus (Filtered) | |
| | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| mg/L | uS/cm | pH units | mV | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | µg/L | mg/L | µg/L | µg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | |
| ANZECC (2000) or Local Guidelines - Surface Water | | | 2200 | 6.5-8 | | | | | | | 350 | 1.5 | | | | | | 1000 | | | | | | | | | | | | | | |
| EPL Discharge Limits for LDP12 | | | 500 | 6.5-8.5 | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Purpose | LocCode | Sampled_Date-Time | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Upstream | LDP12 | 1/07/2022 | 8.6 | 216 | 7.7 | 180.9 | - | 53.73 | 7.03 | - | 53.73 | 19.2 | <0.05 | 2.6 | 0 | 4.5 | 36.3 | 37.9 | - | <5 | 210 | 12 | 400 | 30 | 0.43 | 0.3 | 0.7 | <0.1 | <0.1 | 0.02 | <0.01 | |
| Upstream | LDP12 | 10/08/2022 | 8.5 | 208 | 7.48 | 153.6 | - | 43.78 | 3.31 | - | 43.78 | 16.99 | 0.112 | 1.22 | 0 | 3.41 | 39 | 36.15 | - | <5 | 160 | 12 | 320 | <10 | 0.32 | 0.3 | 0.6 | <0.1 | <0.1 | <0.01 | <0.01 | |
| Upstream | LDP12 | 19/08/2022 | 8.1 | 127 | 7.26 | 187.6 | <1 | 37 | 3.96 | - | - | 17.3 | 0.06 | 1.51 | - | 3.43 | 40.8 | 43.2 | - | <5 | 370 | 14 | 330 | <10 | 0.33 | 0.4 | 0.7 | <0.1 | <0.1 | <0.01 | <0.01 | |
| Upstream | LDP12 | 30/08/2022 | 7.7 | 266 | 7.75 | 145.3 | - | 47.76 | 4.88 | - | 47.76 | 25.1 | <0.05 | 1.9 | 0 | 4.19 | 45.2 | 48.3 | - | <5 | 150 | 16 | 380 | <10 | 0.38 | 0.3 | 0.7 | <0.1 | <0.1 | <0.01 | <0.01 | |
| Upstream | LDP12 | 20/09/2022 | 6.7 | 177.8 | 7.43 | 485 | - | 35.82 | 2.18 | - | 35.82 | 23.74 | 0.097 | 0.941 | 0 | 2.96 | 32 | 15.17 | - | <5 | 150 | 8 | 220 | <10 | 0.22 | 0.7 | 0.9 | <0.1 | <0.1 | <0.01 | <0.01 | |
| Upstream | LDP12 | 26/09/2022 | 8.4 | 207 | 7.49 | 181.6 | - | 36.82 | 2.69 | - | 36.82 | 25.72 | 0.083 | 1.22 | 0 | 3.63 | 34.4 | 31.18 | - | <5 | 190 | 10 | 220 | <10 | 0.22 | 0.4 | 0.6 | <0.1 | <0.1 | <0.01 | <0.01 | |
| Upstream | LDP12 | 5/10/2022 | 6.8 | 190.2 | 7.6 | 198.5 | - | 37.81 | 2.87 | - | 37.81 | 20.77 | 0.116 | 1.26 | 0 | 3.36 | 34.3 | 19.01 | - | <5 | 170 | 10 | 220 | 10 | 0.23 | 0.4 | 0.6 | <0.1 | <0.1 | 0.01 | <0.01 | |
| Upstream | LDP12 | 15/11/2022 | 6.2 | 148.2 | 7.49 | 43.5 | - | 33.17 | 1.07 | - | 33.17 | 21.3 | 0.056 | 0.551 | 0 | 2.89 | 28.1 | 17.4 | - | <5 | 110 | 5 | 130 | <10 | 0.13 | 0.2 | 0.3 | <0.1 | <0.1 | <0.01 | <0.01 | |
| Upstream | LDP12 | 4/04/2023 | 6.7 | 352 | 7.53 | 120.4 | - | 32.71 | 8.54 | - | 32.71 | 35.9 | 0.06 | 3.09 | 0 | 5.4 | 40.2 | 67.8 | - | <5 | 1700 | 21 | 360 | <10 | 0.36 | 2.5 | 2.9 | <0.1 | <0.1 | 0.02 | 0.02 | |
| Upstream | LDP12 | 18/04/2023 | 7.3 | 361 | 7.7 | 106.3 | - | 35 | 9.76 | - | 35 | 38 | 0.059 | 3.82 | 0 | 6.98 | 47.8 | 74.9 | - | <5 | 1190 | 22 | 350 | <10 | 0.35 | 1.3 | 1.6 | <0.1 | <0.1 | 0.02 | 0.03 | |
| Upstream | LDP12 | 4/05/2023 | 7.9 | 242 | 7.34 | 190.6 | - | 31 | 4.66 | - | 31 | 23.4 | 0.14 | 1.97 | 0 | 4.46 | 37 | 47.4 | - | <5 | 400 | 15 | 310 | 20 | 0.33 | 0.5 | 0.8 | <0.1 | <0.1 | <0.01 | <0.01 | |
| Upstream | LDP12 | 27/06/2023 | 8.9 | 307 | 7.55 | 103.6 | - | 48.5 | 5.14 | - | 48.5 | 30.7 | 0.082 | 1.96 | 0 | 4.75 | 47.6 | 57.8 | - | <5 | 110 | 18 | 590 | <10 | 0.59 | 0.3 | 0.9 | <0.1 | <0.1 | <0.01 | <0.01 | |
| | | Min. | 6.2 | 127.0 | 7.3 | 43.5 | <1 | 31.0 | 1.1 | - | 31.0 | 17.0 | <0.05 | 0.6 | 0.0 | 2.9 | 28.1 | 15.2 | - | <5 | 110 | 5 | 130 | <10 | 0.1 | 0.2 | 0.3 | <0.1 | <0.1 | <0.01 | <0.01 | |
| | | Max. | 8.9 | 361.0 | 7.8 | 485.0 | <1 | 53.7 | 9.8 | - | 53.7 | 38.0 | 0.1 | 3.8 | 0.0 | 7.0 | 47.8 | 74.9 | - | <5 | 1700 | 22 | 590 | 30 | 0.6 | 2.5 | 2.9 | <0.1 | <0.1 | 0.0 | 0.0 | |
| | | Average | 7.7 | 234.0 | 7.5 | 175.0 | | 39.0 | 4.7 | | 40.0 | 25.0 | 0.1 | 1.8 | 0.0 | 4.2 | 39.0 | 41.0 | | 2.5 | 409 | 14 | 319 | 9 | 0.3 | 0.6 | 0.9 | 0.1 | 0.1 | 0.0 | 0.0 | |

([Sampled_Date-Time] Between #1 Jul 2022 09:25:00# AND #29 Jun 2023 08:20:00# AND

Matrix_Type In('Surf.Water' , 'WATER') AND

Field_ID In('Coal Settling Pond' , 'Coal Settling Pond_LDP12 (when flow)'))



| | | | Physical Parameters | | | Metals | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|---|---------|-------------------|--|------------------------------|-----------|-----------|----------------------|----------|---------|--------------------|-------------|-----------|--------|-----------|-------|------------------|---------|----------|-----------------------|----------------------|--------|--------|-------------------|------|-----------------|------|-----------|----------------------|---------|------------|--------|-------------------|----------|--------|-----------|----------|---------------------|------|-----------------|
| | | | Total Dissolved Solids (TDS) (Filtered) | Total Suspended Solids (TSS) | Turbidity | Aluminium | Aluminium (Filtered) | Antimony | Arsenic | Arsenic (Filtered) | Arsenic III | Arsenic V | Barium | Beryllium | Boron | Boron (Filtered) | Cadmium | Chromium | Chromium (Hexavalent) | Chromium (Trivalent) | Cobalt | Copper | Copper (Filtered) | Iron | Iron (Filtered) | Lead | Manganese | Manganese (Filtered) | Mercury | Molybdenum | Nickel | Nickel (Filtered) | Selenium | Silver | Strontium | Vanadium | Vanadium (Filtered) | Zinc | Zinc (Filtered) |
| | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| mg/L | mg/L | NTU | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | |
| ANZECC (2000) or Local Guidelines - Surface Water | 1500 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| EPL Discharge Limits for LDP12 | | 50 | 25 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 116 | 116 |
| Purpose | LocCode | Sampled Date-Time | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Upstream | LDP12 | 1/07/2022 | 124 | 11.67 | 6.88 | 1000 | <10 | <1 | <1 | <1 | <1 | <1 | 7 | <1 | <50 | <50 | <0.1 | <1 | <10 | <10 | <1 | 1 | <1 | <50 | <50 | <1 | 47 | 47 | <0.04 | 2 | 2 | 1 | <10 | <1 | 0.024 | <10 | <10 | 39 | 12 |
| Upstream | LDP12 | 10/08/2022 | 186 | 5.667 | 9.6 | 220 | <10 | <1 | <1 | <1 | <1 | <1 | 5 | <1 | <50 | <50 | <0.1 | <1 | <10 | <10 | <1 | <1 | <1 | <50 | <50 | <1 | 36 | 33 | <0.04 | 3 | 1 | <1 | <10 | <1 | 0.008 | <10 | <10 | <5 | <5 |
| Upstream | LDP12 | 19/08/2022 | 127 | 5 | 11 | 360 | <10 | <1 | <1 | <1 | <1 | <1 | 6 | <1 | <50 | <50 | <0.1 | <1 | <10 | <10 | <1 | <1 | <1 | <50 | <50 | <1 | 36 | 37 | <0.04 | 2 | <1 | <1 | <10 | <1 | 0.011 | <10 | <10 | <5 | <5 |
| Upstream | LDP12 | 30/08/2022 | 130 | 8.333 | 12.8 | 120 | <10 | <1 | <1 | <1 | <1 | <1 | 6 | <1 | <50 | <50 | <0.1 | <1 | <10 | <10 | <1 | <1 | <1 | <50 | <50 | <1 | 41 | 37 | <0.04 | 3 | <1 | <1 | <10 | <1 | 0.016 | <10 | <10 | <5 | <5 |
| Upstream | LDP12 | 20/09/2022 | 190 | 5.667 | 10.2 | 90 | <10 | <1 | <1 | <1 | <1 | <1 | 4 | <1 | 80 | <50 | <0.1 | <1 | <10 | <10 | <1 | <1 | <1 | <50 | <50 | <1 | 26 | 23 | <0.04 | 2 | <1 | 1 | <10 | <1 | 0.006 | <10 | <10 | <5 | <5 |
| Upstream | LDP12 | 26/09/2022 | 264 | 7.667 | 10.21 | 540 | <10 | <1 | <1 | <1 | <1 | <1 | 4 | <1 | <50 | <50 | <0.1 | <1 | <10 | <10 | <1 | <1 | <1 | <50 | <50 | <1 | 27 | 24 | <0.04 | 2 | <1 | <1 | <10 | <1 | 0.007 | <10 | <10 | <5 | <5 |
| Upstream | LDP12 | 5/10/2022 | 110 | 8.2 | 7.4 | 1120 | 10 | <1 | <1 | <1 | <1 | <1 | 4 | <1 | <50 | <50 | <0.1 | <1 | <10 | <10 | <1 | <1 | <1 | <50 | <50 | <1 | 39 | 36 | <0.04 | 1 | 1 | 1 | <10 | <1 | 0.007 | <10 | <10 | <5 | <5 |
| Upstream | LDP12 | 15/11/2022 | 122 | 9.2 | 10.4 | 1730 | 30 | <1 | <1 | <1 | <1 | <1 | 4 | <1 | <50 | <50 | <0.1 | <1 | <10 | <10 | <1 | <1 | <1 | <50 | <50 | <1 | 13 | 11 | <0.04 | 3 | <1 | <1 | <10 | <1 | 0.004 | <10 | <10 | <5 | <5 |
| Upstream | LDP12 | 4/04/2023 | 196 | 11.2 | 5.73 | 2020 | 160 | <1 | <1 | <1 | <1 | <1 | 10 | <1 | <50 | <50 | <0.1 | <1 | <10 | <10 | <1 | <1 | <1 | <50 | <50 | <1 | 52 | 59 | <0.04 | 2 | 2 | 2 | <10 | <1 | 0.02 | <10 | <10 | <5 | <5 |
| Upstream | LDP12 | 18/04/2023 | 340 | 3.4 | 3.49 | 480 | 20 | 1 | <1 | <1 | <1 | <1 | 11 | <1 | <50 | <50 | <0.1 | <1 | <10 | <10 | <1 | <1 | <1 | <50 | <50 | <1 | 124 | 127 | <0.04 | 6 | 3 | 3 | <10 | <1 | 0.026 | <10 | <10 | <5 | <5 |
| Upstream | LDP12 | 4/05/2023 | 168 | 10 | 12.8 | 280 | <10 | <1 | <1 | <1 | <1 | <1 | 5 | <1 | <50 | <50 | <0.1 | <1 | <10 | <10 | <1 | <1 | <1 | <50 | <50 | <1 | 49 | 47 | <0.04 | 4 | 2 | 2 | <10 | <1 | 0.012 | <10 | <10 | <5 | <5 |
| Upstream | LDP12 | 27/06/2023 | 132 | - | 10.2 | 2980 | 20 | <1 | <1 | <1 | <1 | <1 | 6 | <1 | 80 | 100 | <0.1 | <1 | <10 | <10 | <1 | <1 | <1 | <50 | <50 | <1 | 73 | 62 | <0.04 | 8 | 2 | 2 | <10 | <1 | 0.015 | <10 | <10 | <5 | <5 |
| | | Min. | 110 | 3 | 3 | 90 | <10 | <1 | <1 | <1 | <1 | <1 | 4 | <1 | <50 | <50 | <0.1 | <1 | <10 | <10 | <1 | <1 | <1 | <50 | <50 | <1 | 13 | 11 | <0.04 | 1 | <1 | <1 | <10 | <1 | 0.00 | <10 | <10 | <5 | <5 |
| | | Max. | 340 | 12 | 13 | 2980 | 160 | 1 | <1 | <1 | <1 | <1 | 11 | <1 | 80 | 100 | <0.1 | <1 | <10 | <10 | <1 | 1 | <1 | 70 | <50 | <1 | 124 | 127 | <0.04 | 8 | 3 | 3 | <10 | <1 | 0.03 | <10 | <10 | 39 | 12 |
| | | Average | 174 | 8 | 9 | 912 | 23 | 1 | 1 | 1 | 1 | 1 | 6 | 1 | 34 | 31 | 0.1 | 1 | 5 | 5 | 1 | 1 | 1 | 36 | 25 | 1 | 47 | 45 | 0.02 | 3 | 1 | 1 | 5 | 1 | 0.01 | 5 | 5 | 6 | 3 |

([Sampled_Date-Time] Between #1 Jul 2022 09:25:00# AND #29 Jun 2023 08:20:00# AND

Matrix_Type In('Surf.Water' , 'WATER') AND

Field_ID In('Coal Settling Pond' , 'Coal Settling Pond_LDP12 (when flow)')

APPENDIX H TABULATED GROUNDWATER DATA



| Purpose | LocCode | Sampled Date | Standing Water Level (Field) | | Field Parameters | | | | | | | | | | Major Anions and Cations | | | | | | | | | | Minor Anions | | Nutrients | | | | Physical Parameters | | | | | | | | | | | | | | | | Metals | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|---------|---------|--------------|------------------------------|-------|------------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--------------------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--------------|-------|-----------|-------|-------|-------|---------------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| | | | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD | m AHD |



| | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|---------------------------------------|----------|------------|---------|-----|-------|-----|----|-------|-----|------|------|------|-------|---|---------|------|------|------|-------|-------|-------|-------|------|-------|-------|--------|------|-------|------|-------|------|------|------|------|------|------|-------|-------|-------|------|------|------|-------|-------|-------|-------|-------|-------|--------|--------|-------|------|-------|--------|------|-------|-------|-------|------|------|----|
| Adjacent to MPAR and Downgradient | D2 | 28/04/2023 | 903.400 | 1.7 | 1010 | 5.8 | 62 | 75 | <-1 | 13 | 42.6 | 13 | 57.3 | - | 0.124 | 35.7 | <-1 | 10.8 | 94.1 | 367 | - | 70 | 123 | 10 | <-10 | 0.01 | - | 647 | 1150 | 870 | <-1 | 2 | 2 | 27 | <-1 | 250 | 210 | <-0.1 | <-1 | <-10 | <-10 | 44 | 9 | 7 | 8140 | 6580 | 6 | 1130 | 1090 | <-0.04 | <-1 | 76 | 78 | 0.3 | <-1 | 0.22 | <-10 | <-10 | 86 | 82 | |
| | | Min. | 903.4 | 1.7 | 1010 | 5.1 | 53 | 39.5 | <-1 | 1 | 43 | 1 | 57.3 | - | 0 | 36 | <-1 | 10.8 | 94 | 367 | 14000 | 60 | 123 | <-10 | <-10 | <-0.01 | 1050 | 647 | 910 | 470 | <-1 | <-1 | <-1 | 27 | <-1 | 160 | 150 | <-0.1 | <-1 | <-10 | <-10 | 44 | 3 | 1 | 5610 | 1680 | 2 | 1130 | 1090 | <-0.04 | <-1 | 76 | 78 | 0 | <-1 | 0.22 | <-10 | <-10 | 86 | 82 | |
| | | Max. | 904.9 | 2.8 | 1720 | 5.8 | 70 | 243.5 | <-1 | 13 | 85 | 13 | 111.0 | - | 0 | 84 | <-1 | 16.0 | 123 | 767 | 14000 | 80 | 238 | 30 | <-10 | 0 | 1050 | 1200 | 1420 | 960 | <-1 | 2 | 2 | 62 | 2 | 270 | 240 | 0 | 1 | <-10 | <-10 | 129 | 9 | 7 | 8140 | 6580 | 6 | 1820 | 1810 | <-0.04 | <-1 | 146 | 139 | <-0.04 | <-1 | 0.60 | <-10 | <-10 | 508 | 473 | |
| | | Average | - | 2.2 | 1388 | 5.3 | 60 | 136.0 | 0.5 | 7 | 66 | 7 | 86.0 | - | 0 | 60 | - | 14.0 | 114 | 587 | - | 72 | 187 | 6 | 5 | 0 | - | 994 | 1160 | 725 | 1 | 1 | 1 | 46 | 1 | 228 | 198 | 0 | 1 | 5 | 5 | 80 | 5 | 3 | 7075 | 4118 | 4 | 1498 | 1415 | 0.02 | 1 | 110 | 103 | 3 | 1 | 0.41 | 5 | 5 | 330 | 308 | |
| Adjacent to MPAR and Downgradient | D8 | 14/09/2022 | 904.649 | 6.7 | 227 | 5.6 | 50 | 181.6 | <-1 | 11 | 16.7 | 11 | 8.3 | - | <-0.001 | 12.1 | <-1 | 1.8 | 6.24 | 81.5 | - | <-10 | 25 | 20 | <-10 | 0.02 | - | 172 | 480 | 180 | <-1 | <-1 | <-1 | 29 | <-1 | <-50 | <-50 | <-0.1 | <-1 | 5 | 5 | 2 | 3 | 2 | 441 | 106 | <-1 | 166 | 130 | <-0.08 | <-1 | 34 | 34 | <-10 | <-10 | 0.09 | <-10 | <-10 | 46 | 39 | |
| Adjacent to MPAR and Downgradient | D8 | 24/11/2022 | 904.949 | 6.2 | 206 | 6.2 | 50 | 66.9 | <-1 | 13 | 14.2 | 13 | 8.3 | - | 0.025 | 9.79 | <-1 | 1.76 | 8.22 | 64.9 | - | <-10 | 20 | 10 | <-10 | 0.01 | - | 164 | 520 | 180 | <-1 | <-1 | <-1 | 35 | <-1 | <-50 | <-50 | <-0.1 | <-1 | <-10 | <-10 | 2 | 5 | 2 | 510 | 150 | <-1 | 142 | 136 | <-0.04 | <-1 | 34 | 28 | <-10 | <-10 | 0.08 | <-10 | <-10 | 43 | 29 | |
| Adjacent to MPAR and Downgradient | D8 | 2/03/2023 | 904.149 | 4.3 | 224 | 5.3 | 43 | 154.8 | <-1 | 9 | 14.9 | 9 | 10.3 | - | 0.014 | 11.1 | <-1 | 1.82 | 6.43 | 77 | - | 90 | 24 | 20 | <-10 | 0.02 | - | 163 | 220 | 20 | <-1 | 8 | <-1 | 40 | <-1 | <-50 | <-50 | 0.2 | <-1 | <-10 | <-10 | 17 | 2 | 2 | 250 | <-10 | <-1 | 319 | 254 | <-0.04 | <-1 | 59 | 53 | <-0.2 | <-1 | 0.09 | <-10 | <-10 | 72 | 62 | |
| Adjacent to MPAR and Downgradient | D8 | 22/06/2023 | 904.049 | 5.6 | 295 | 5.3 | 30 | 101.7 | <-1 | 10 | 18.2 | 10 | 14.4 | - | <-0.001 | 13.4 | <-1 | 2.14 | 11.4 | 92.9 | - | 20 | 32 | 30 | <-10 | 0.03 | - | 170 | 80 | 20 | <-1 | <-1 | <-1 | 36 | <-1 | <-50 | <-50 | <-0.1 | <-1 | <-10 | <-10 | 2 | 2 | <-1 | 60 | <-50 | <-1 | 211 | 201 | <-0.04 | <-1 | 57 | 49 | <-0.2 | <-1 | 0.10 | <-10 | <-10 | 71 | 65 | |
| | | Min. | 904.0 | 4.3 | 206 | 5.3 | 30 | 66.9 | <-1 | 9 | 14 | 9 | 8.3 | - | 0 | 10 | <-10 | 1.8 | 6 | 65 | - | 20 | 10 | <-10 | 0 | - | 163 | 80 | 20 | <-1 | <-1 | <-1 | 29 | <-1 | <-50 | <-50 | <-0.1 | <-1 | 5 | 5 | 2 | 2 | 2 | 60 | <-50 | <-1 | 142 | 130 | <-0.08 | <-1 | 34 | 28 | <-10 | <-10 | 0.08 | <-10 | <-10 | 43 | 29 | | |
| | | Max. | 904.9 | 6.7 | 295 | 6.2 | 50 | 181.6 | <-1 | 13 | 18 | 13 | 14.4 | - | <-0.001 | 13 | <-1 | 2.1 | 11 | 93 | - | 90 | 32 | 30 | <-10 | 0 | - | 172 | 520 | 180 | <-1 | 8 | <-1 | 40 | <-1 | <-50 | <-50 | 0 | <-1 | <-10 | <-10 | 17 | 5 | 2 | 510 | 150 | <-1 | 319 | 254 | <-0.04 | <-1 | 59 | 53 | <-10 | <-10 | 0.10 | <-10 | <-10 | 72 | 65 | |
| | | Average | - | 5.7 | 238 | 5.5 | 43 | 126.0 | 0.5 | 11 | 16 | 11 | 10.5 | - | 0 | 12 | 1 | 1.9 | 8 | 79 | - | 30 | 25 | 20 | 5 | 0 | - | 167 | 325 | 100 | 1 | 2 | 1 | 35 | 1 | 25 | 25 | 0 | 1 | 5 | 5 | 6 | 3 | 2 | 315 | 77 | 1 | 210 | 181 | 0.02 | 1 | 46 | 41 | 3 | 1 | 0.09 | 5 | 5 | 58 | 49 | |
| Adjacent to MPAR and Downgradient | D9 | 13/09/2022 | 908.707 | 4.4 | 9420 | 6.1 | 21 | 33.2 | <-1 | 141 | 565 | 141 | 1.100 | - | - | 470 | <-1 | 71.7 | 1380 | 4270 | - | 550 | 1380 | <-10 | <-10 | <-1 | - | 8300 | 680 | <-1 | 4 | 3 | 38 | <-1 | 1750 | 1730 | 0.1 | 2 | <-1 | 235 | 5 | - | 59100 | 48300 | 2 | 15100 | 15000 | 0.20 | 3 | 1470 | 1490 | <-10 | <-10 | 2.06 | <-10 | <-10 | 127 | 74 | | | |
| Adjacent to MPAR and Downgradient | D9 | 24/11/2022 | 908.207 | 3.2 | 9700 | 6.2 | 24 | -33.2 | <-1 | 118 | 624 | 118 | 1.150 | - | <-1 | 504 | <-1 | 74.2 | 1380 | 4440 | - | 290 | 1440 | <-100 | <-100 | <-0.1 | - | 8310 | 250 | <-10 | <-1 | 3 | <-1 | 35 | <-1 | 1440 | 1630 | <-0.1 | <-1 | <-10 | <-10 | 240 | 1 | <-1 | 56300 | 22500 | 1 | 15600 | 14800 | <-0.05 | <-1 | 1670 | 1420 | <-10 | <-10 | 3.47 | <-10 | <-10 | 92 | 38 | |
| Adjacent to MPAR and Downgradient | D9 | 1/03/2023 | 908.307 | 2 | 9390 | 6.1 | 19 | 45.4 | <-1 | 109 | 536 | 109 | 1.080 | - | <-0.001 | 448 | <-1 | 66.5 | 1200 | 4420 | - | 320 | 1440 | <-10 | <-10 | <-0.01 | - | 8240 | 430 | <-10 | <-1 | 12 | 2 | 36 | <-1 | 1730 | 1840 | <-0.1 | <-1 | <-10 | <-10 | 260 | 63 | 35 | 73400 | 45100 | <-1 | 18800 | 17800 | 0.36 | 2 | 1700 | 1610 | 0.4 | <-1 | 3.99 | <-10 | <-10 | 118 | 78 | |
| Adjacent to MPAR and Downgradient | D9 | 21/06/2023 | 908.107 | 2.3 | 10060 | 6.1 | 17 | 68.8 | <-1 | 126 | 564 | 126 | 1.220 | - | <-1 | 477 | <-1 | 81.4 | 1350 | 5160 | - | 300 | 1510 | 10 | <-10 | 0.01 | - | 8890 | <-10 | <-10 | <-1 | <-1 | 28 | <-1 | 28 | <-1 | 1850 | 1690 | <-0.1 | <-1 | <-10 | <-10 | 236 | <-1 | <-1 | 35800 | 34600 | <-1 | 15700 | 14600 | 0.08 | <-1 | 1730 | 1700 | 0.3 | <-1 | 3.56 | <-10 | <-10 | 69 | 65 |
| | | Min. | 908.1 | 2.0 | 9390 | 6.1 | 17 | 33.2 | <-1 | 109 | 536 | 109 | 1.080 | - | <-0.001 | 448 | <-1 | 66.5 | 1180 | 4270 | - | 290 | 1380 | <-10 | <-10 | <-0.01 | - | 8240 | <-10 | <-10 | <-1 | <-1 | 28 | <-1 | 28 | <-1 | 1440 | 1630 | <-0.1 | <-1 | <-10 | <-10 | 236 | <-1 | <-1 | 35800 | 22500 | <-1 | 15100 | 14600 | <-1 | 1470 | 1420 | 0 | <-1 | 3.06 | <-10 | <-10 | 69 | 38 | |
| | | Max. | 909.2 | 4.4 | 10060 | 6.2 | 24 | 68.8 | <-1 | 141 | 624 | 141 | 1.220 | - | <-1 | 504 | <-1 | 81.4 | 1380 | 5160 | - | 360 | 1510 | <-100 | <-100 | <-0.1 | - | 8890 | 680 | <-10 | <-1 | 12.0 | 3 | 38 | <-1 | 1850 | 1840 | 0 | 2 | <-1 | <-10 | 260 | 63 | 35 | 73400 | 48300 | 2 | 18800 | 17800 | 0.36 | 3 | 1730 | 1700 | <-10 | <-10 | 3.99 | <-10 | <-10 | 127 | 78 | |
| | | Average | - | 3.0 | 9643 | 6.1 | 20 | 34.0 | 0.5 | 124 | 572 | 124 | 1.138 | - | 0 | 475 | 1 | 73.0 | 1278 | 4573 | - | 368.0 | 1443 | 29 | 28 | 0 | - | 8435 | 341 | 5 | 1 | 4.9 | 2 | 34 | 1 | 1693 | 1723 | 0 | 1 | 5 | 5 | 240 | 17 | 9 | 56150 | 37625 | 1 | 16300 | 15550 | 0.17 | 2 | 1643 | 1555 | 3 | 1 | 3.50 | 5 | 5 | 102 | 64 | |
| Brine waste pond leak detection bores | MPGMS-D5 | 21/07/2022 | - | 1.5 | 3668 | 6.4 | 33 | 69.6 | <-1 | 1820 | 461 | 1820 | 3.930 | - | <-1 | 840 | <-1 | 459 | 9620 | 22000 | - | 4860 | 6700 | <-10 | <-10 | <-0.01 | - | 36400 | 140 | 130 | <-10 | 12 | 16 | 47 | <-10 | 3180 | 2820 | 7 | <-10 | <-10 | <-10 | 1360 | <-10 | <-10 | 3510 | 2680 | 16 | 93800 | 91100 | 0.14 | <-10 | 6310 | 6130 | <-100 | <-10 | 1.74 | <-100 | <-100 | 561 | 521 | |
| Brine waste pond leak detection bores | MPGMS-D5 | 11/08/2022 | - | - | 35070 | 6.4 | 45 | - | <-1 | 1840 | 459 | 1840 | 3.790 | - | - | 786 | <-1 | 405 | 9200 | 20700 | - | - | - | - | - | - | - | 240 | - | <-10 | 14 | - | 44 | <-10 | 3130 | 7.4 | <-10 | - | - | 1240 | 20 | - | 3990 | - | 14 | 82000 | - | 0.14 | <-10 | 5980 | <-100 | <-10 | 1.71 | <-100 | - | 531 | - | | | | |
| Brine waste pond leak detection bores | MPGMS-D5 | 5/10/2022 | - | - | 31400 | 6.5 | - | - | - | 1831 | 426 | 1831 | 3.590 | - | - | 753 | 0 | 345 | 8320 | 19500 | - | - | - | - | - | - | - | 340 | - | <-10 | <-10 | - | 52 | <-10 | 2510 | - | 8.1 | <-10 | - | - | 1020 | 14 | - | 3580 | - | 12 | 79400 | - | 0.10 | 48 | 5390 | - | <-100 | <-100 | 1.58 | <-100 | - | 468 | - | | |
| Brine waste pond leak detection bores | MPGMS-D5 | 20/10/2022 | - | 2.7 | 32250 | 6.5 | 35 | 83.4 | <-1 | 1570 | 467 | 1570 | 3.620 | - | <-1 | 809 | <-1 | 383 | 8970 | 19800 | - | 4110 | 5940 | <-10 | <-10 | <-0.01 | - | 31000 | 160 | <-100 | <-10 | 11 | <-10 | 47 | <-10 | 1730 | 1580 | 5.3 | <-10 | <-10 | <-10 | 901 | 14 | 10 | 2920 | 2150 | <-10 | 67300 | 65000 | 0.12 | <-10 | 4760 | 4620 | <-100 | <-10 | 1.49 | <-100 | <-100 | 410 | 387 | |
| Brine waste pond leak detection bores | MPGMS-D5 | 11/01/2023 | - | 1.2 | 32920 | 6.6 | 33 | 89.7 | <-1 | 1710 | 444 | 1710 | 4.490 | - | <-1 | 757 | <-1 | 381 | 8720 | 20200 | - | 910 | 6150 | <-10 | <-10 | <-0.01 | - | 32800 | 220 | <-100 | <-10 | 12 | <-10 | 58 | <-10 | 2710 | 2160 | 92.1 | <-10 | <-10 | <-10 | 3000 | <-10 | <-10 | 5110 | 4200 | 68 | 85400 | 79600 | 0.14 | 11 | 5570 | 5260 | 5.6 | <-10 | 1.61 | <-100 | <-100 | 1520 | 1480 | |
| Brine waste pond leak detection bores | MPGMS-D5 | 27/04/2023 | - | 1.4 | 36390 | 6.5 | 34 | 43.8 | <-1 | 1630 | 489 | 1630 | 4.520 | - | <-1 | 901 | <-1 | 450 | 10000 | 17300 | - | 4730 | 6070 | <-10 | <-10 | <-0.01 | - | 37400 | 360 | <-100 | <-10 | <-10 | 245 | <-10 | 2700 | 2470 | 41.3 | <-10 | <-10 | <-10 | 4370 | 18 | <-10 | 5620 | 5830 | 144 | 86700 | 81200 | 0.11 | <-10 | 7760 | 7120 | 4.2 | <-10 | 1.88 | <-100 | <-100 | 2690 | 2480 | | |
| | | Min. | - | 1.2 | 3668 | 6.4 | 33 | 43.8 | <-1 | 1570 | 426 | 1570 | 3.590 | - | <-1 | 753 | 0 | 345 | 8320 | 17300 | - | 910.0 | 5940 | <-10 | <-10 | <-0.01 | - | 31000 | 140 | <-100 | <-10 | <-10 | <-10 | 44 | <-10 | 1730 | 1580 | 5 | <-10 | <-10 | <-10 | 901 | <-10 | <-10 | 2920 | 2150 | <-10 | 67300 | 65000 | 0.10 | <-10 | 4760 | 4620 | 4 | <-10 | | | | | | |

APPENDIX I NALCO

Ecolab | Nalco Water - Global Analytical & Microbiology

Quality assurance/quality control program (2023)

The laboratory's Quality assurance/quality control program ensures that sampling activities and analytical data is accurate, reliable and acceptable.

The Quality assurance/quality control program consists of both internal and external measures.

Internal

- Laboratory instrumentation and field equipment are calibrated at the correct intervals, as prescribed in the relevant NATA 'General equipment table'.
- Regular preventative maintenance is carried out on all key laboratory instrumentation and field equipment.
- Trip blanks (where appropriate) are supplied to monitor contamination.
- Certified reference materials are analysed routinely.
- Duplicate analysis is conducted to check precision.
- Laboratory blanks are analysed to monitor contamination.
- Quality control checks on media are performed.
- All records and subsequent reports are systematically checked.
- Quality control charts are used to statistically monitor trends in data.
- The laboratory is regularly internally audited.

External

- Ecolab Global Analytical & Microbiology laboratory participates in regular chemical and microbiological external proficiency testing programs as well as NATA audits as per their surveillance program.

Sampling and Data Collection

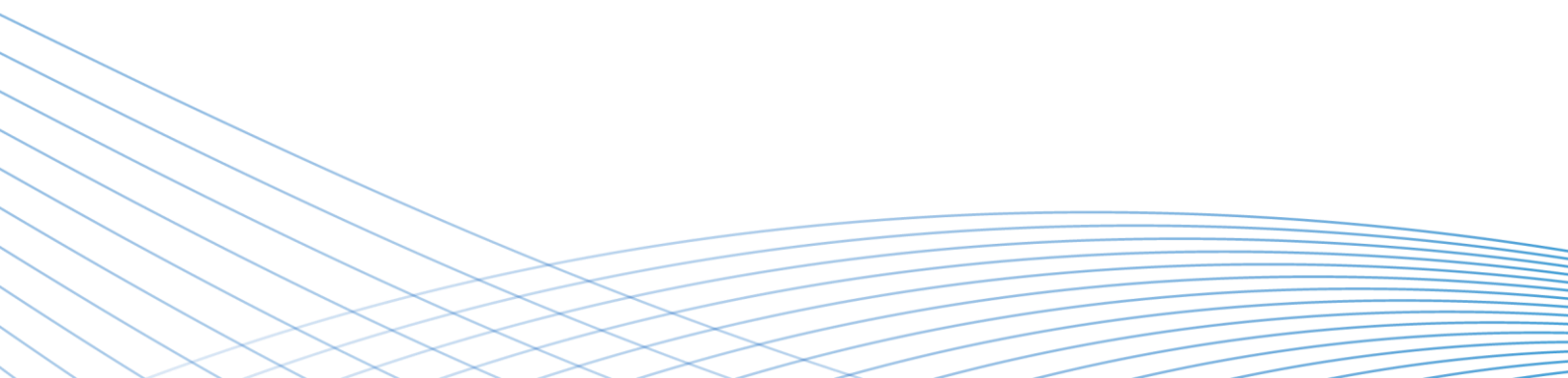
- All sampling is performed by trained personnel in accordance with procedure A-2.18 and relevant parts of Australian Standard 5667, for which NATA accreditation is held.
- Site measurements (Dissolved Oxygen, pH, Turbidity, Temperature and Conductivity) and sampling observations (water depth) are recorded and reported in accordance with procedure CA12125.

Sample Bottles

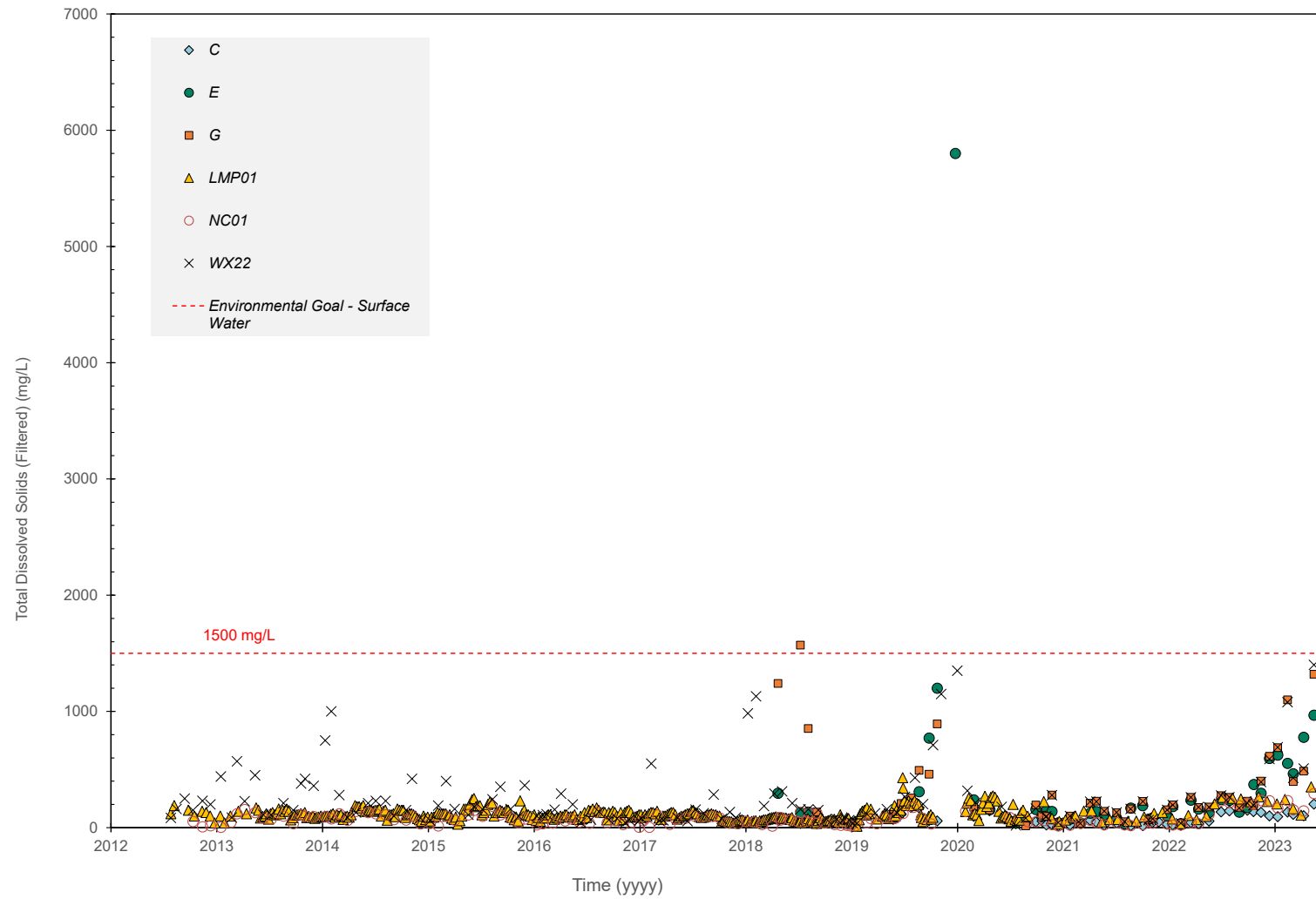
- Pre-labeled sample containers are used for routine sampling and testing.
- The sample bottles are prepared so that samples are preserved in accordance with Australian Standard 5667.1:1998 and Standard Methods for the Examination of Water and Wastewater, 22nd Edition (APHA).

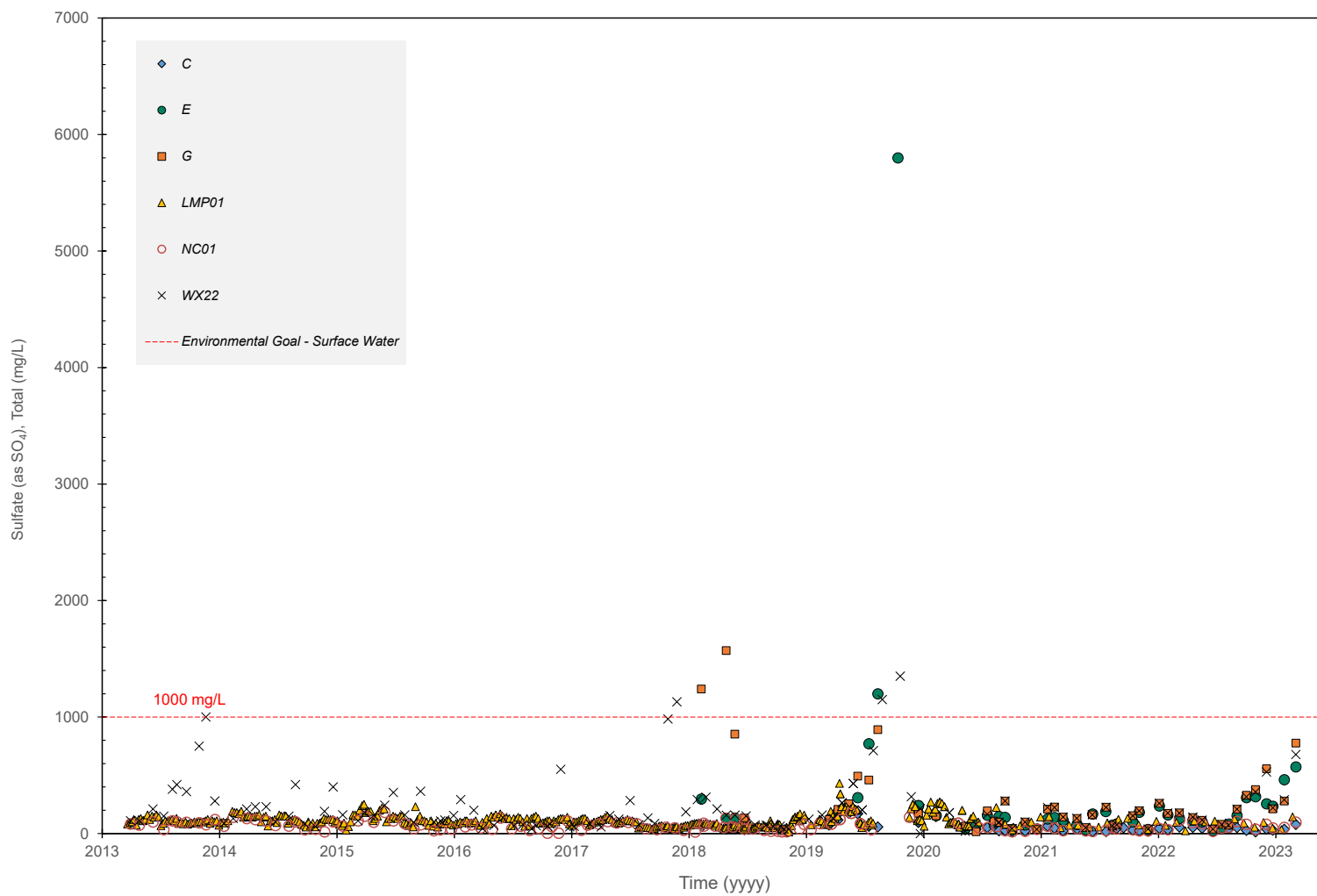
Delivery of Samples

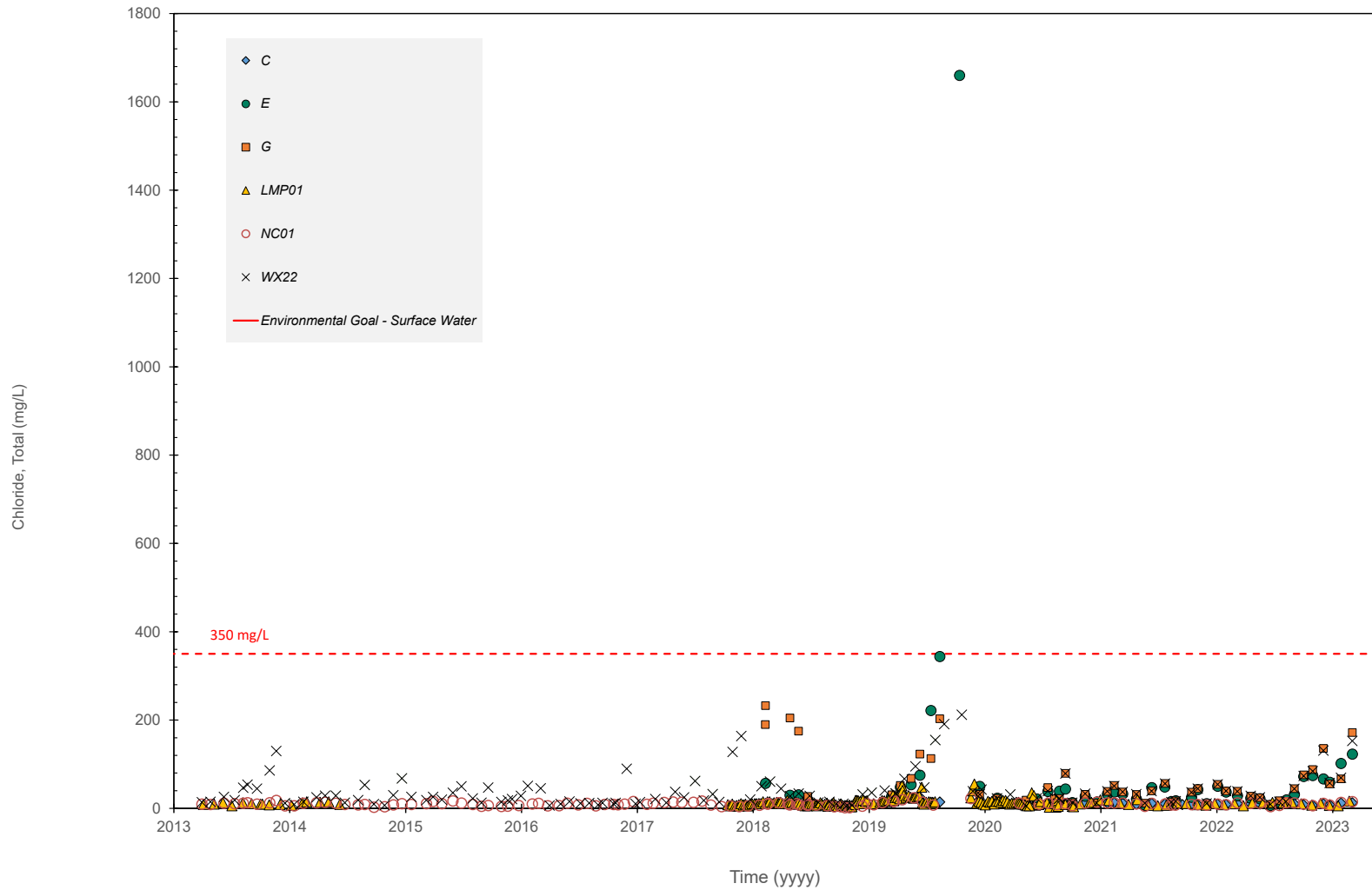
- Eskies and freezer packs are used to maintain the integrity of the samples during transport from the sampling sites to our Global Analytical & Microbiology laboratory (Sydney).

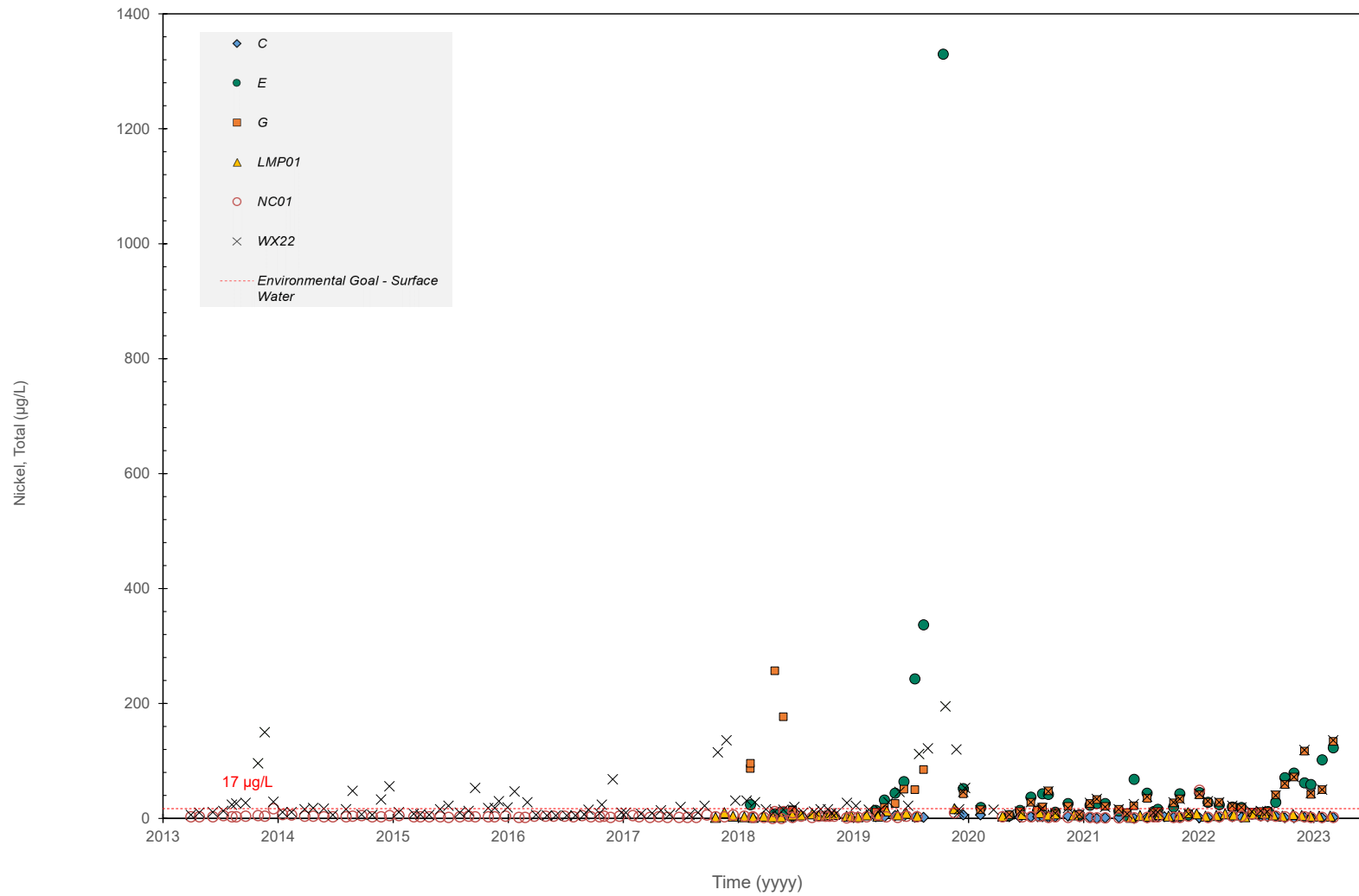


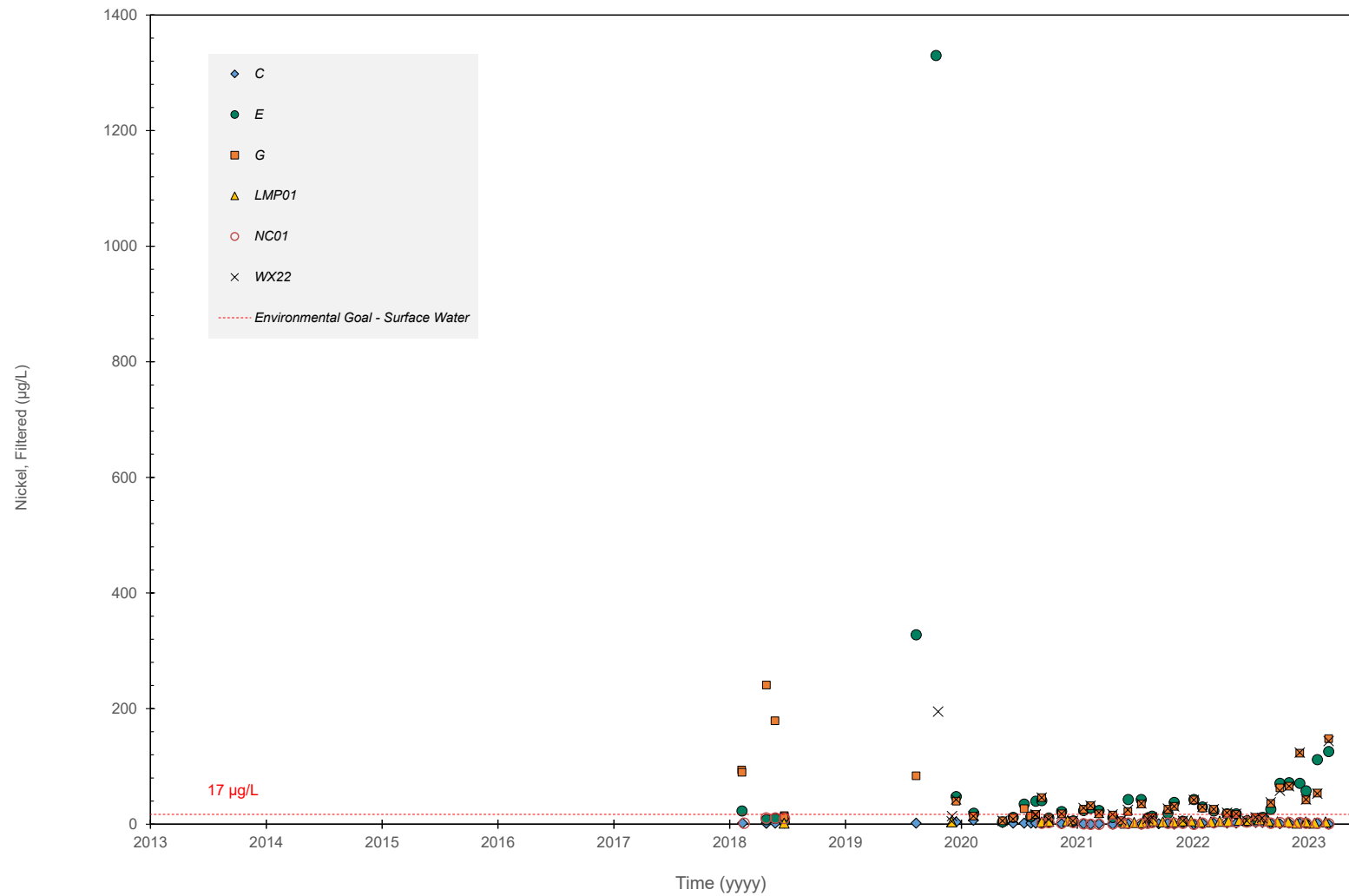
APPENDIX J SURFACE WATER TRENDS

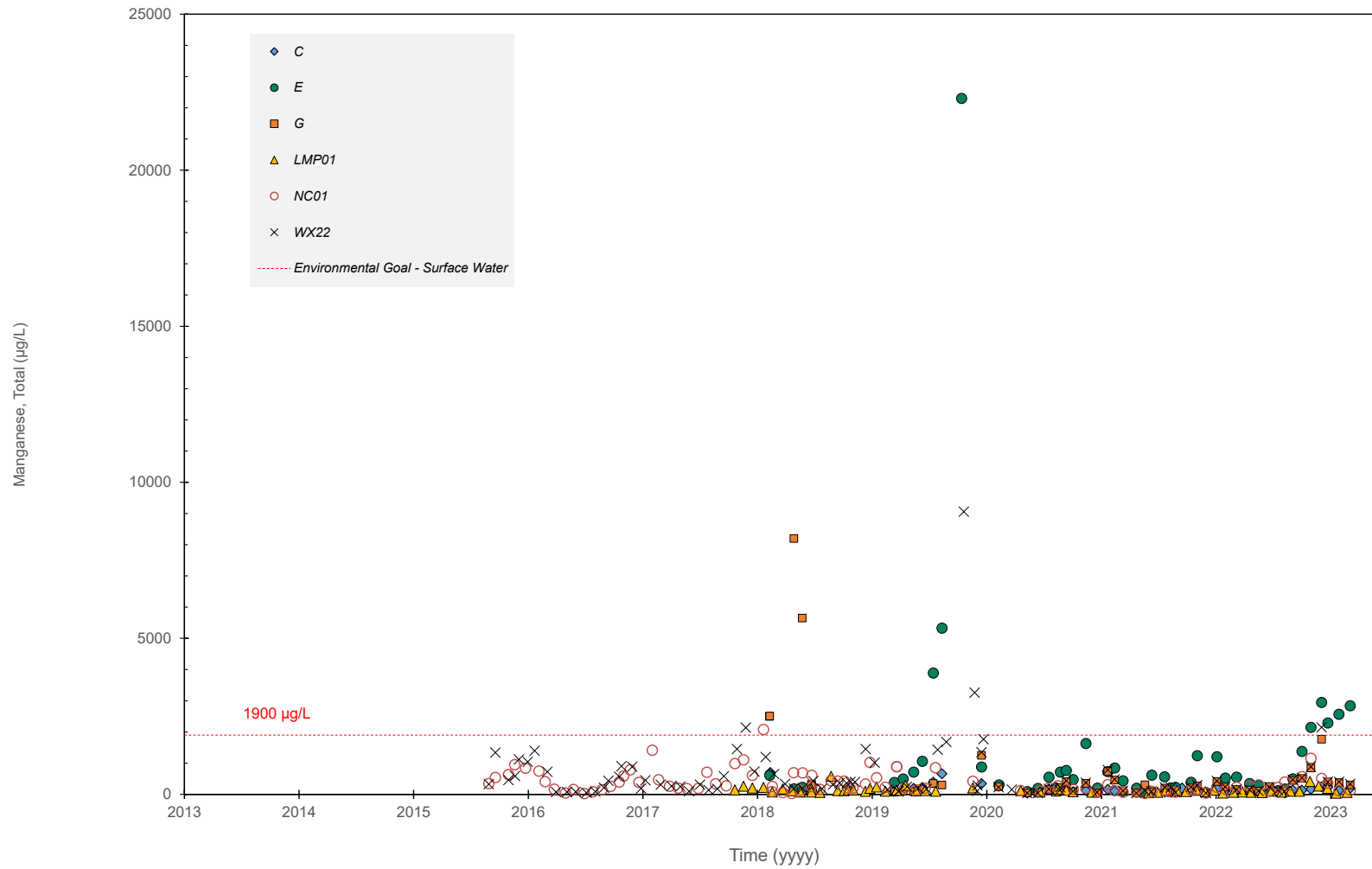


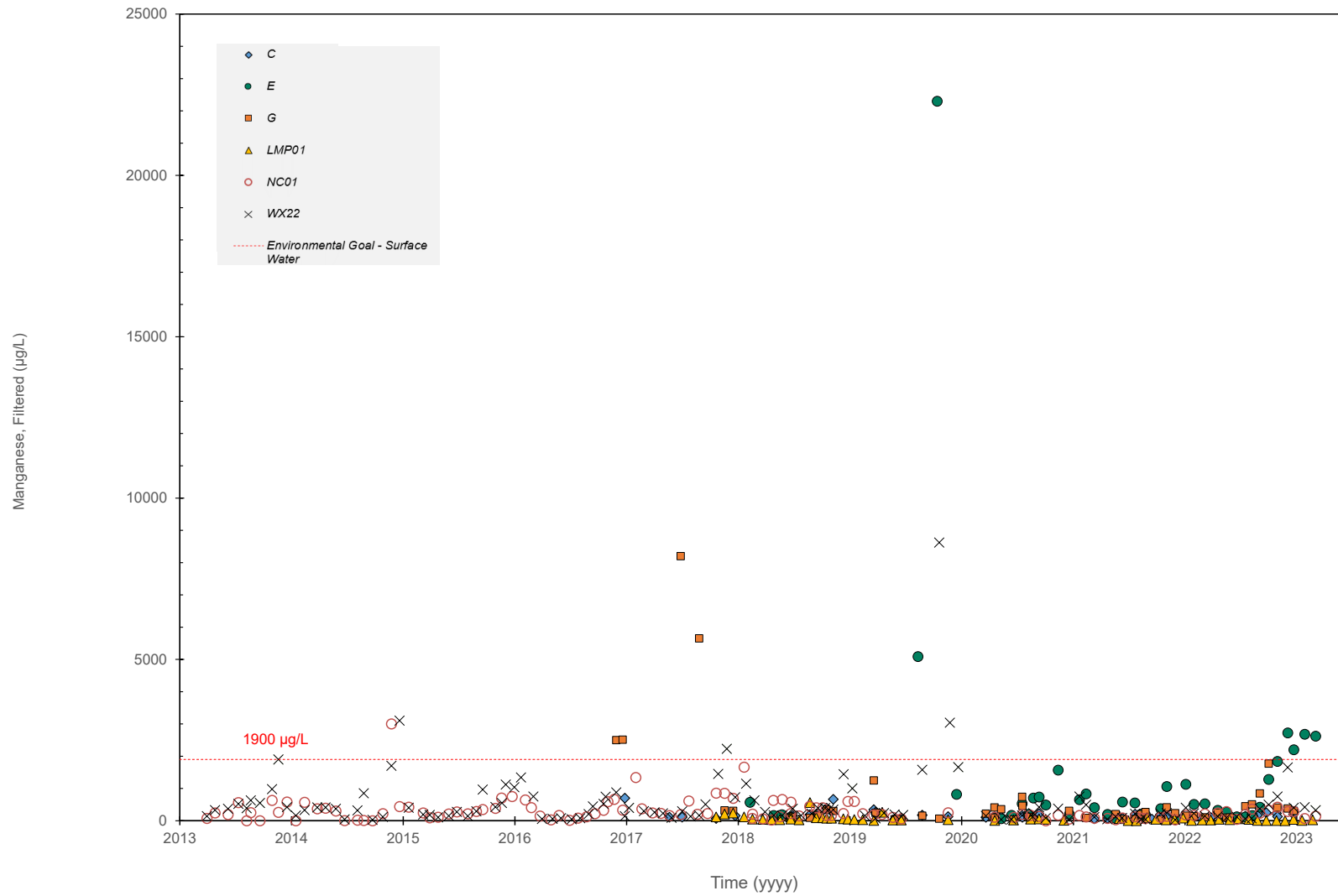


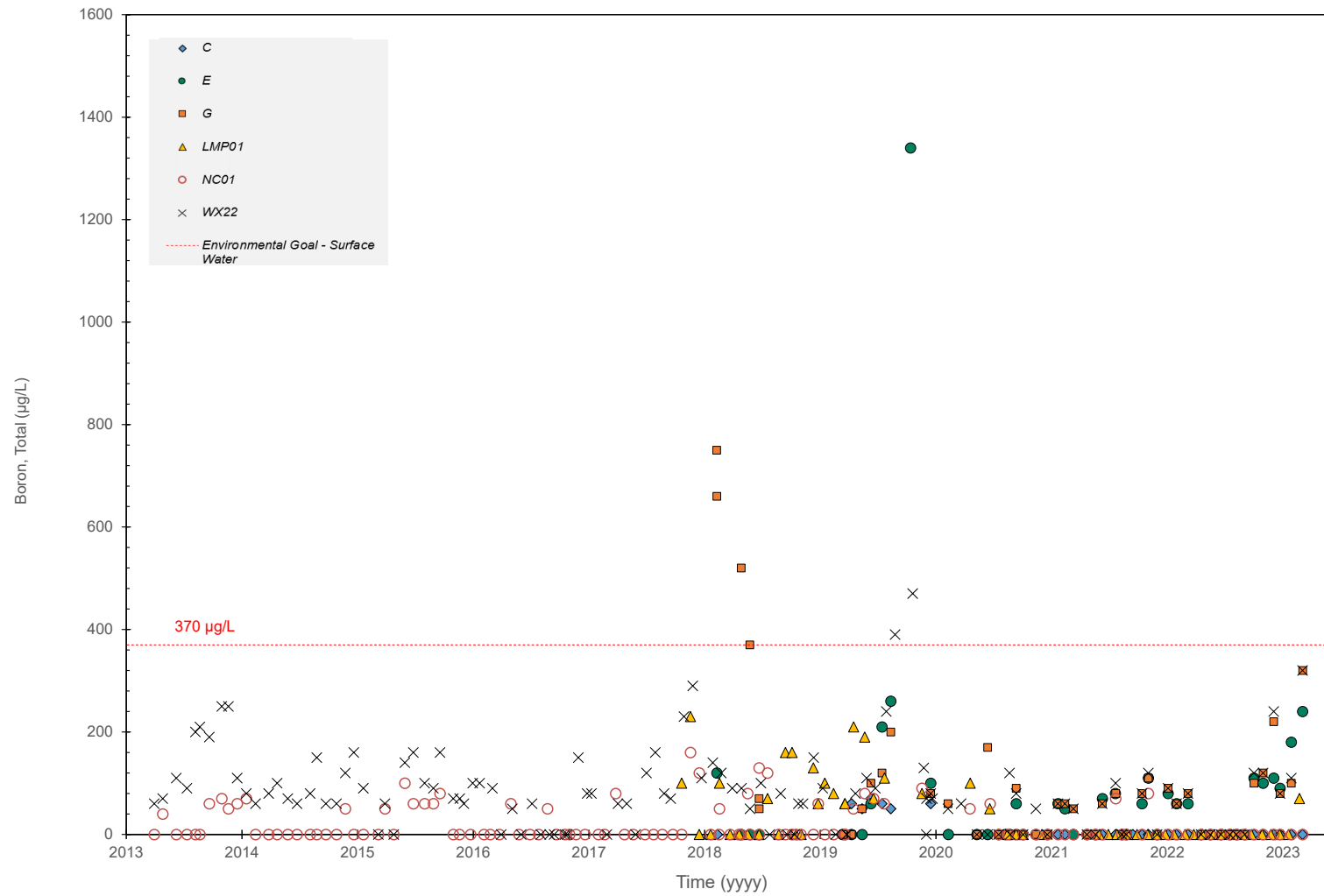


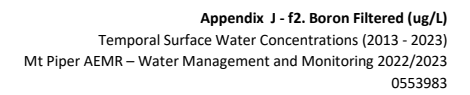




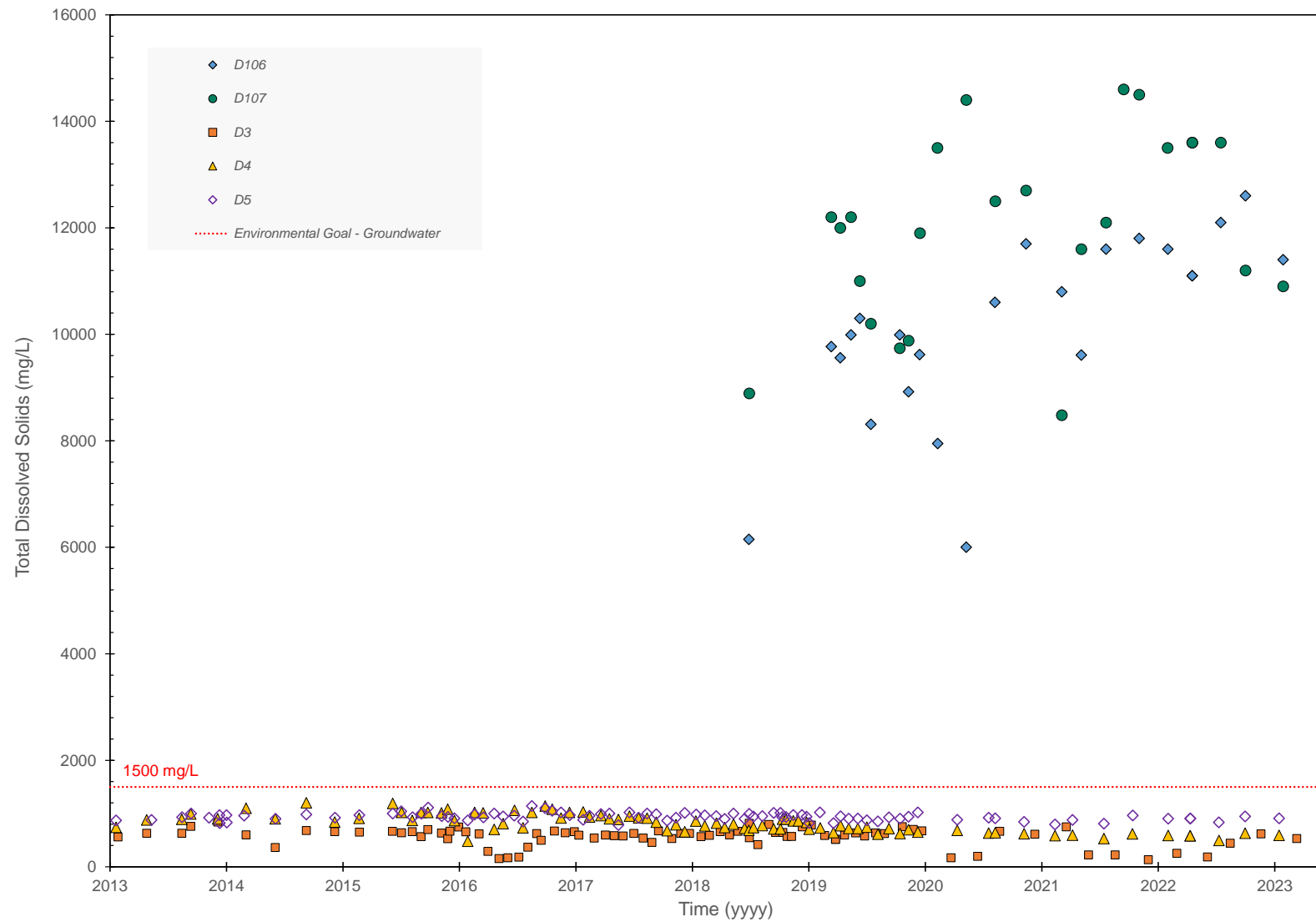


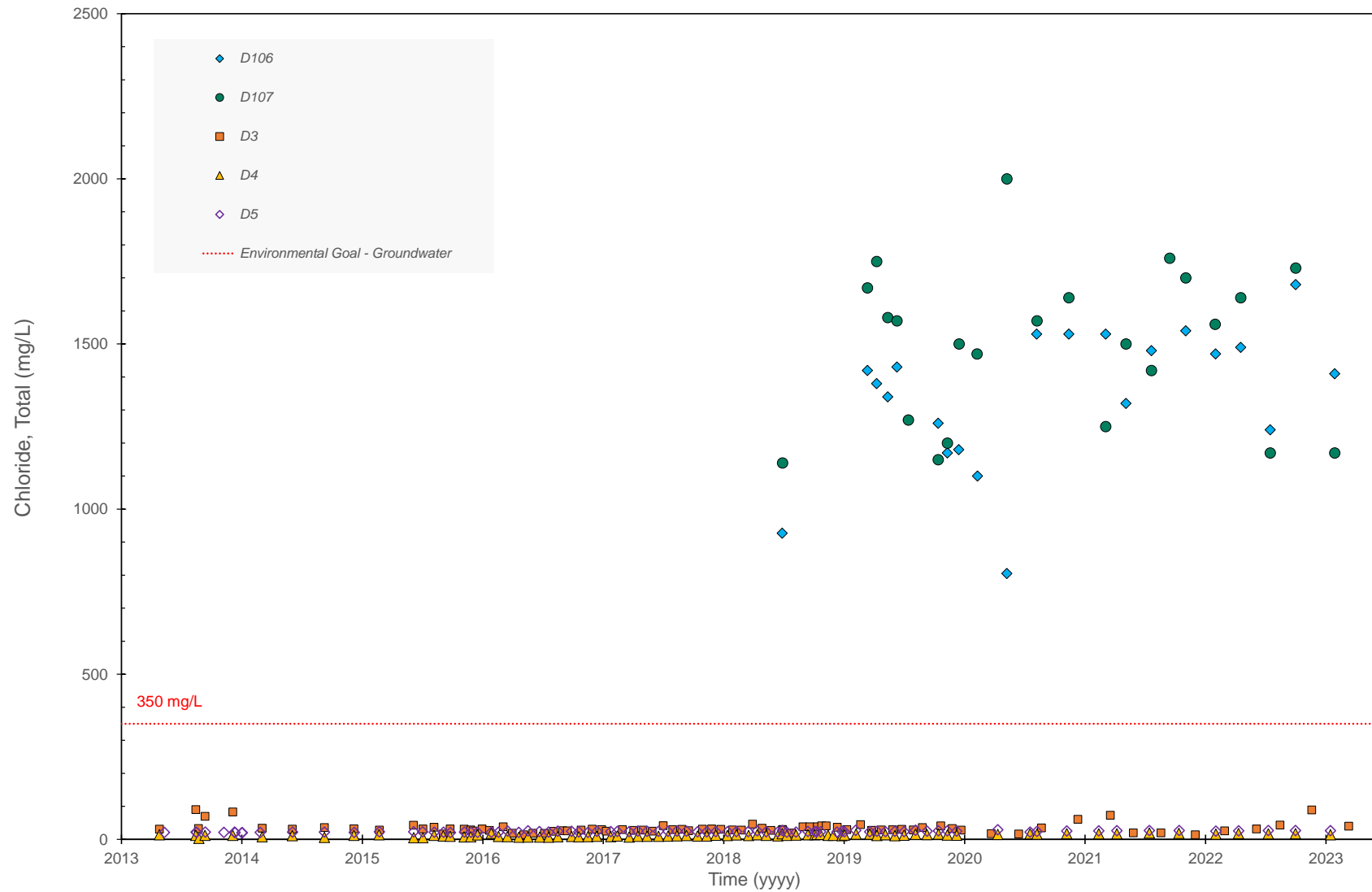


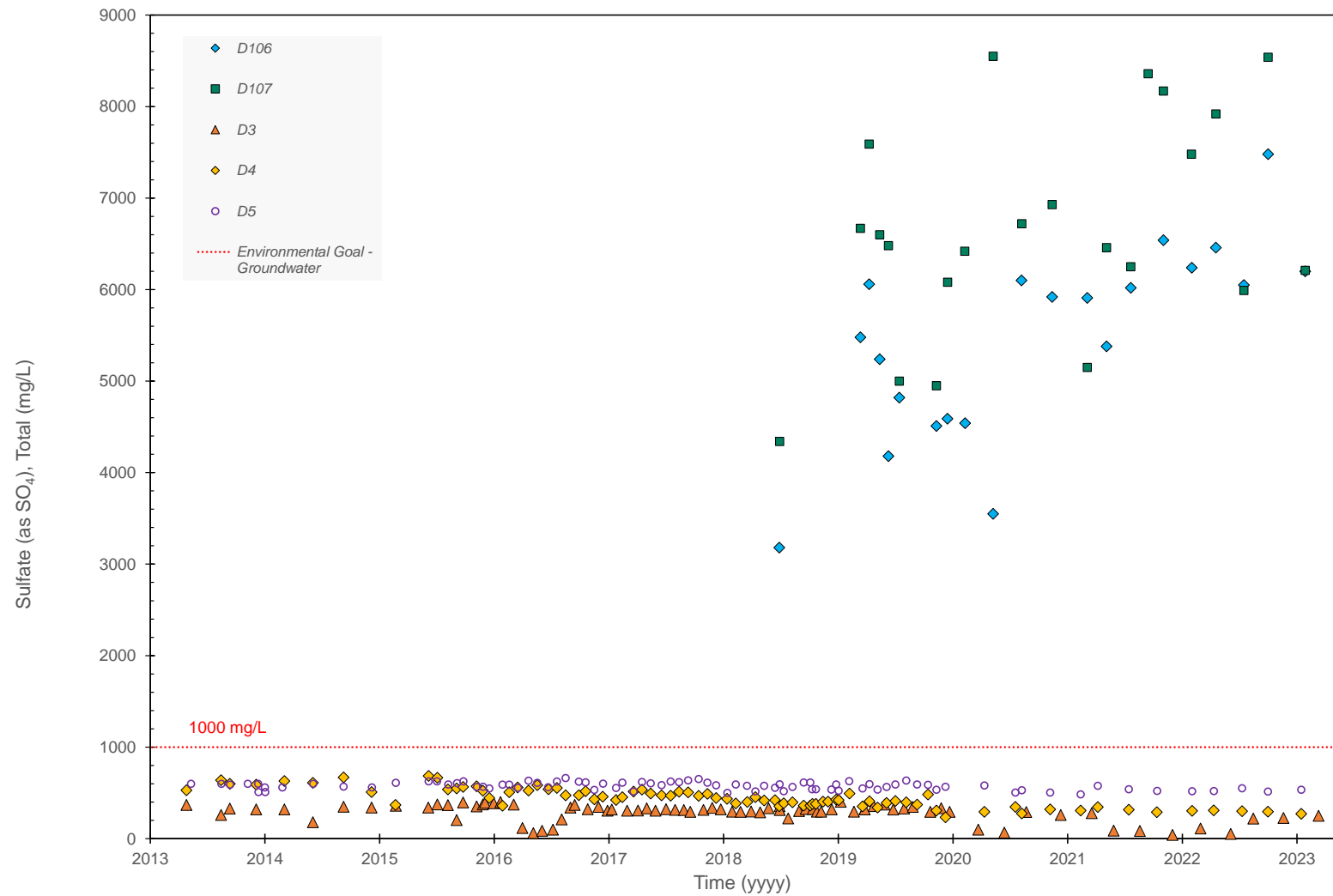


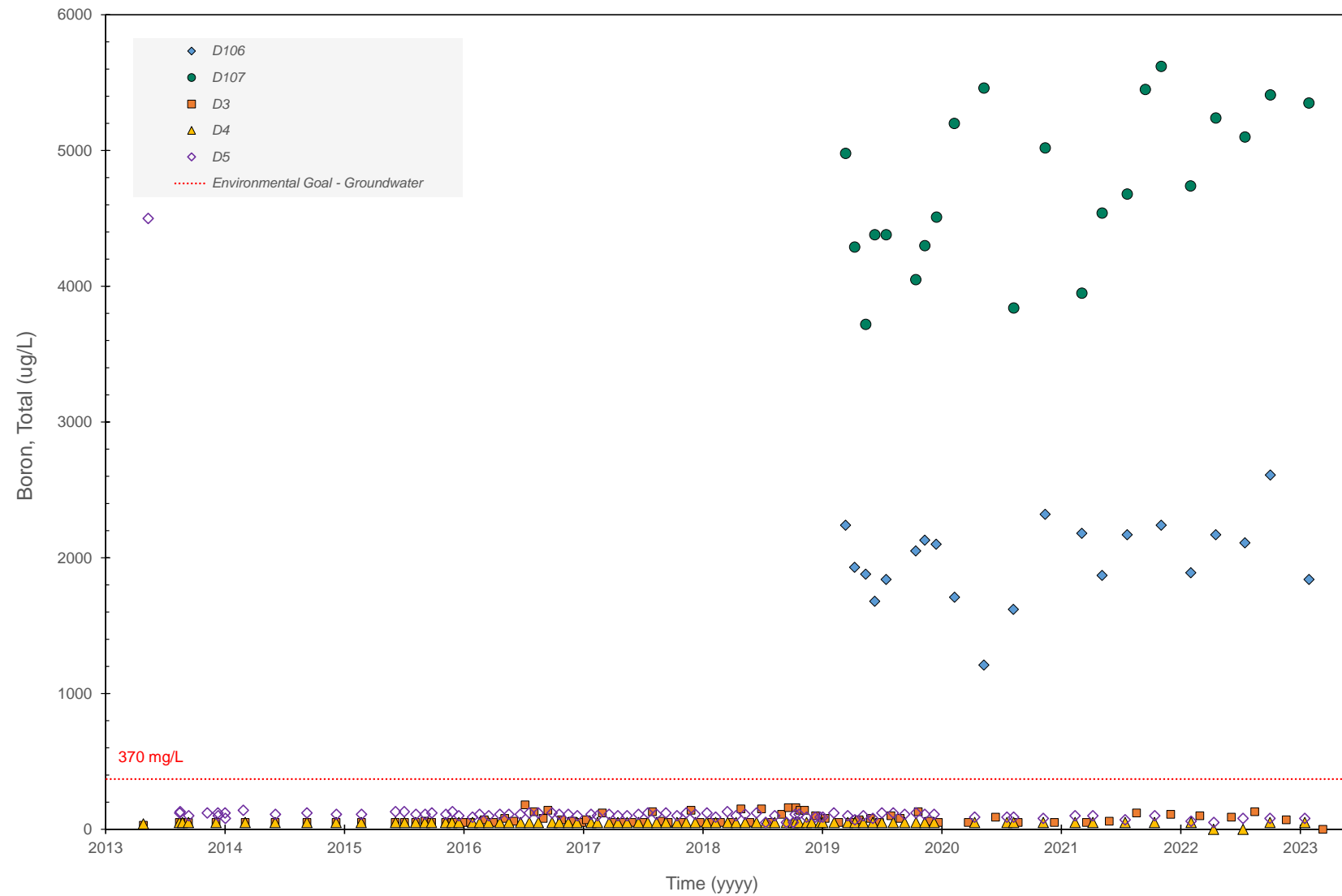


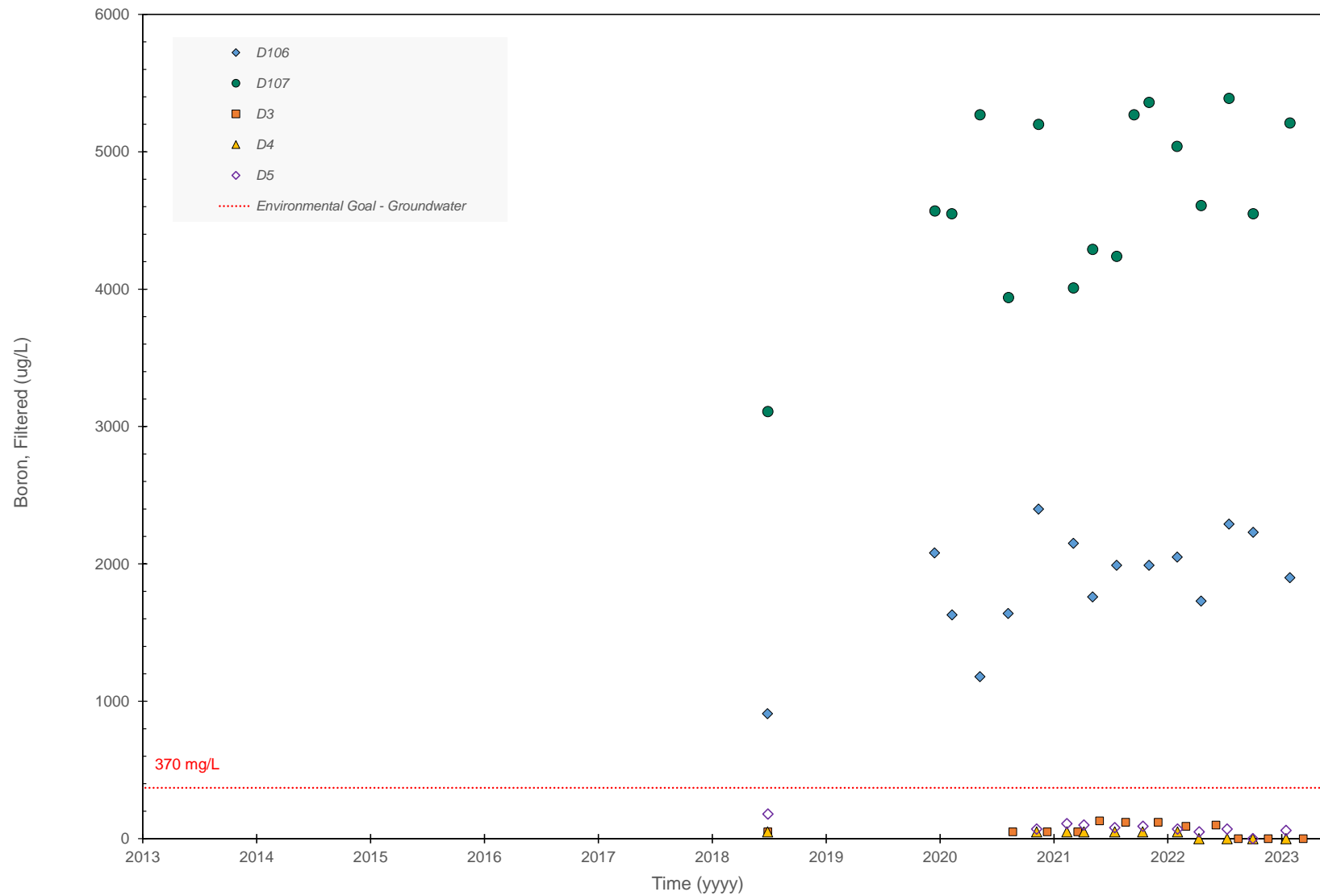
APPENDIX K GROUNDWATER TRENDS

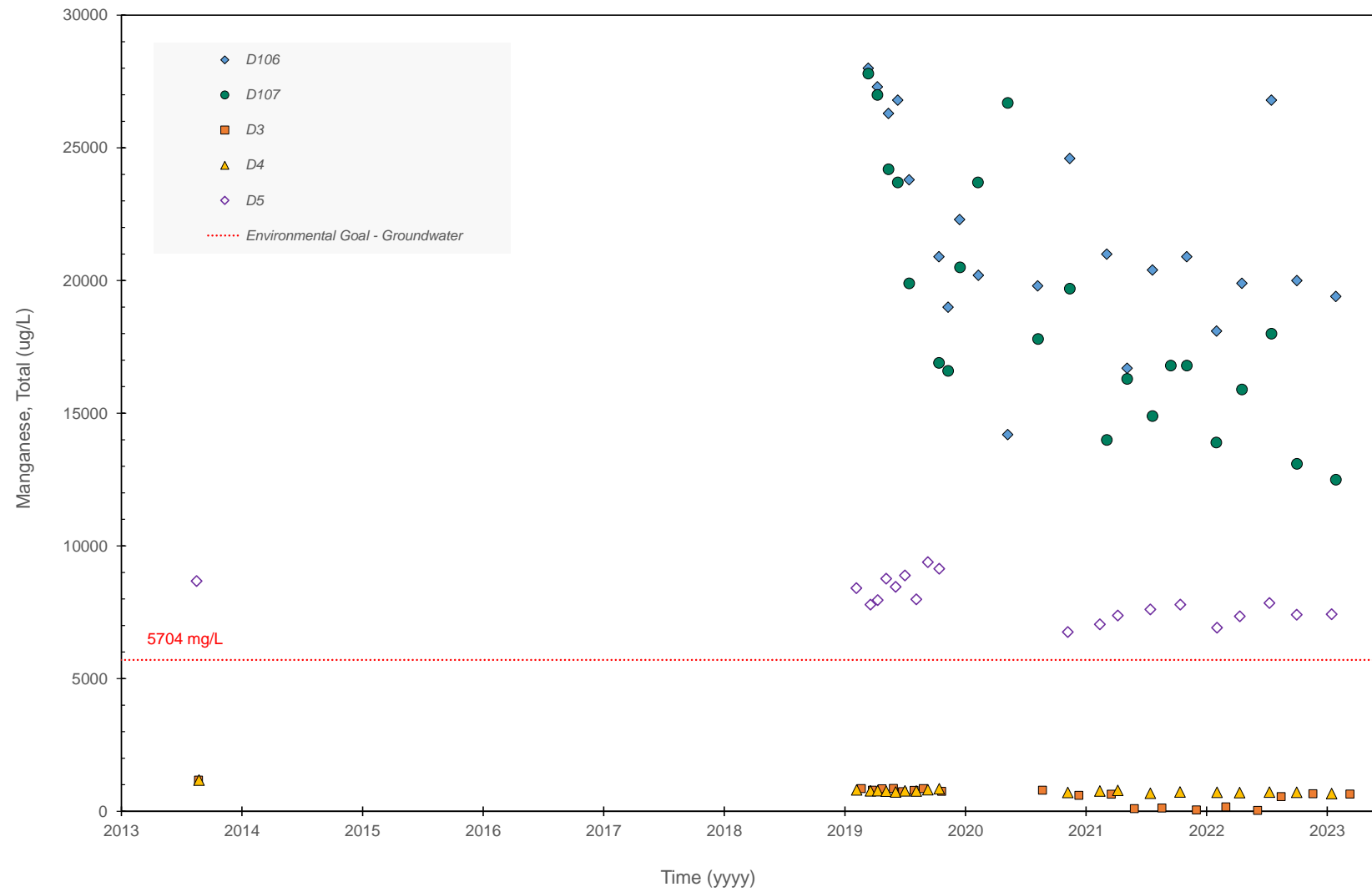


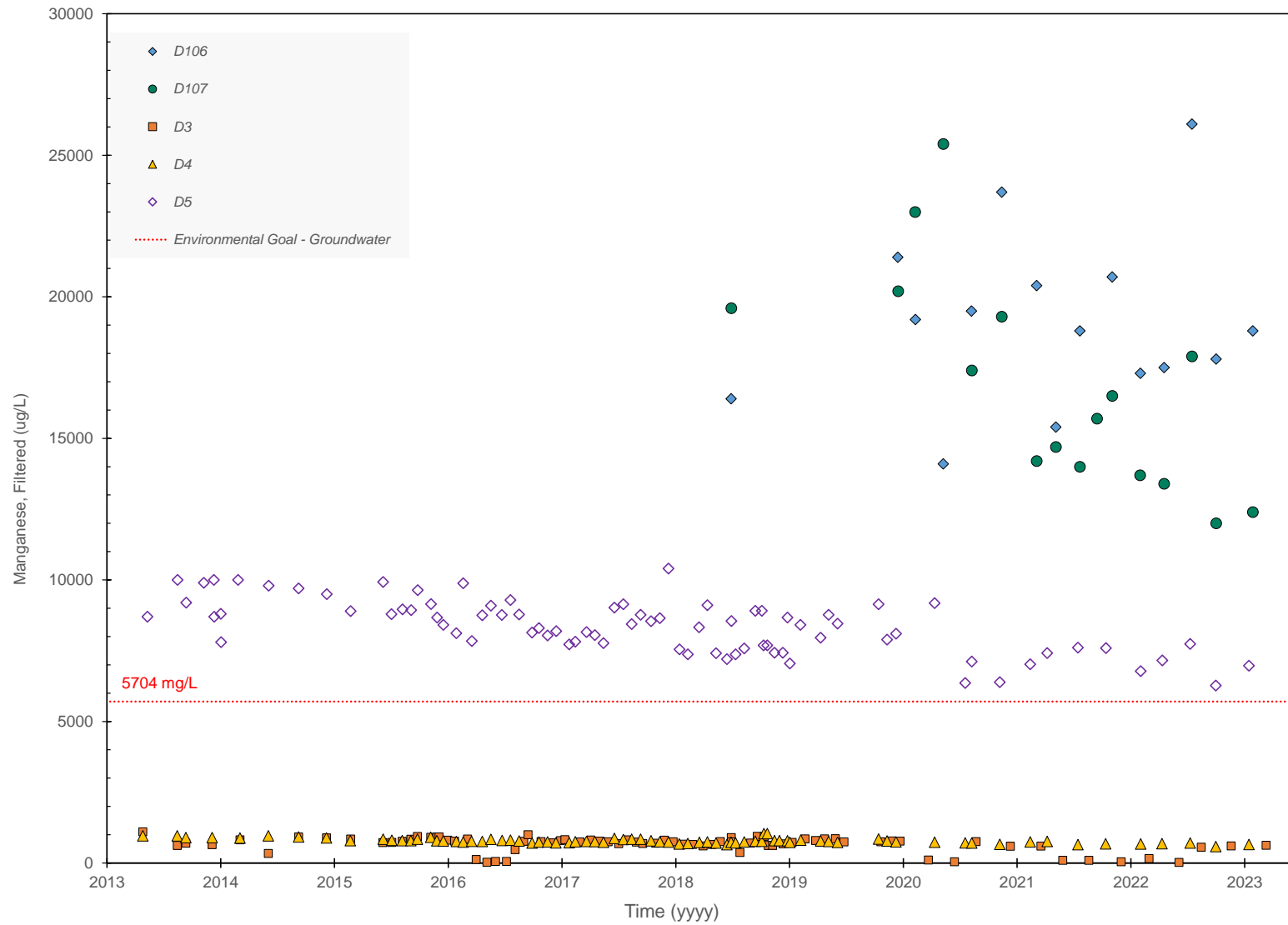


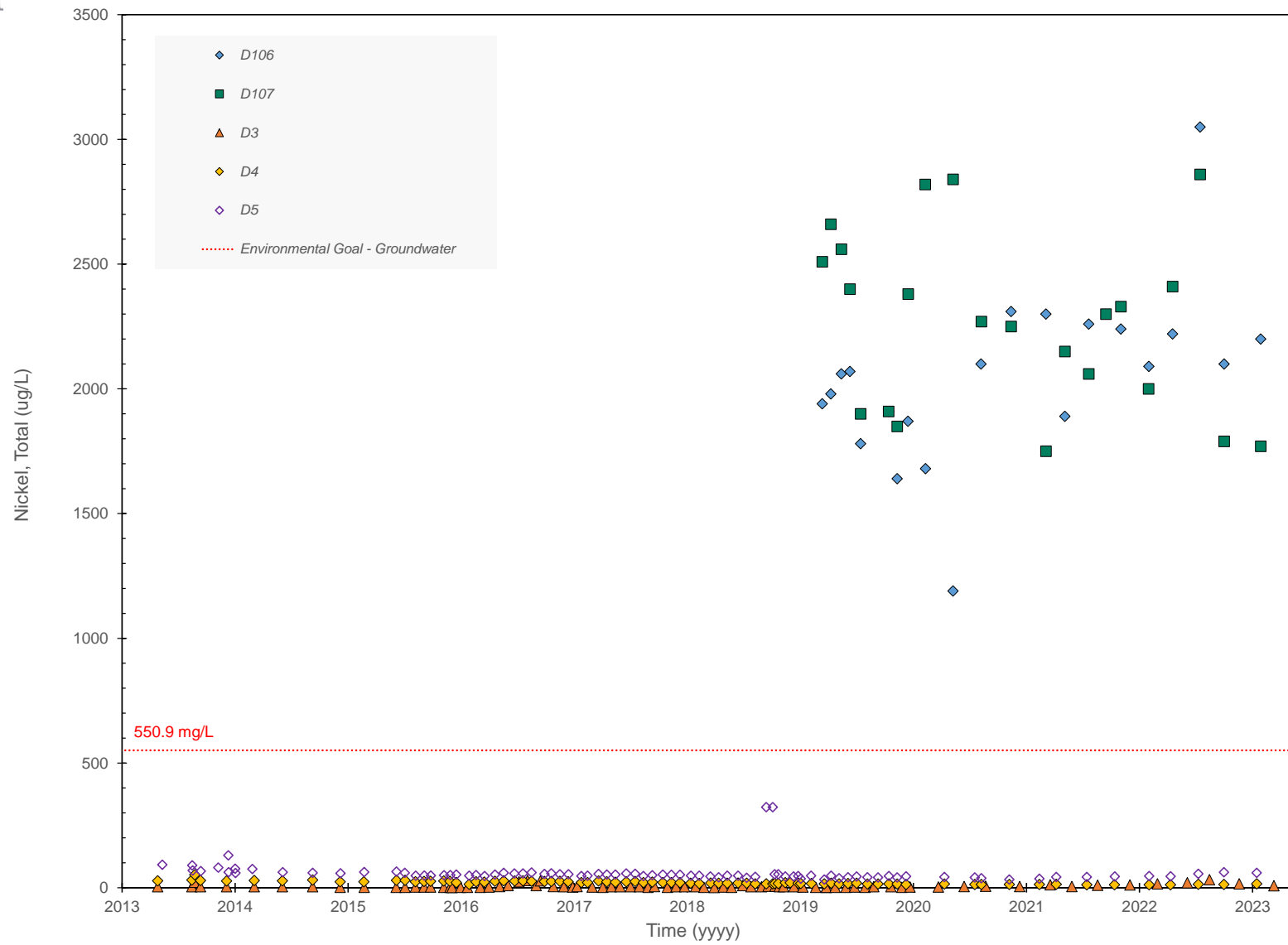


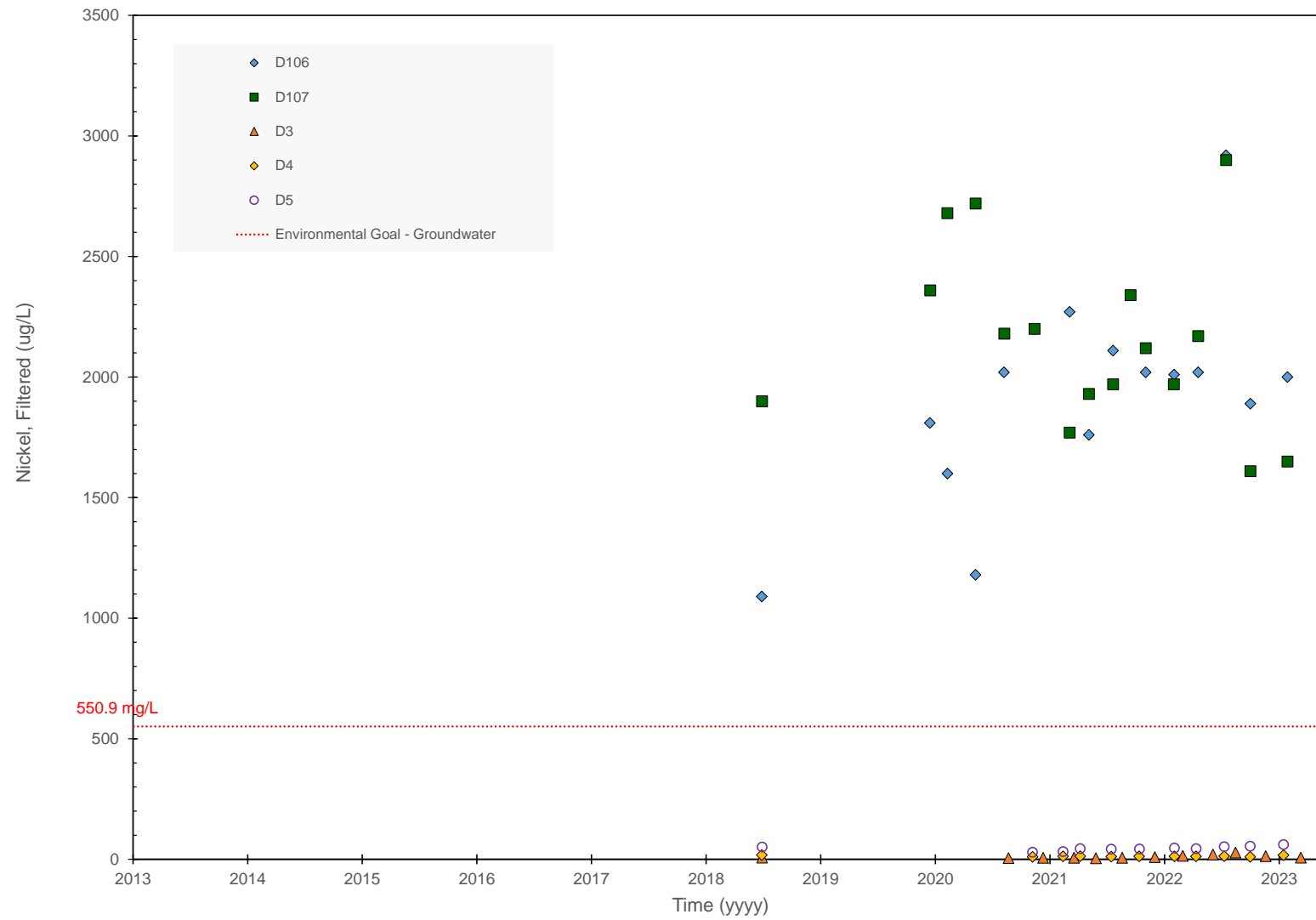


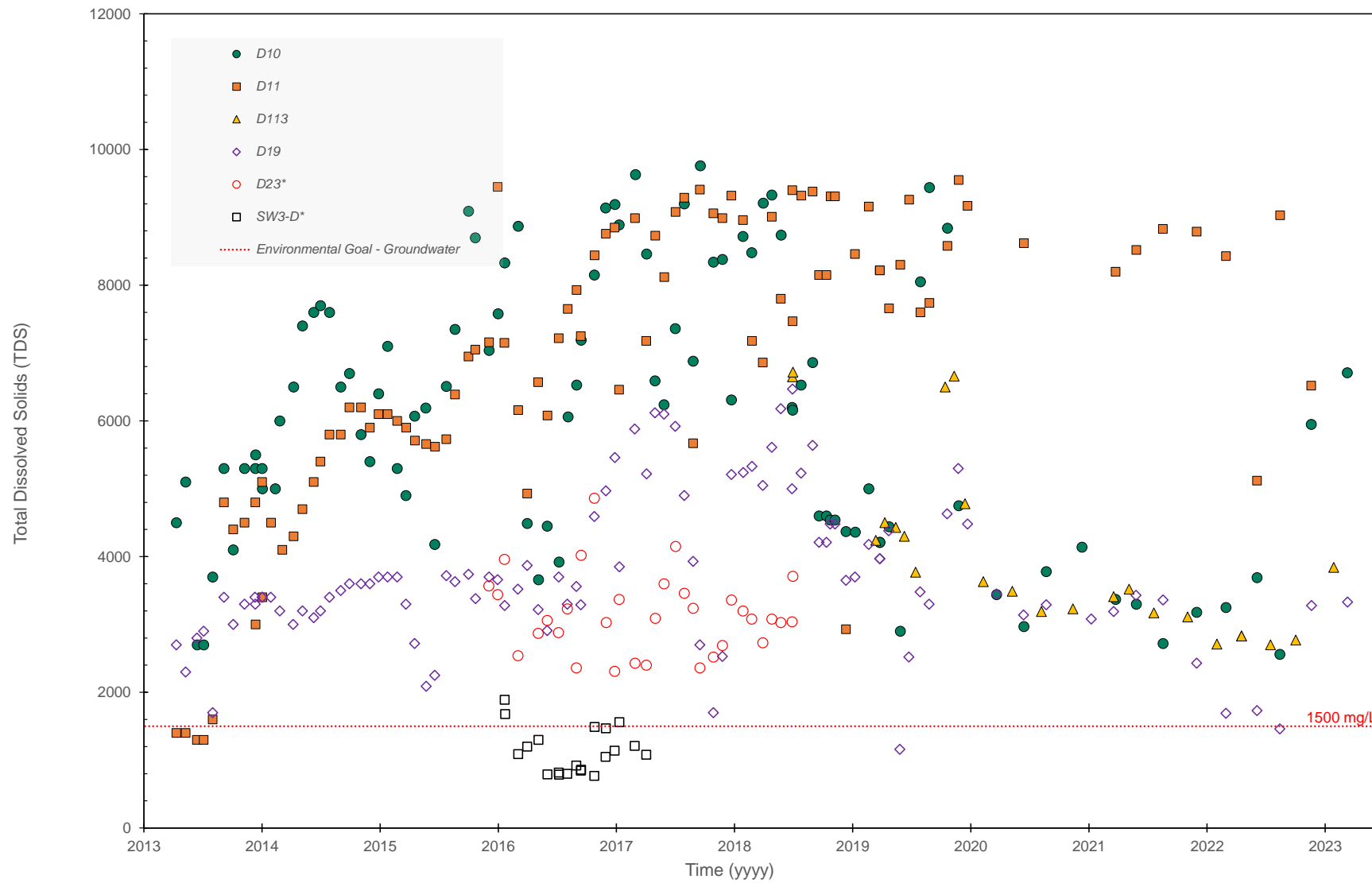




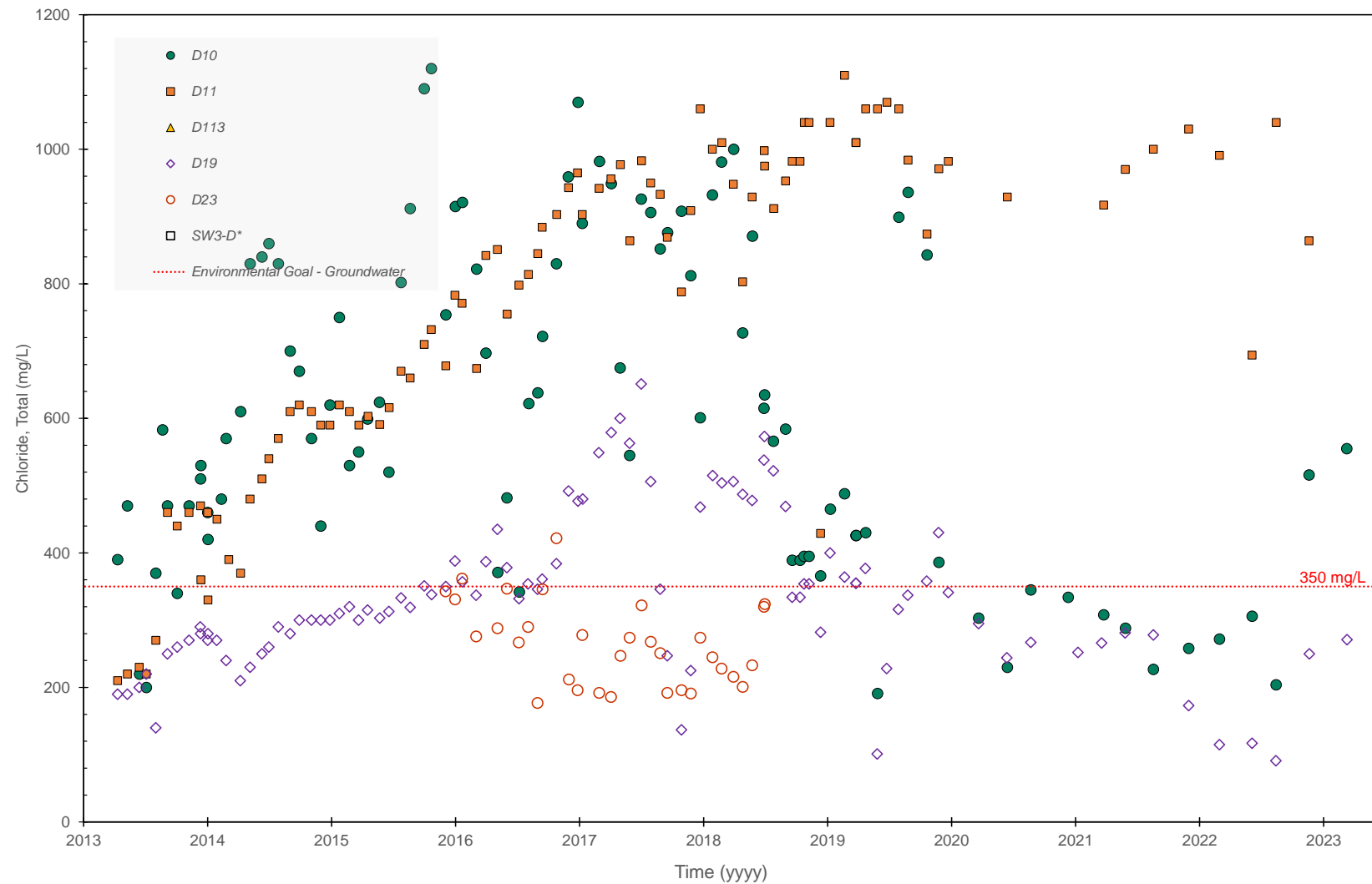




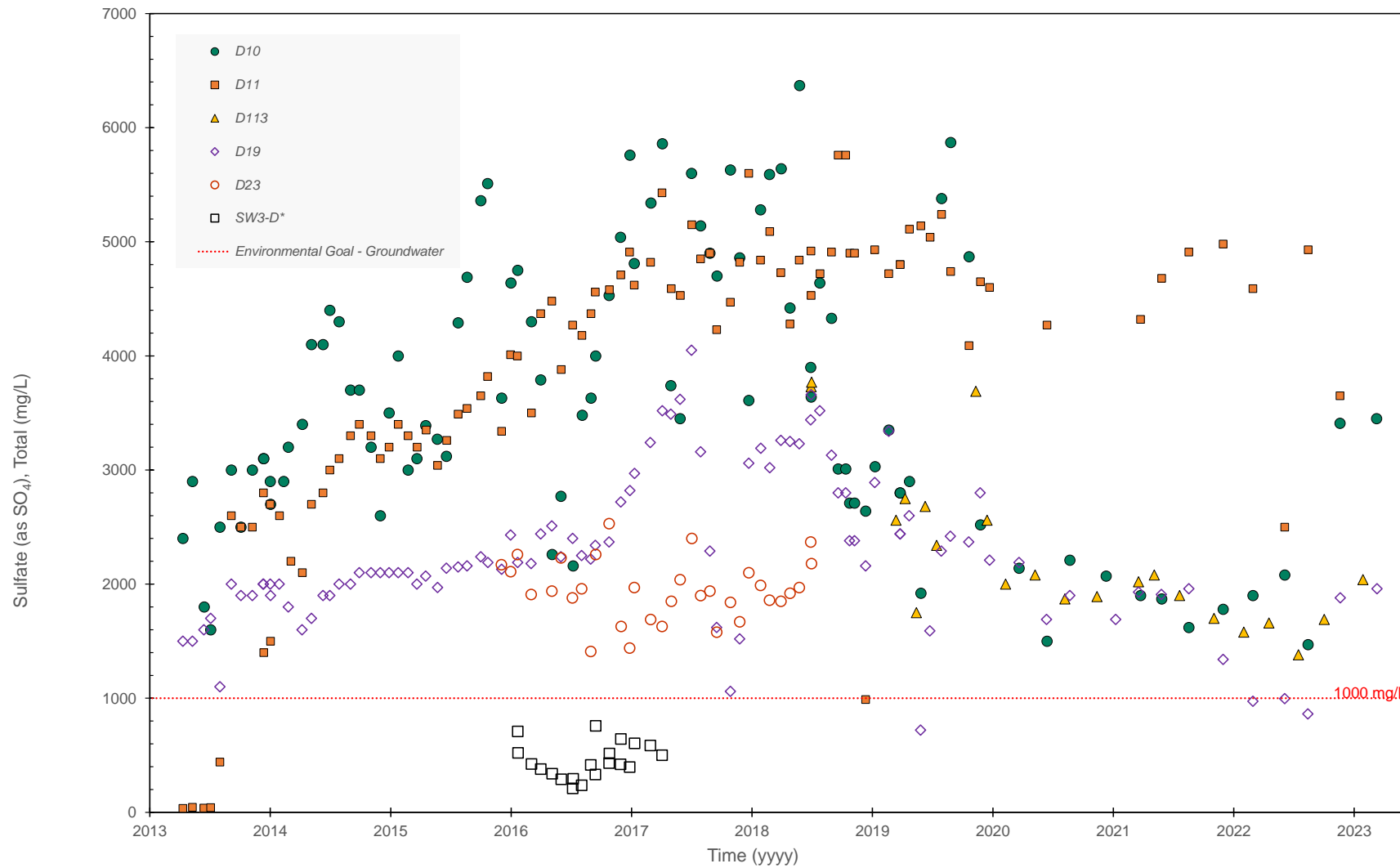




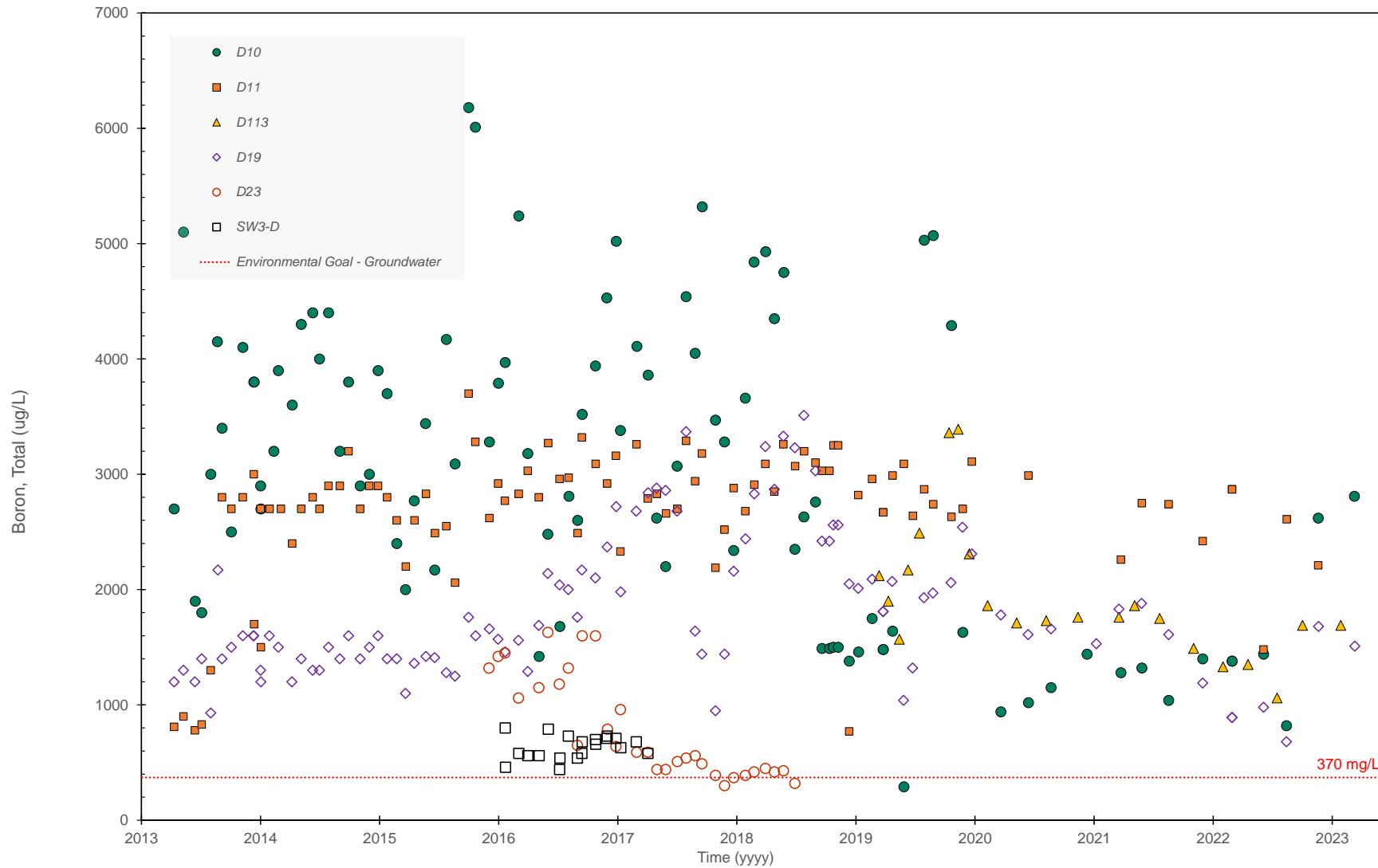
*Data for B5 and SWD-3 has not been supplied by EnergyAustralia since 2017 due to wells reported as either blocked or dry.



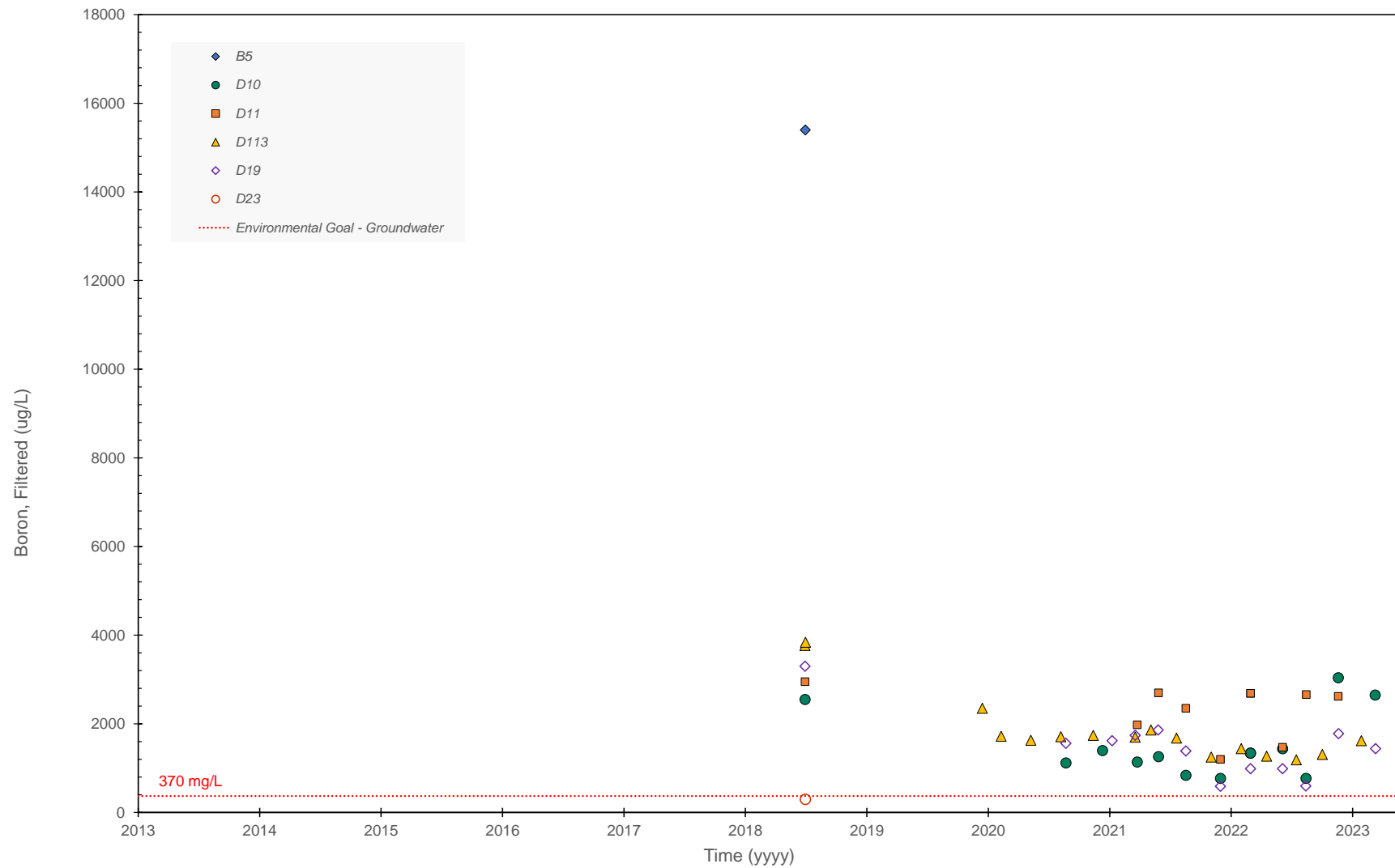
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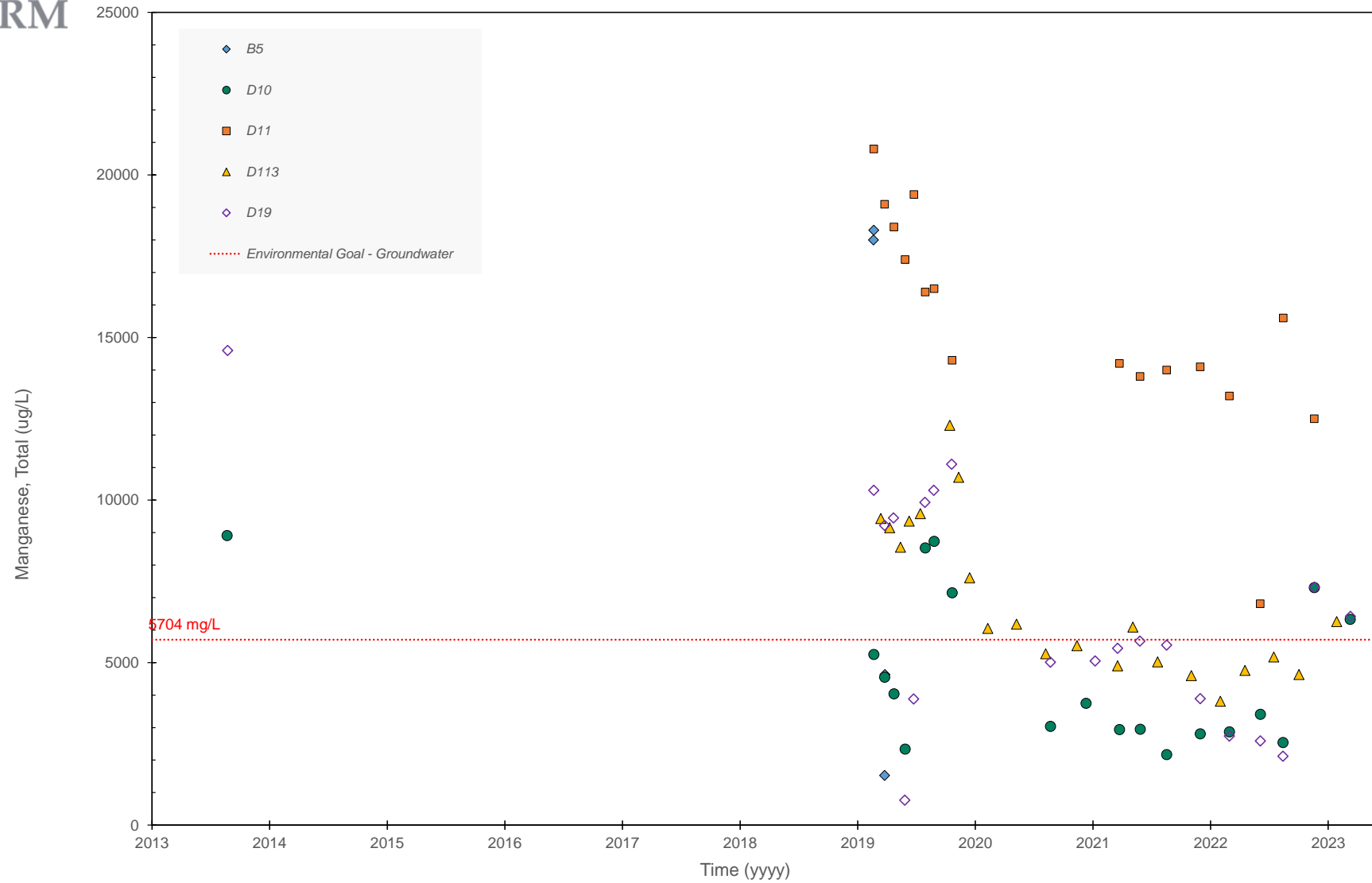
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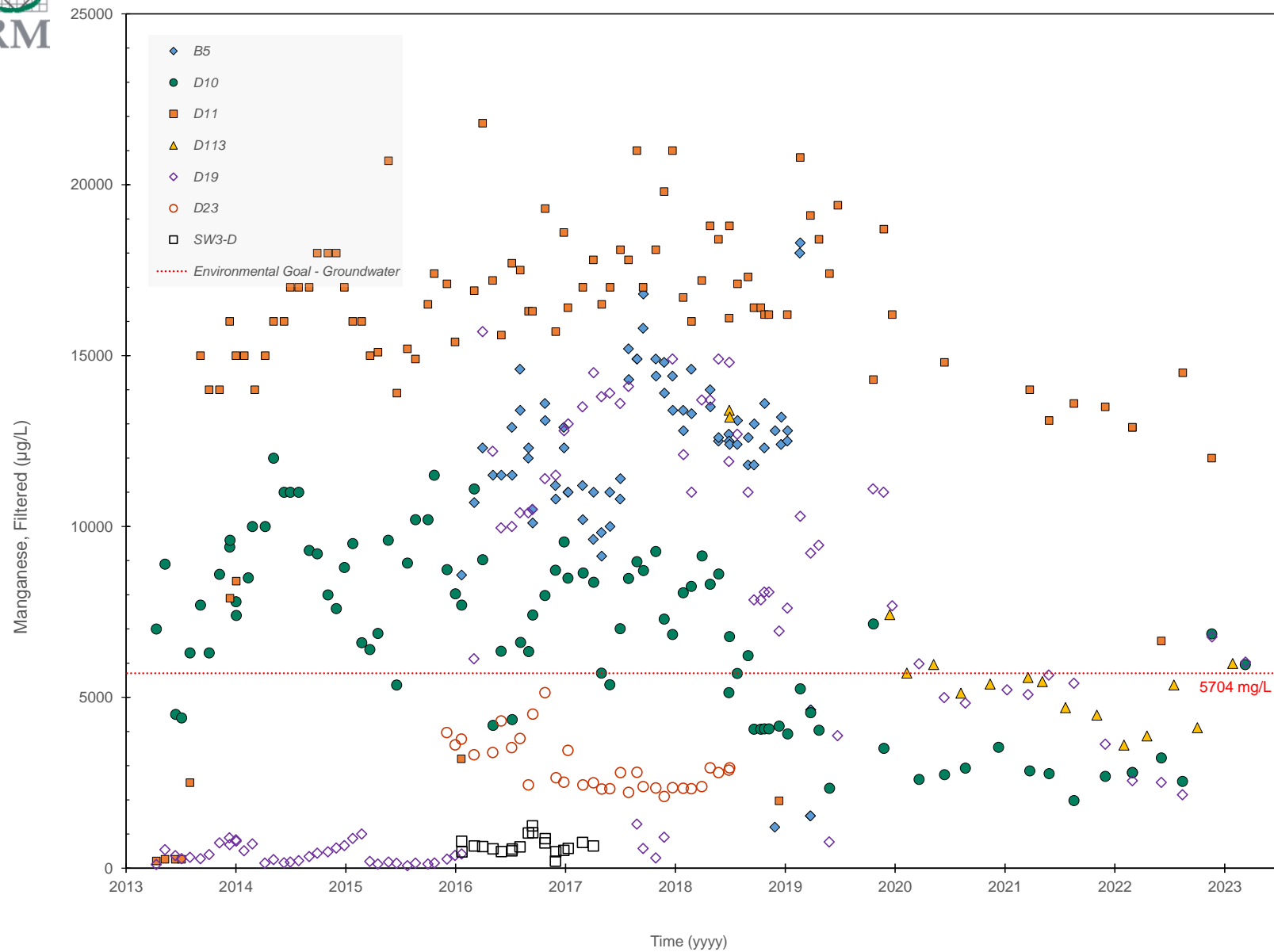


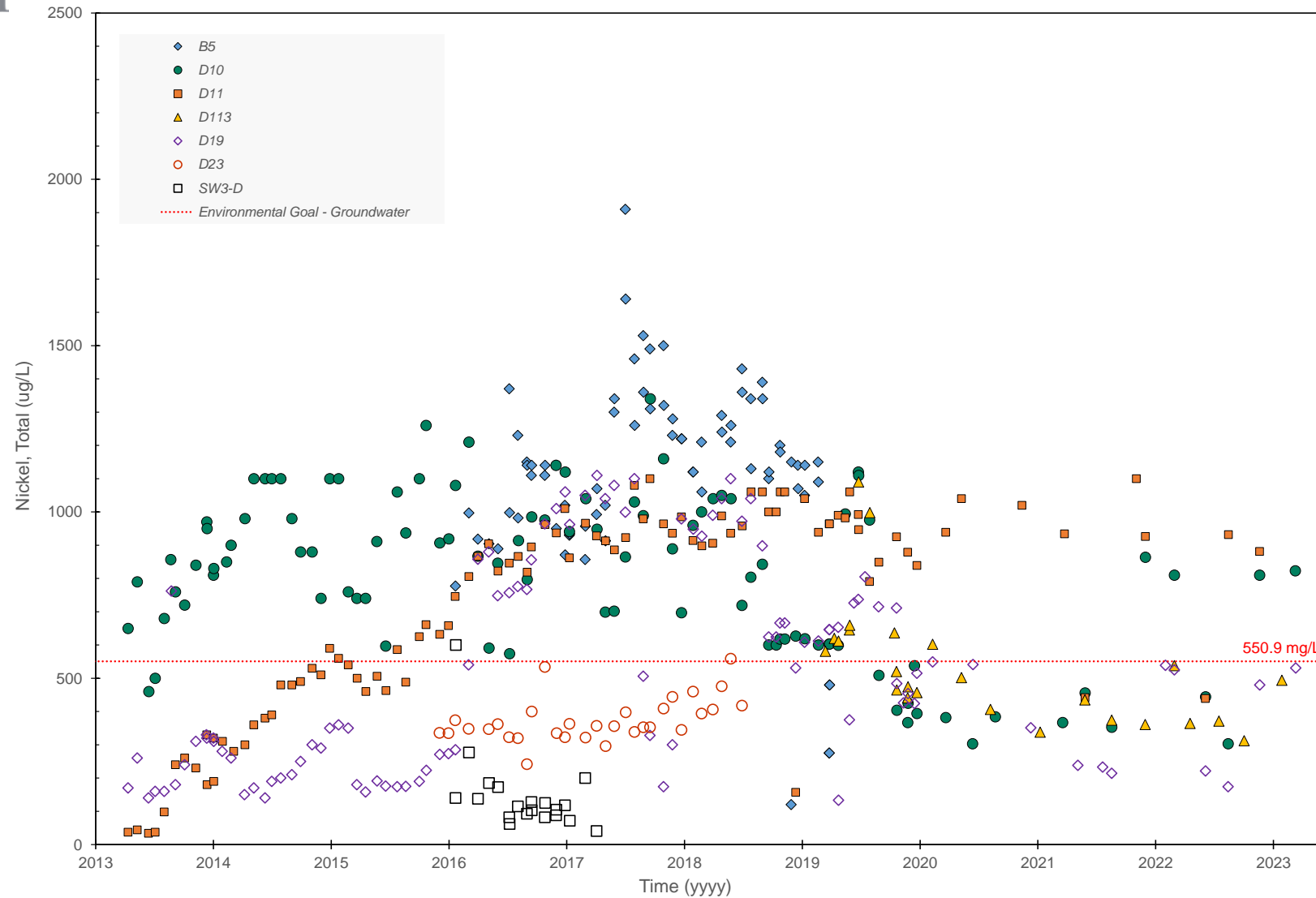
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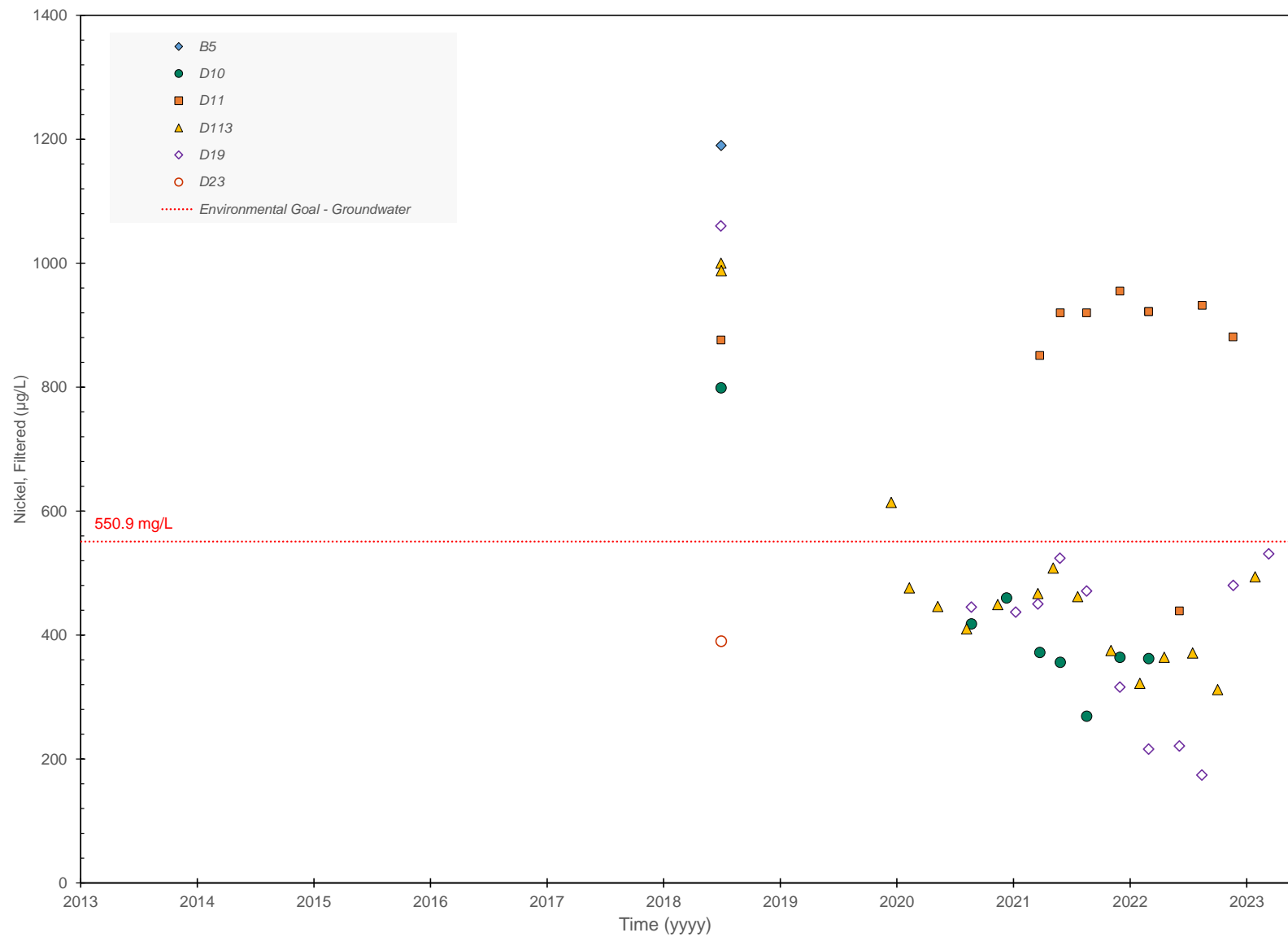


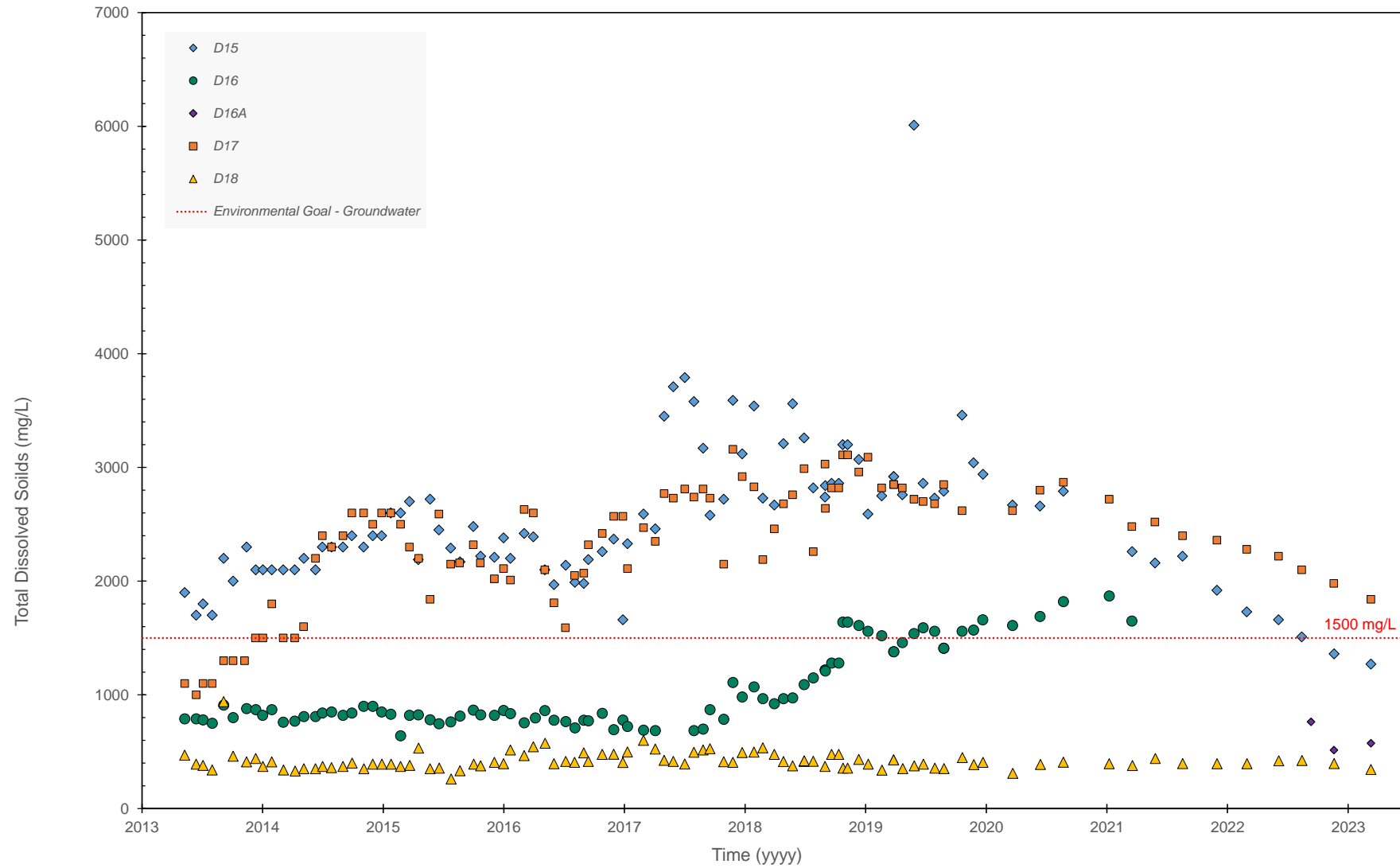
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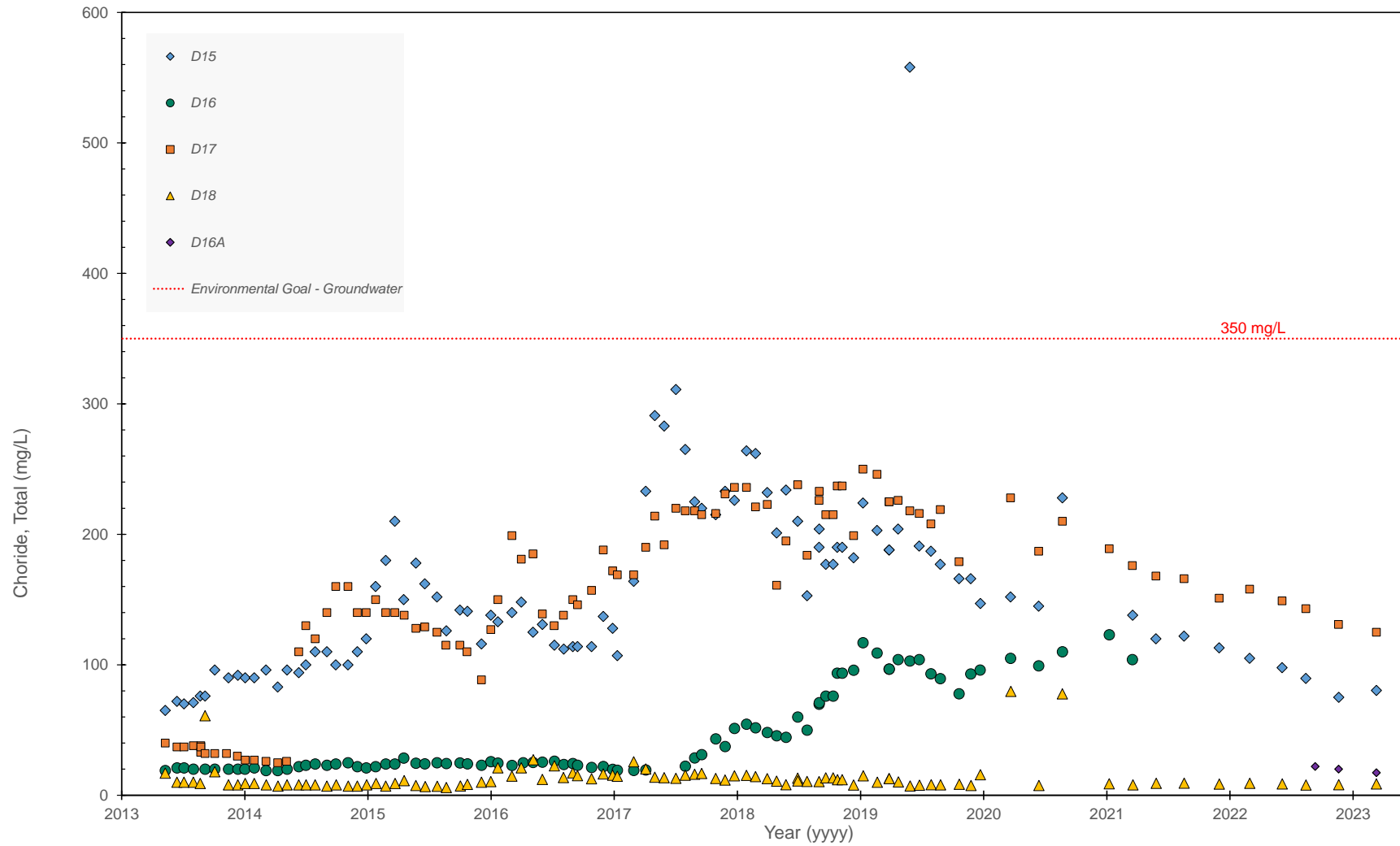


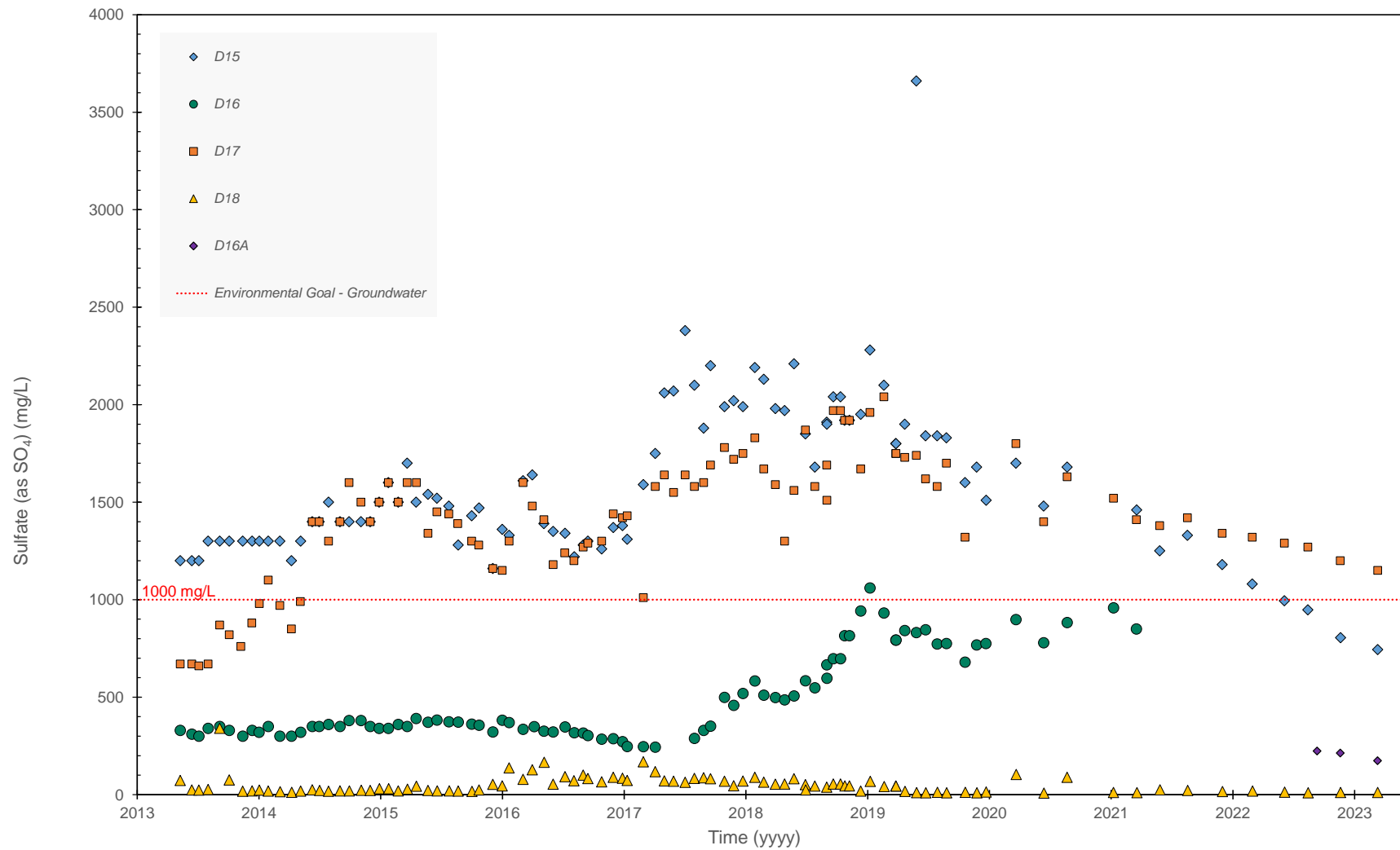


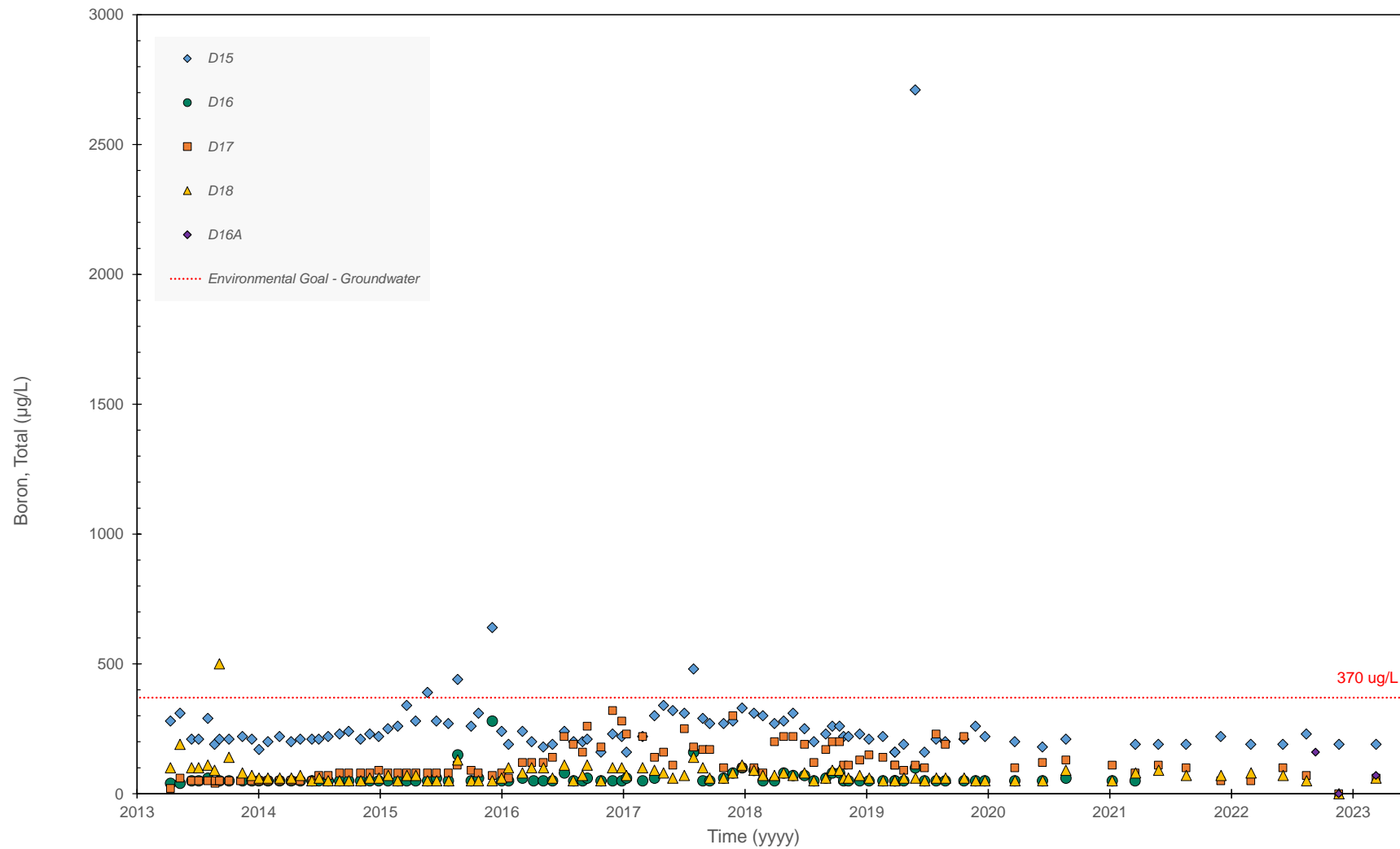


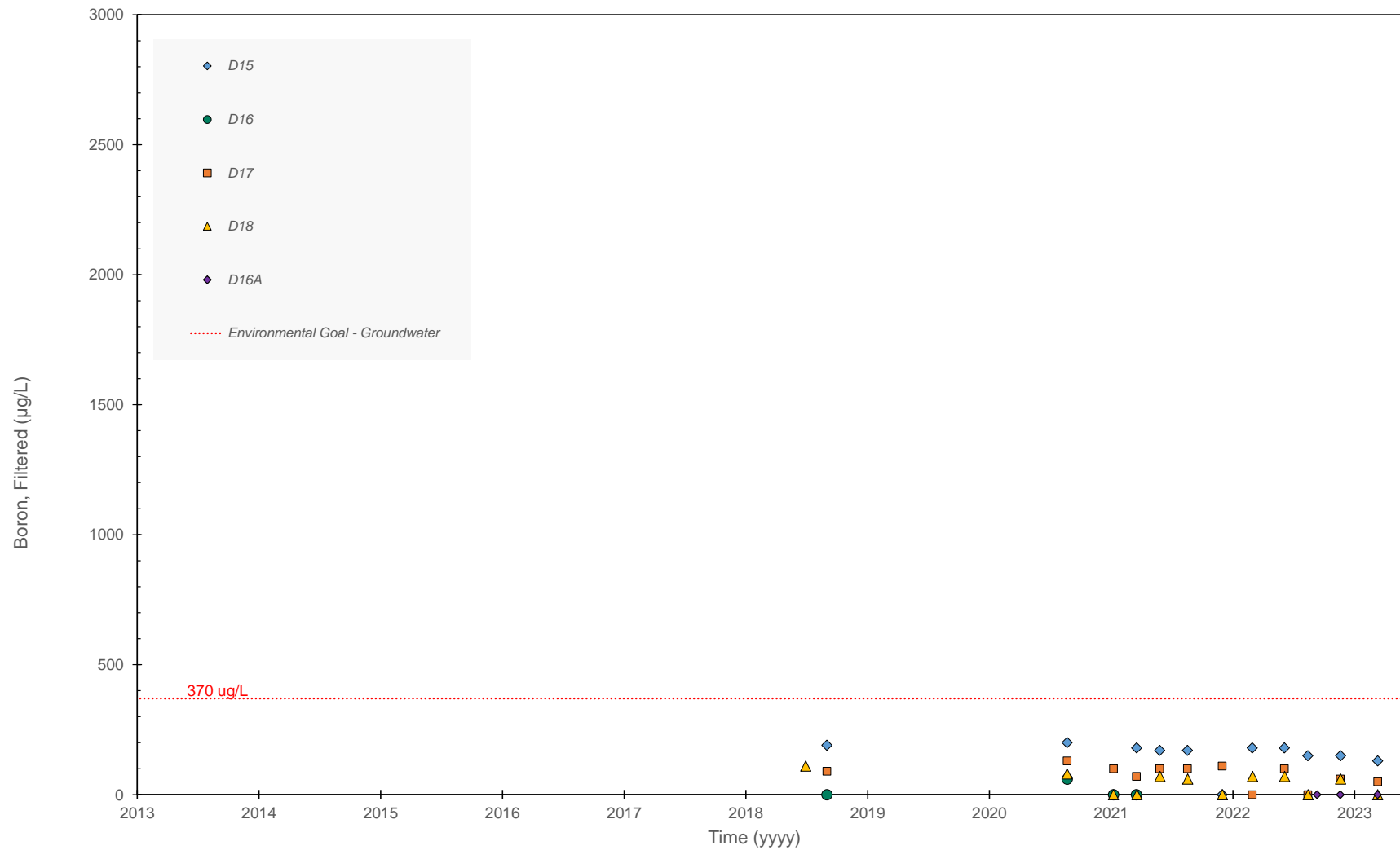


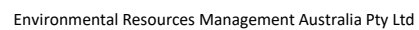


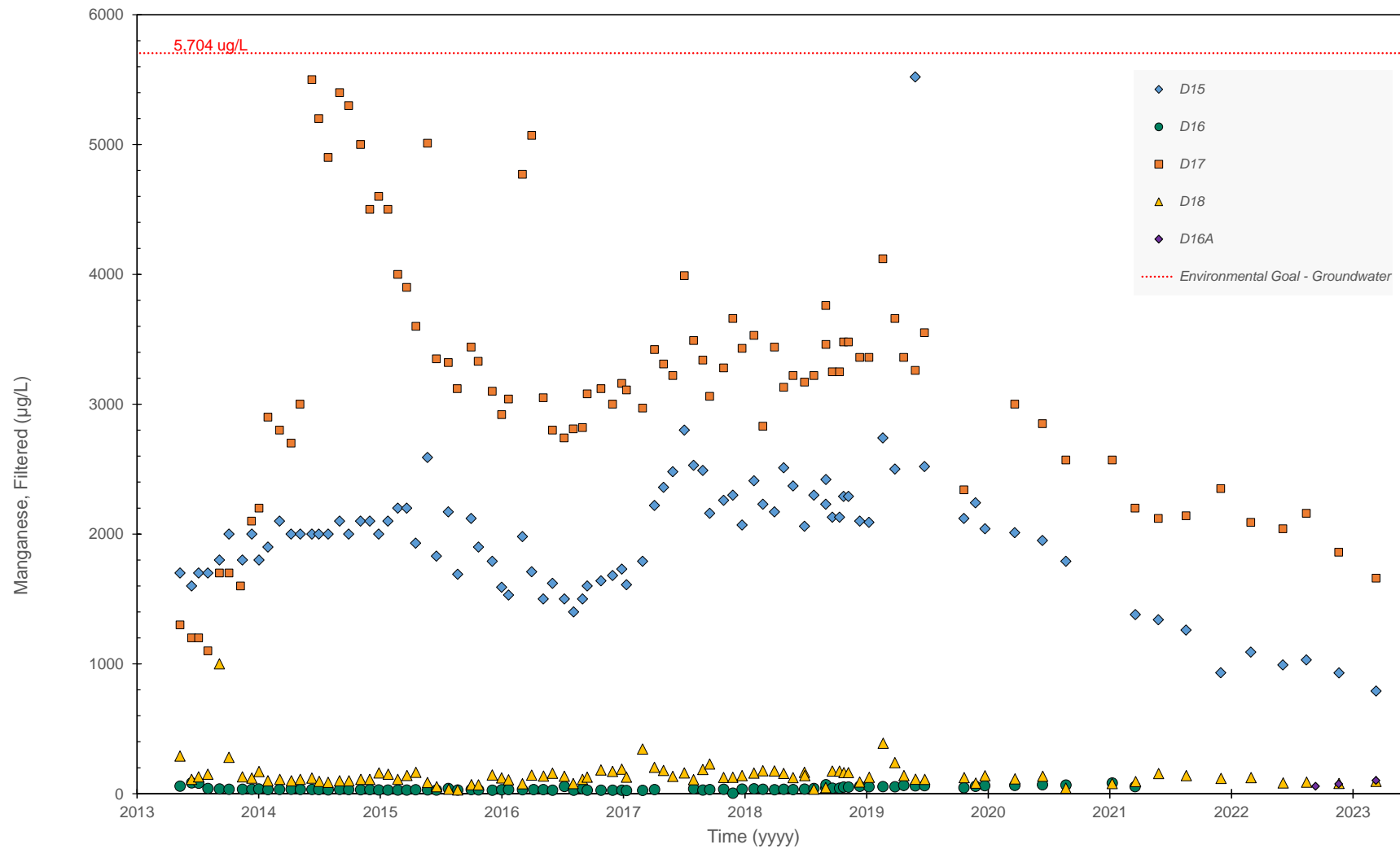


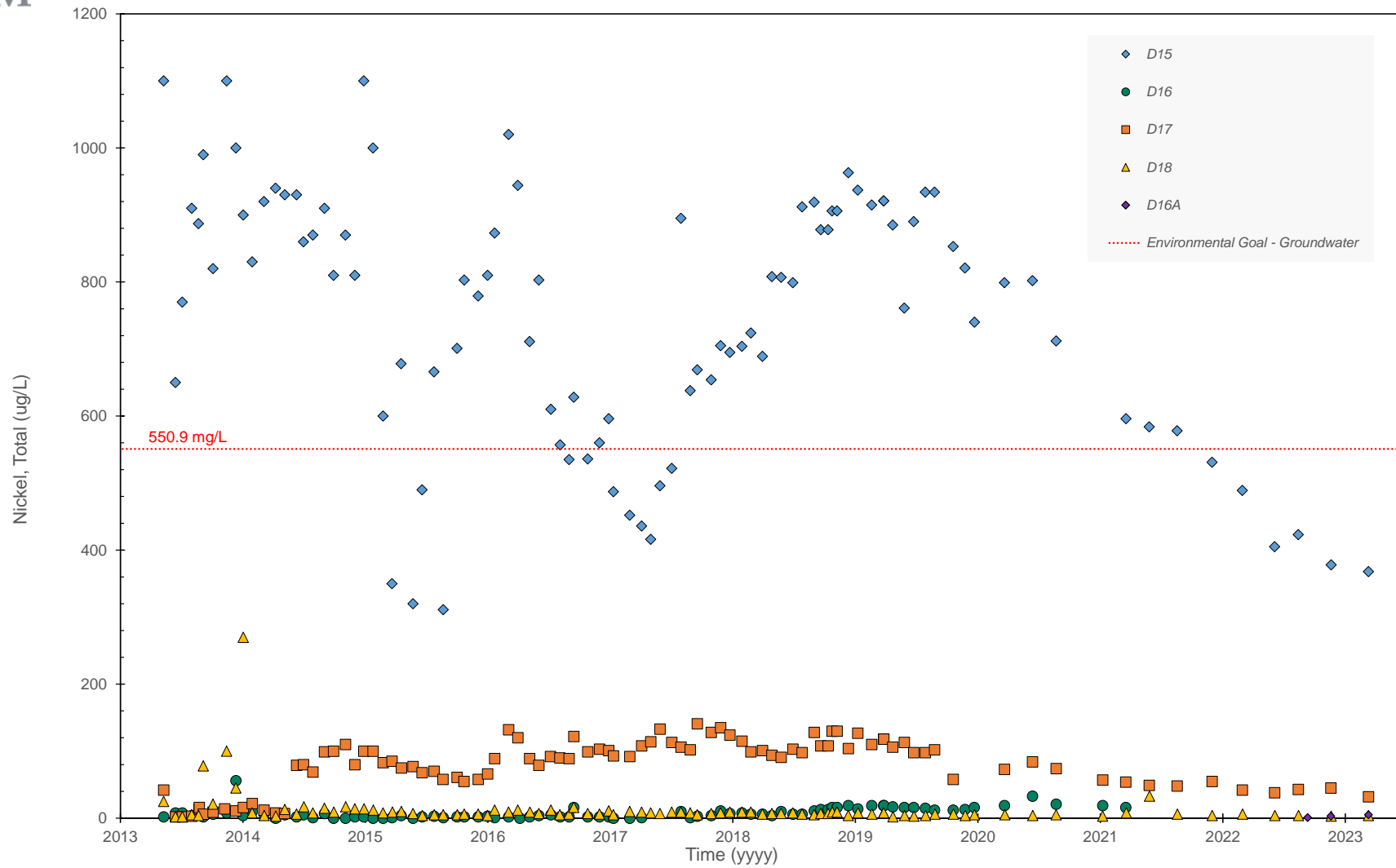


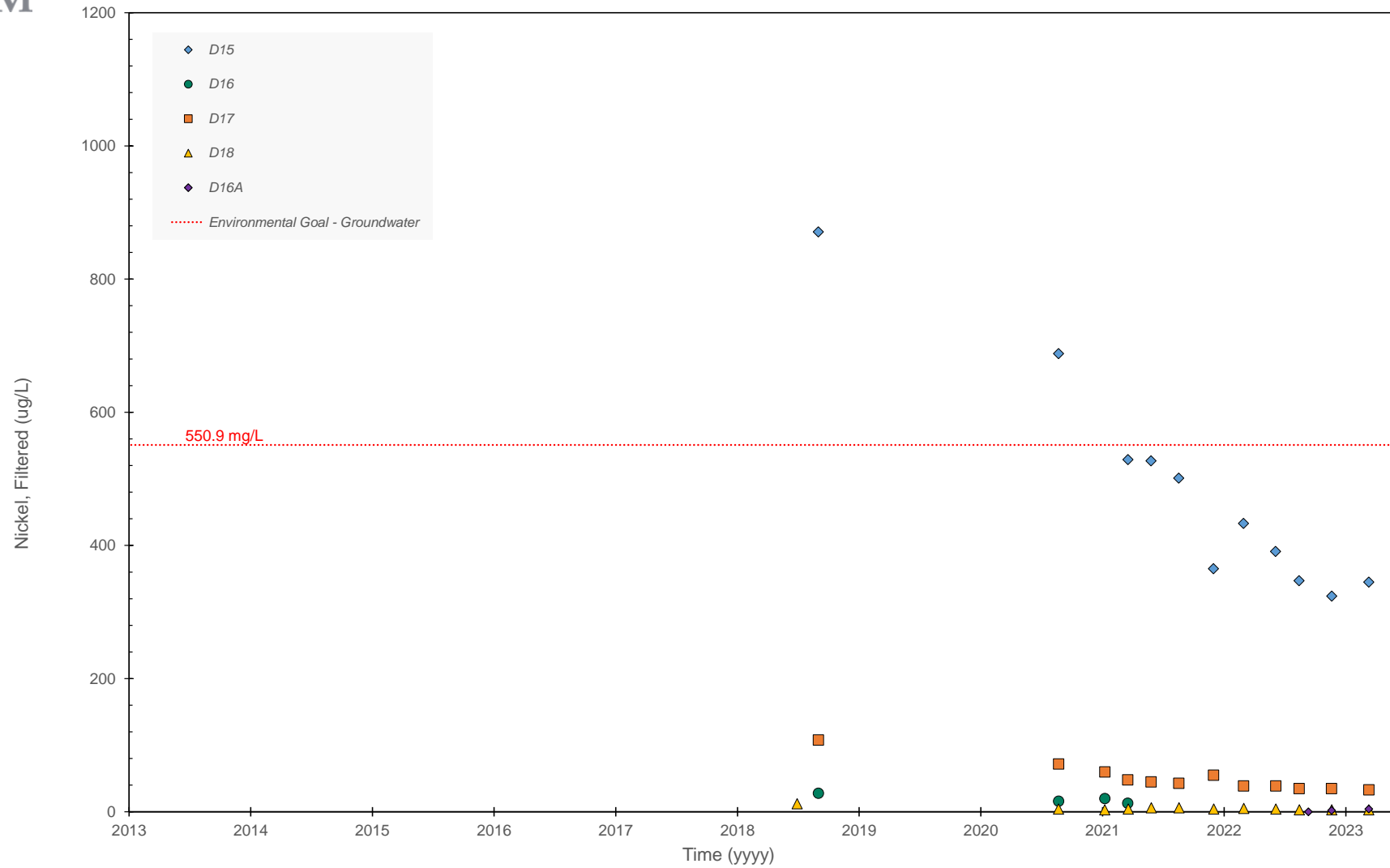


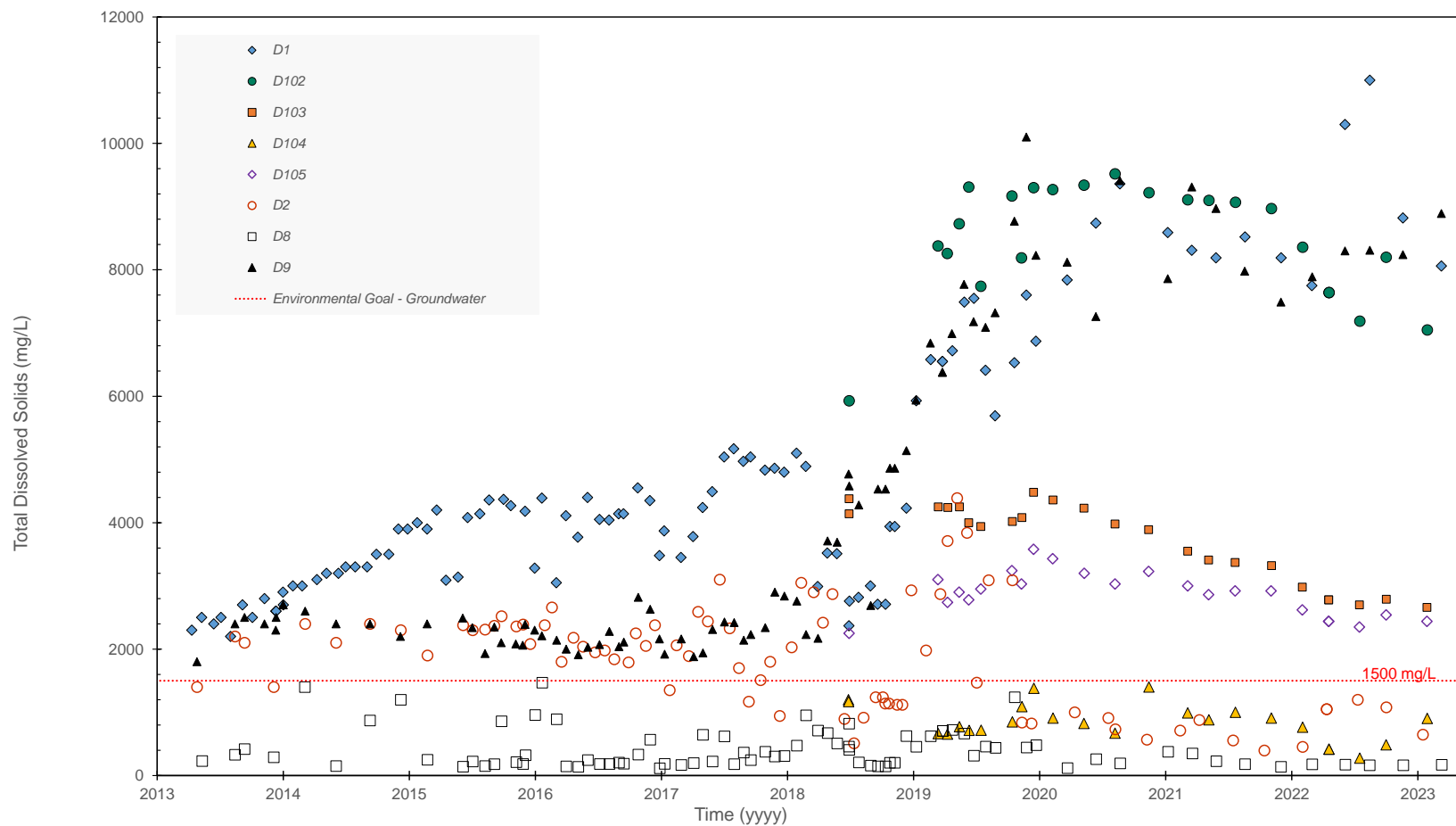


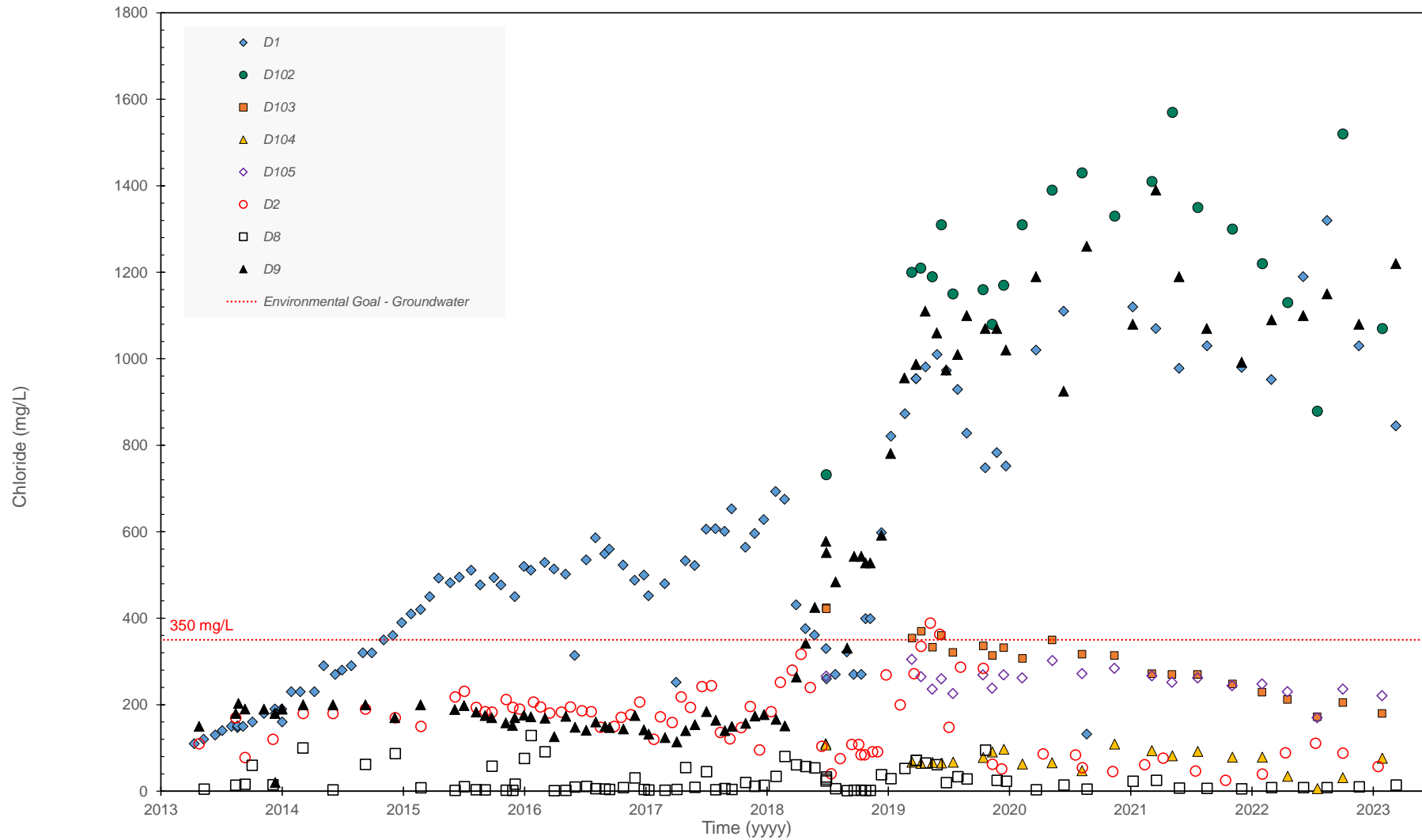


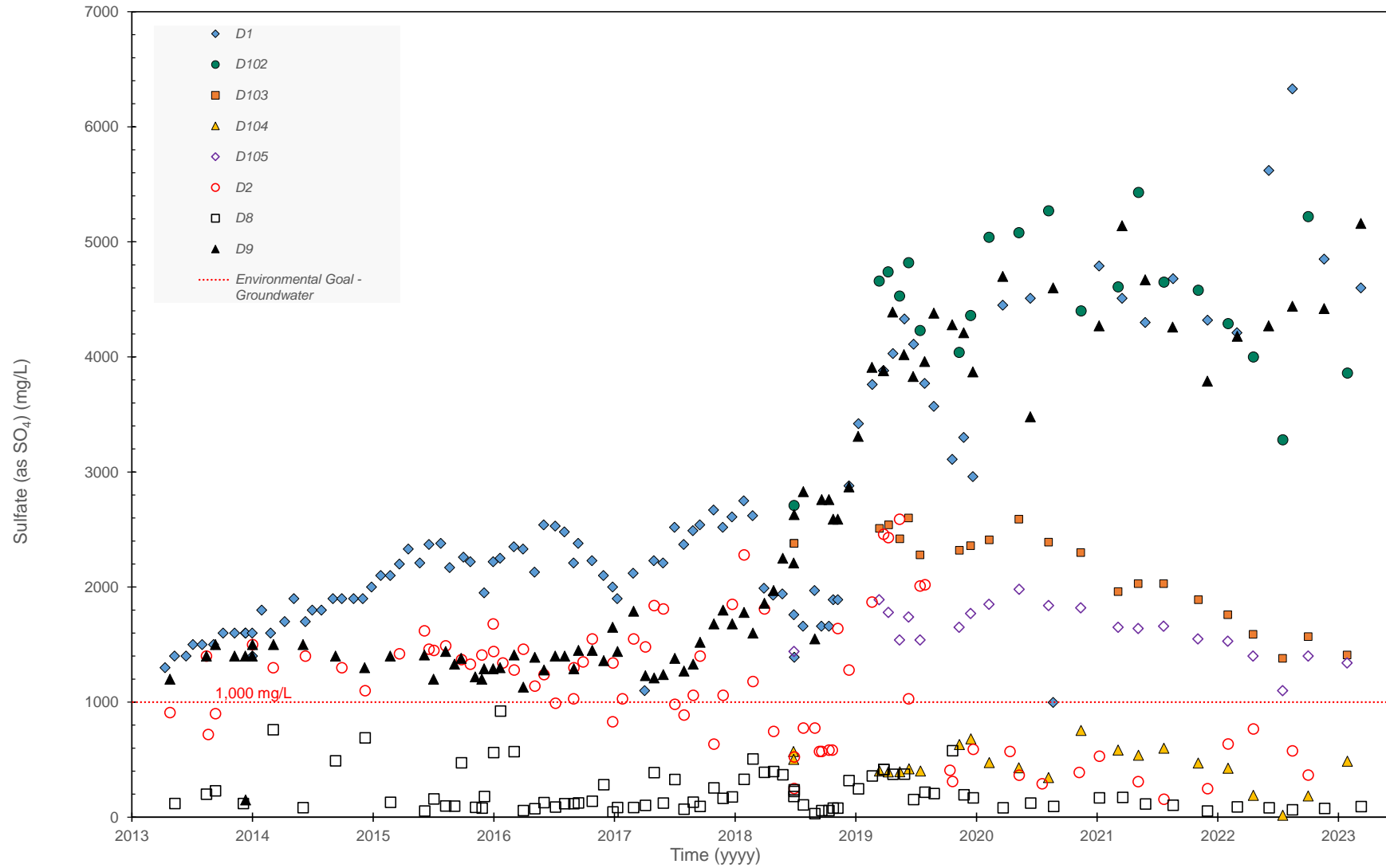


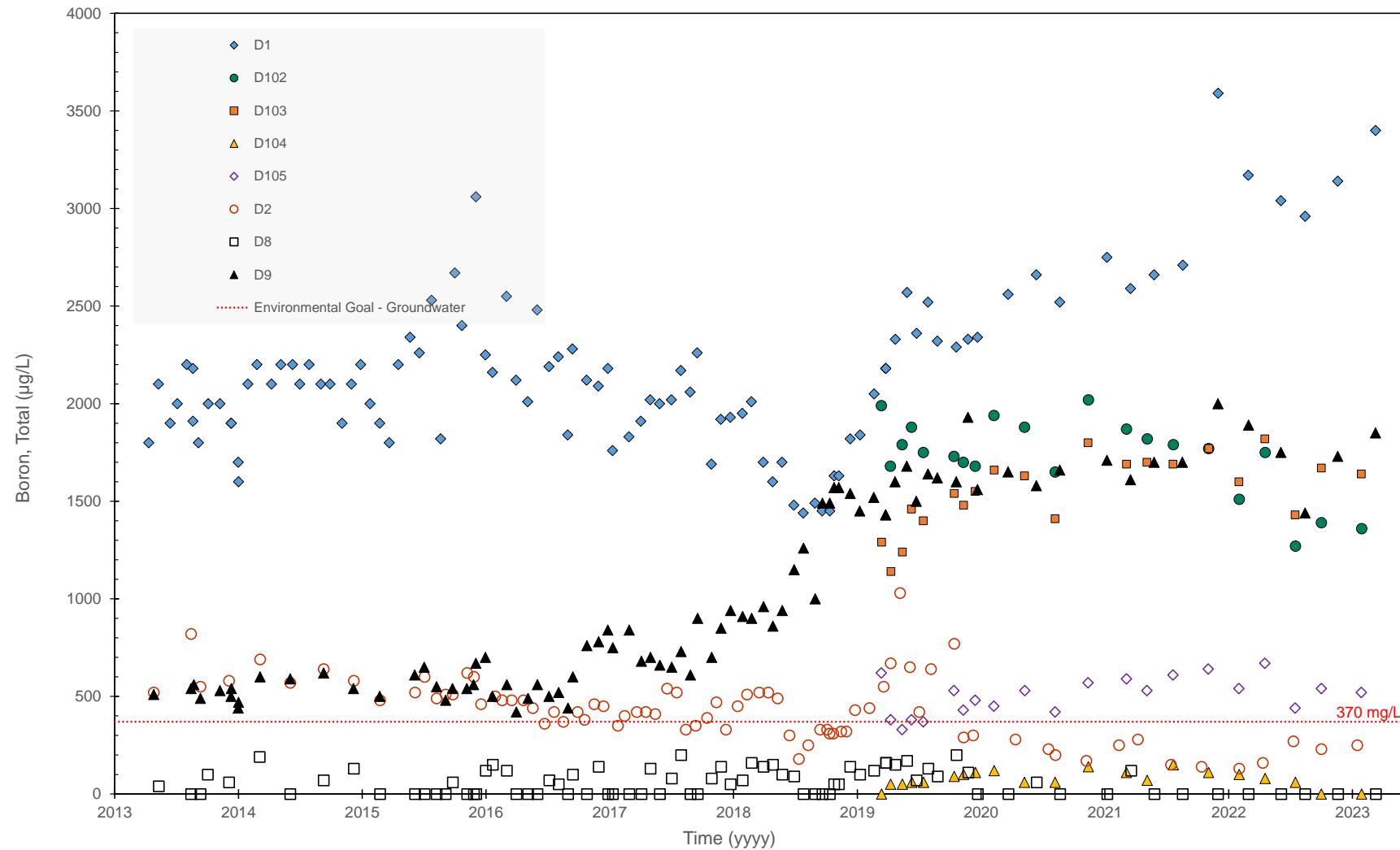


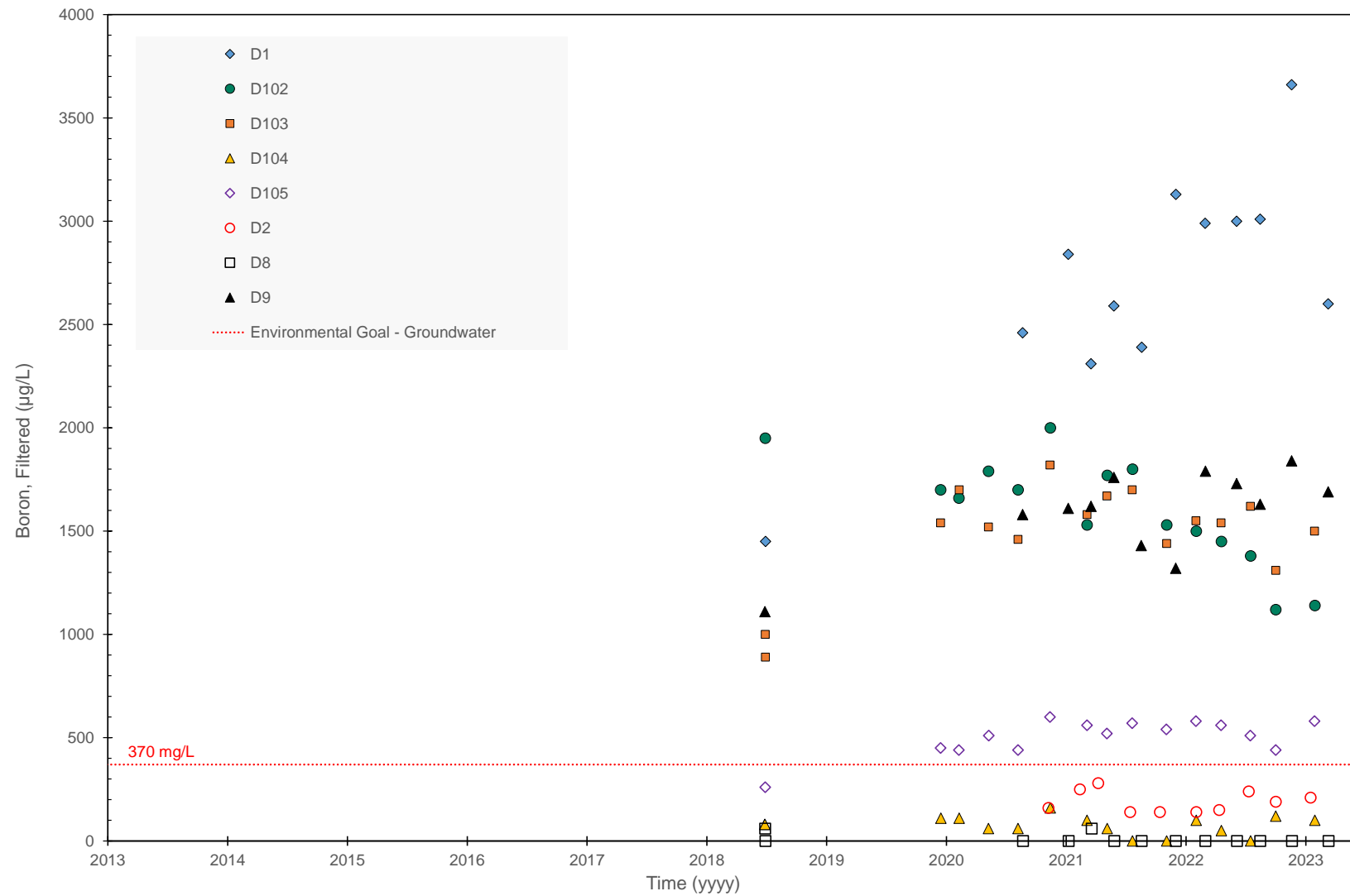


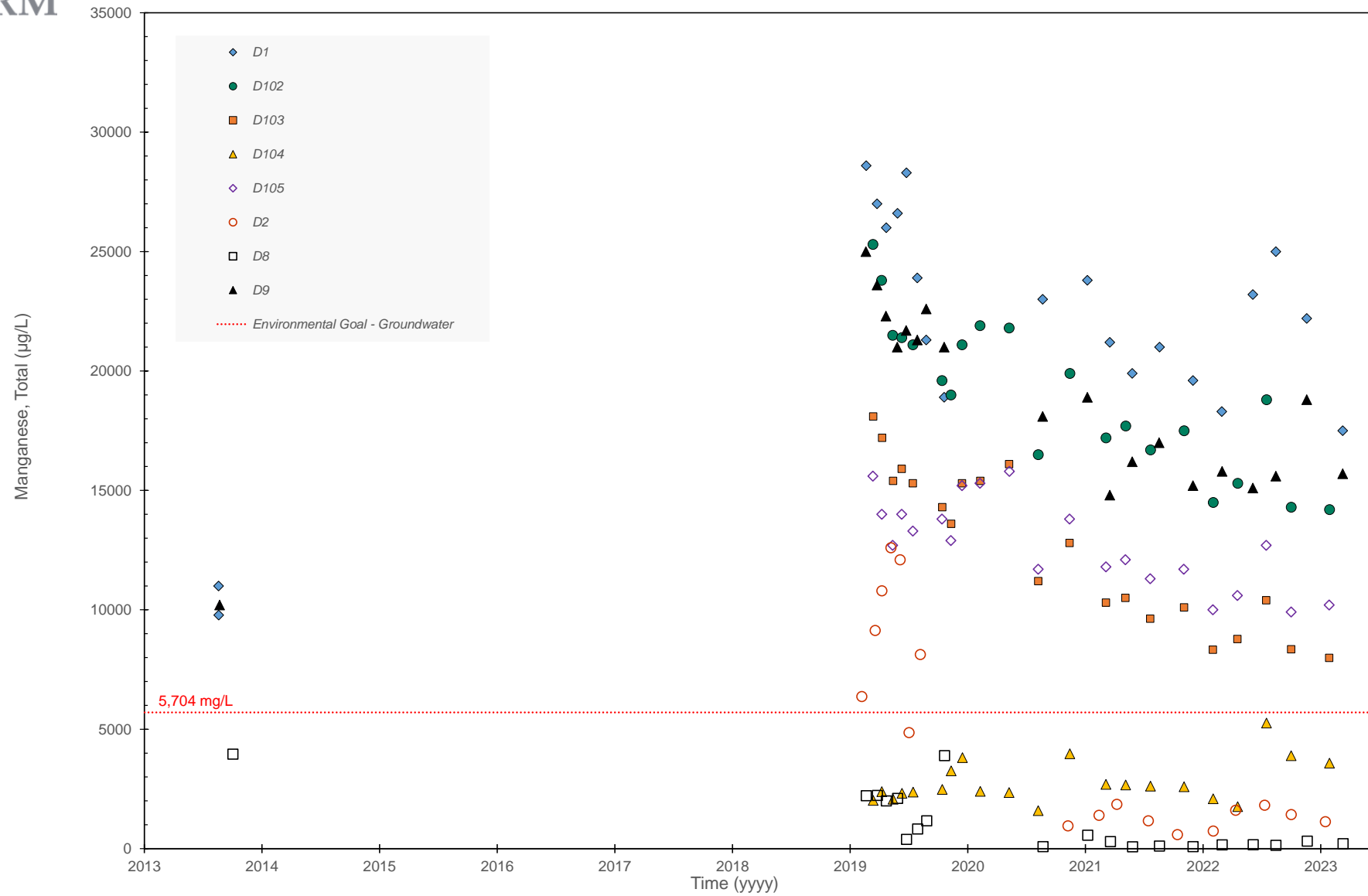


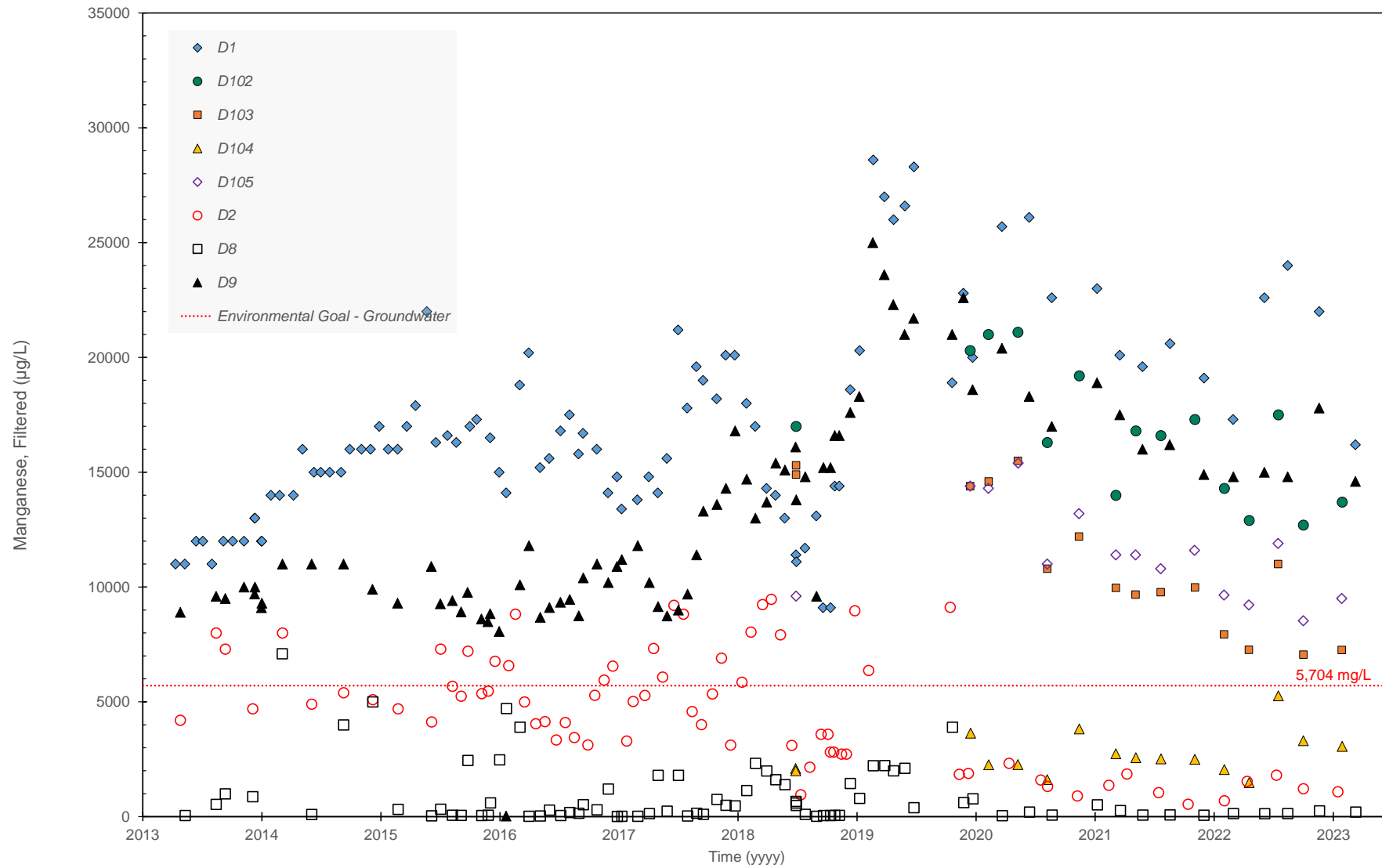


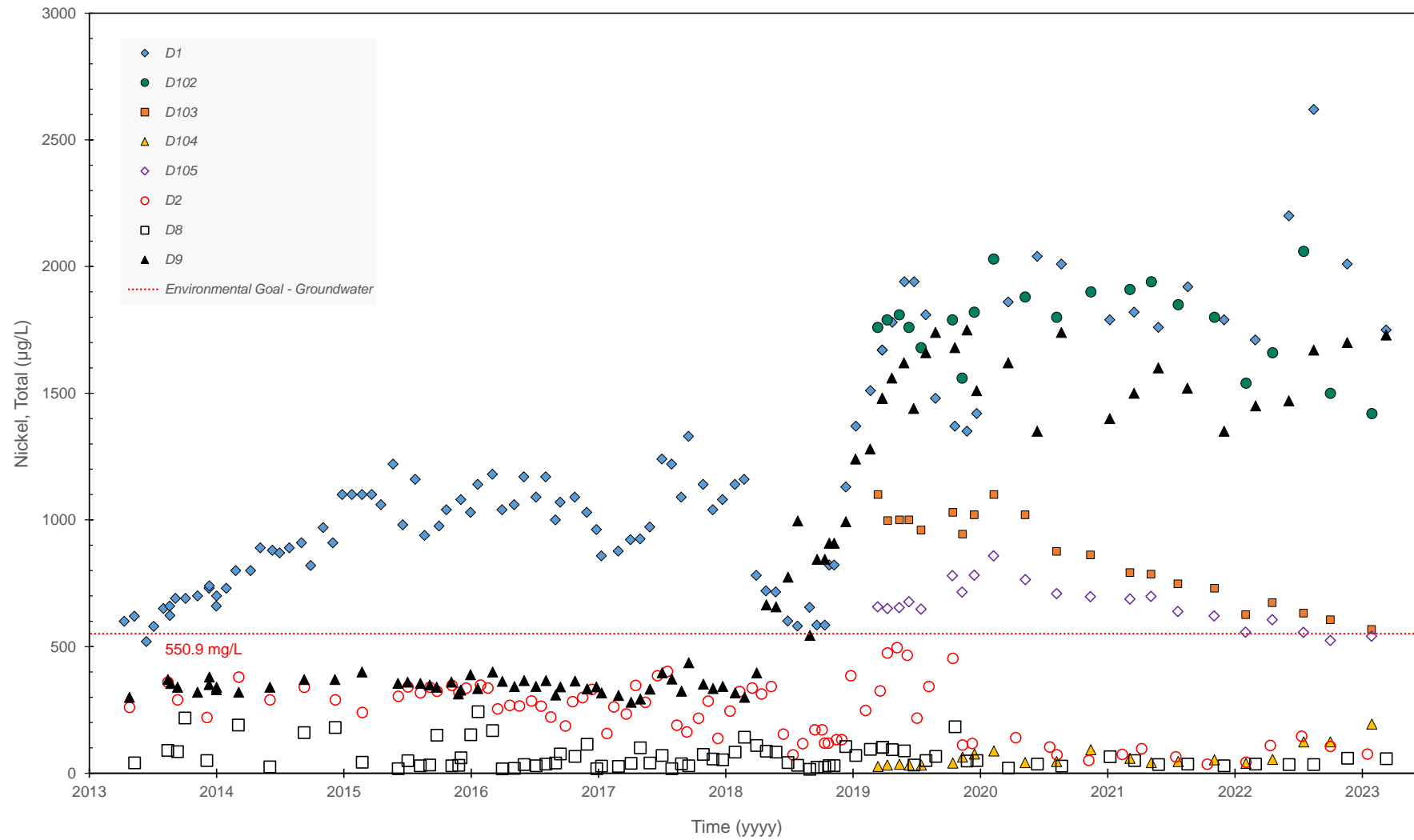


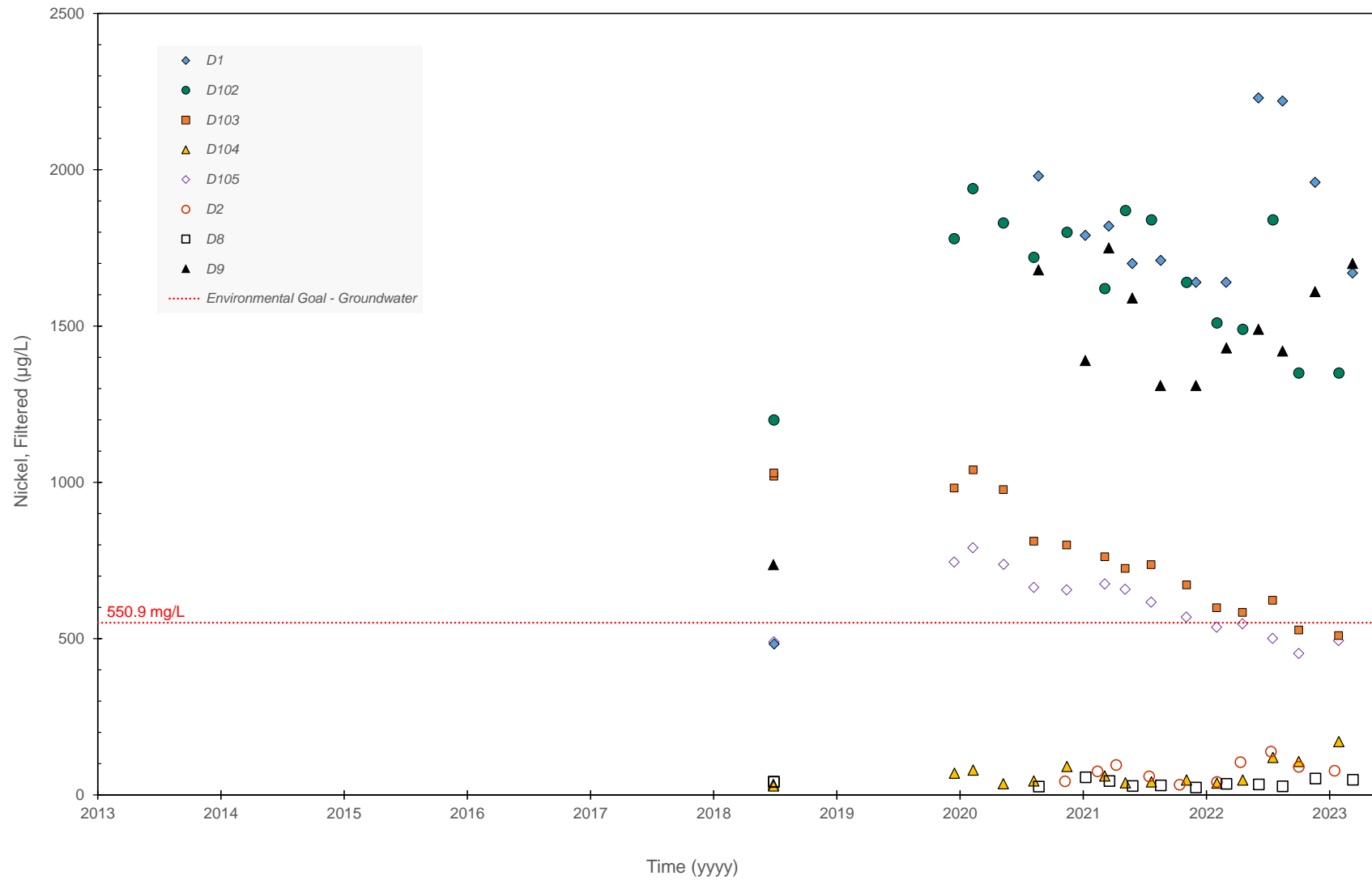


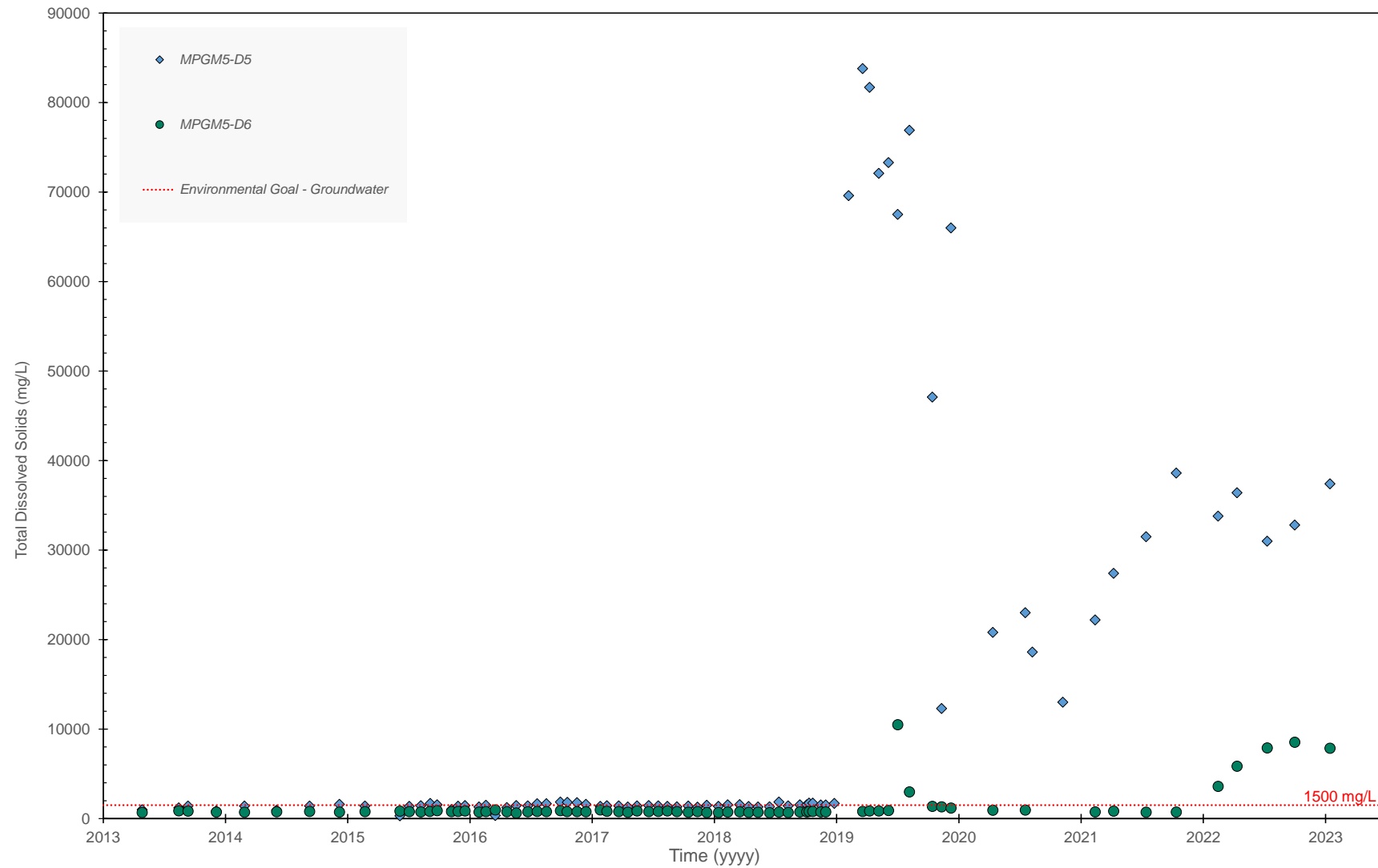


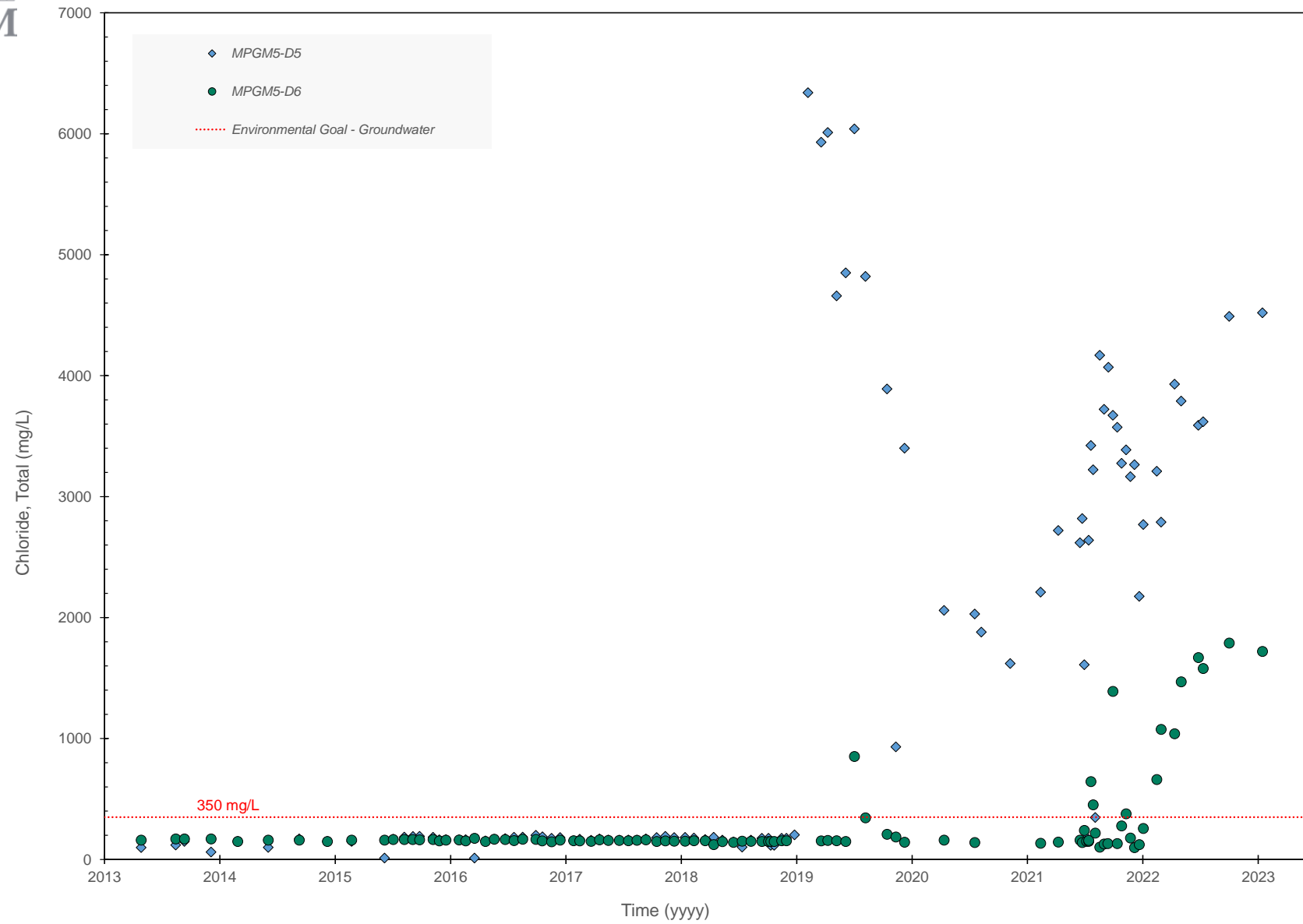


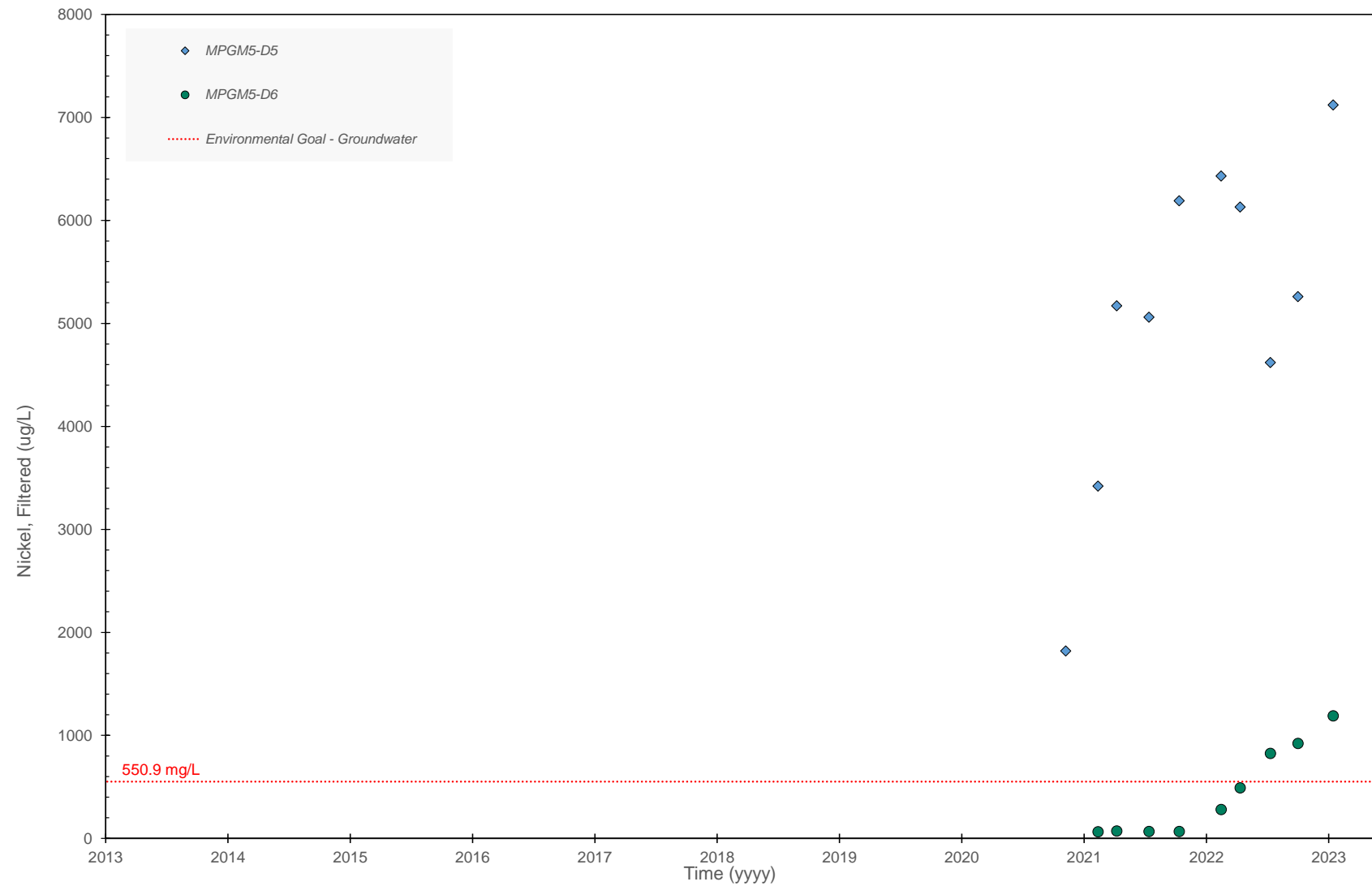


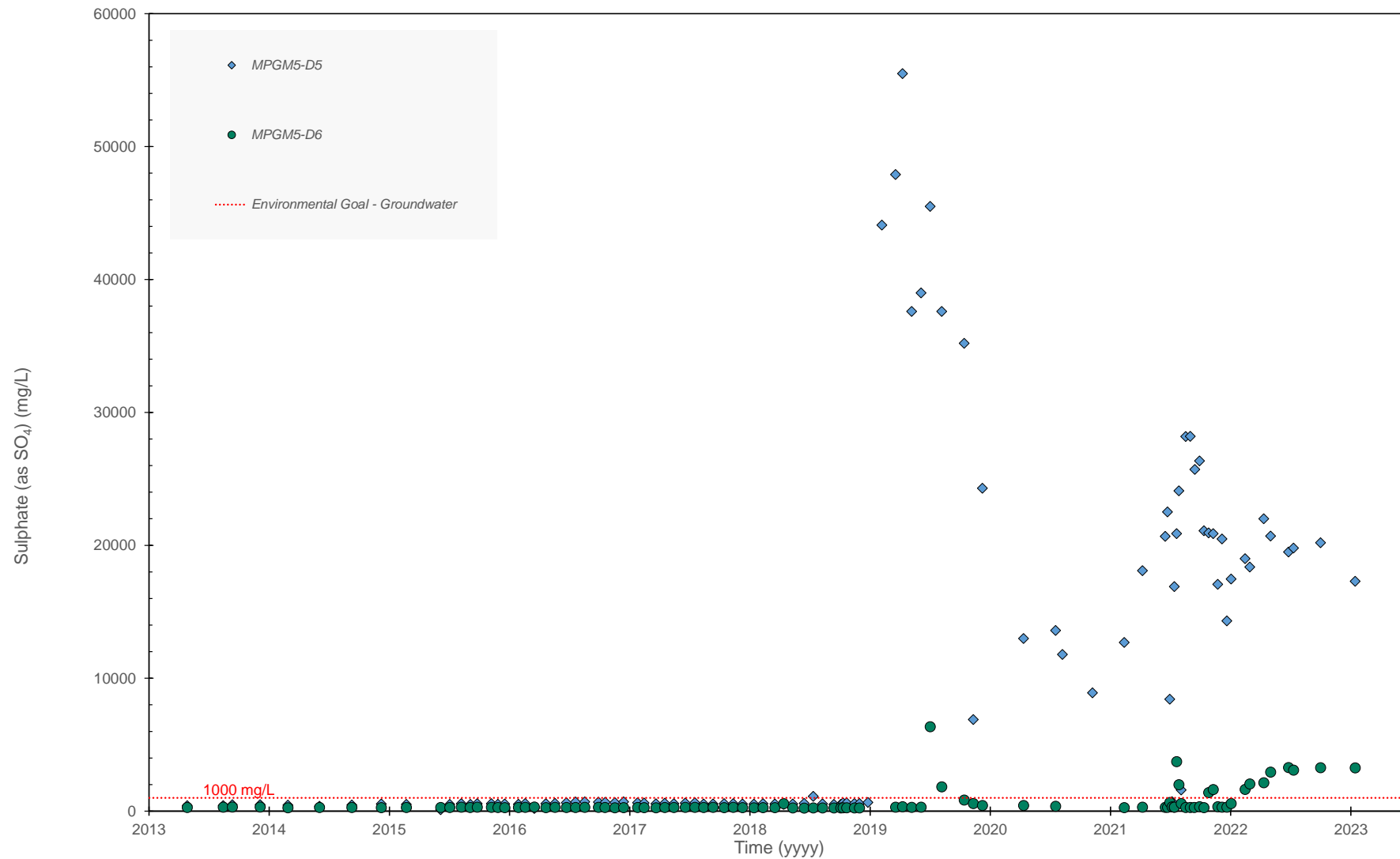


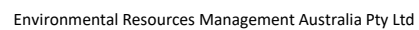


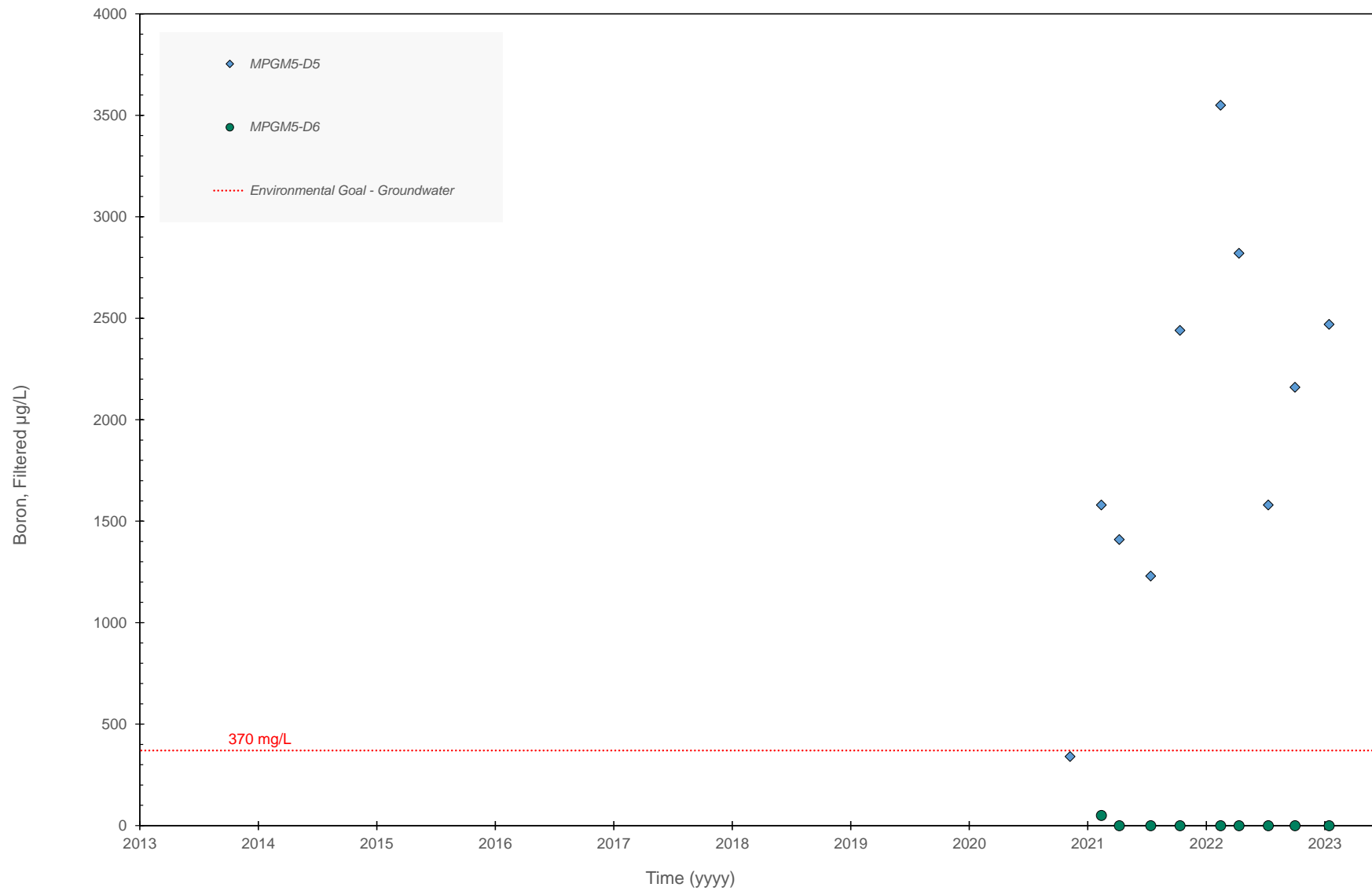


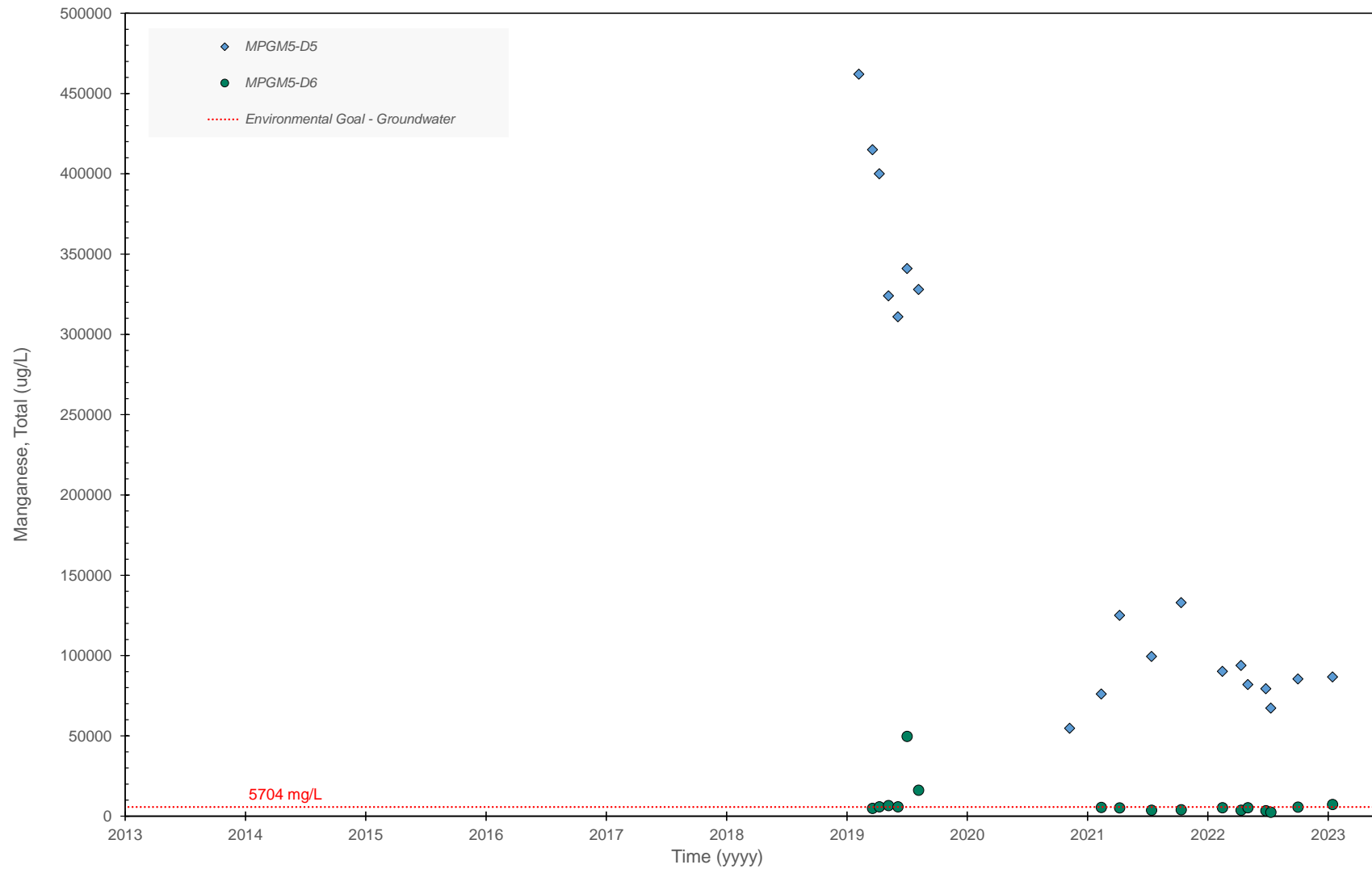


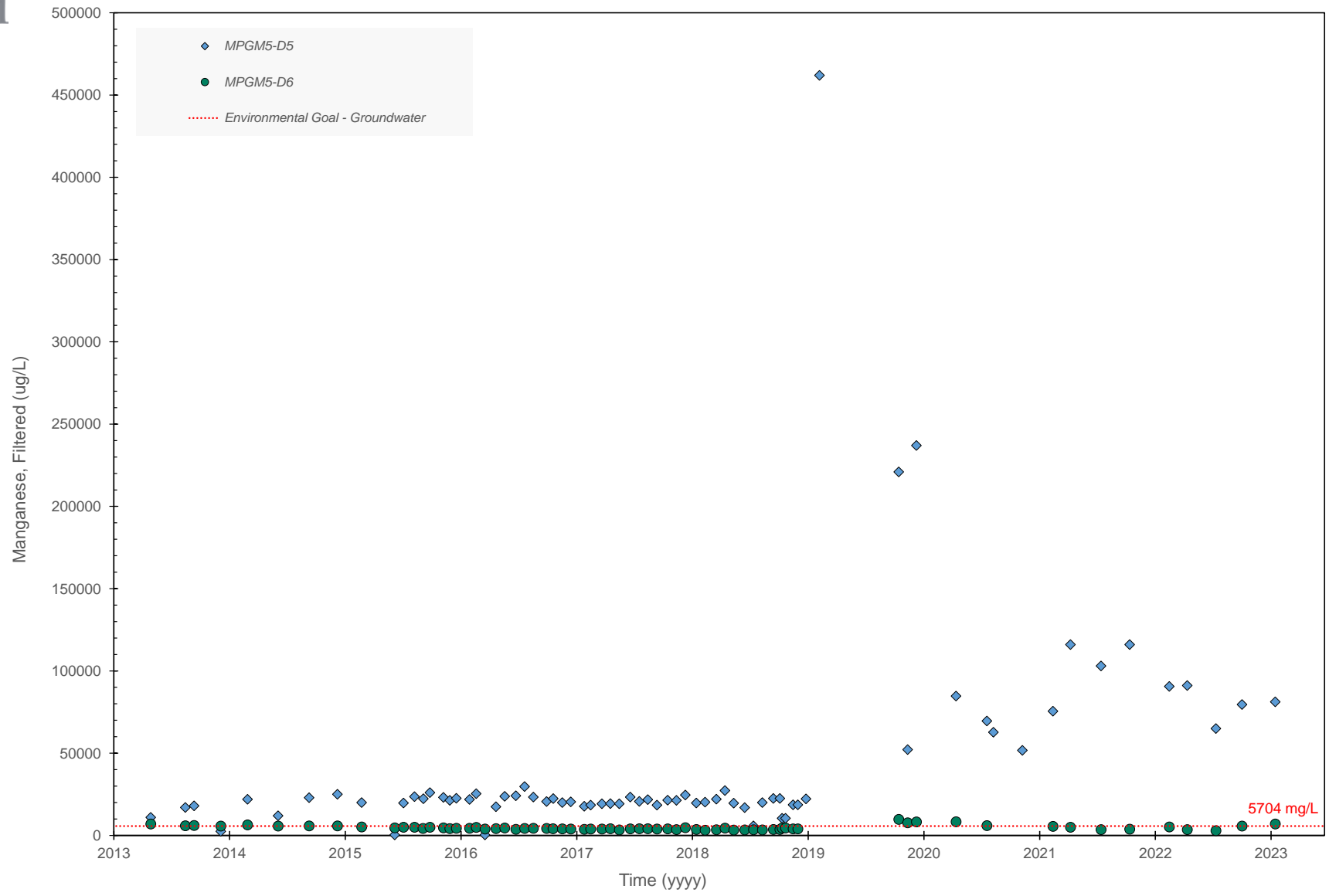


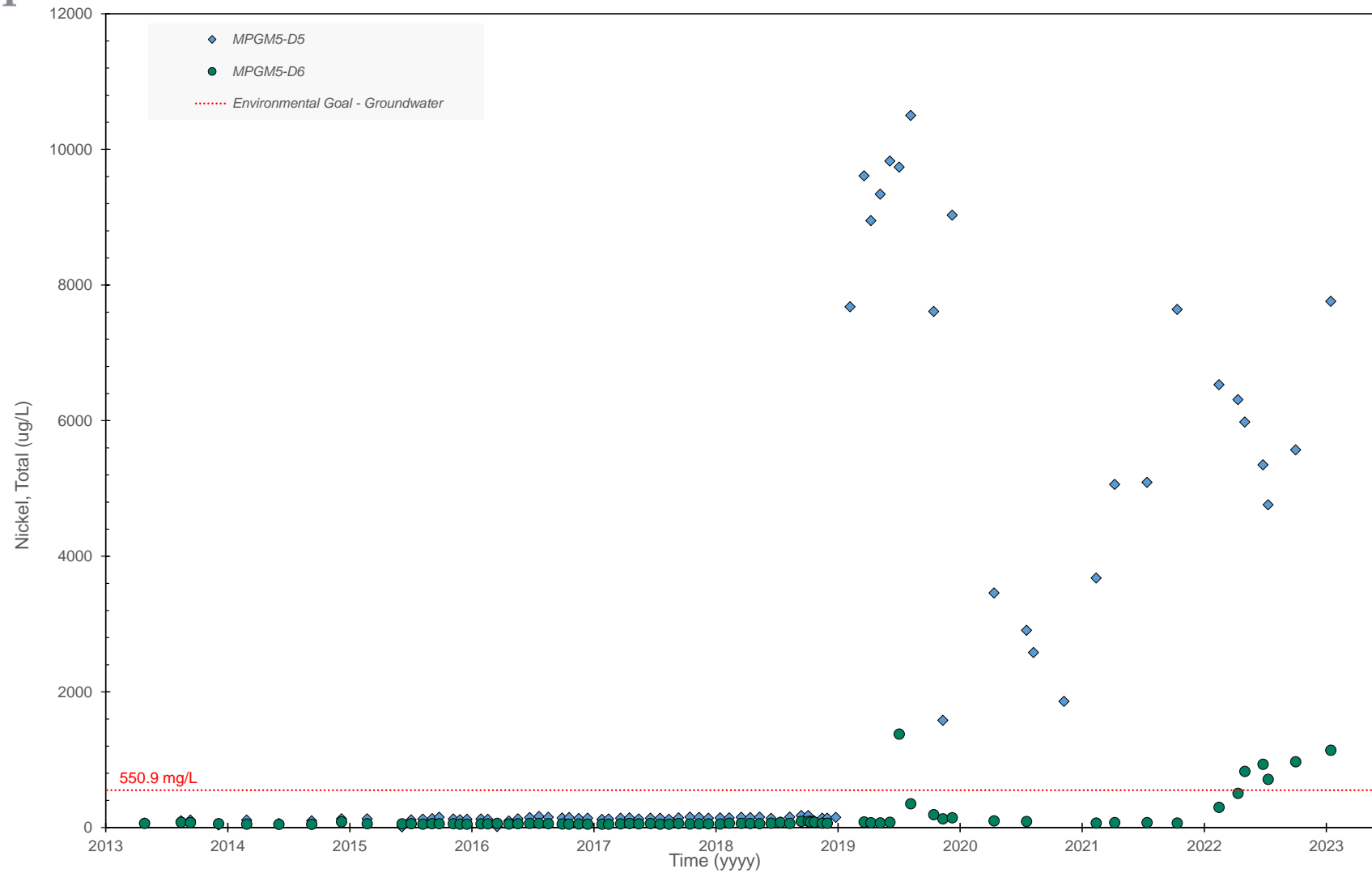








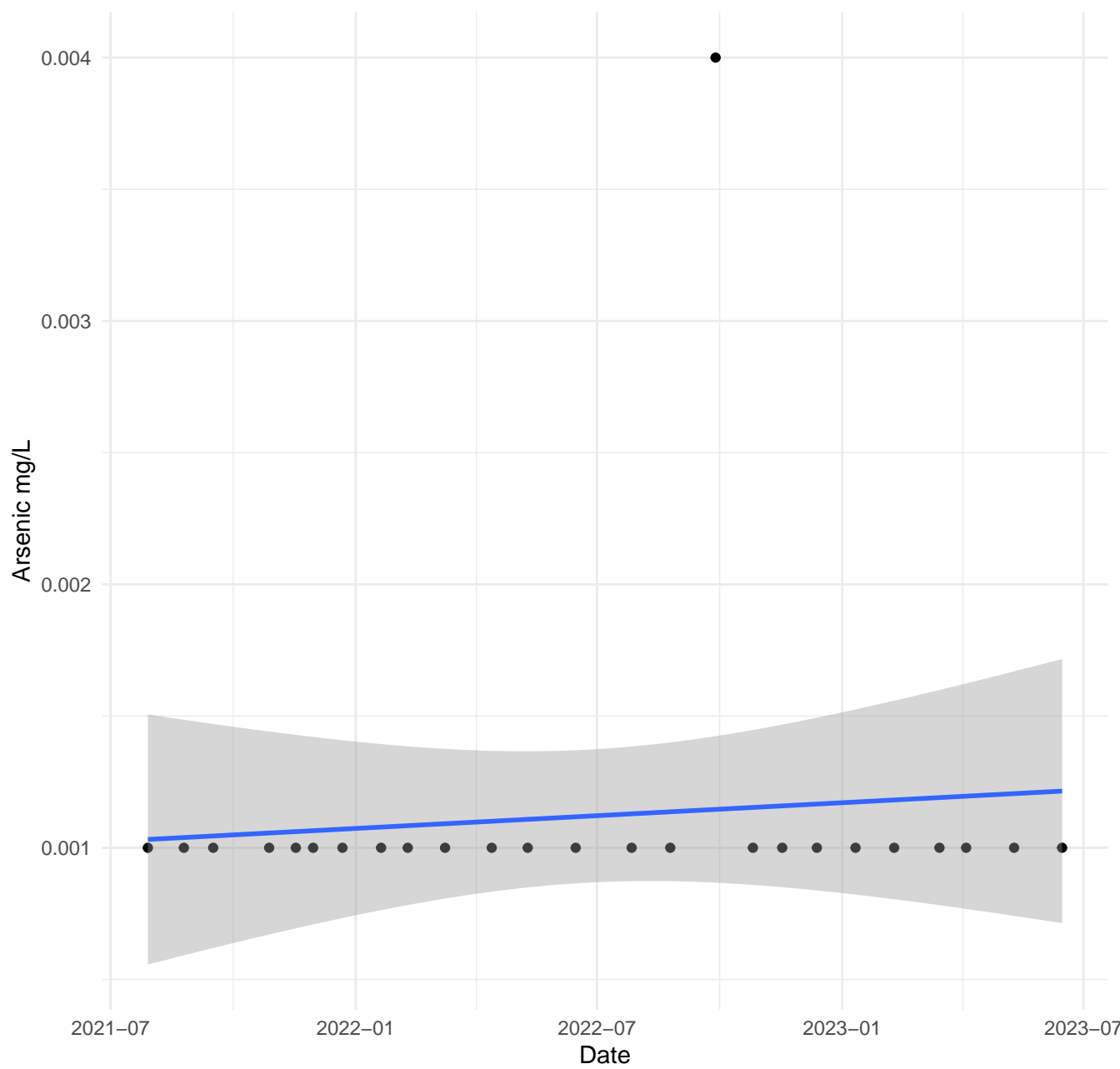




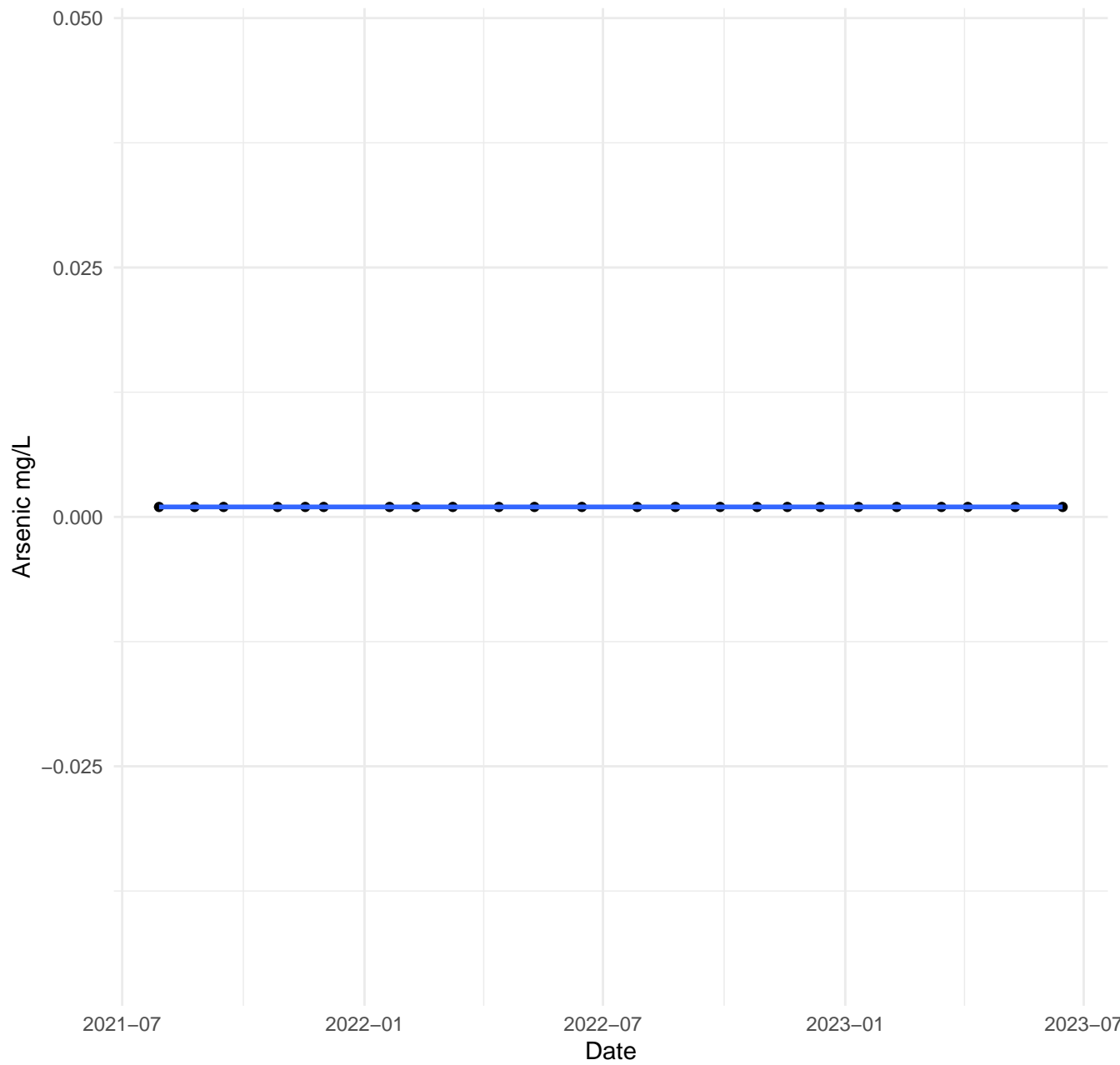
APPENDIX L SURFACE WATER STATISTICAL ANALYSIS

| Location | Stats | Arsenic | Boron | Cadmium | Chloride | Chromium | Copper | Fluoride | Iron | Lead | Manganese | Mercury | Molybdenum | Nickel | Selenium | Sulphate as SO ₄ | Zinc | Dissolved Solids, Total | Electrical Conductivity Field |
|----------|-------|---------|-------|---------|----------|----------|--------|----------|-------|-------|-----------|---------|------------|--------|----------|-----------------------------|-------|-------------------------|-------------------------------|
| C | R | 0.09 | 0.00 | 0.09 | 0.30 | 0.09 | -0.19 | -0.16 | -0.19 | -0.04 | 0.35 | -0.15 | 0.13 | 0.03 | 0.08 | 0.22 | -0.14 | 0.18 | 0.19 |
| | R2 | 0.01 | 0.00 | 0.01 | 0.09 | 0.01 | 0.04 | 0.03 | 0.04 | 0.00 | 0.13 | 0.02 | 0.02 | 0.00 | 0.01 | 0.05 | 0.02 | 0.03 | 0.04 |
| E | R | 0.00 | 0.61 | 0.00 | 0.61 | 0.09 | -0.03 | 0.07 | 0.55 | 0.05 | 0.69 | -0.15 | 0.05 | 0.58 | 0.01 | 0.62 | -0.19 | 0.62 | 0.60 |
| | R2 | 0.00 | 0.38 | 0.00 | 0.37 | 0.01 | 0.00 | 0.00 | 0.30 | 0.00 | 0.47 | 0.02 | 0.00 | 0.34 | 0.00 | 0.39 | 0.03 | 0.38 | 0.36 |
| G | R | 0.00 | 0.56 | 0.00 | 0.58 | 0.09 | -0.12 | 0.18 | -0.16 | -0.01 | 0.50 | 0.00 | 0.00 | 0.63 | 0.01 | 0.58 | 0.06 | 0.53 | 0.56 |
| | R2 | 0.00 | 0.32 | 0.00 | 0.34 | 0.01 | 0.01 | 0.03 | 0.02 | 0.00 | 0.25 | 0.00 | 0.00 | 0.40 | 0.00 | 0.34 | 0.00 | 0.28 | 0.32 |
| LDP01 | R | 0.16 | 0.41 | 0.00 | 0.22 | 0.04 | 0.12 | 0.05 | 0.15 | 0.10 | 0.19 | -0.21 | 0.21 | 0.34 | 0.00 | 0.18 | 0.23 | 0.52 | -0.35 |
| | R2 | 0.03 | 0.17 | 0.00 | 0.05 | 0.00 | 0.01 | 0.00 | 0.02 | 0.01 | 0.04 | 0.04 | 0.04 | 0.11 | 0.00 | 0.03 | 0.05 | 0.27 | 0.13 |
| LMP01 | R | -0.02 | 0.43 | -0.02 | 0.06 | -0.02 | -0.20 | -0.13 | 0.01 | -0.10 | 0.28 | -0.23 | 0.01 | 0.03 | -0.51 | 0.10 | -0.09 | 0.06 | 0.12 |
| | R2 | 0.00 | 0.18 | 0.00 | 0.00 | 0.00 | 0.04 | 0.02 | 0.00 | 0.01 | 0.08 | 0.05 | 0.00 | 0.00 | 0.26 | 0.01 | 0.01 | 0.00 | 0.01 |
| NC01 | R | 0.09 | -0.26 | 0.09 | 0.34 | 0.17 | 0.02 | 0.58 | 0.63 | 0.66 | 0.09 | 0.03 | 0.54 | 0.28 | 0.36 | -0.04 | 0.11 | 0.52 | 0.12 |
| | R2 | 0.01 | 0.07 | 0.01 | 0.12 | 0.03 | 0.00 | 0.34 | 0.40 | 0.44 | 0.01 | 0.00 | 0.29 | 0.08 | 0.13 | 0.00 | 0.01 | 0.27 | 0.01 |
| WX22 | R | 0.09 | 0.57 | 0.00 | 0.59 | 0.03 | 0.11 | 0.14 | 0.12 | 0.06 | 0.48 | 0.14 | 0.16 | 0.63 | 0.01 | 0.59 | 0.22 | 0.55 | 0.57 |
| | R2 | 0.01 | 0.32 | 0.00 | 0.34 | 0.00 | 0.01 | 0.02 | 0.01 | 0.00 | 0.23 | 0.02 | 0.03 | 0.39 | 0.00 | 0.35 | 0.05 | 0.30 | 0.32 |

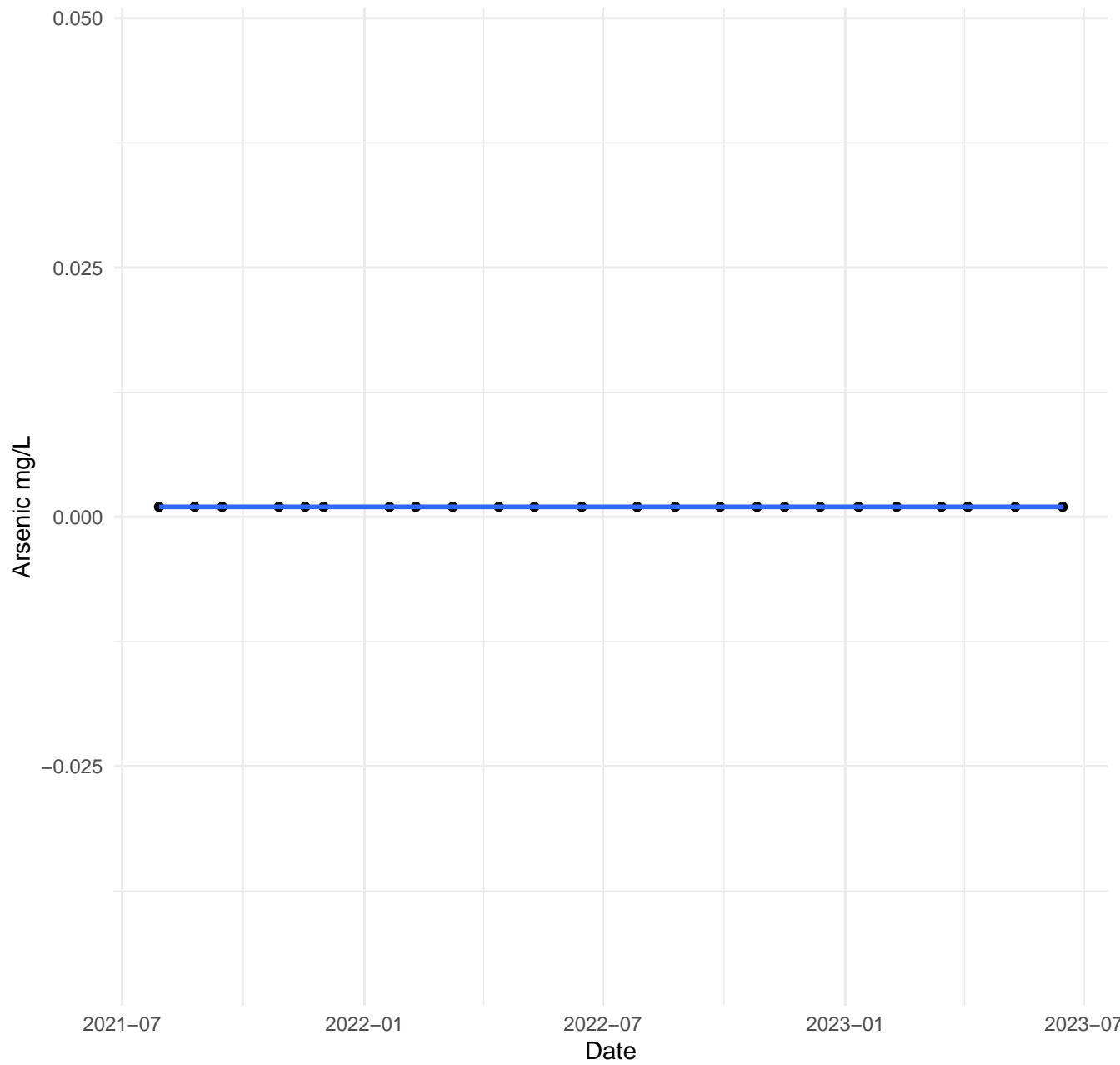
Arsenic at C



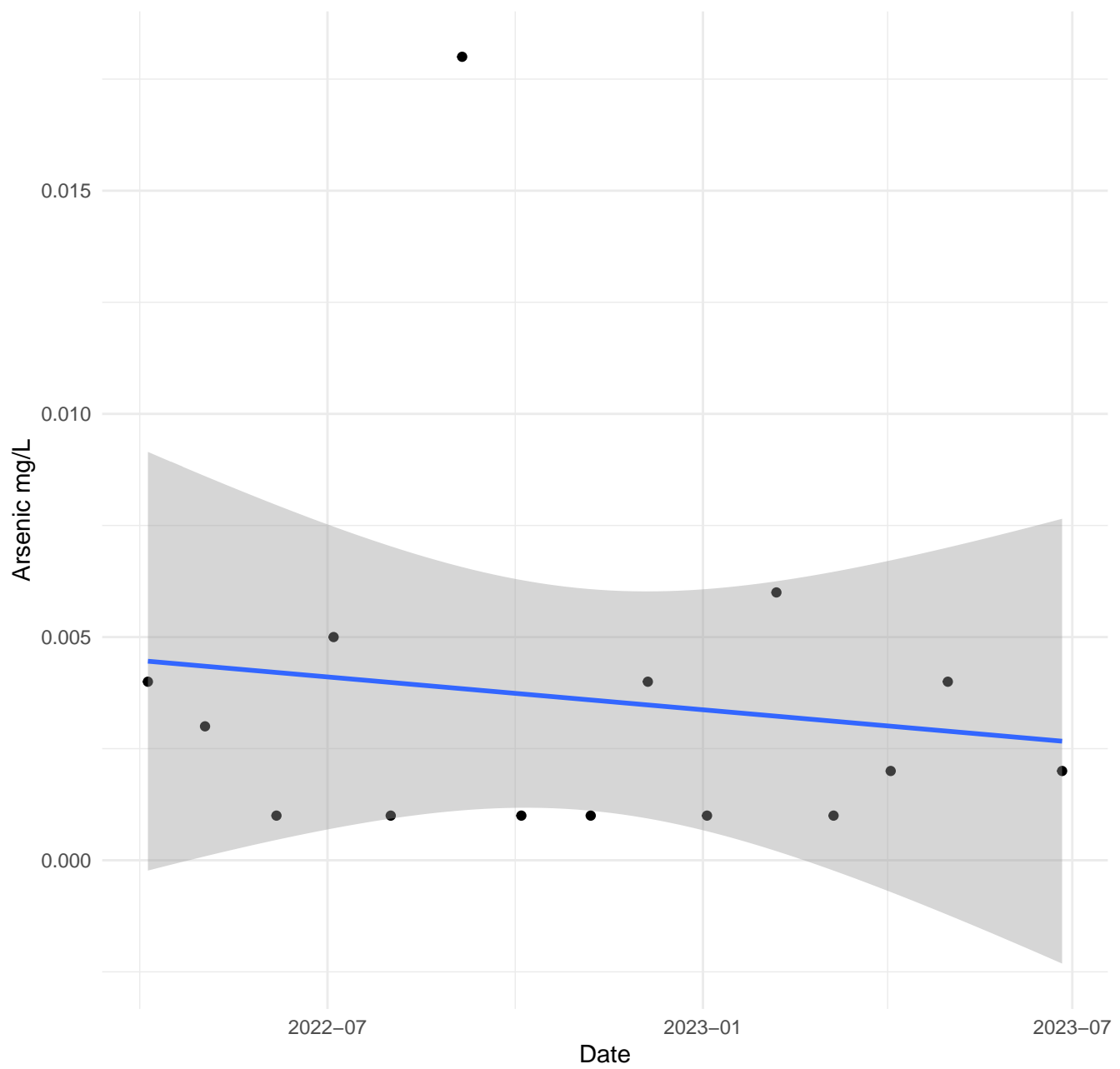
Arsenic at E



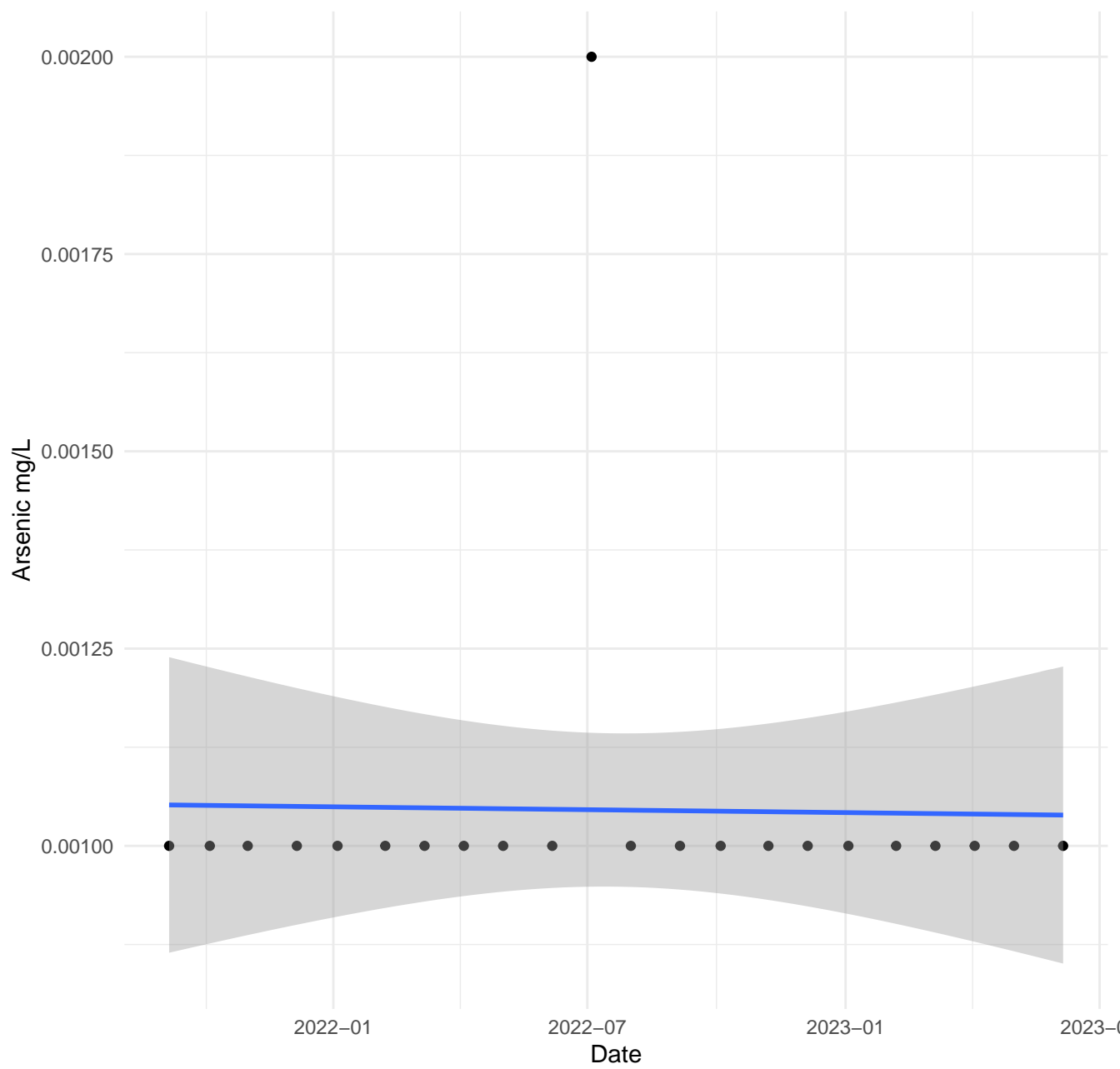
Arsenic at G



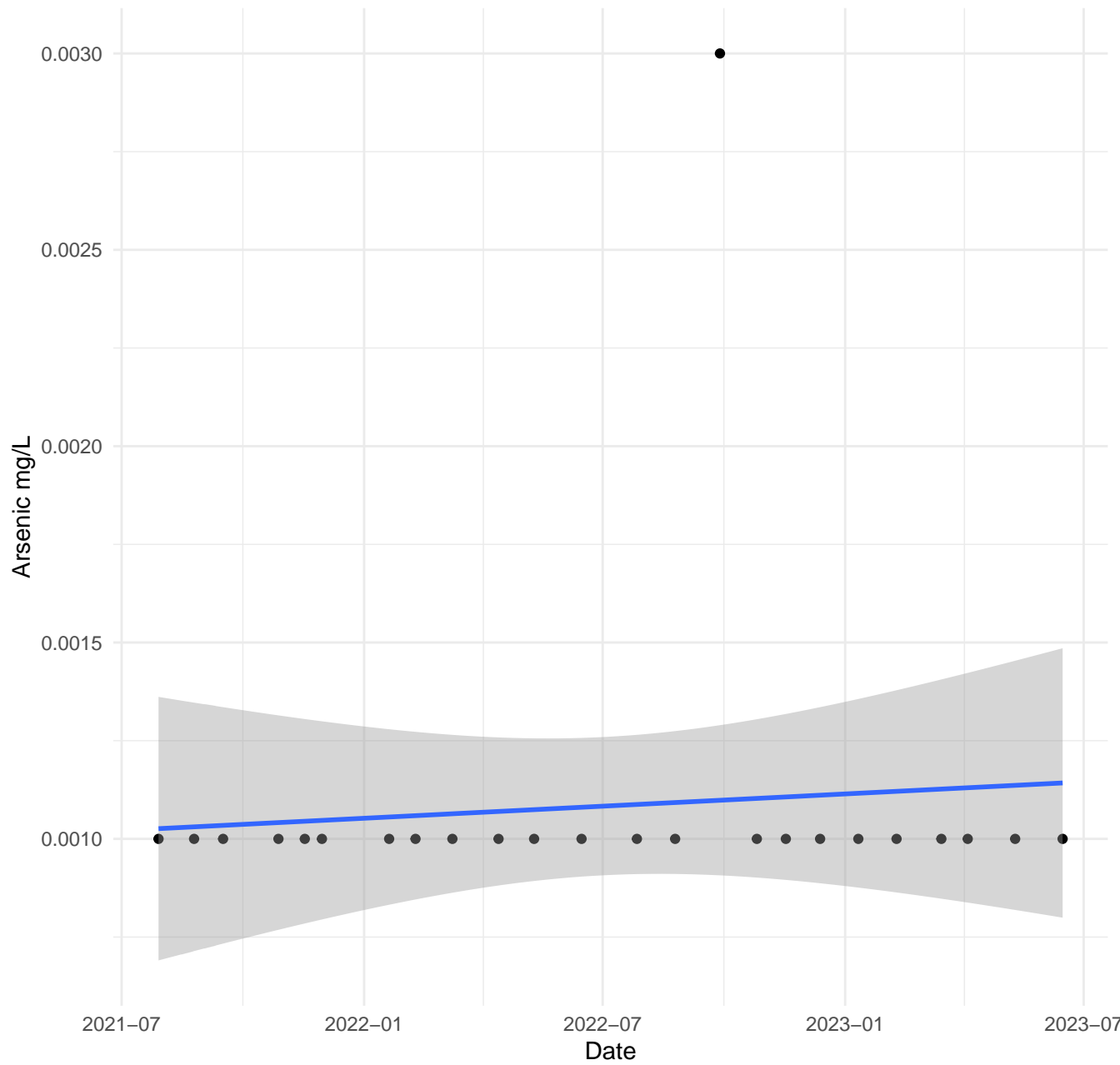
Arsenic at LDP01



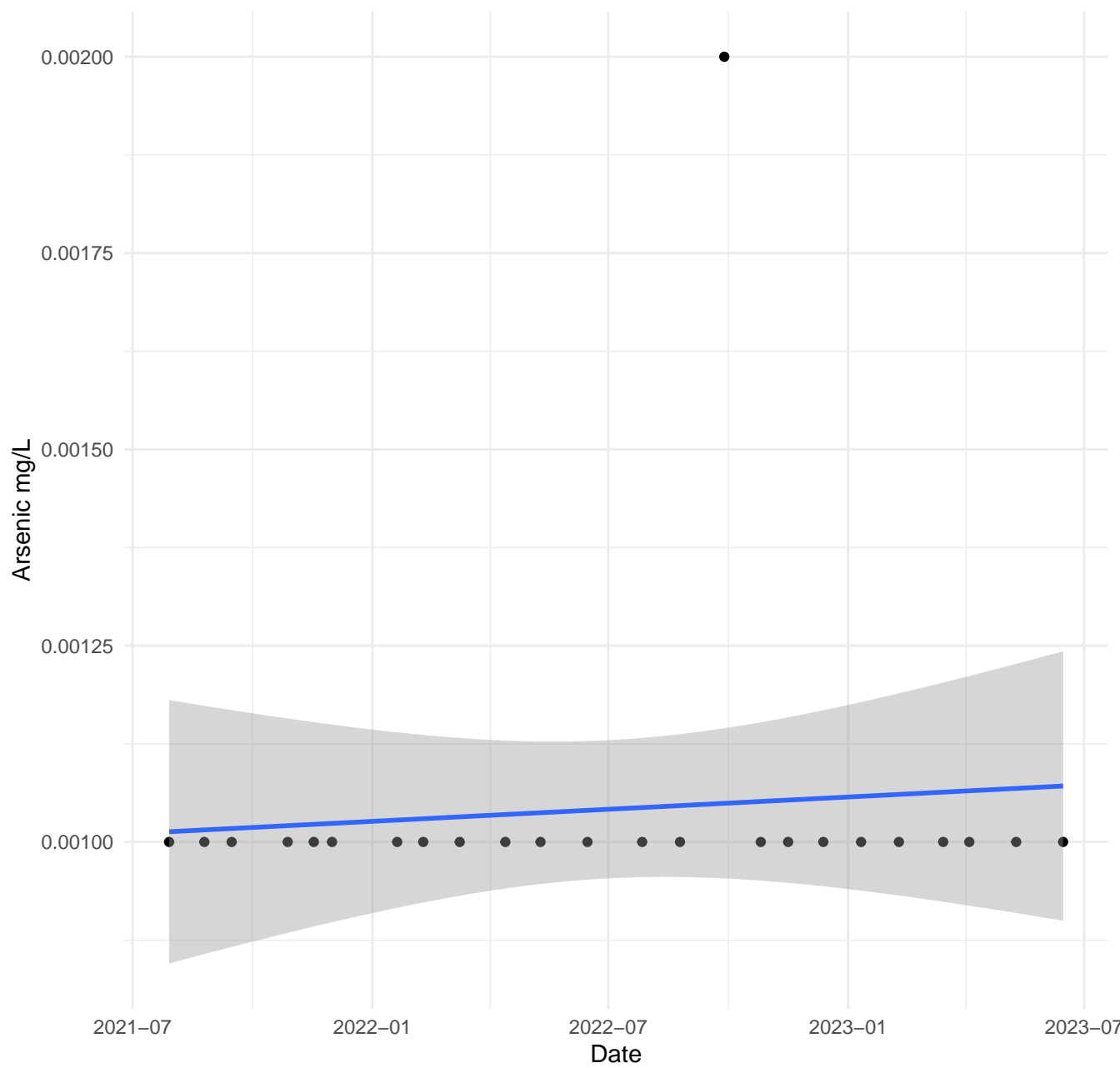
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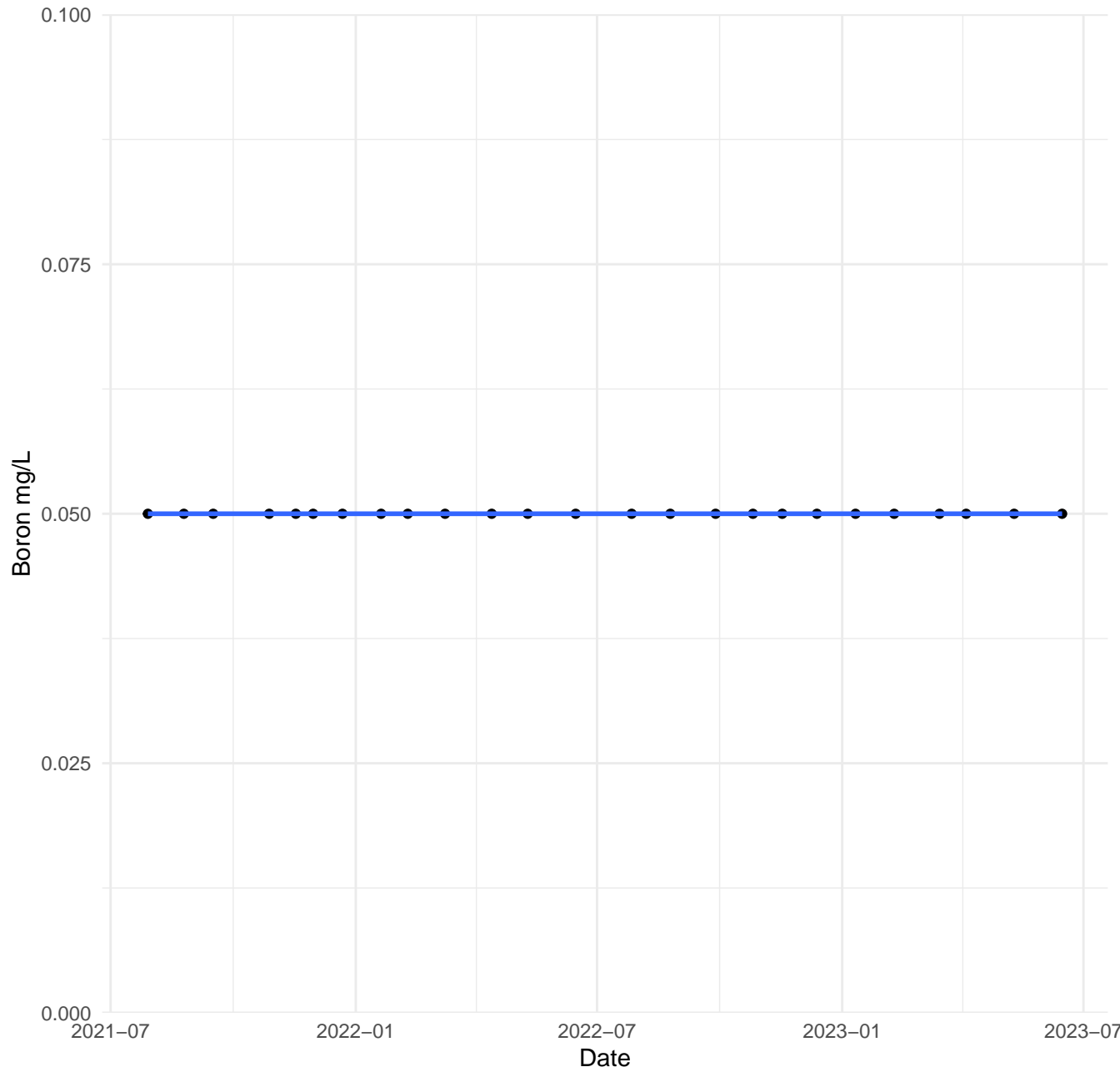
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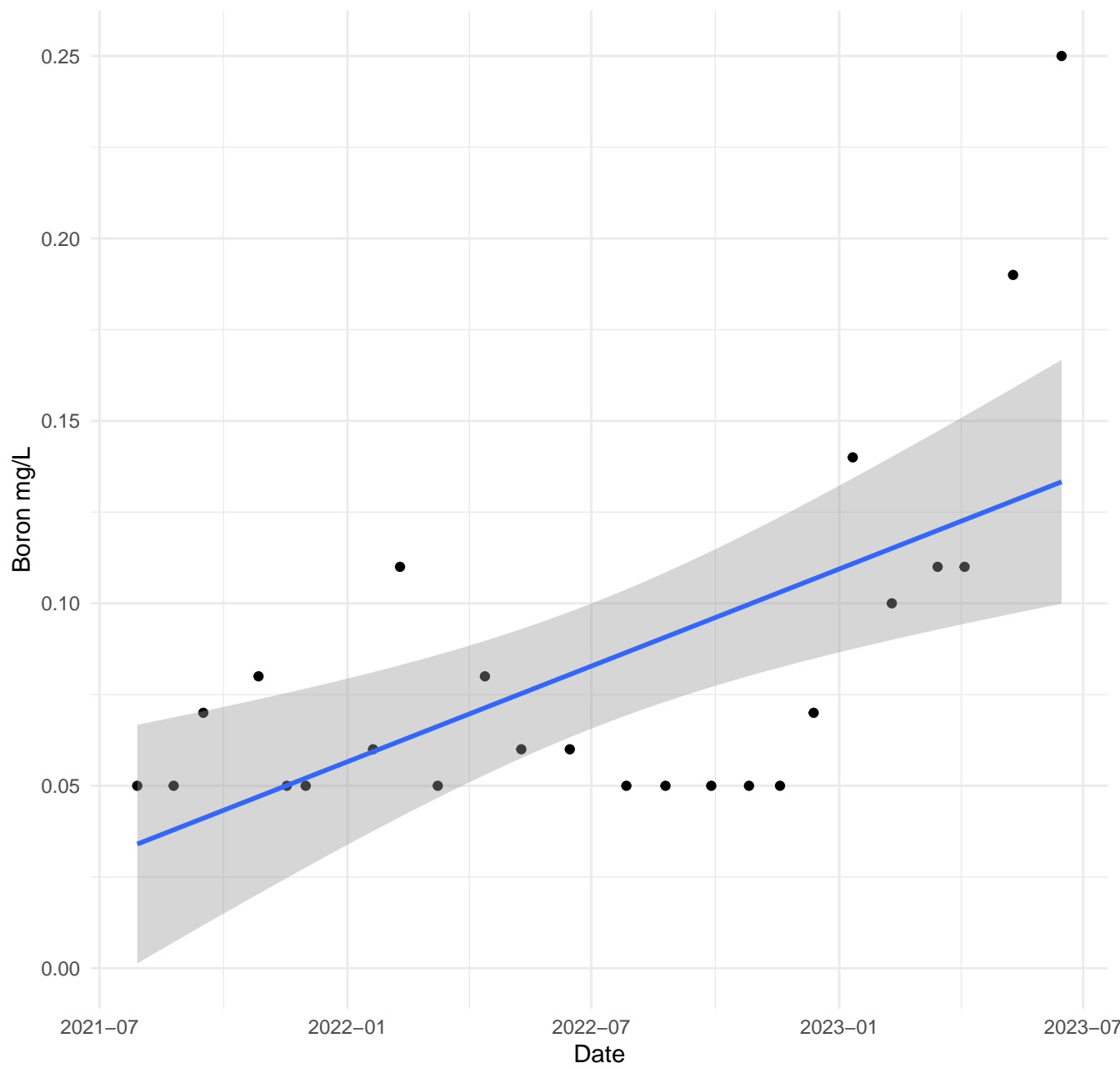
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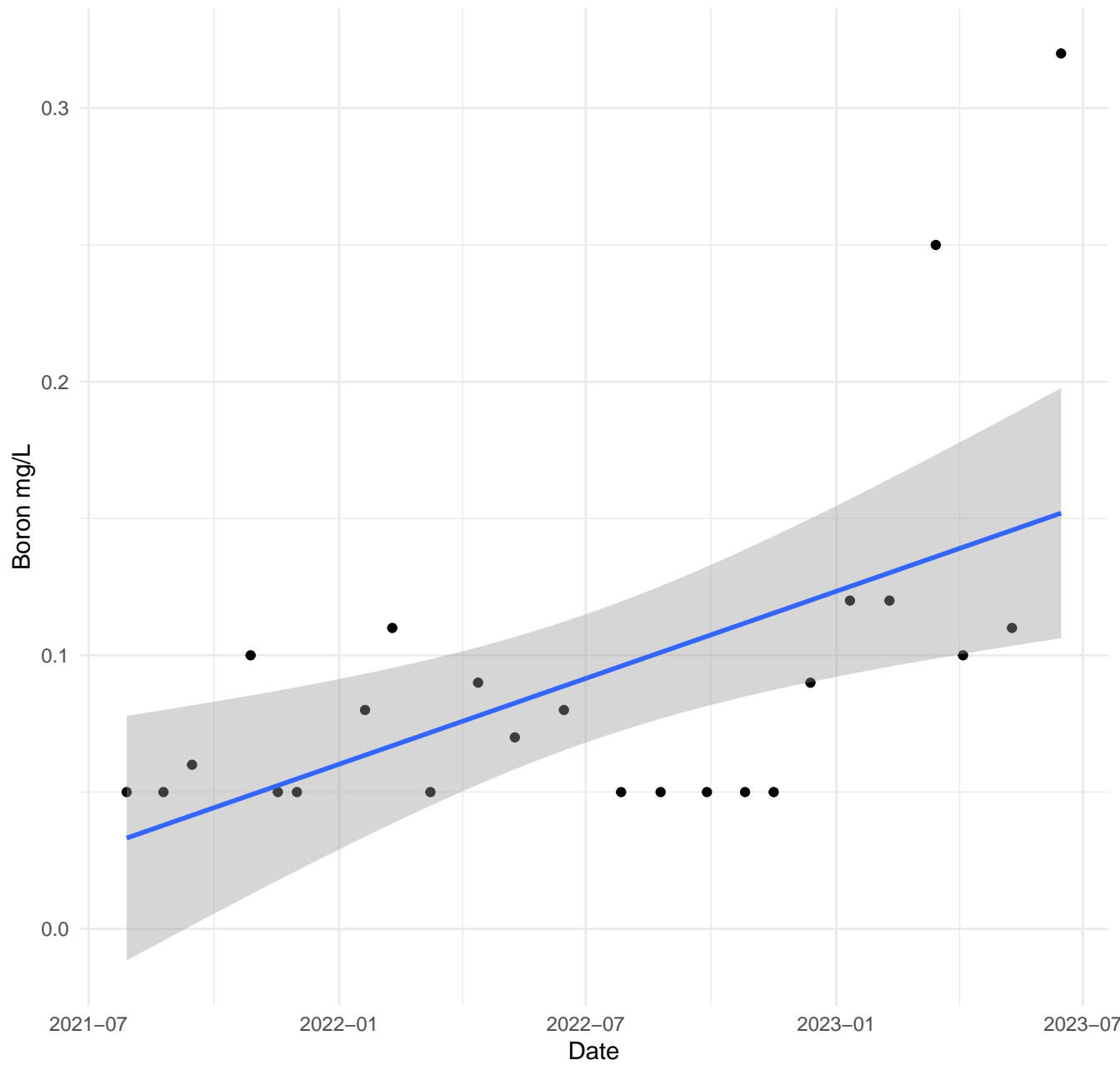
Boron at C



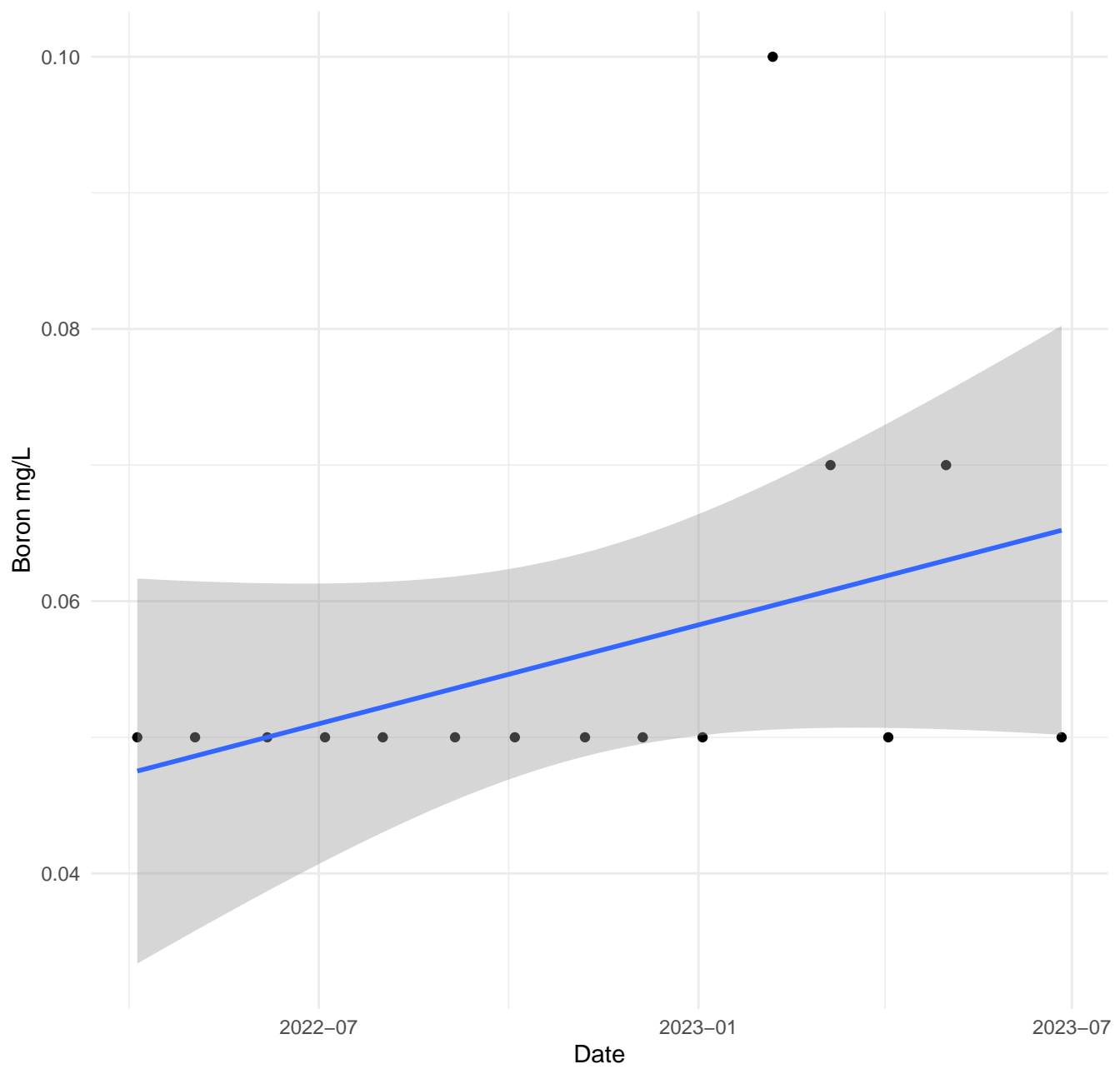
Boron at E



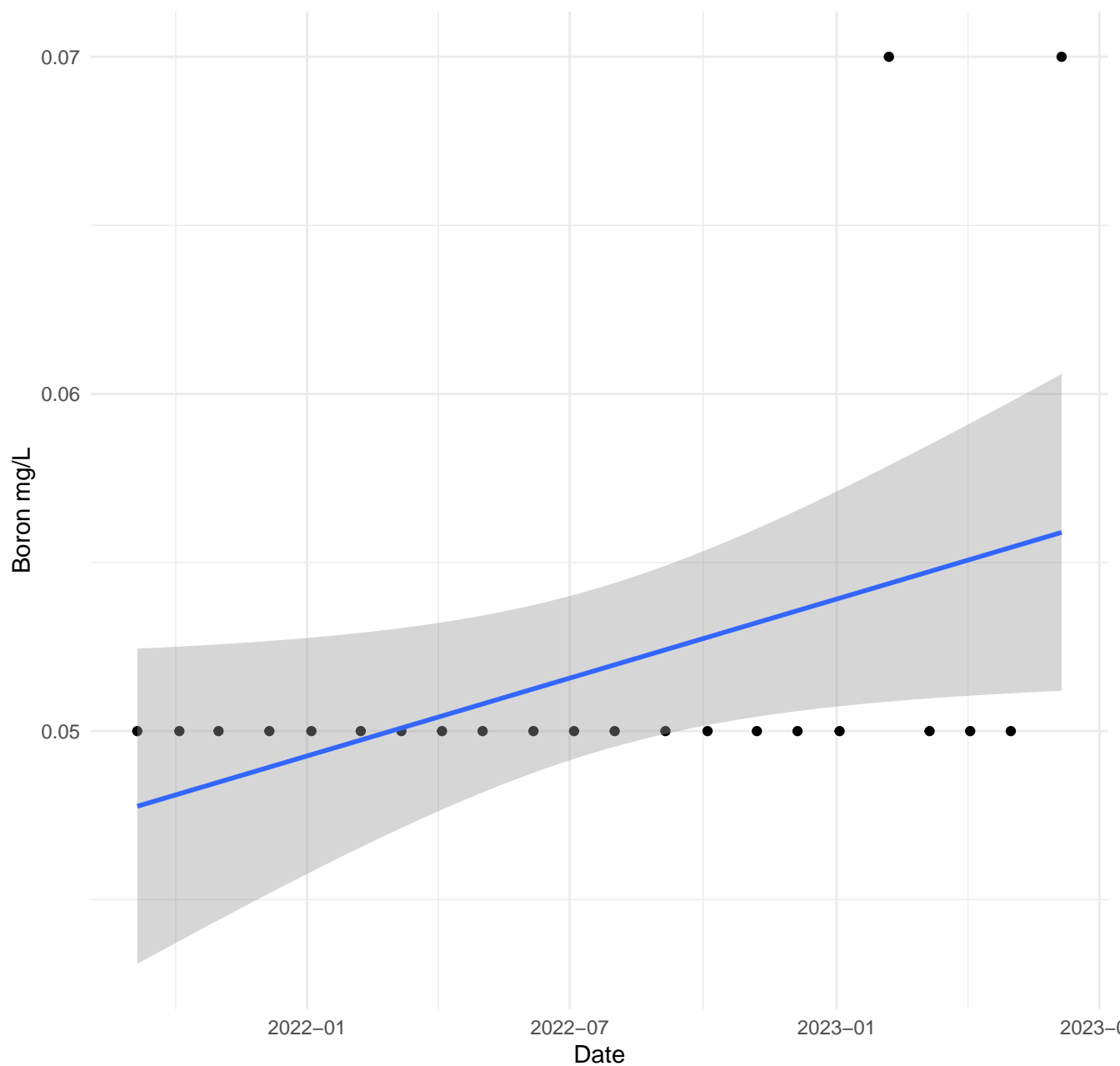
Boron at G



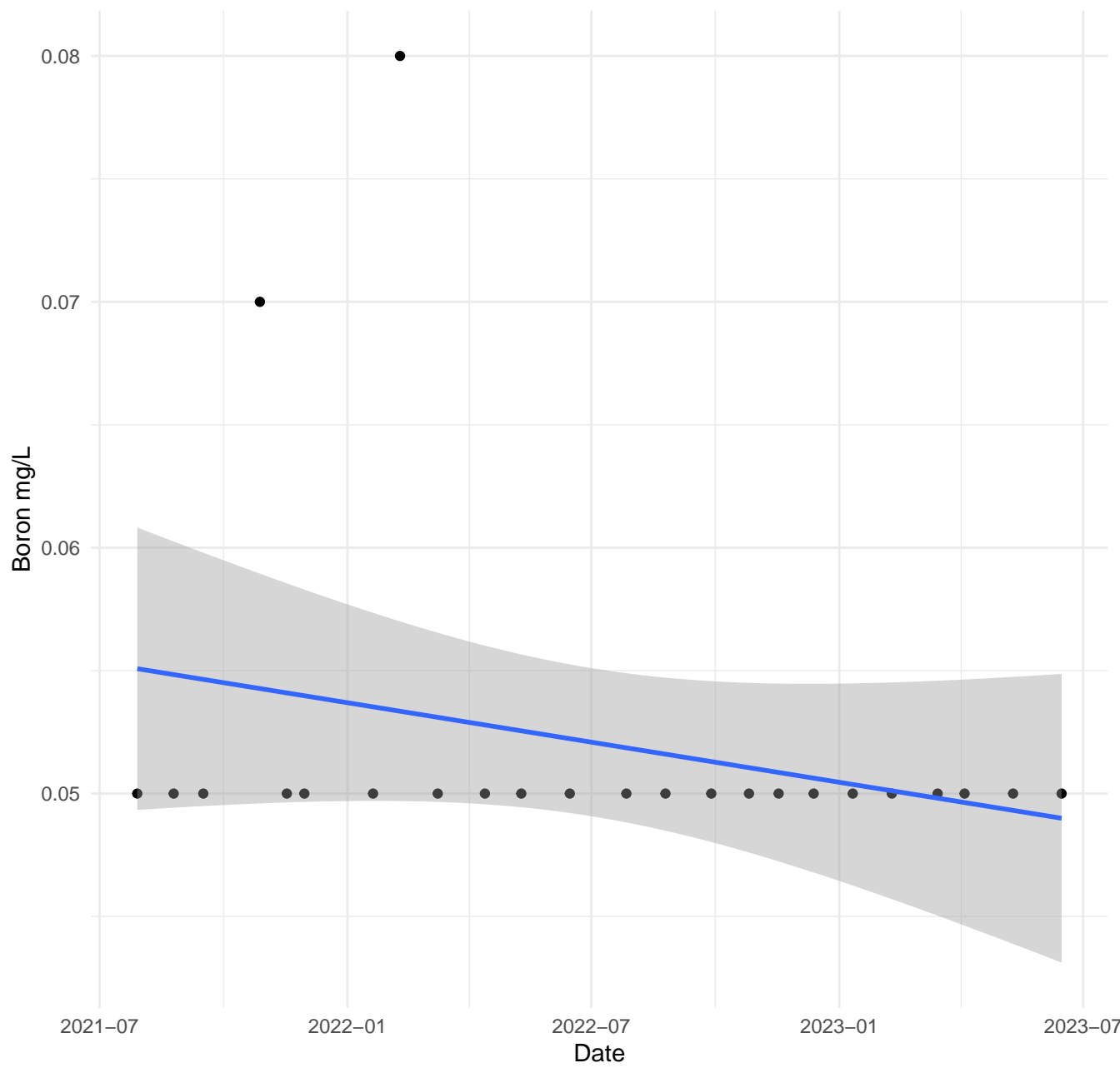
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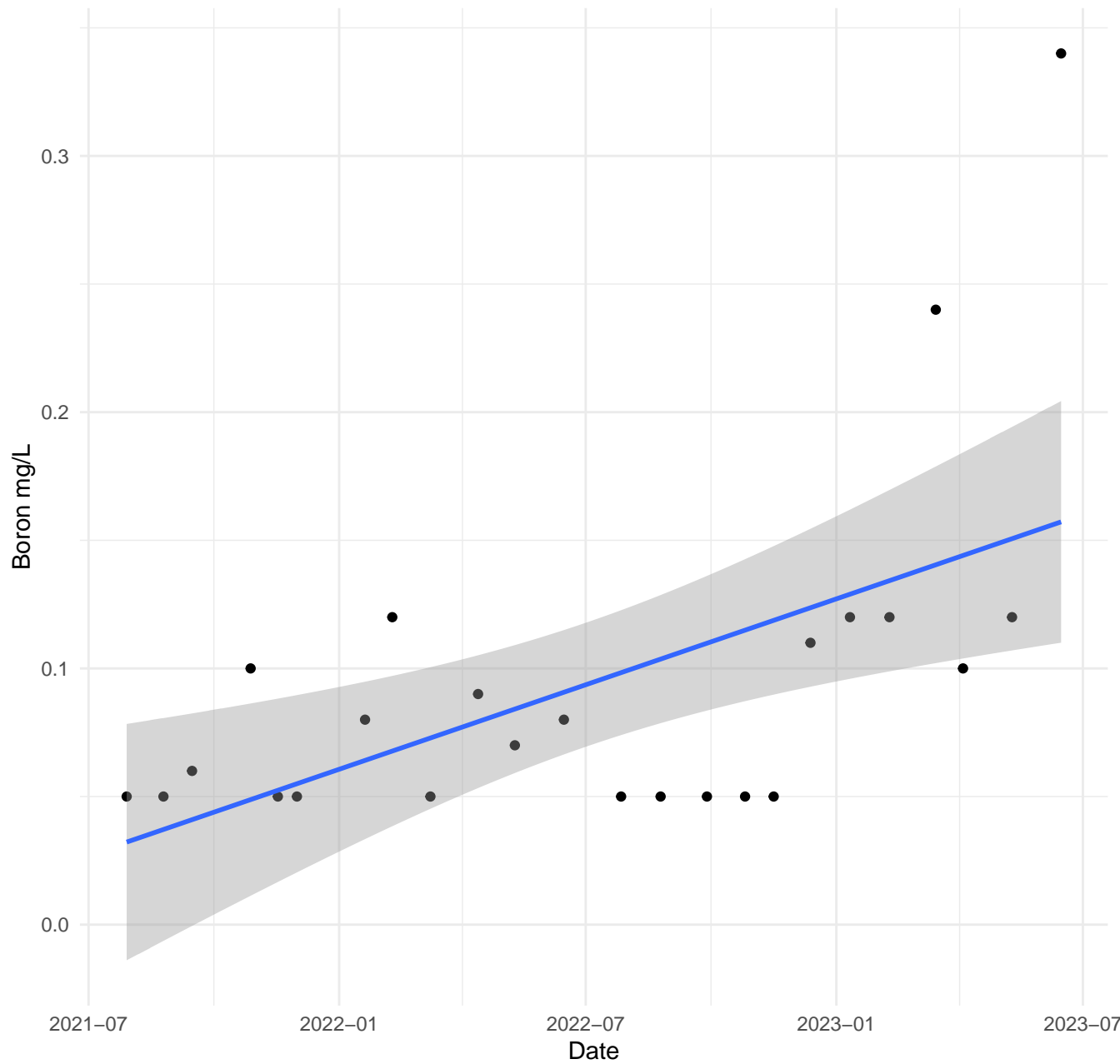
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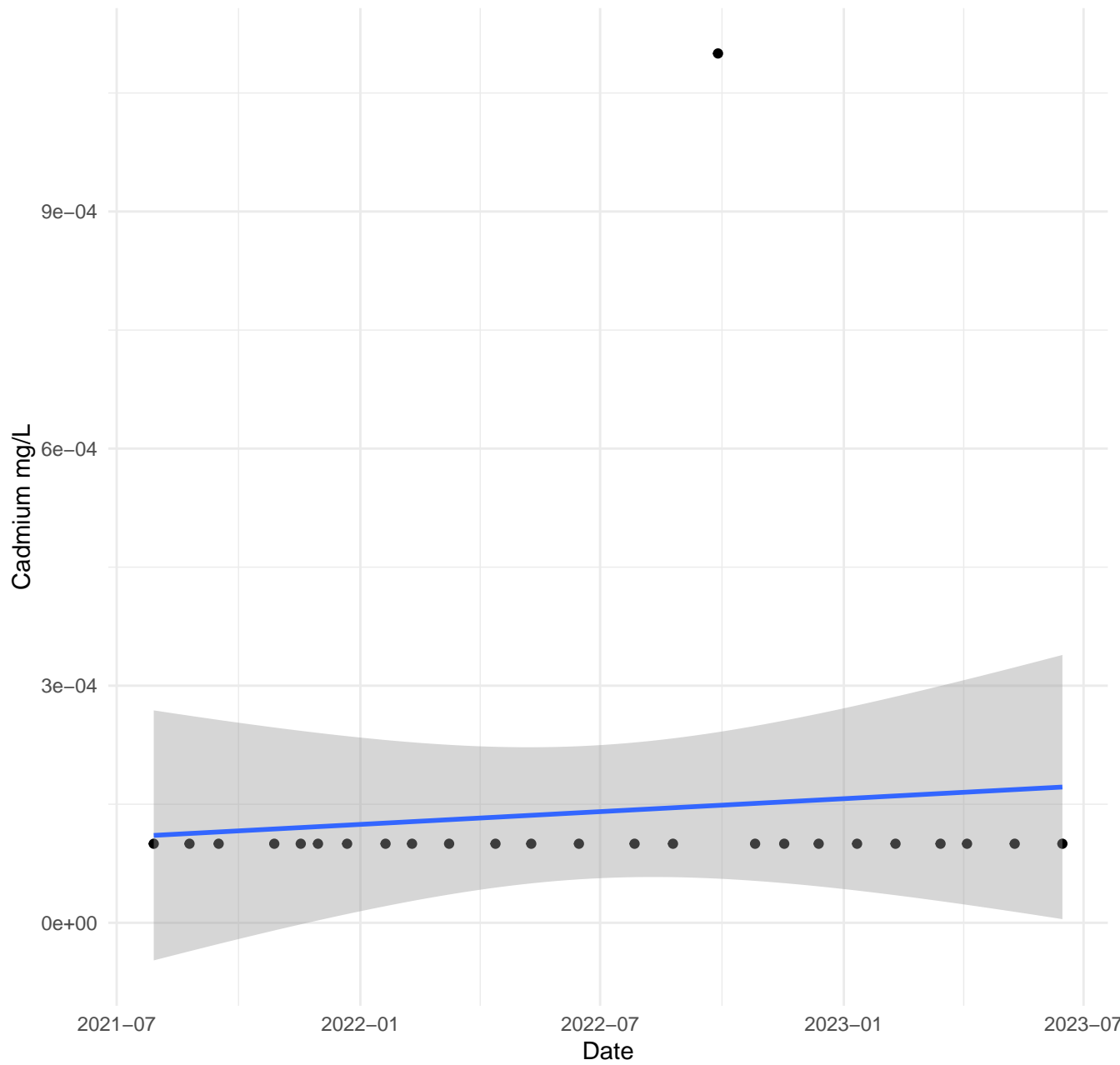
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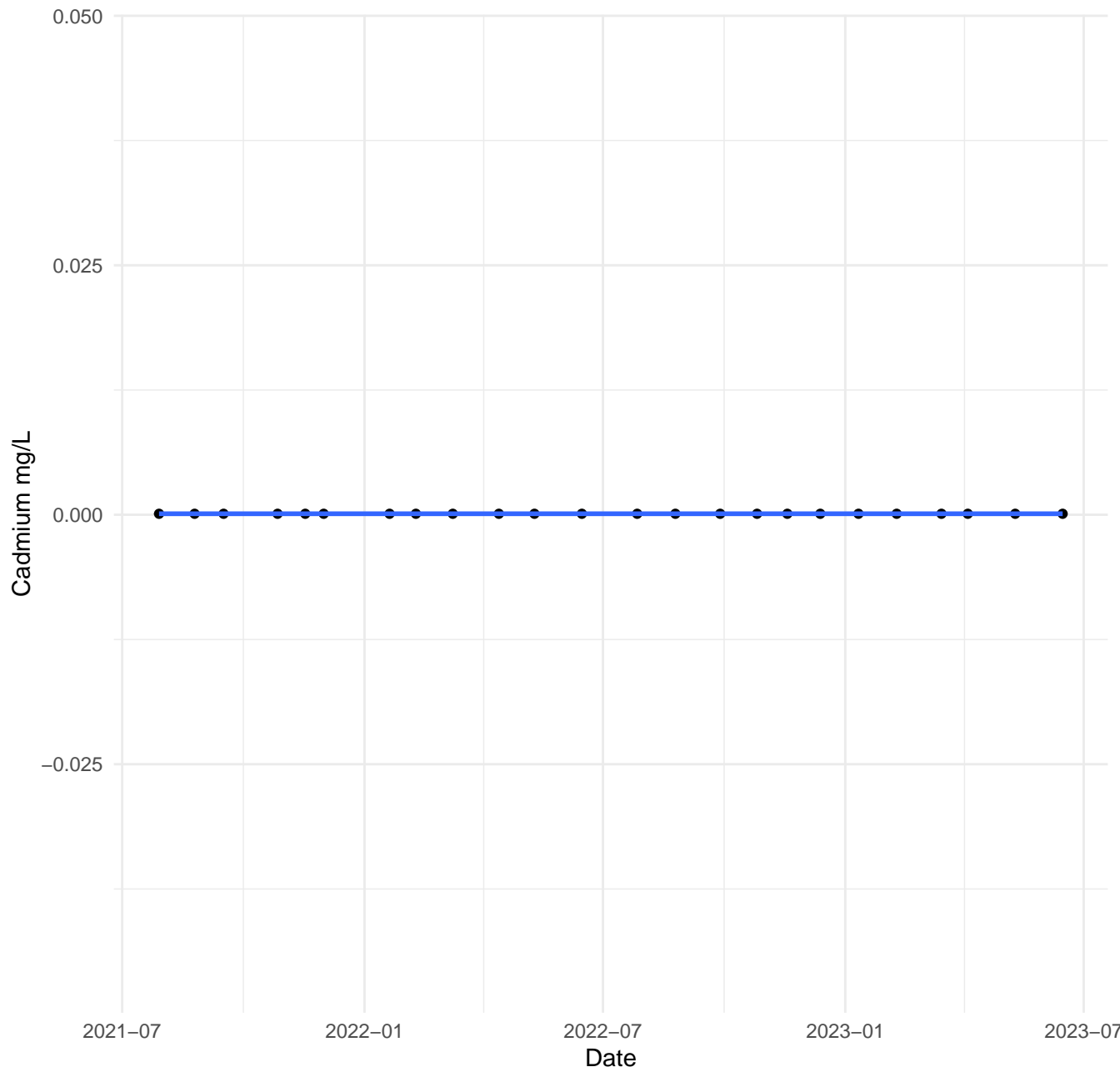
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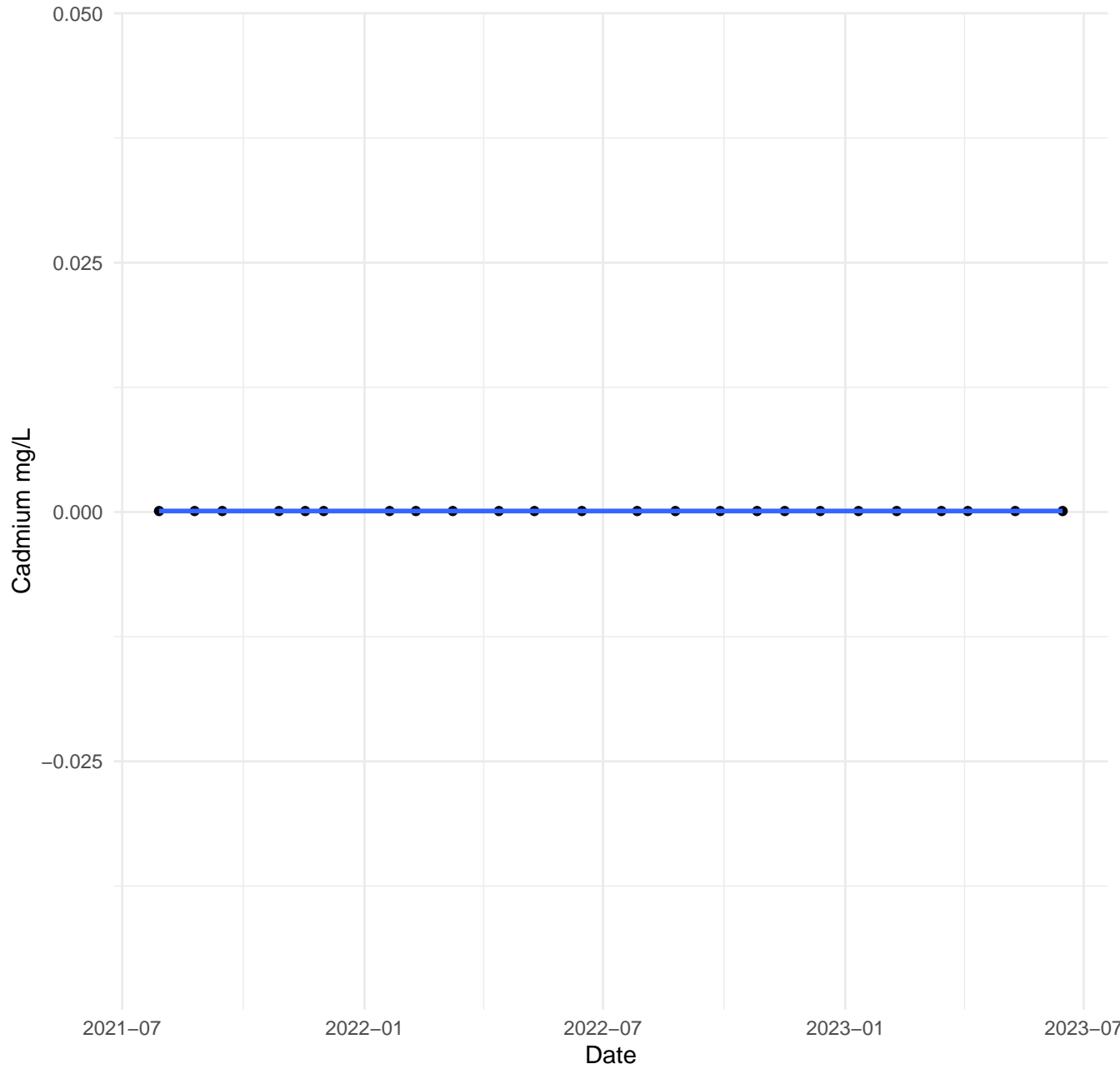
Cadmium at C



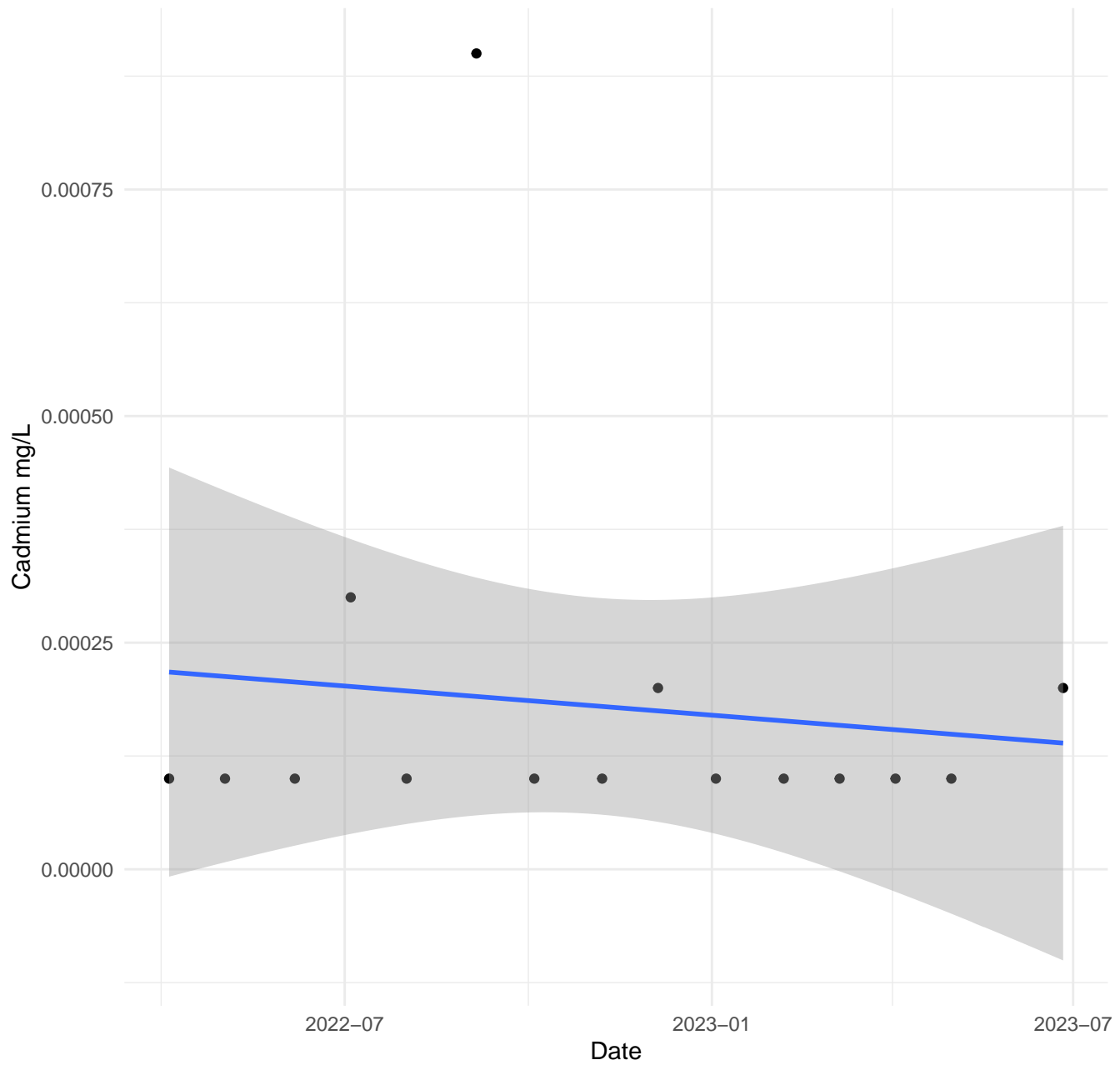
Cadmium at E



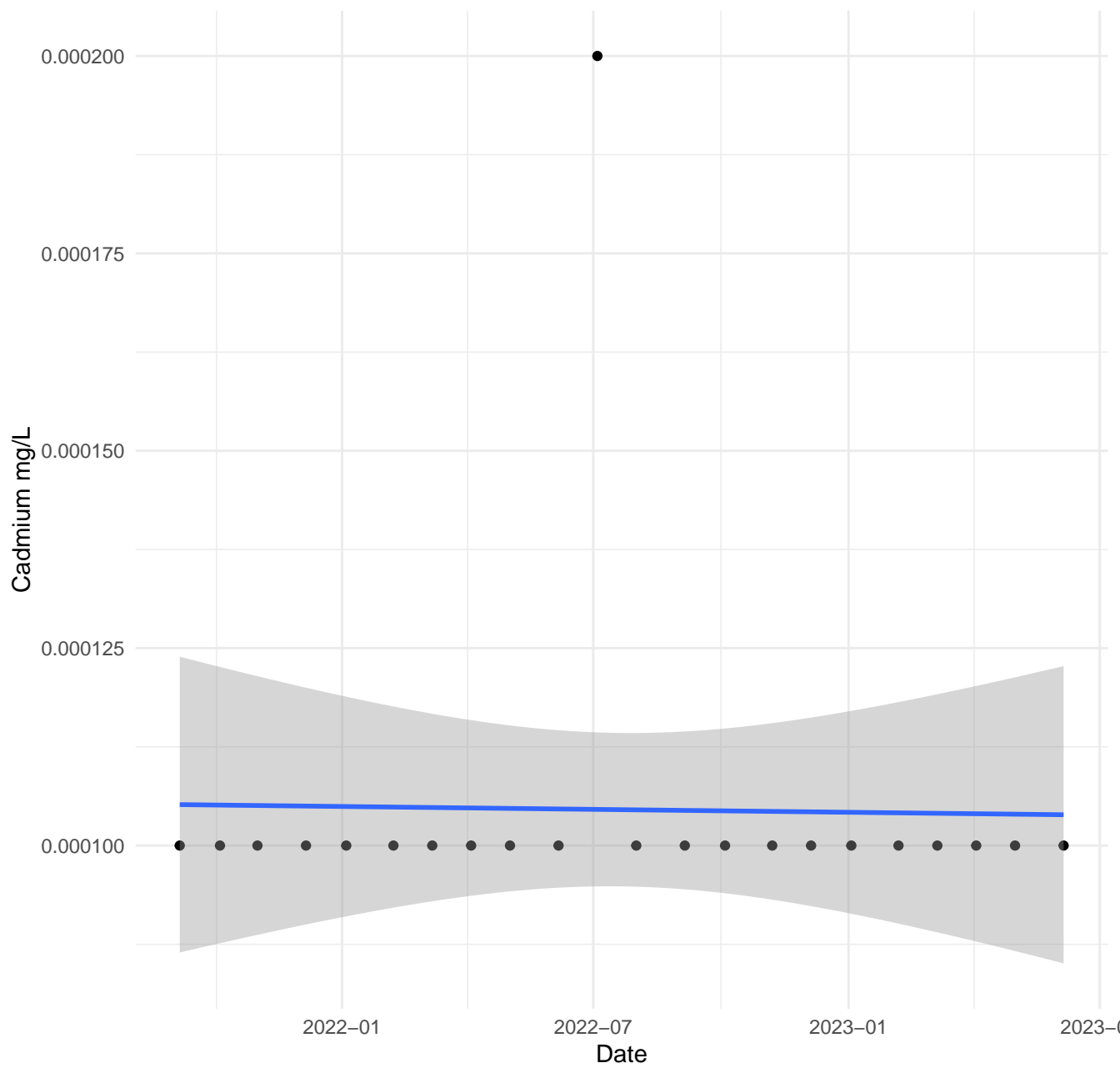
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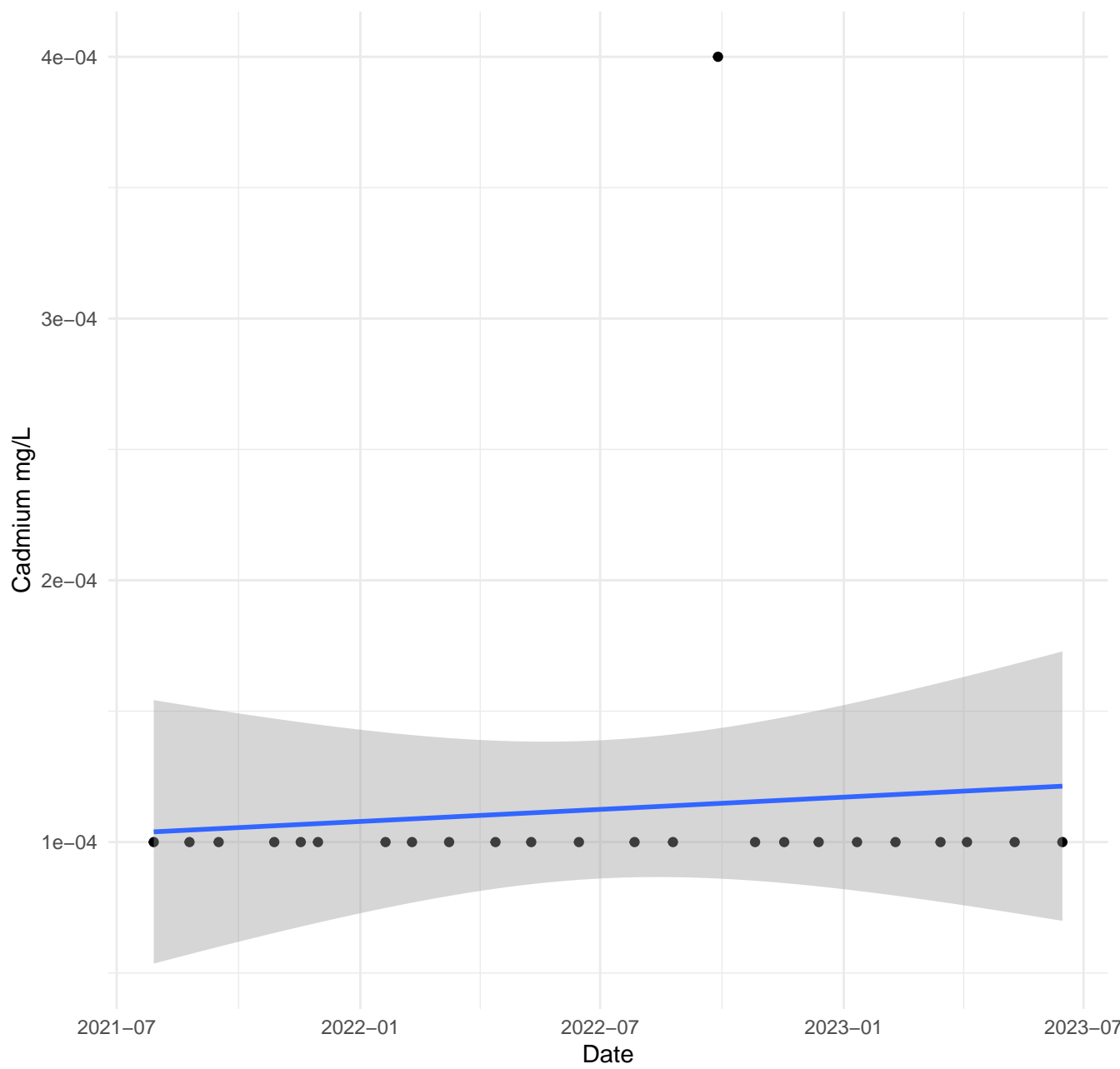
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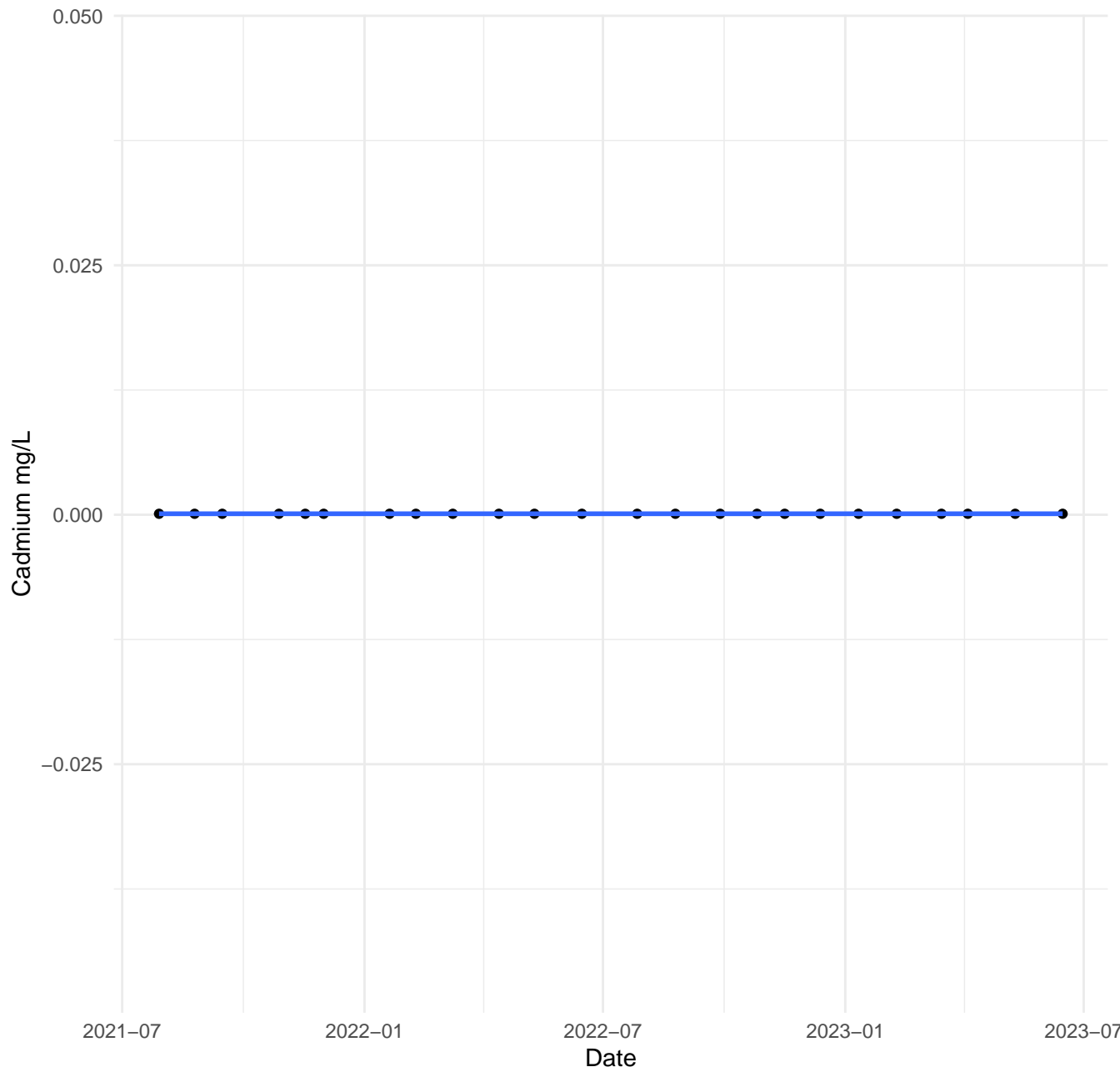
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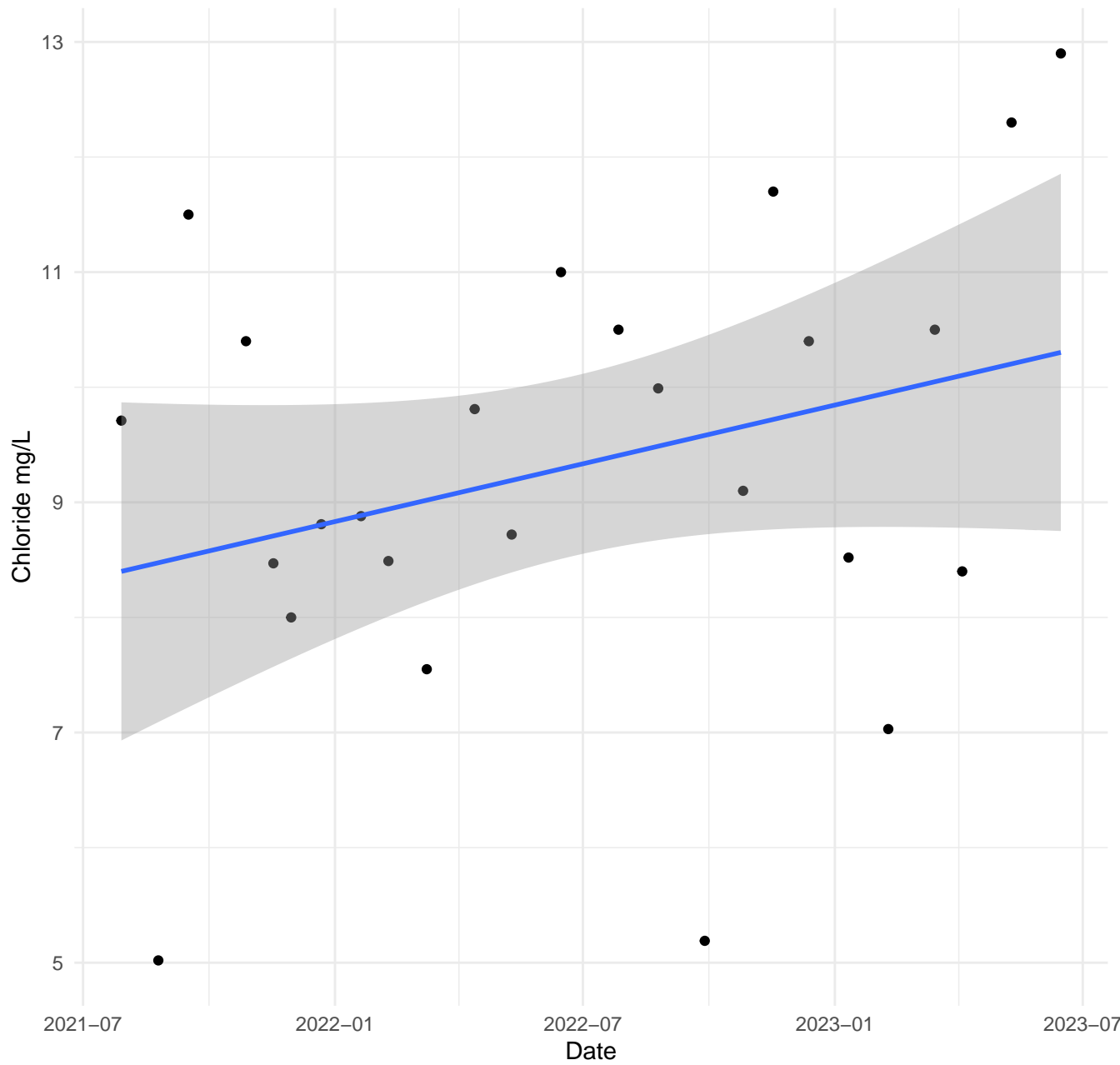
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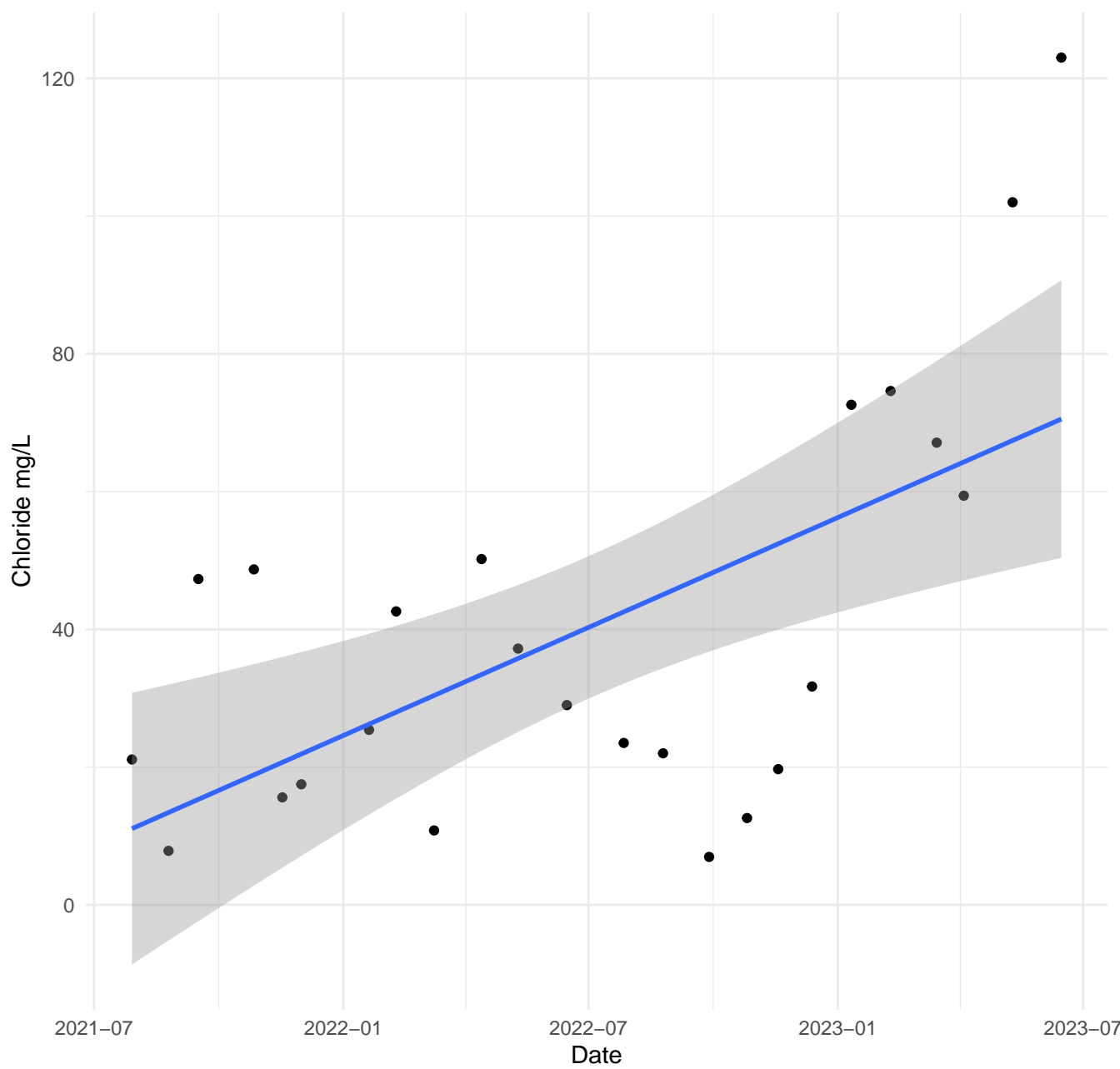
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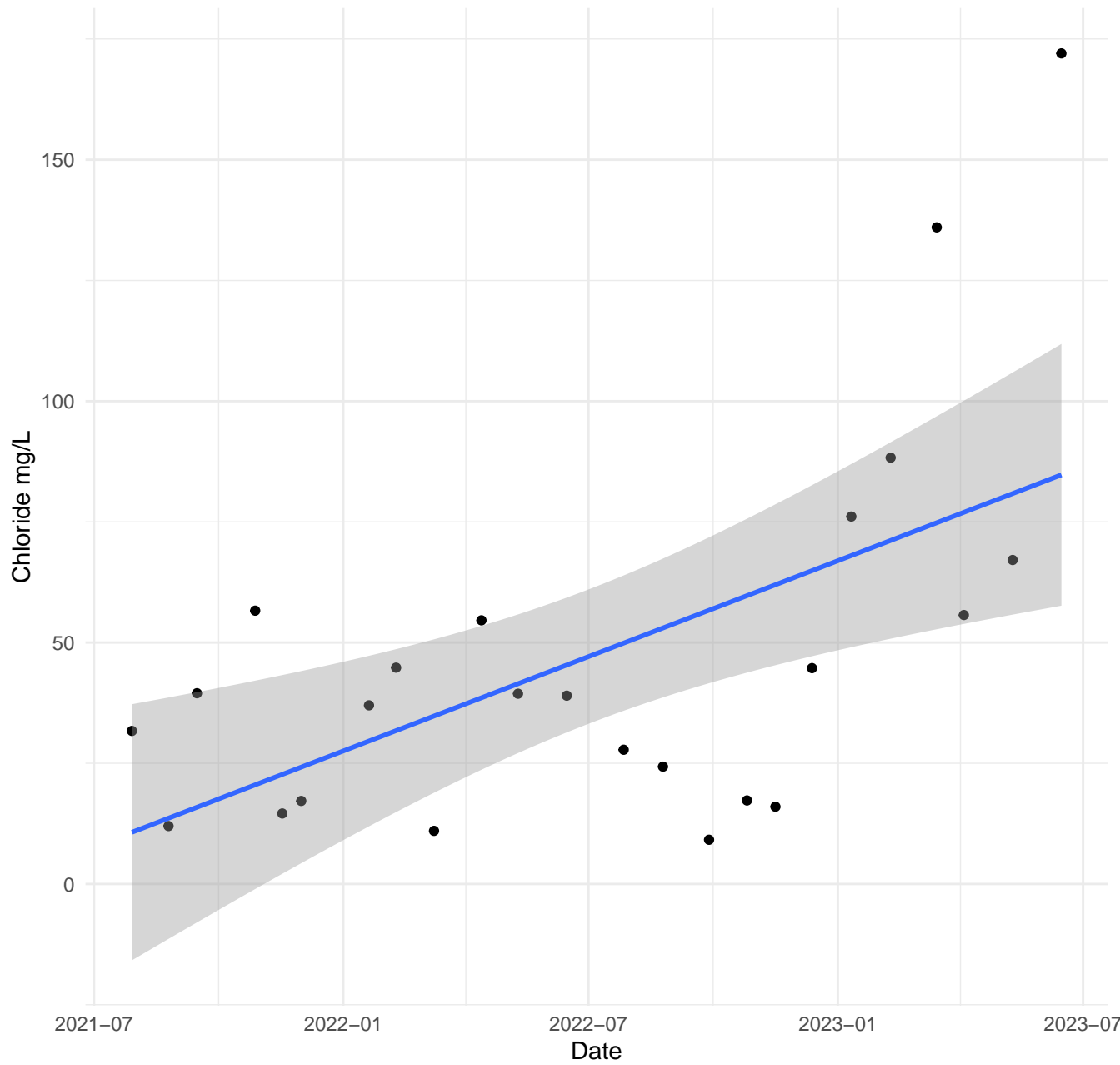
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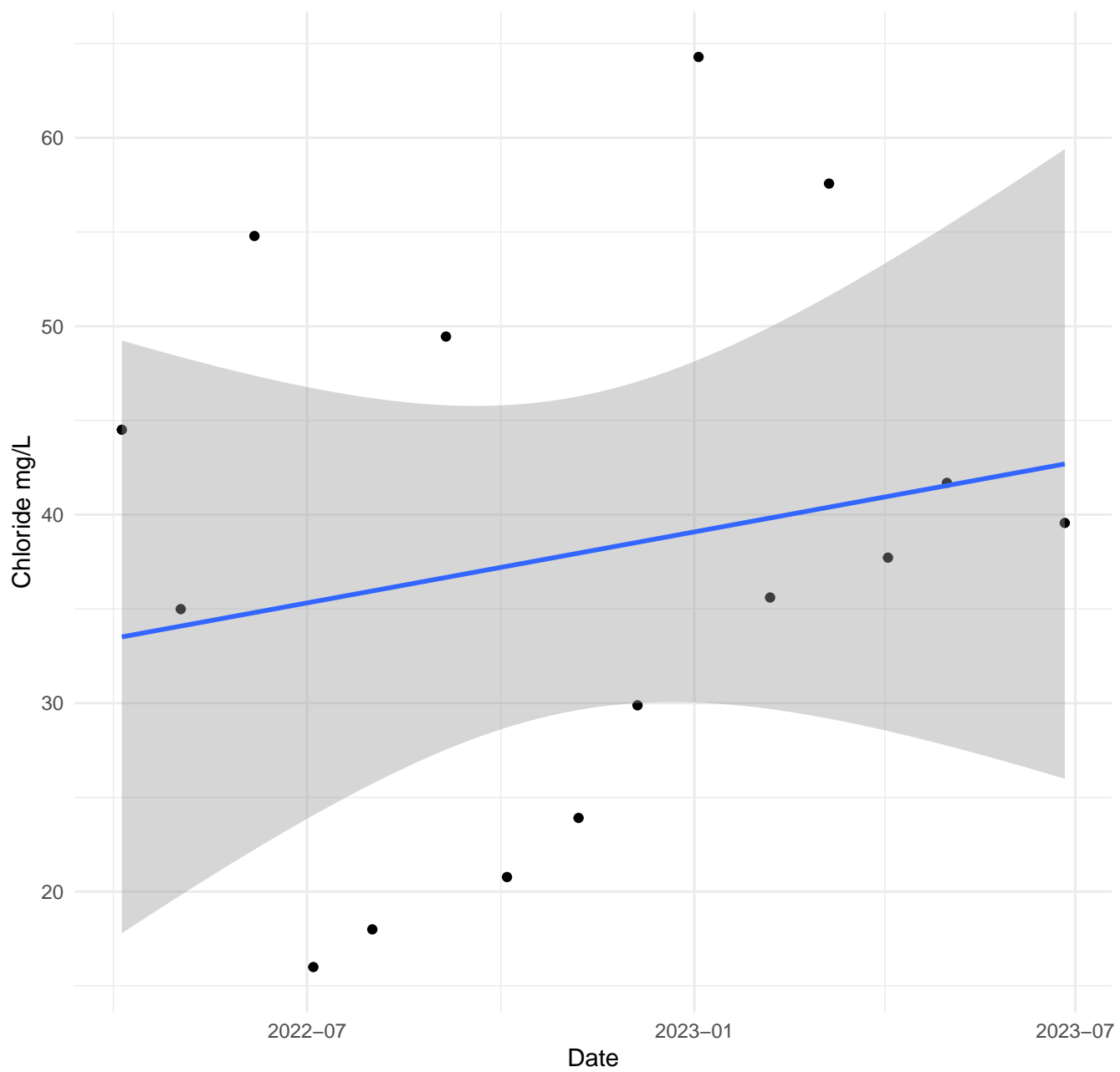
Chloride at E



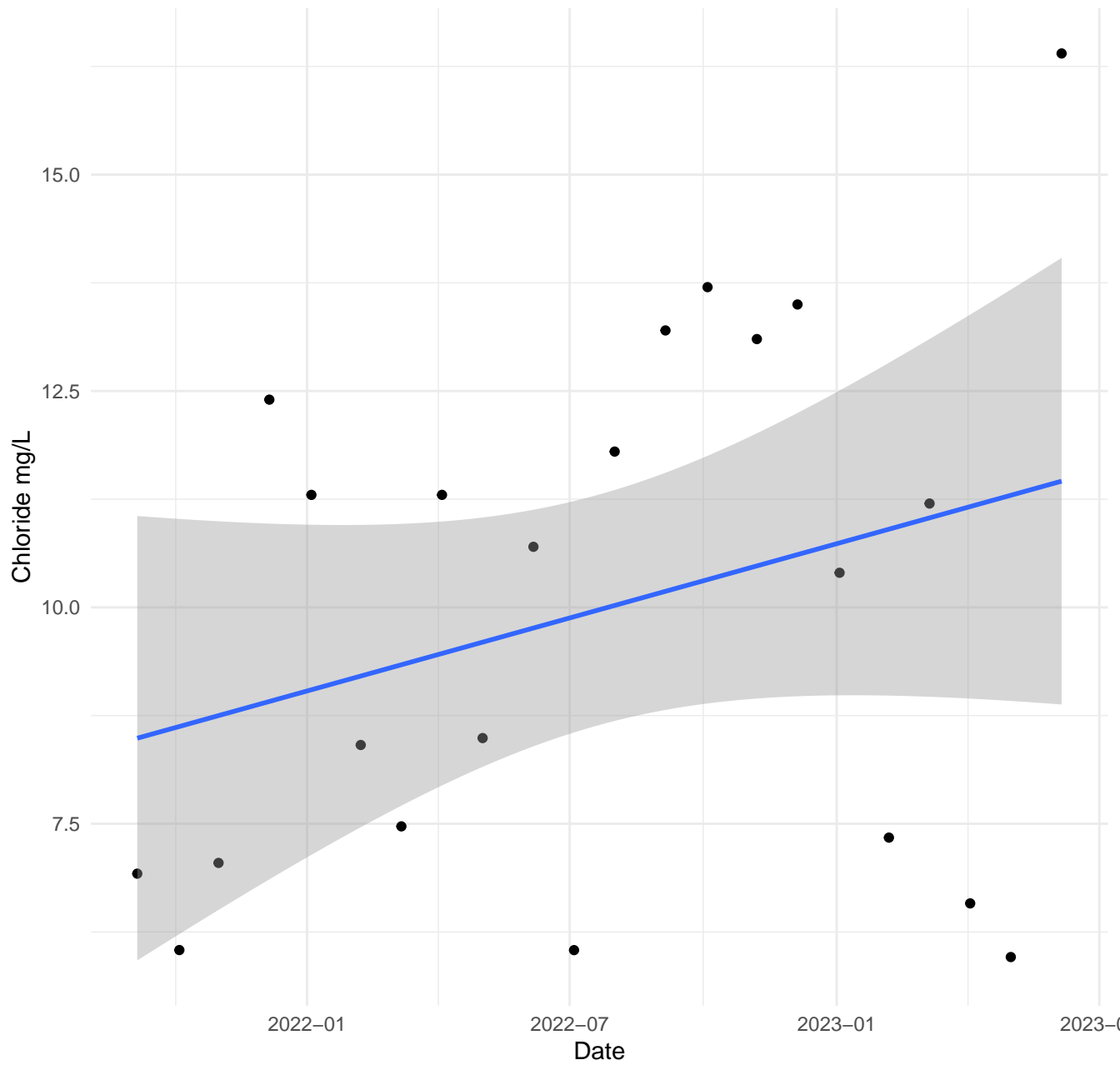
Chloride at G



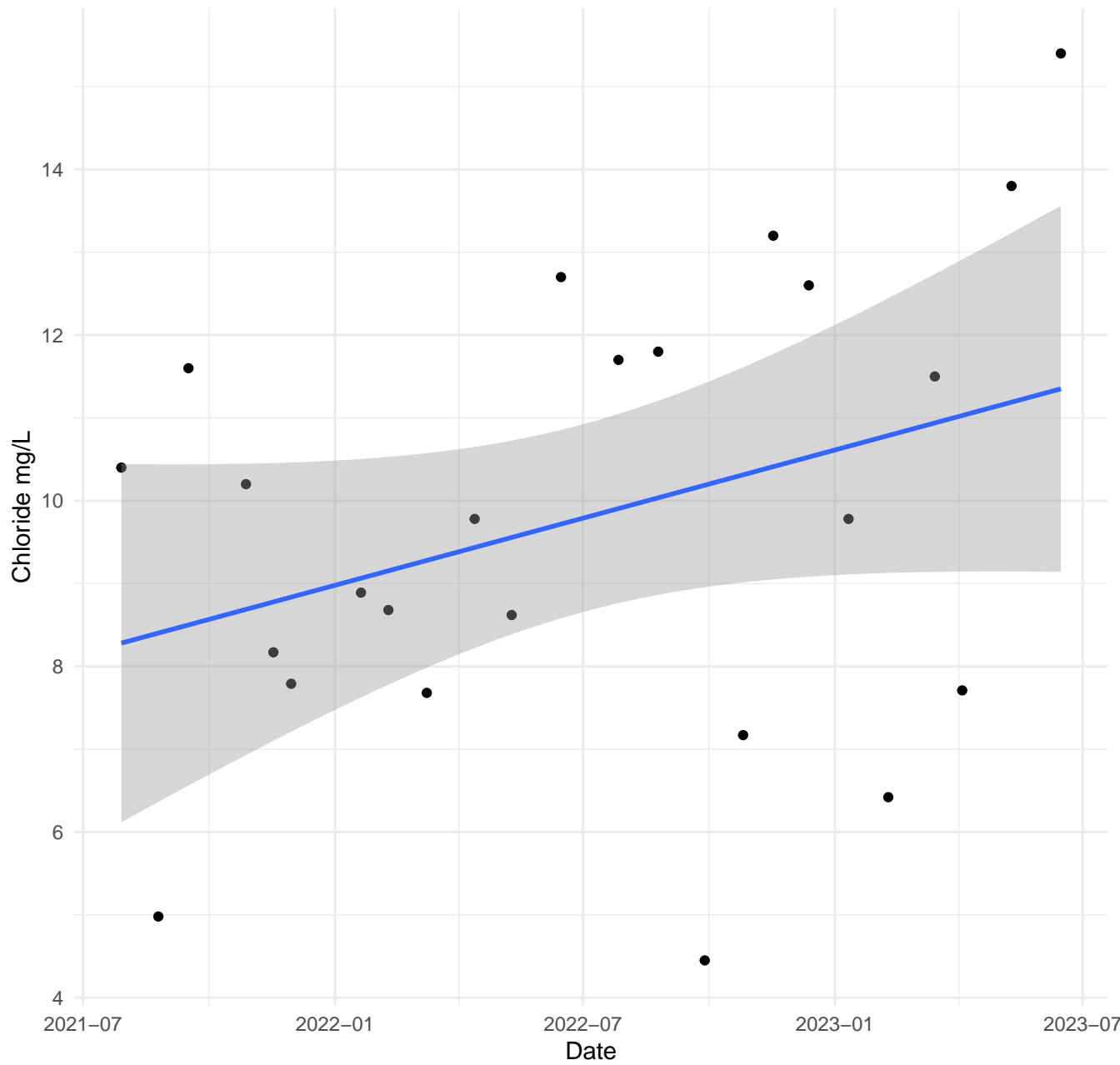
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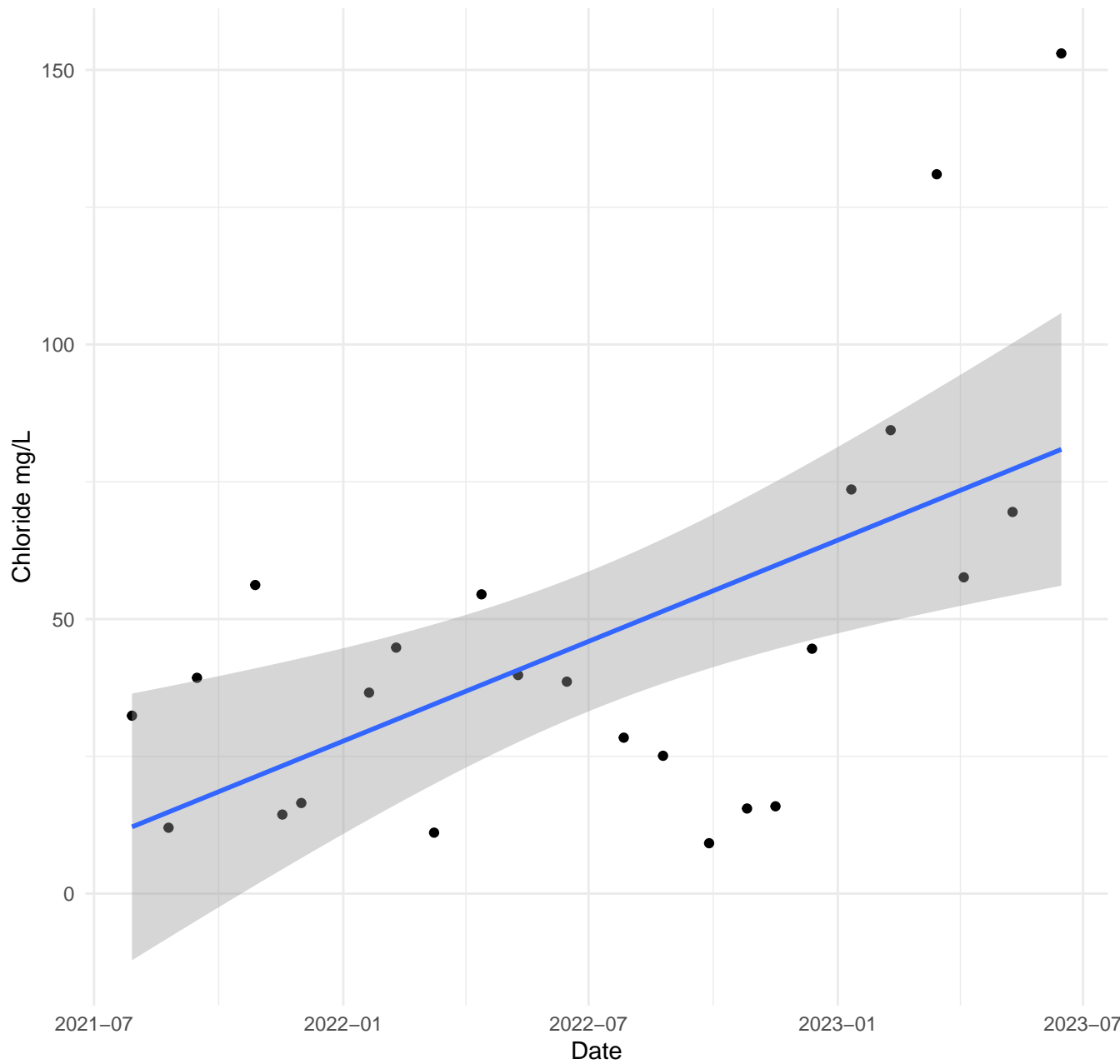
Chloride at LMP01



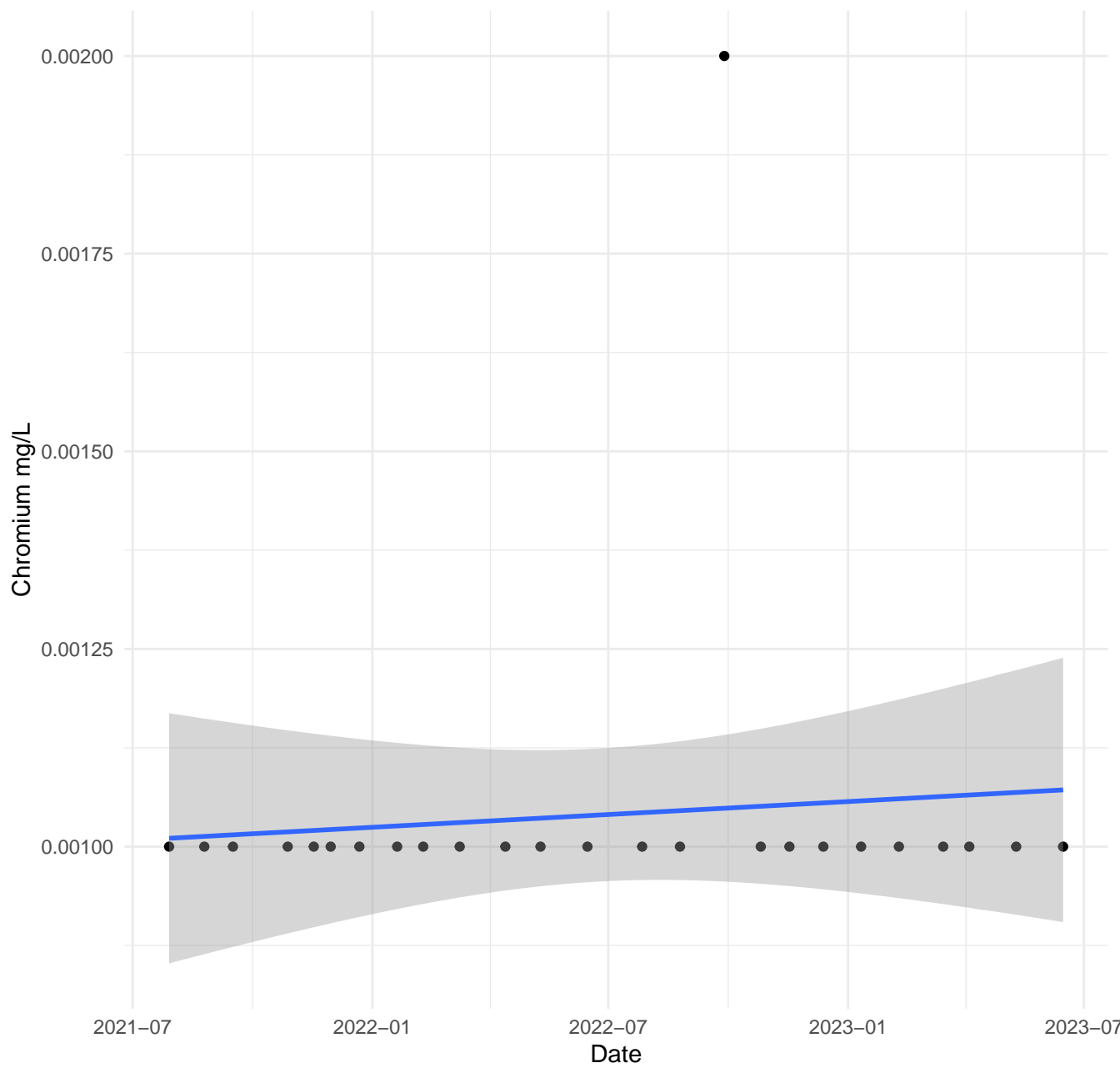
Chloride at NC01



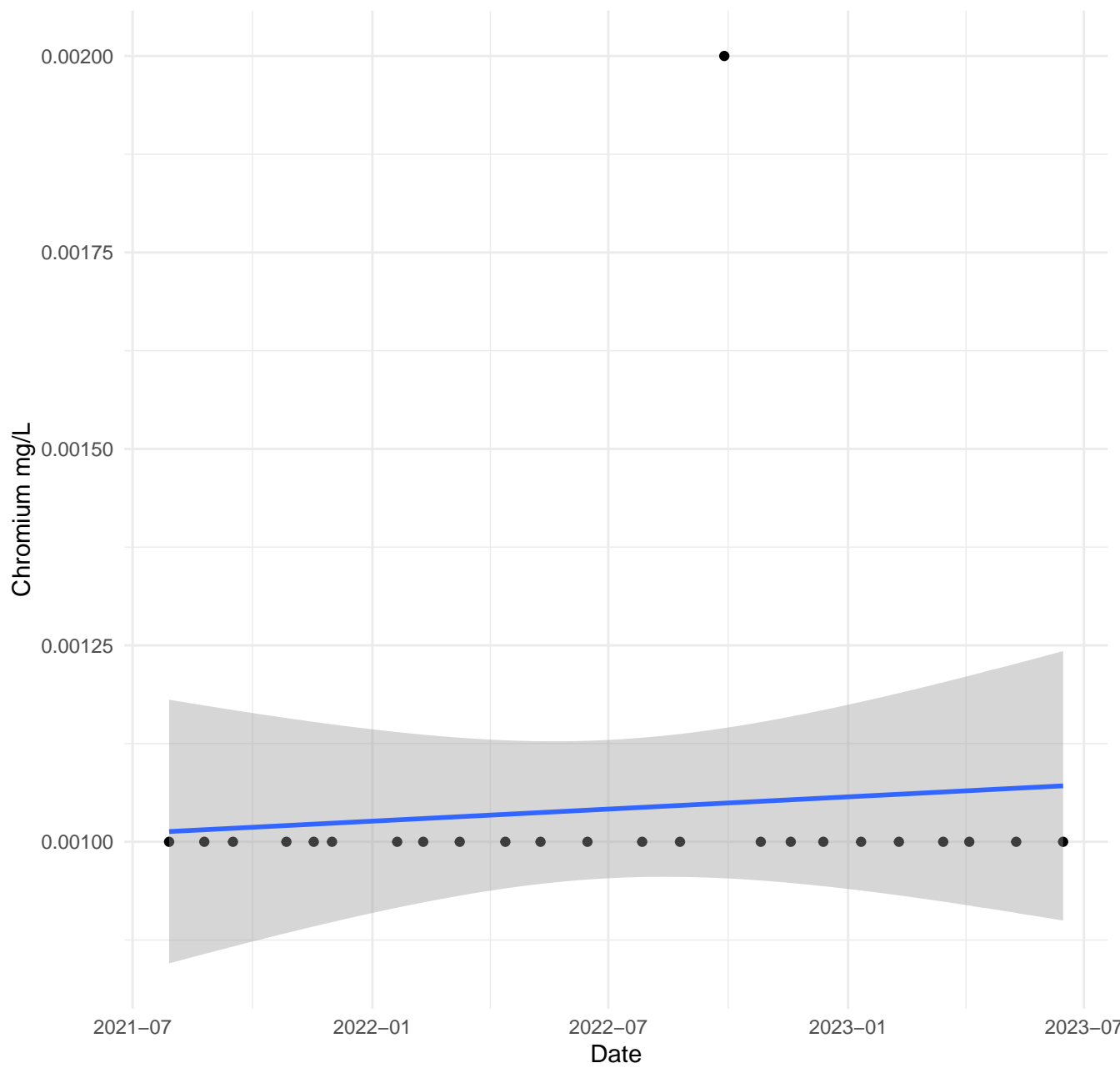
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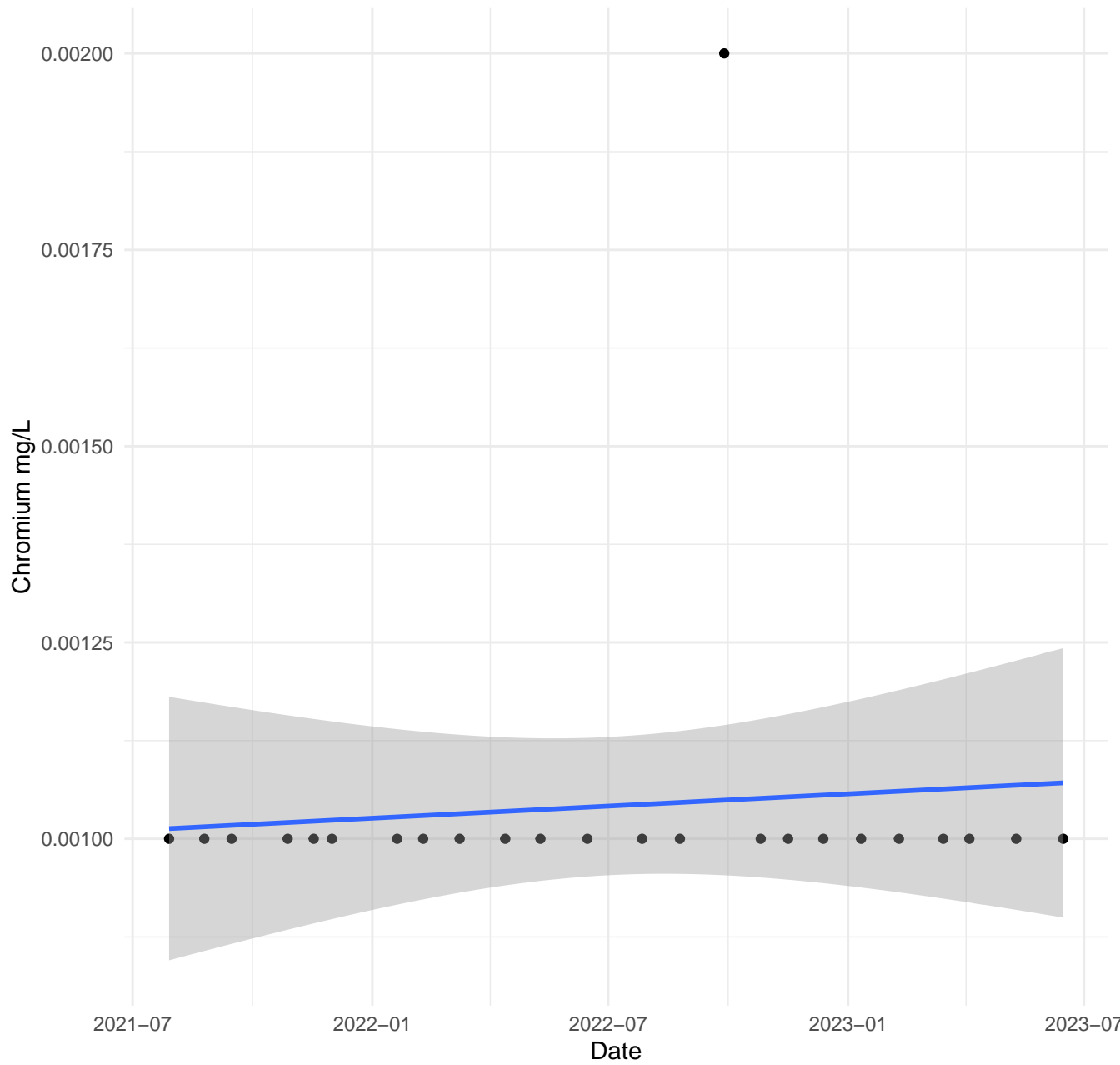
Chromium at C



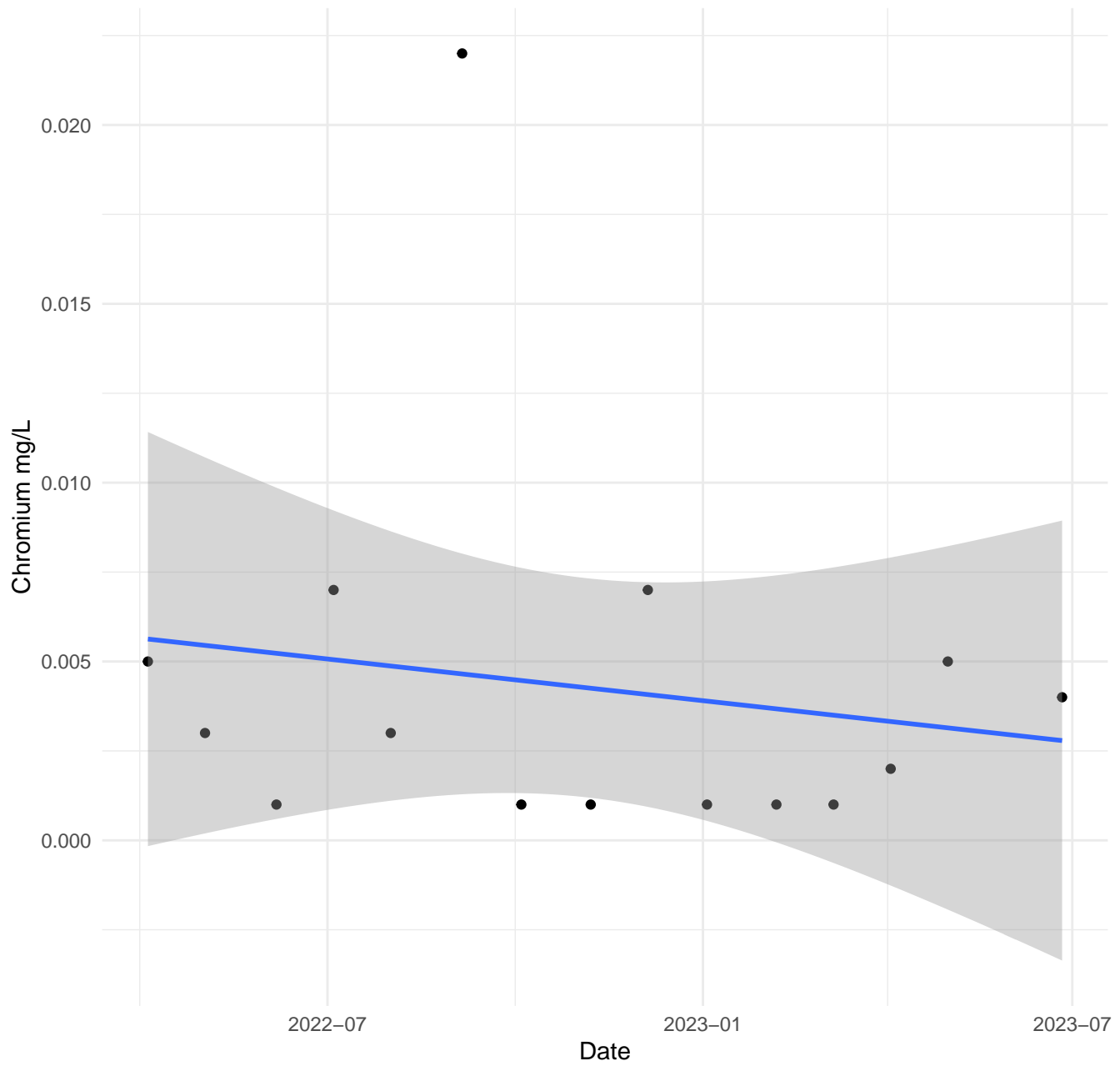
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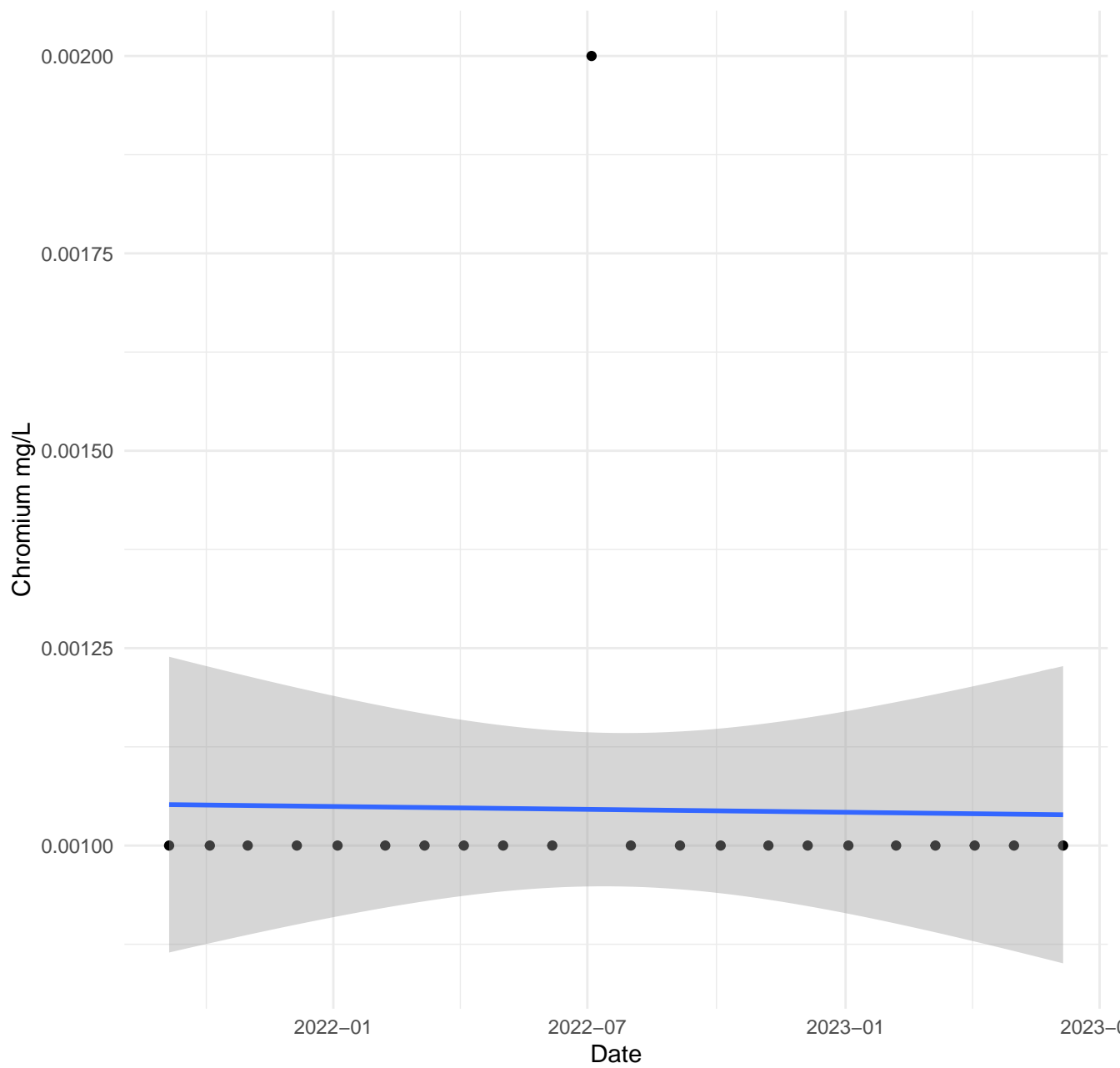
Chromium at G



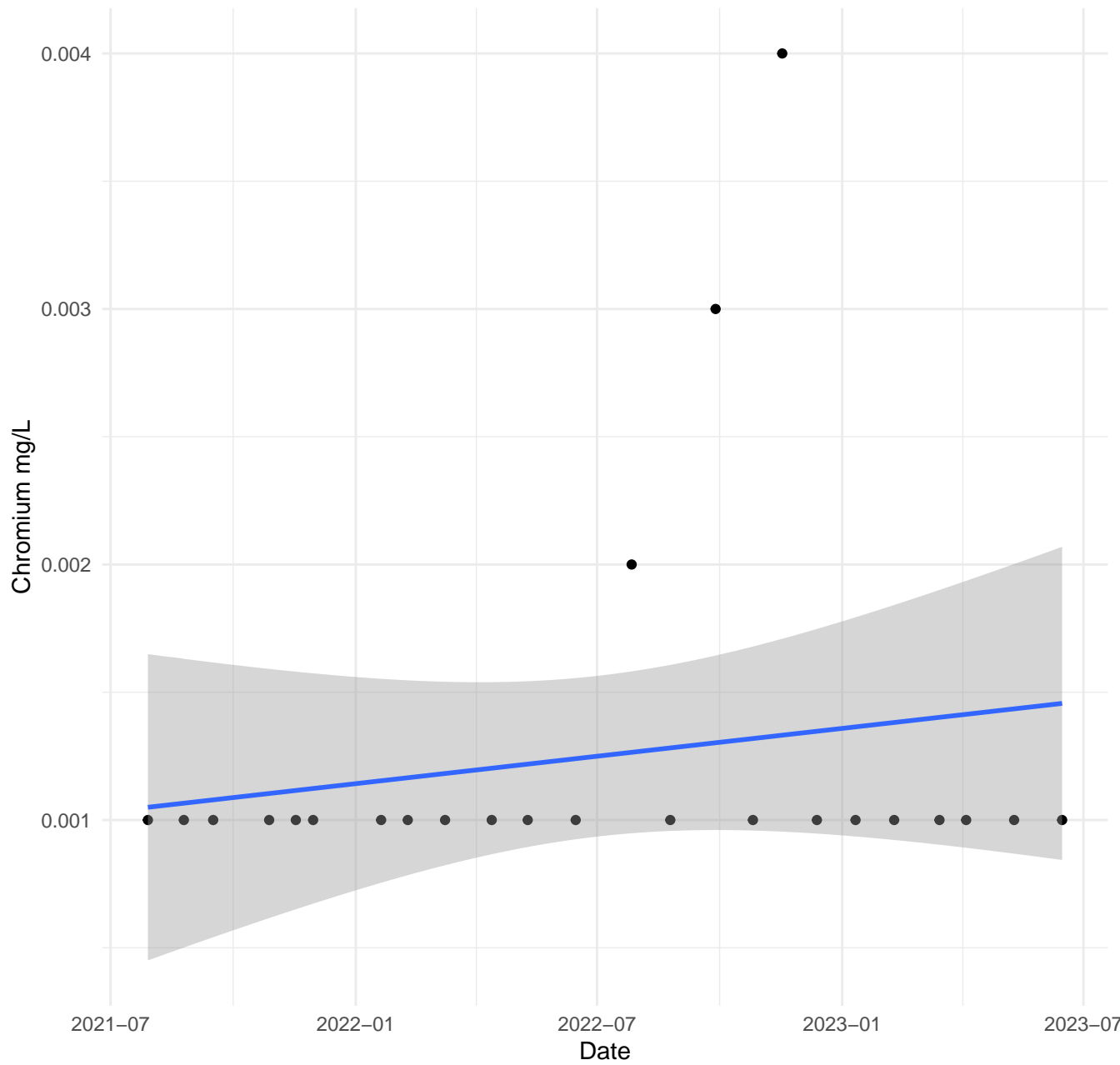
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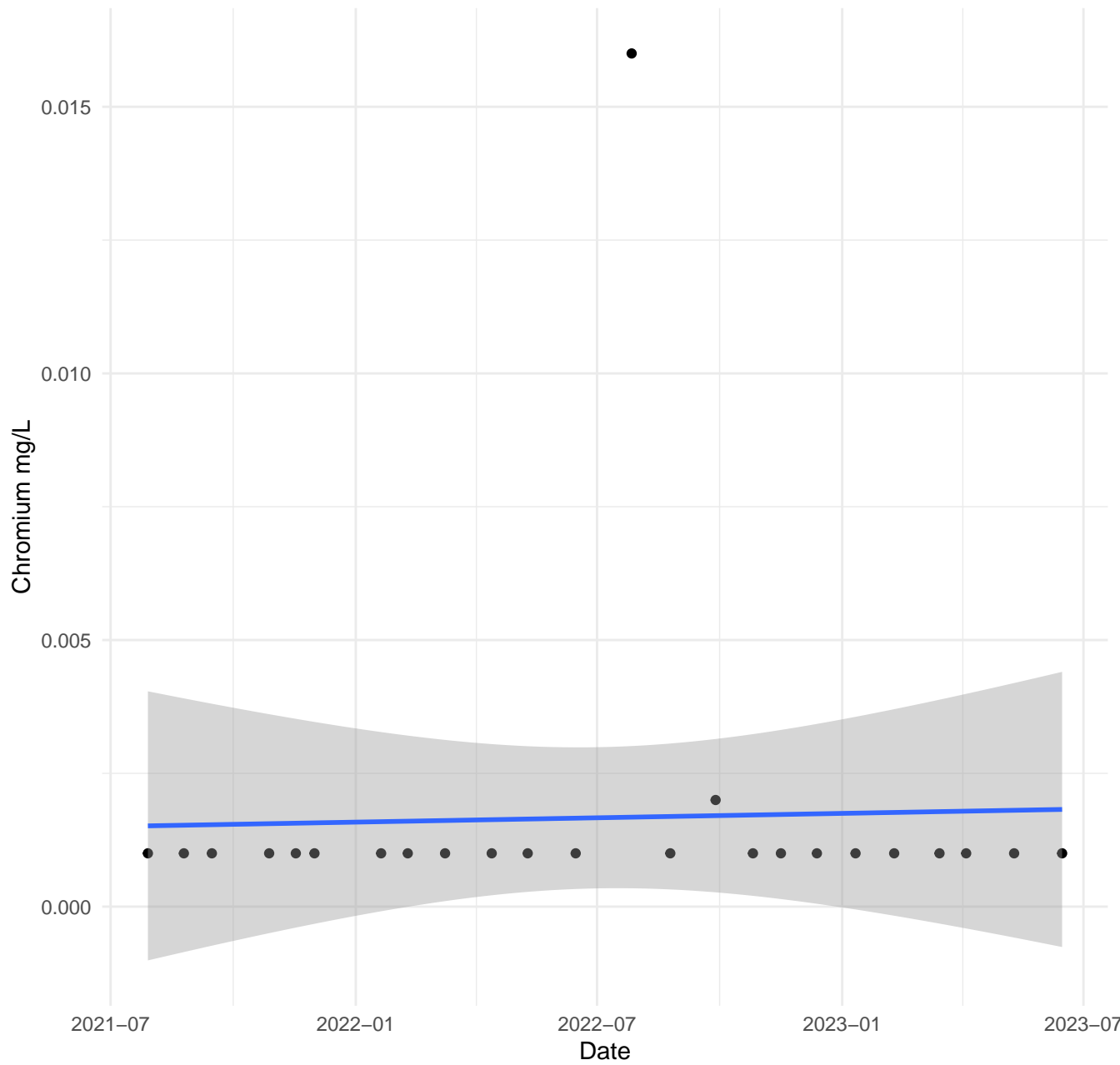
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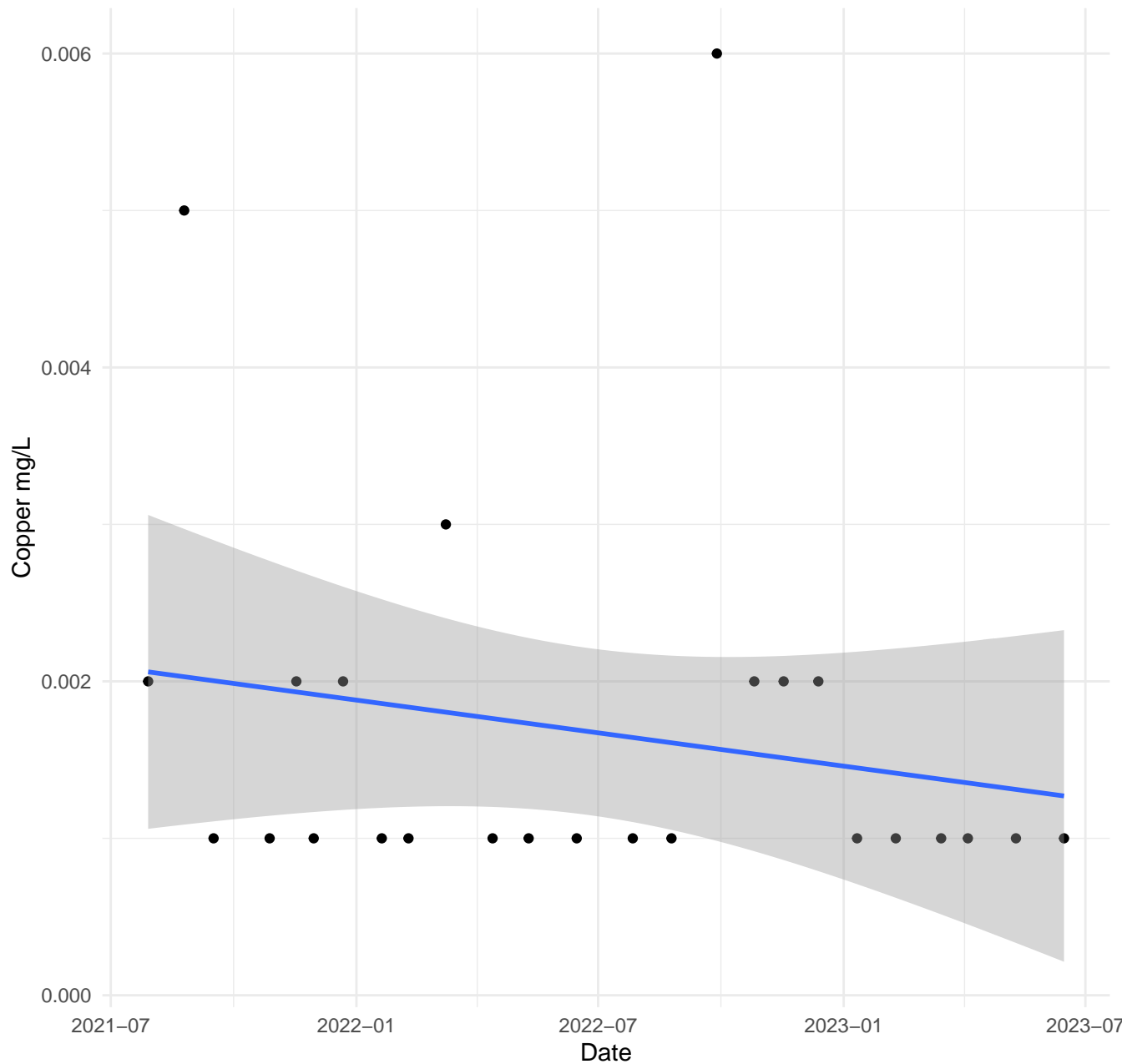
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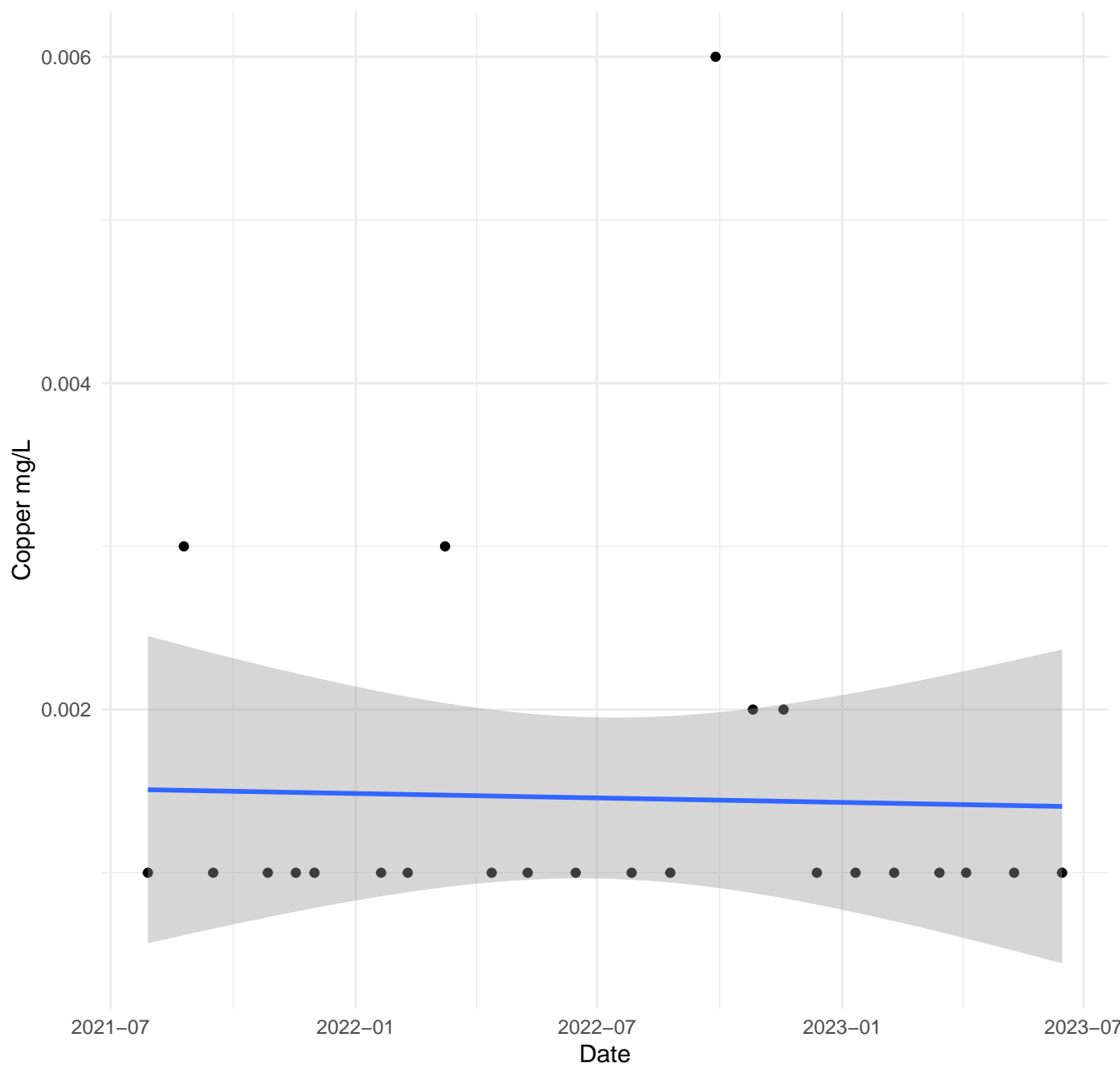
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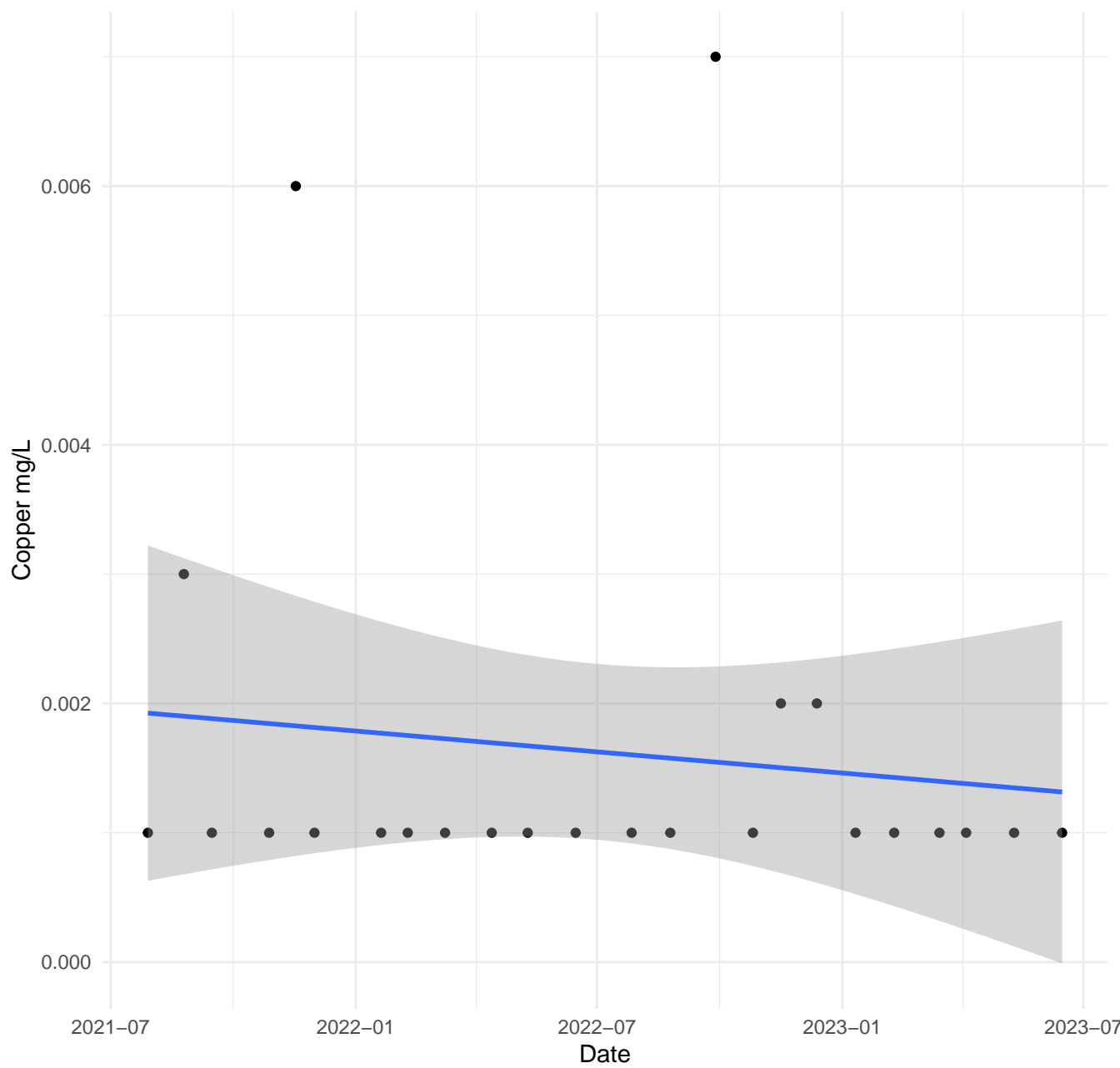
Copper at C



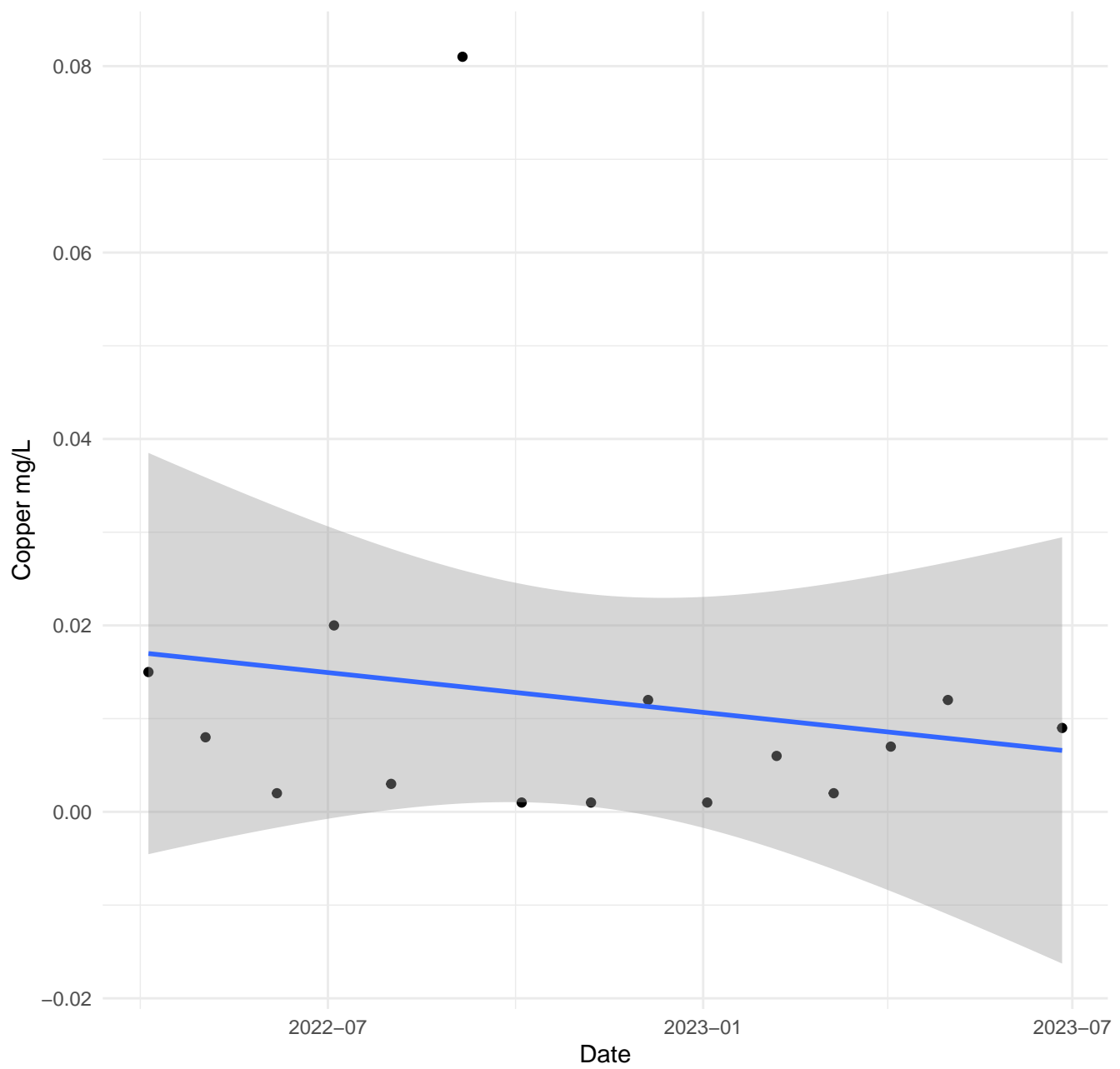
Copper at E



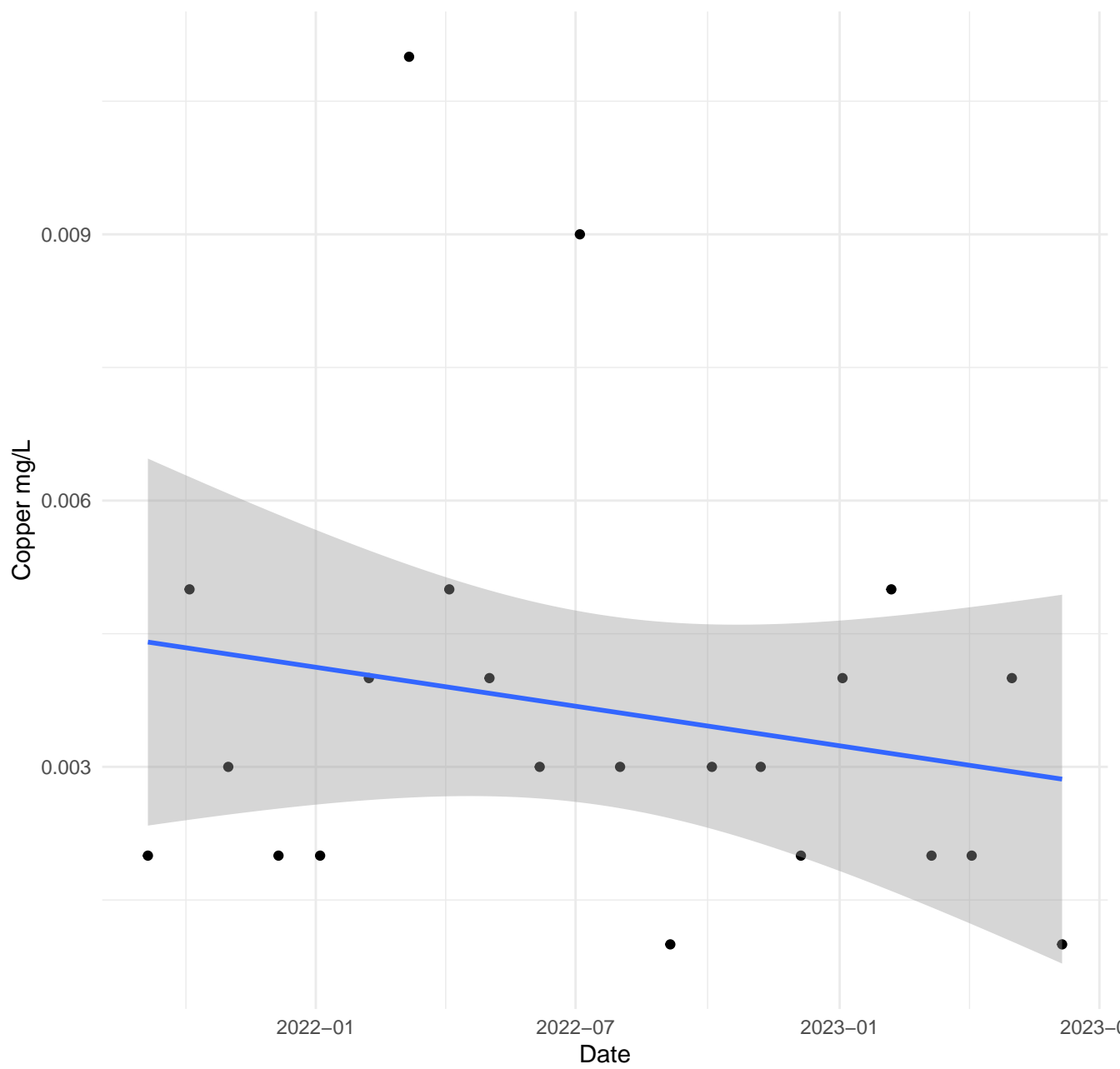
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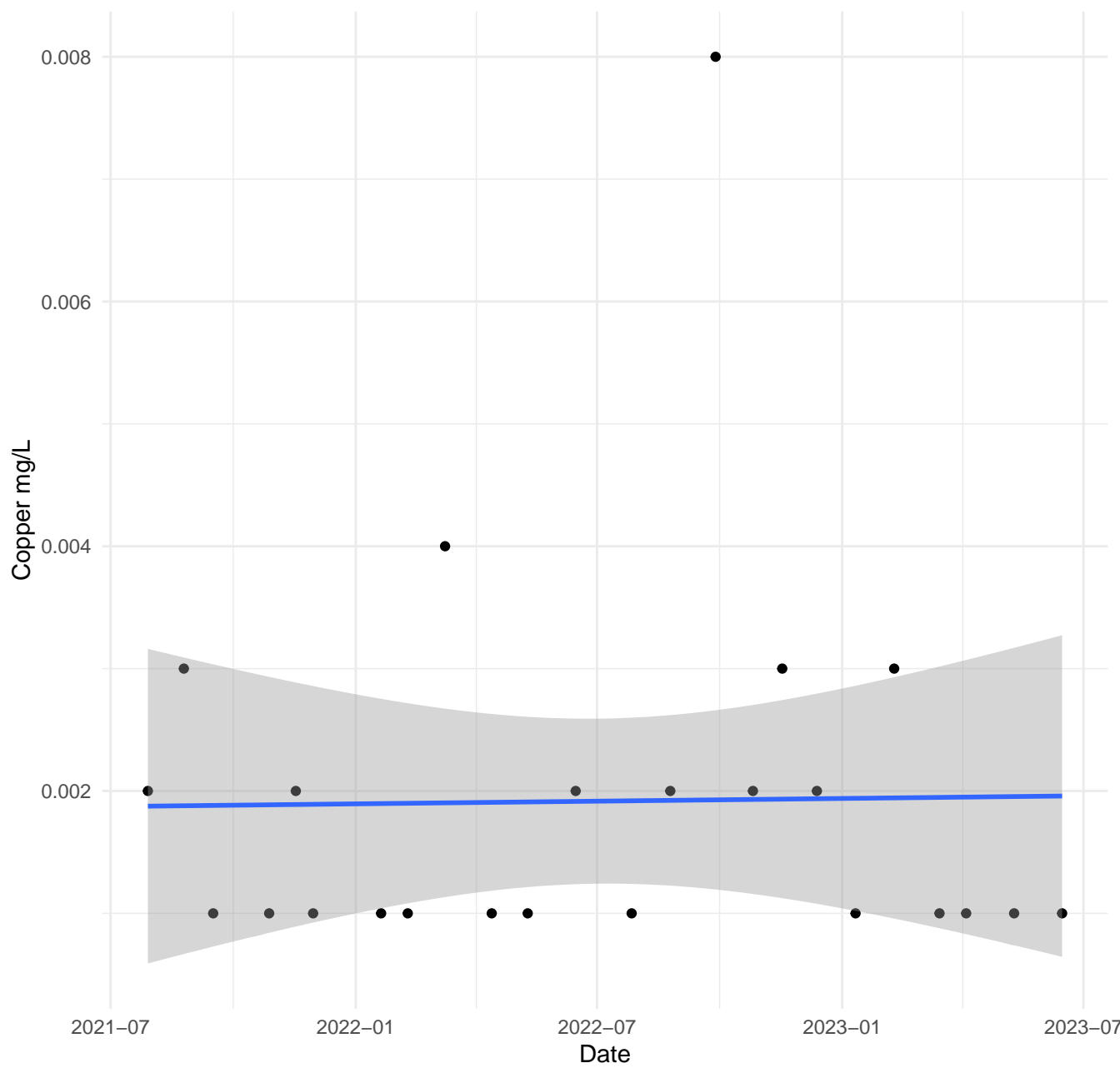
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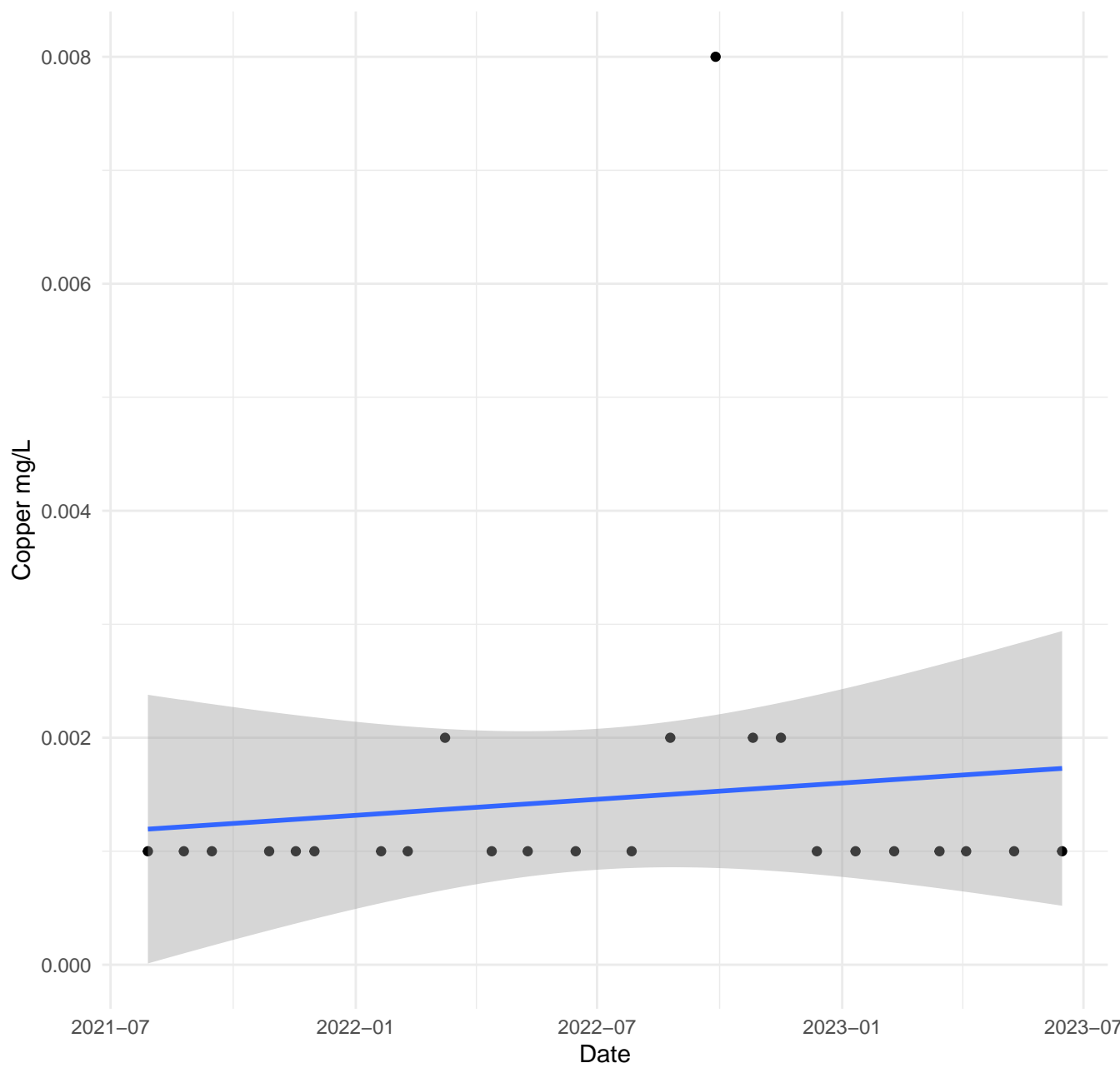
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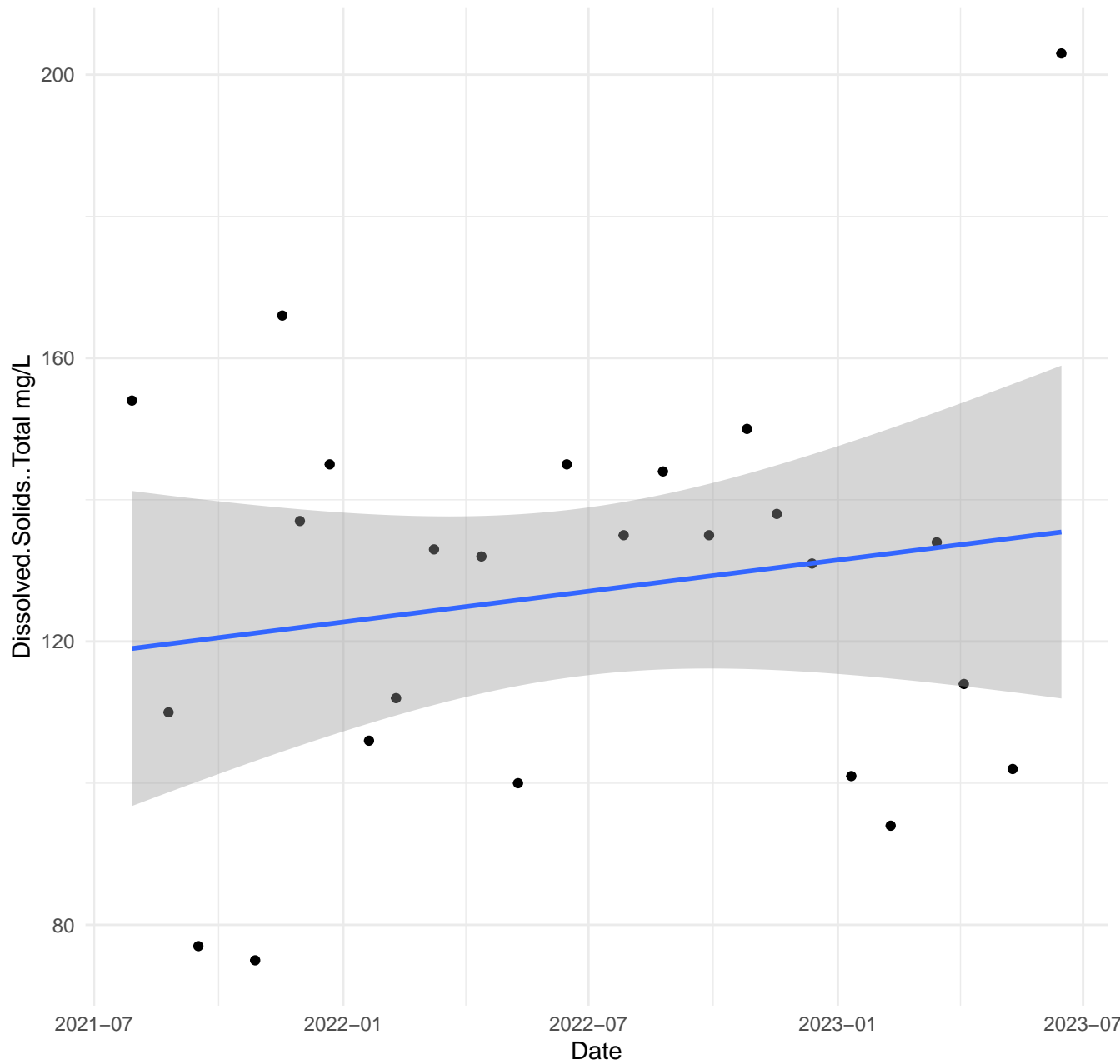
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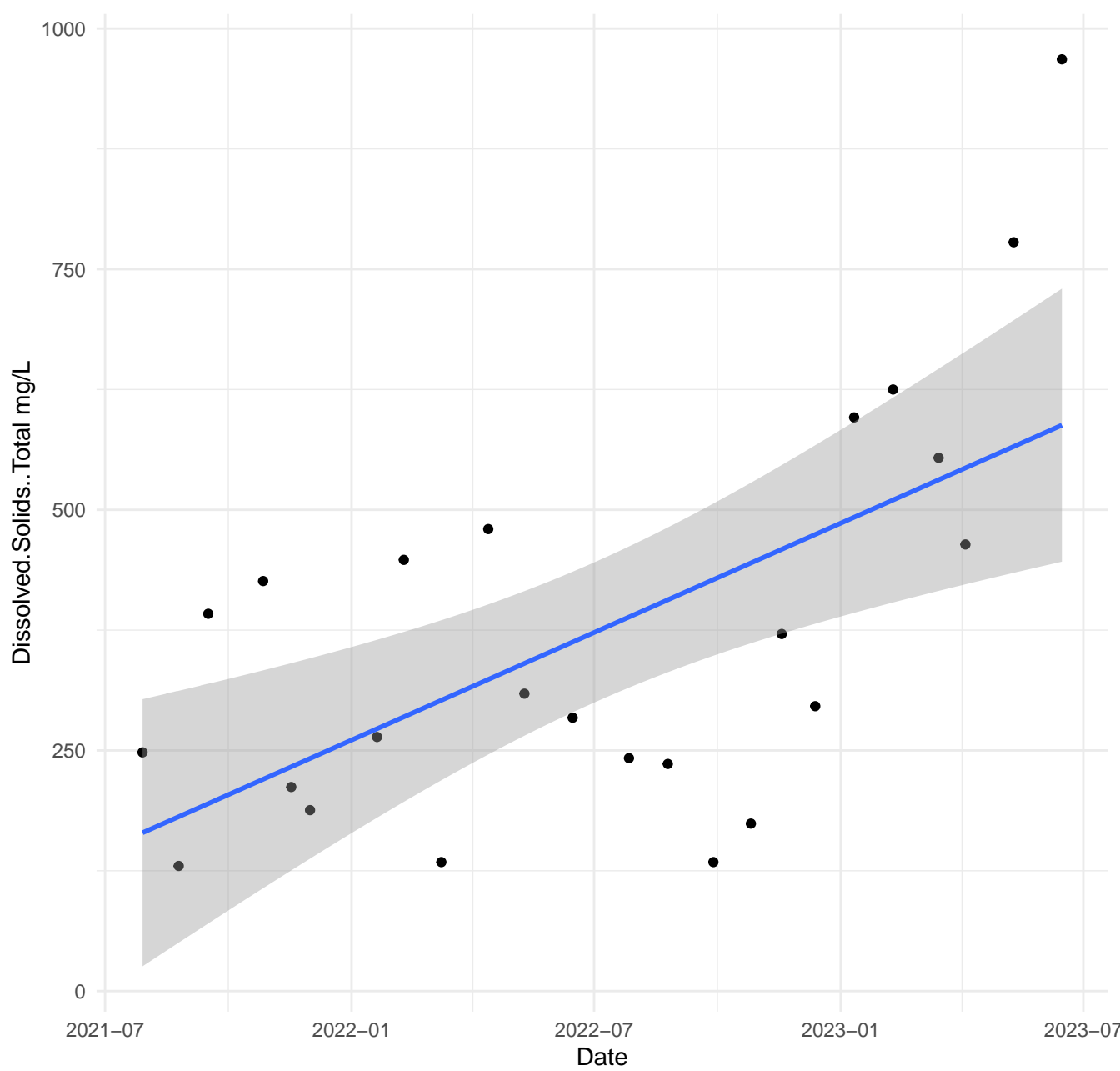
Copper at WX22



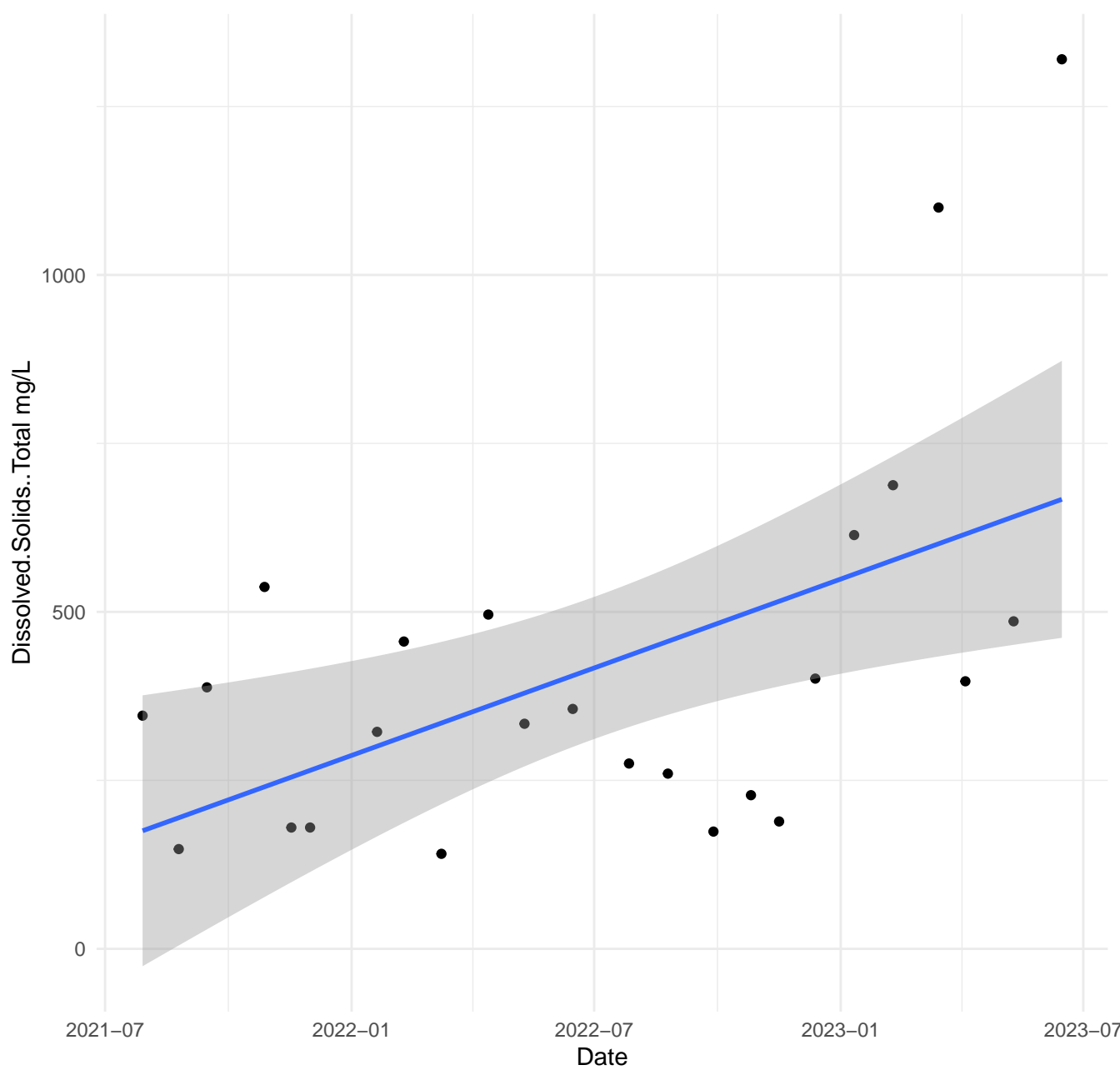
Dissolved.Solids..Total at C



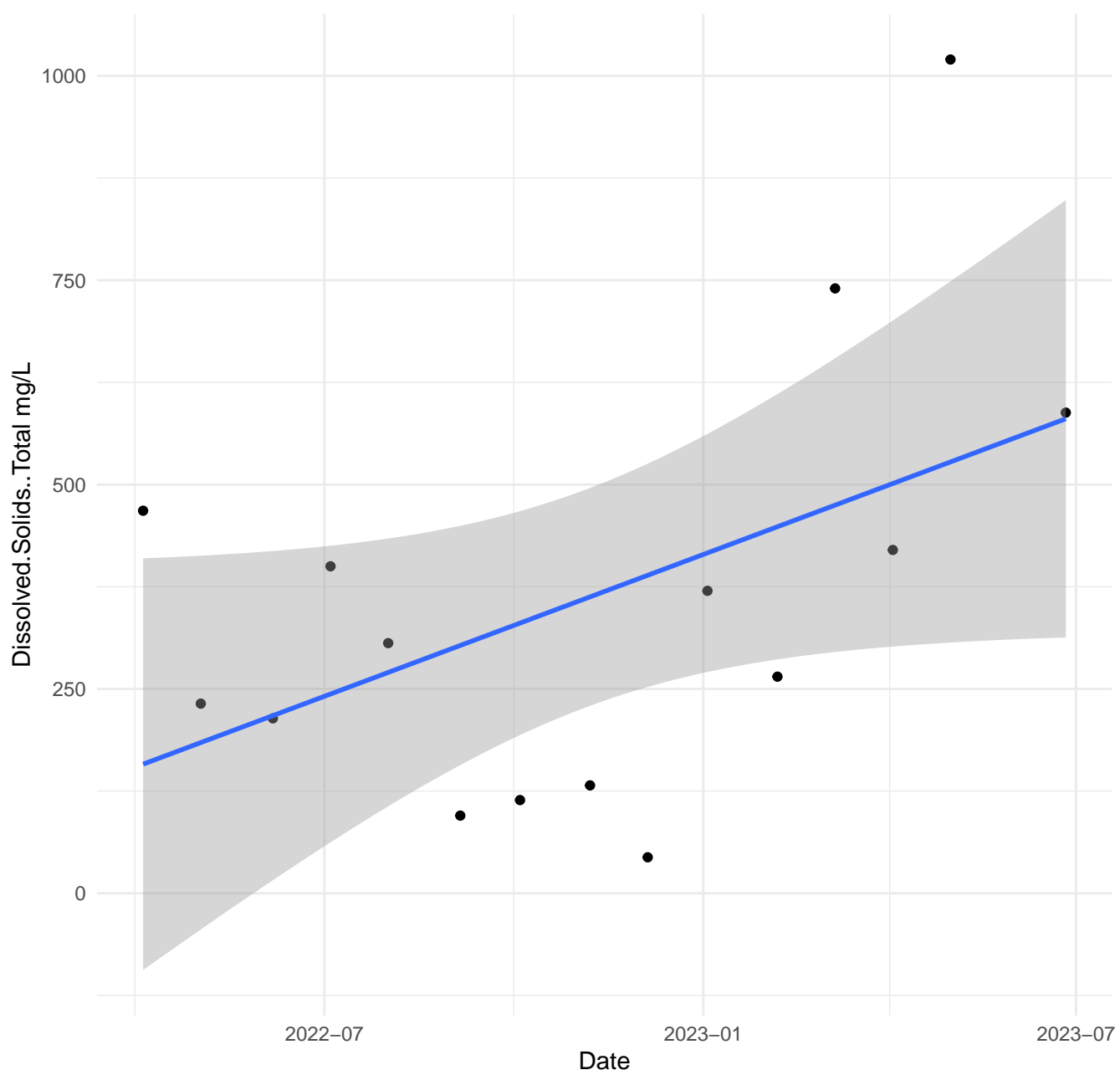
Dissolved.Solids..Total at E



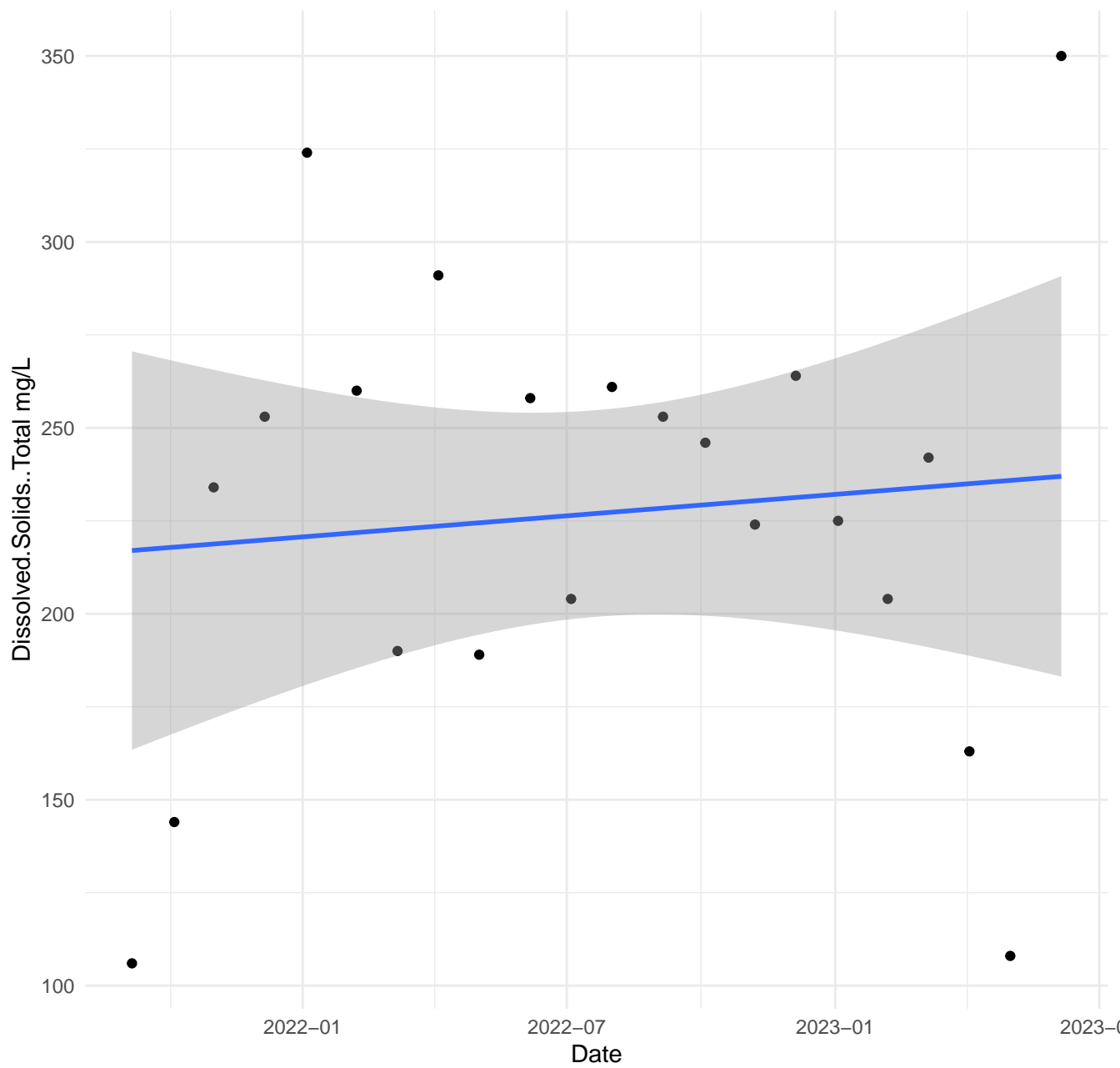
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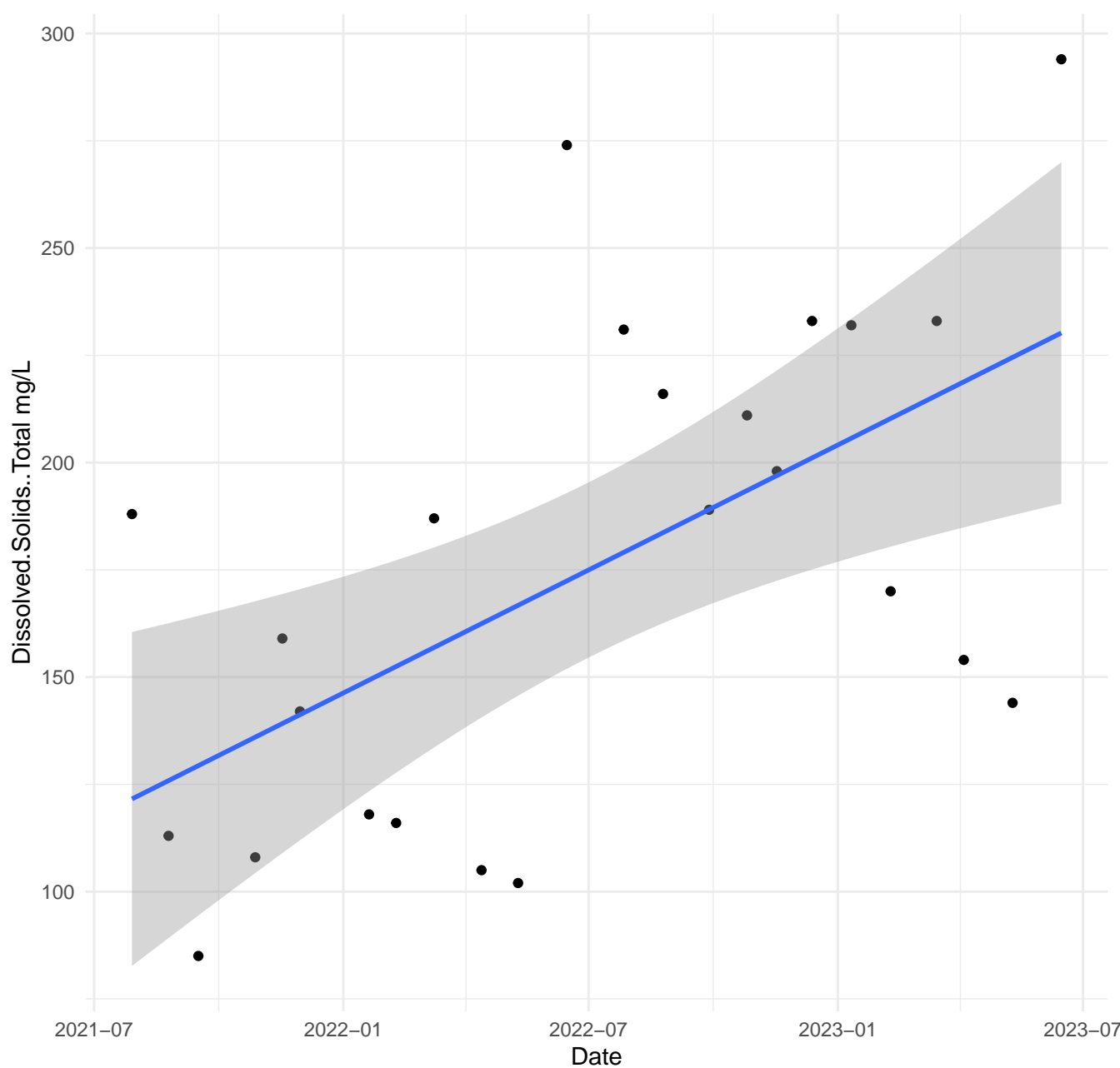
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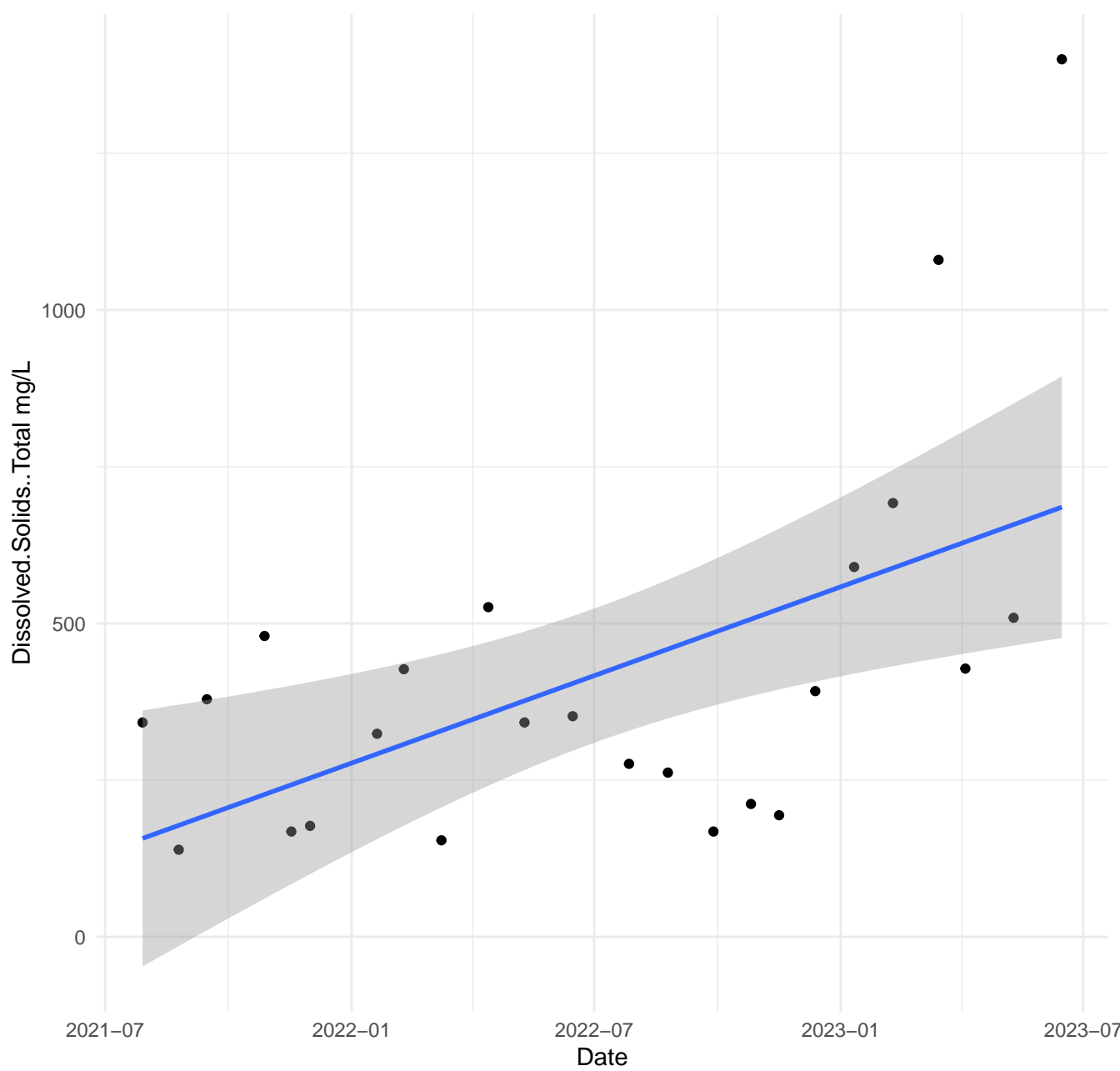
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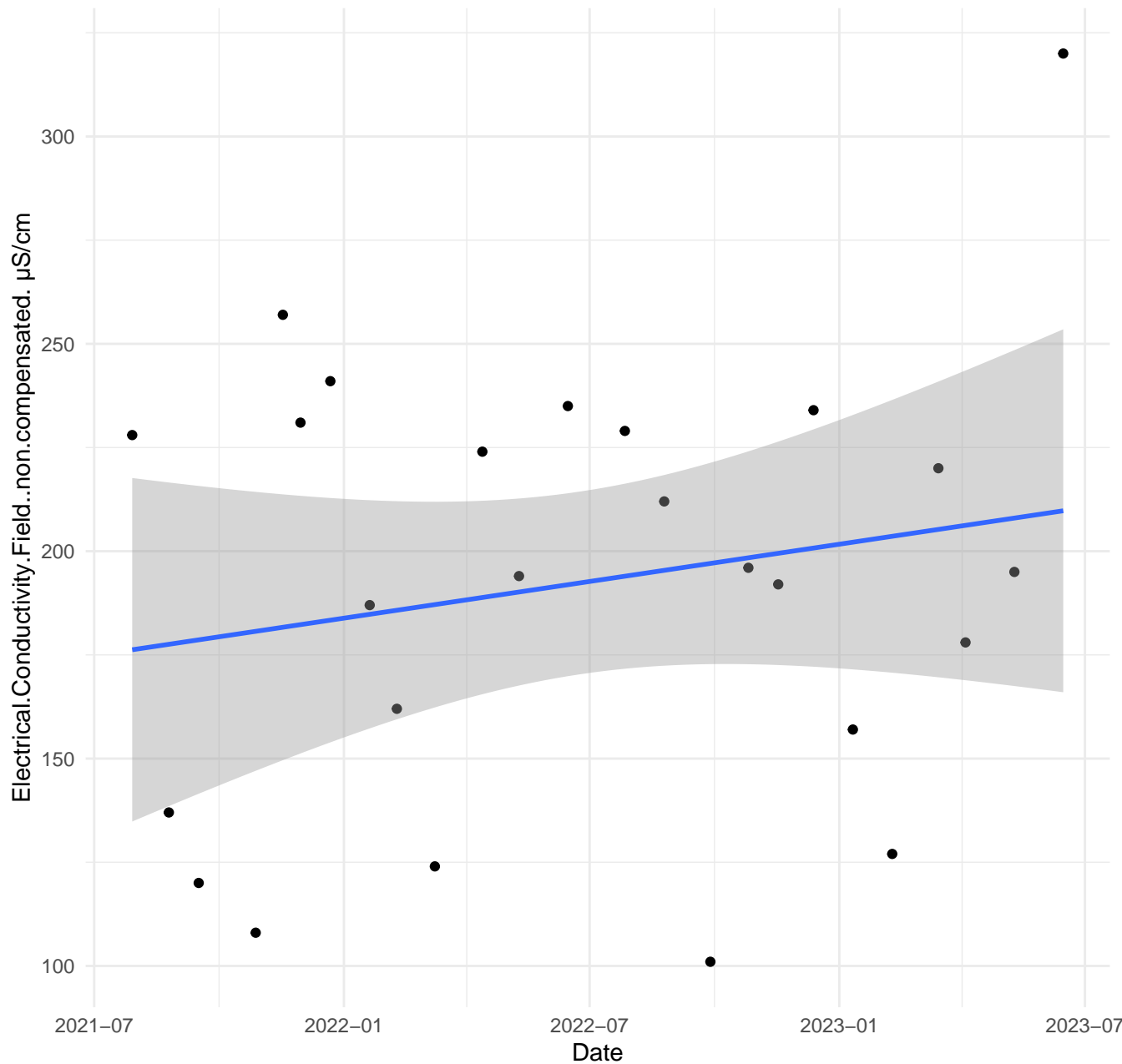
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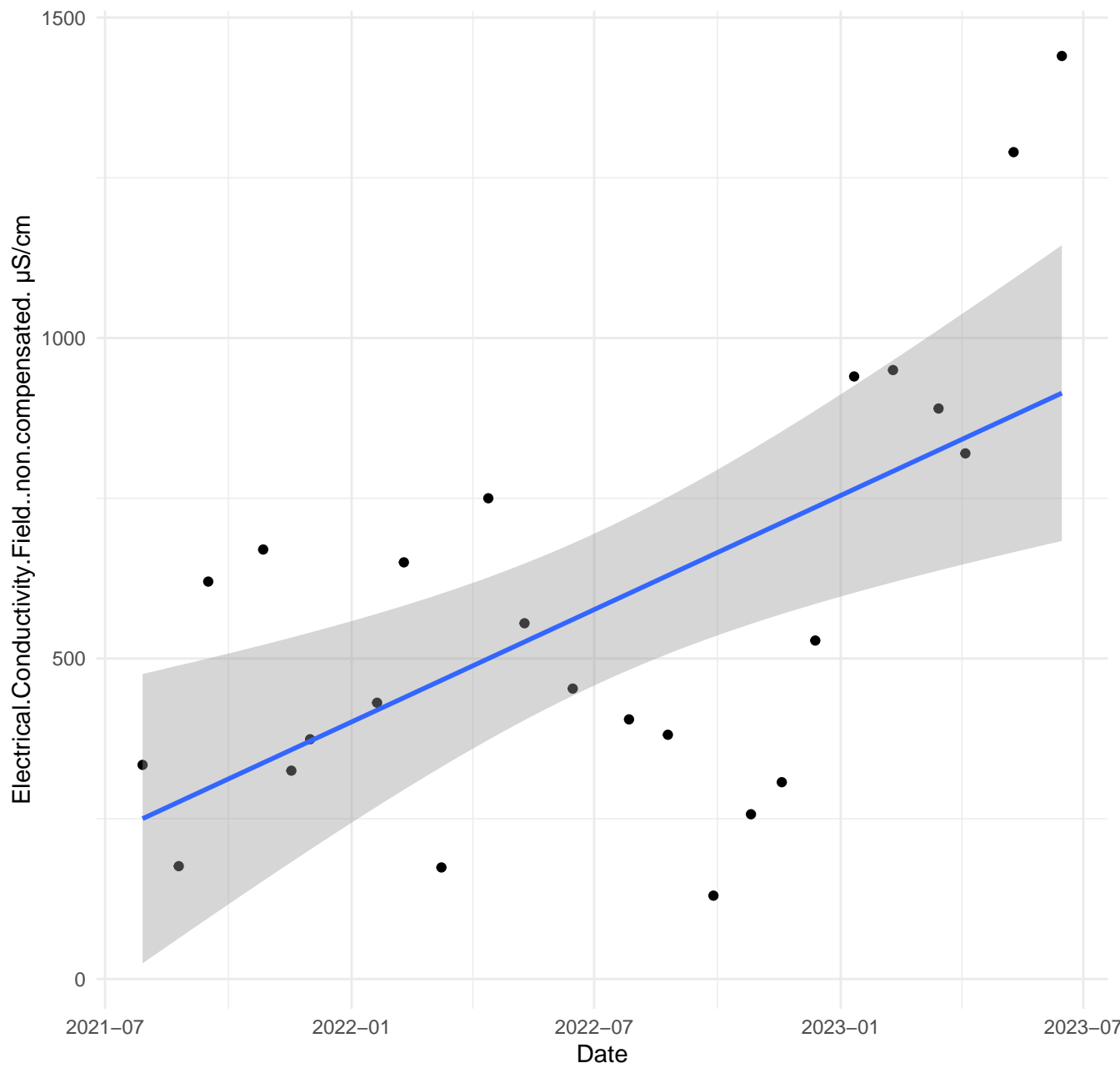
Dissolved.Solids..Total at WX22



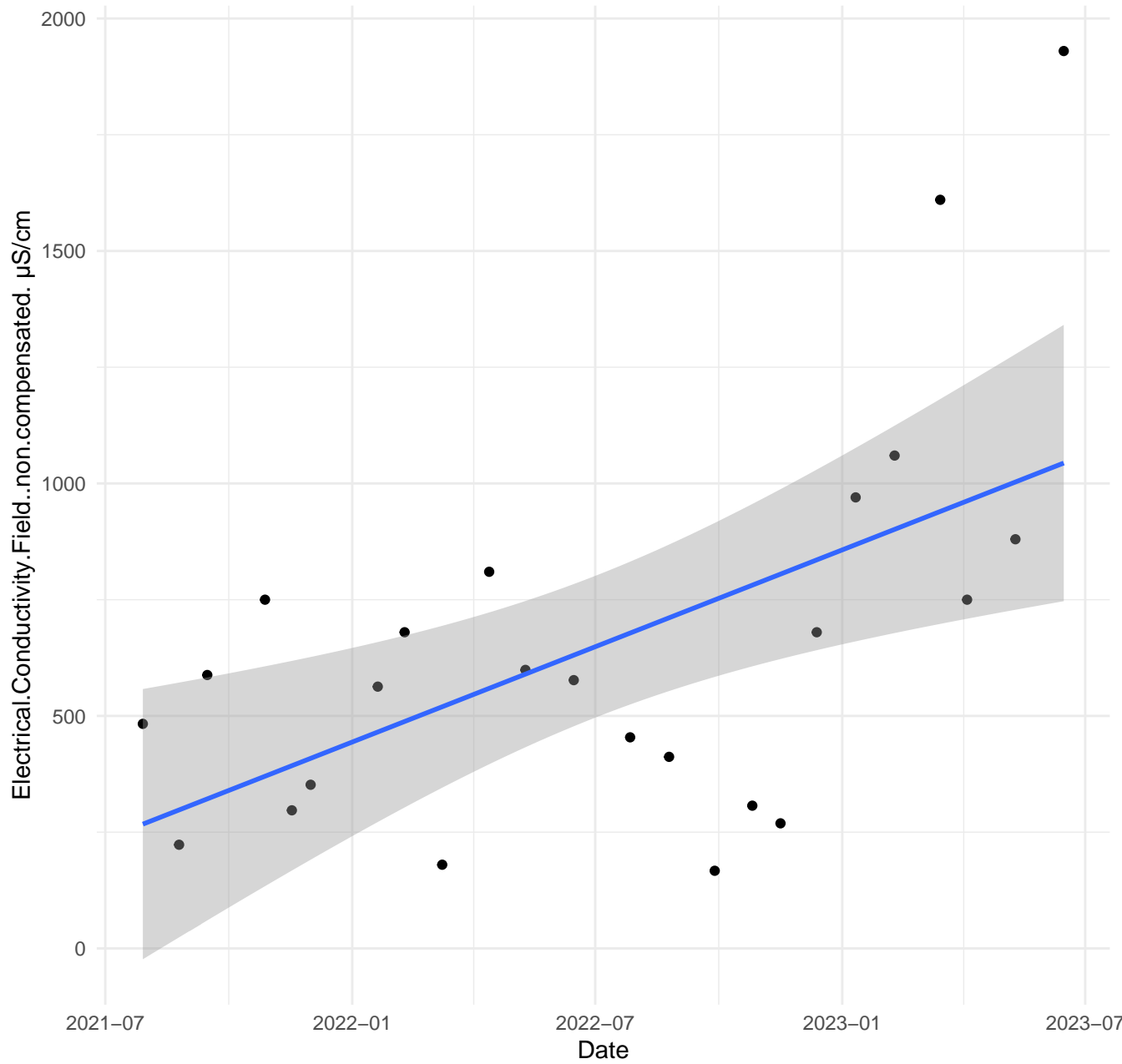
Electrical.Conductivity.Field..non.compensated. at C



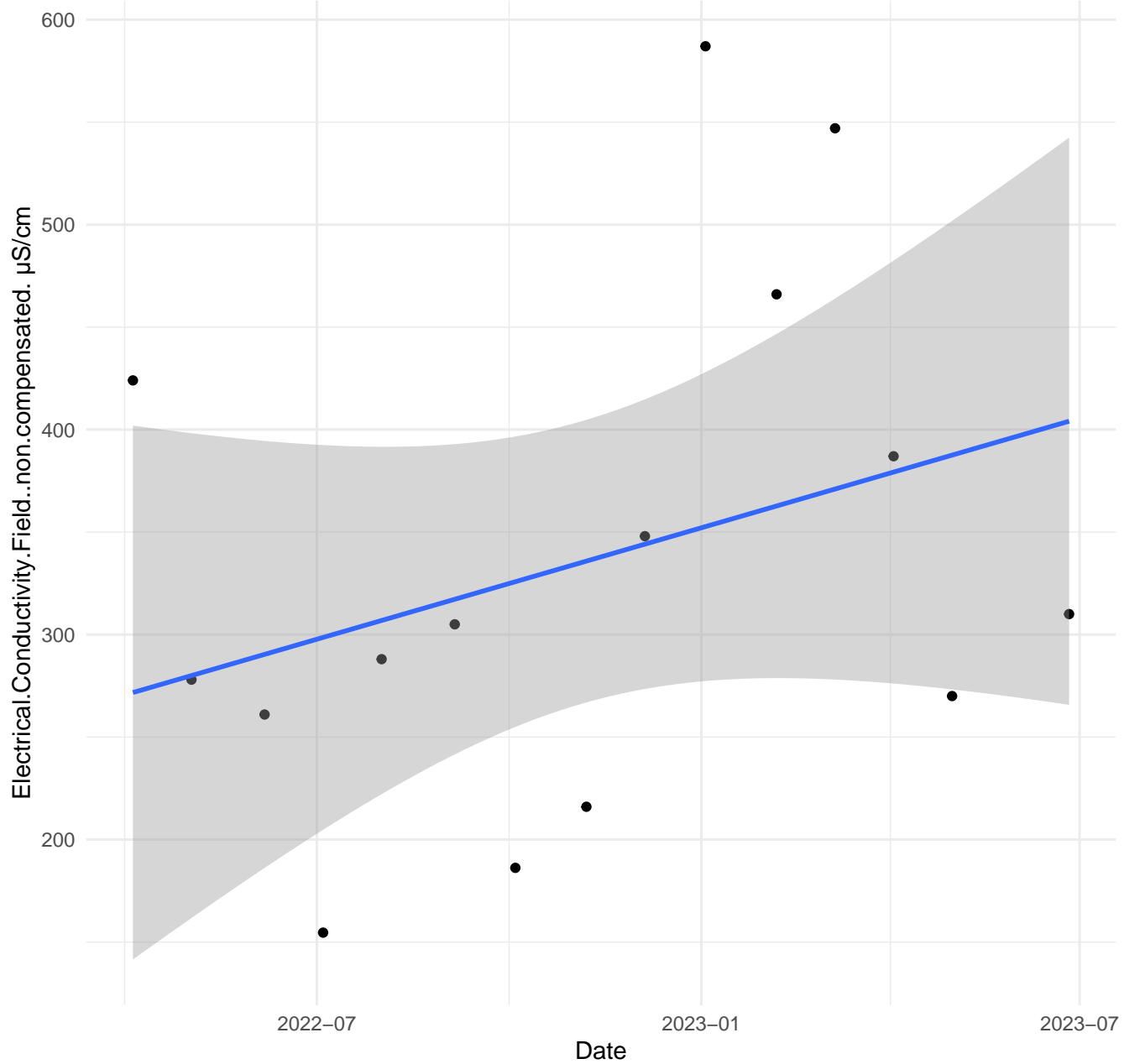
Electrical.Conductivity.Field..non.compensated. at E



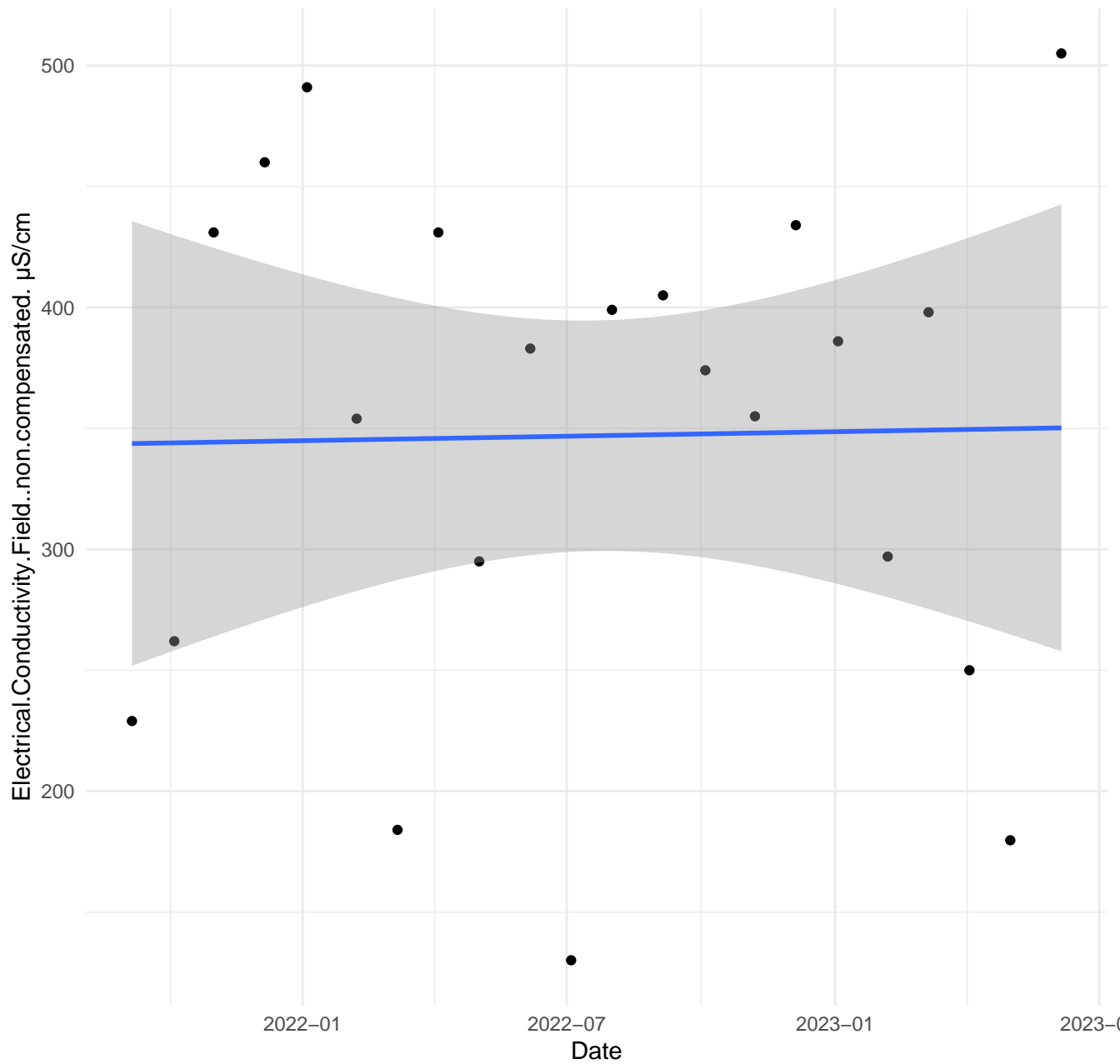
Electrical.Conductivity.Field..non.compensated. at G



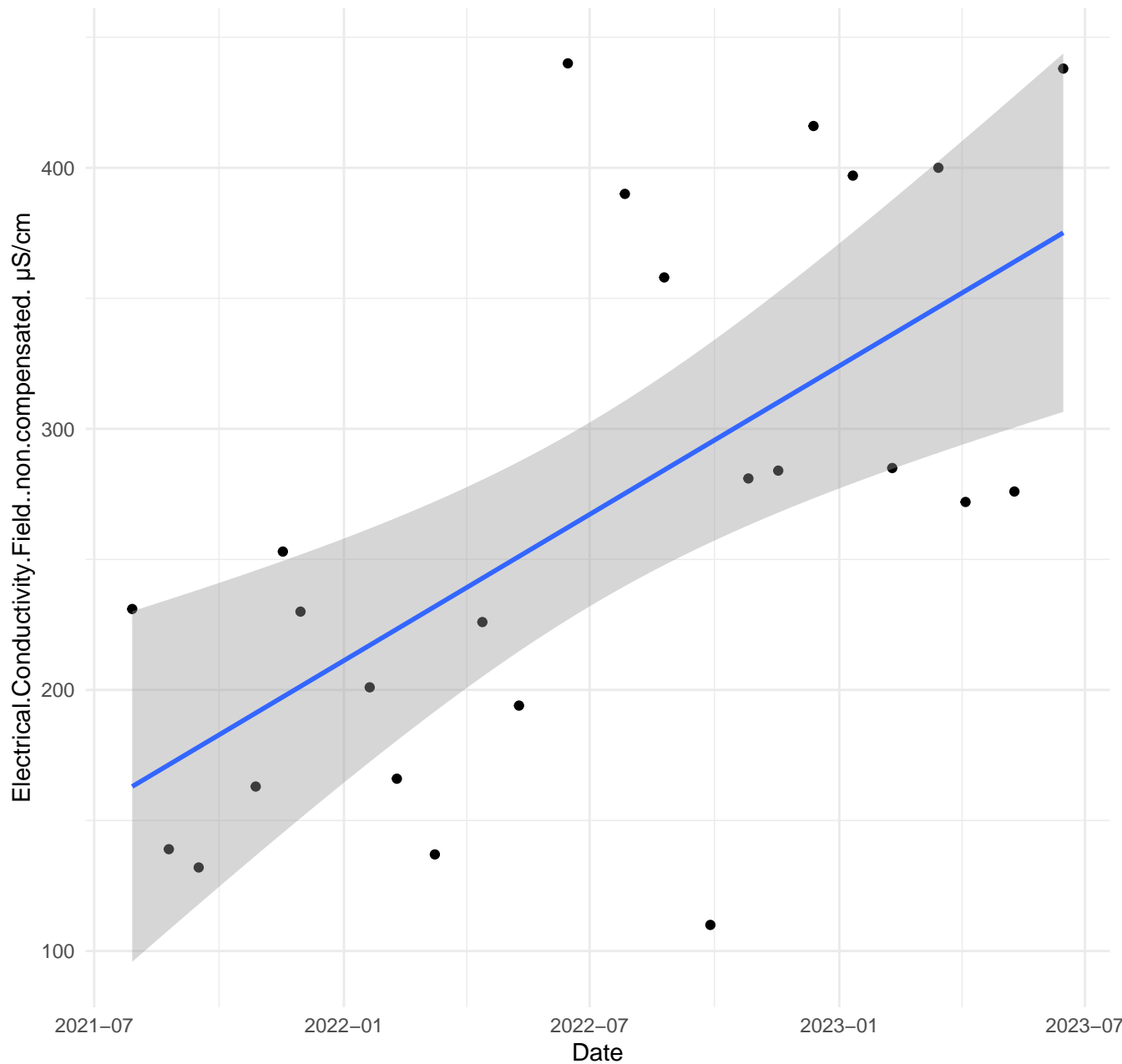
Electrical.Conductivity.Field..non.compensated. at LDP01



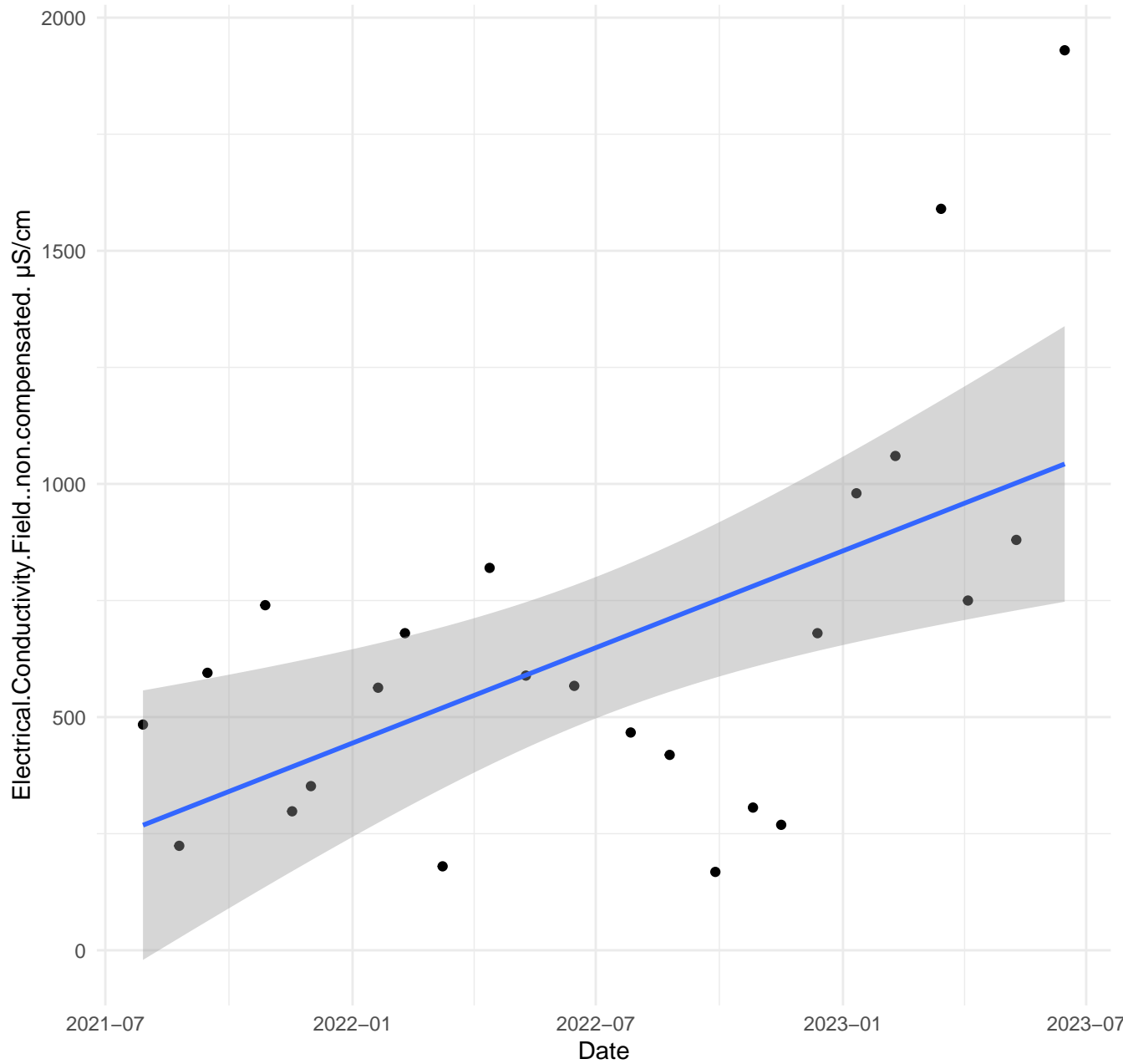
Electrical.Conductivity.Field..non.compensated. at LMP01



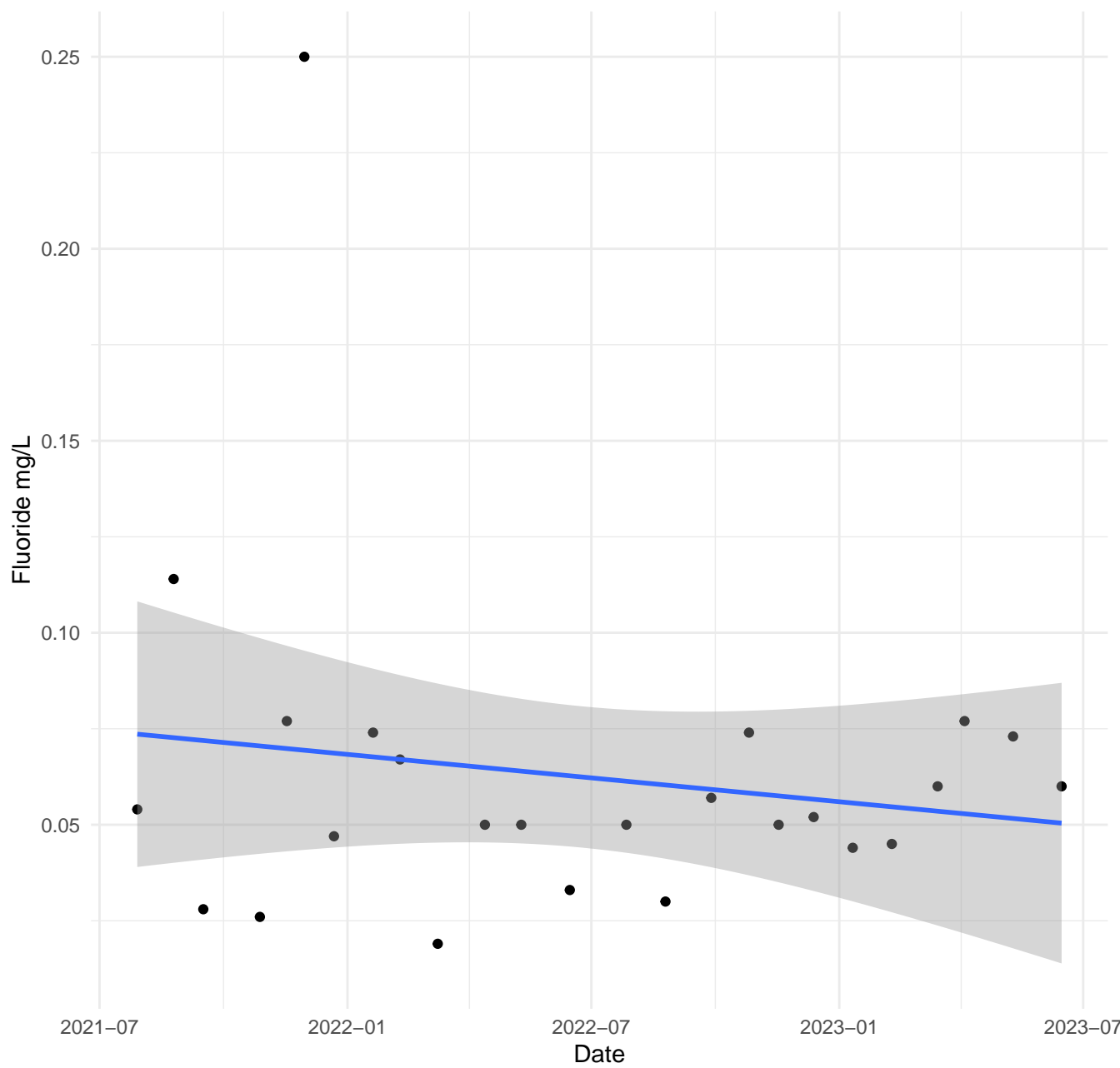
Electrical.Conductivity.Field..non.compensated. at NC01



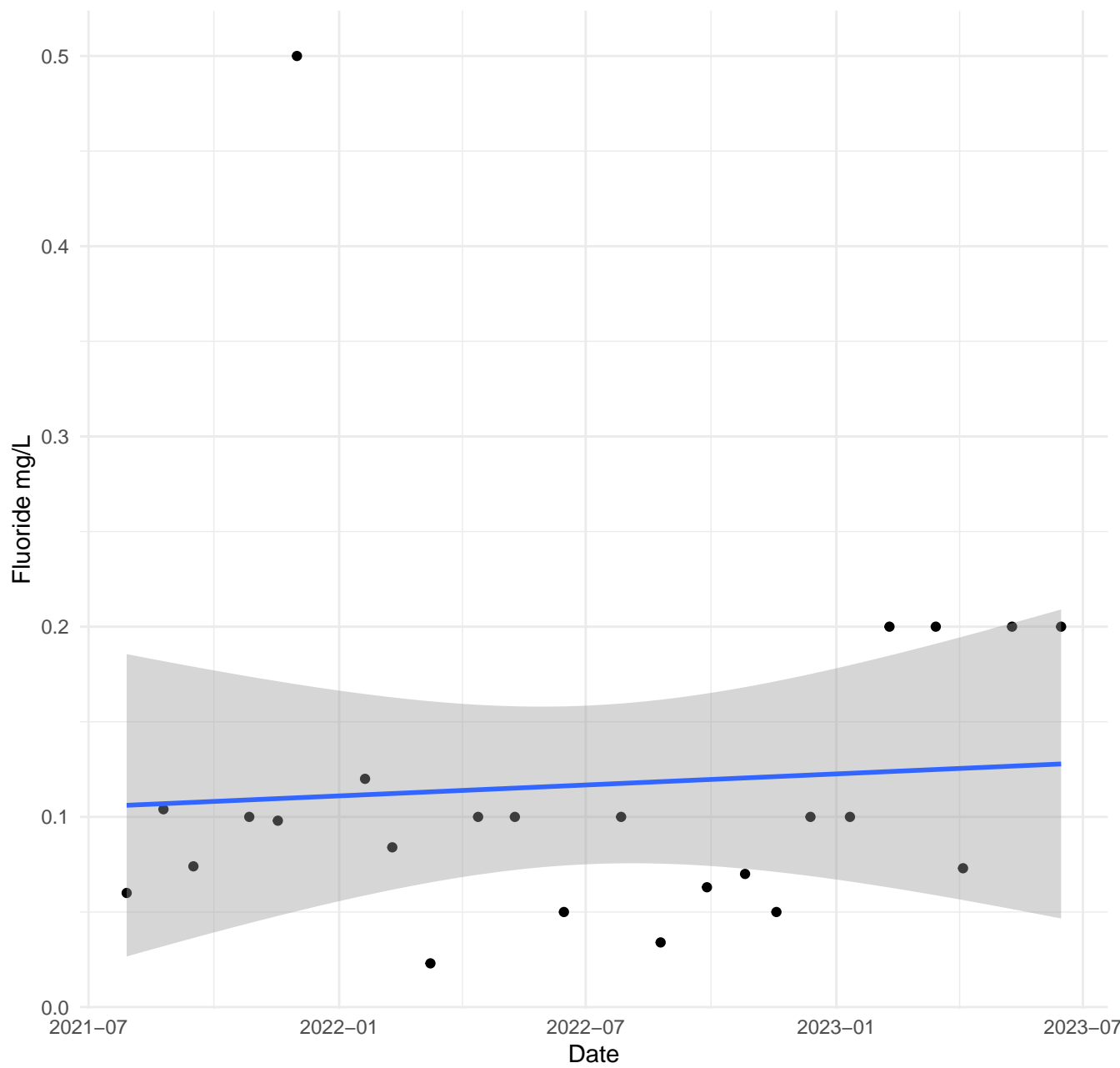
Electrical.Conductivity.Field..non.compensated. at WX22



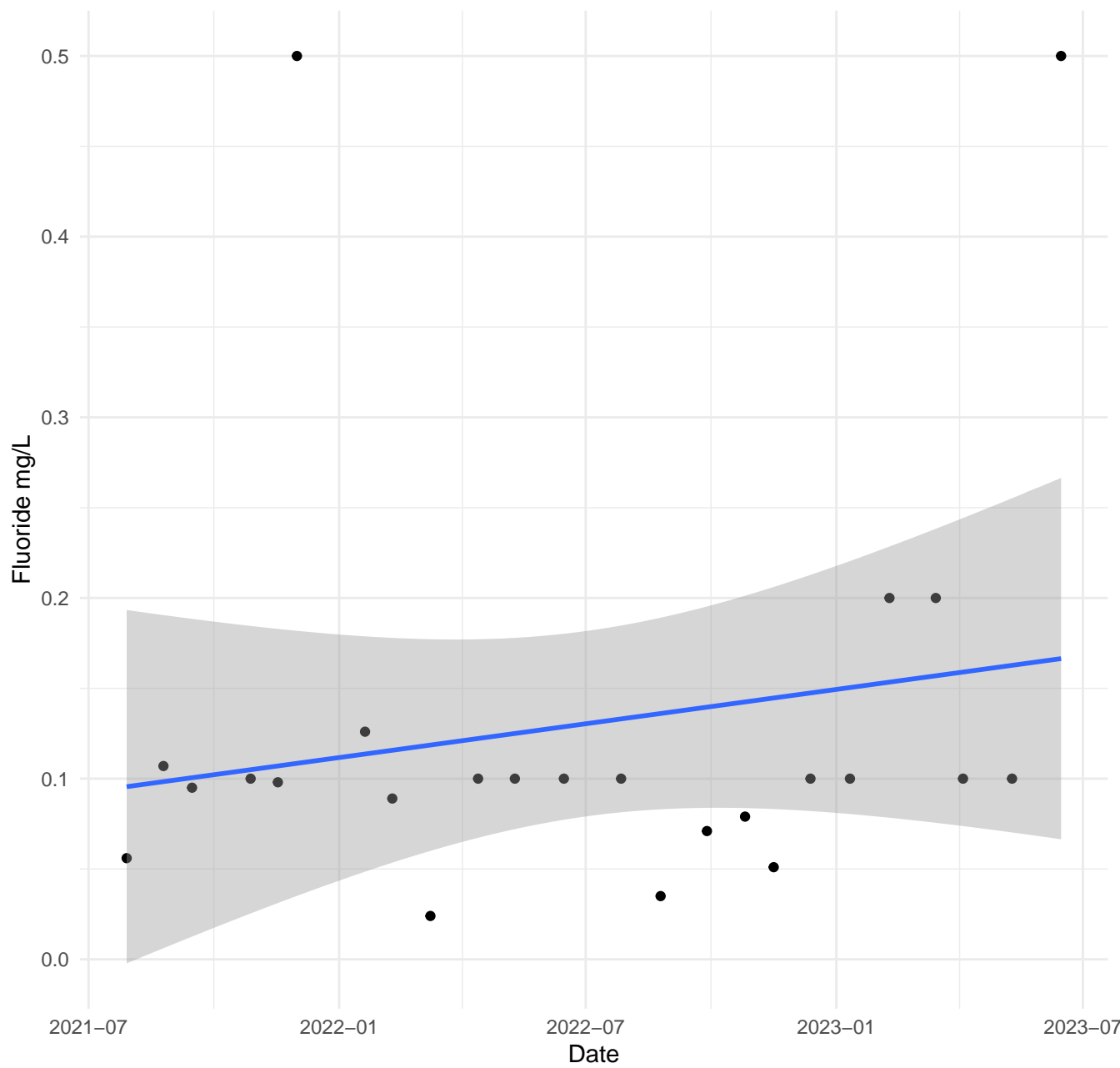
Fluoride at C



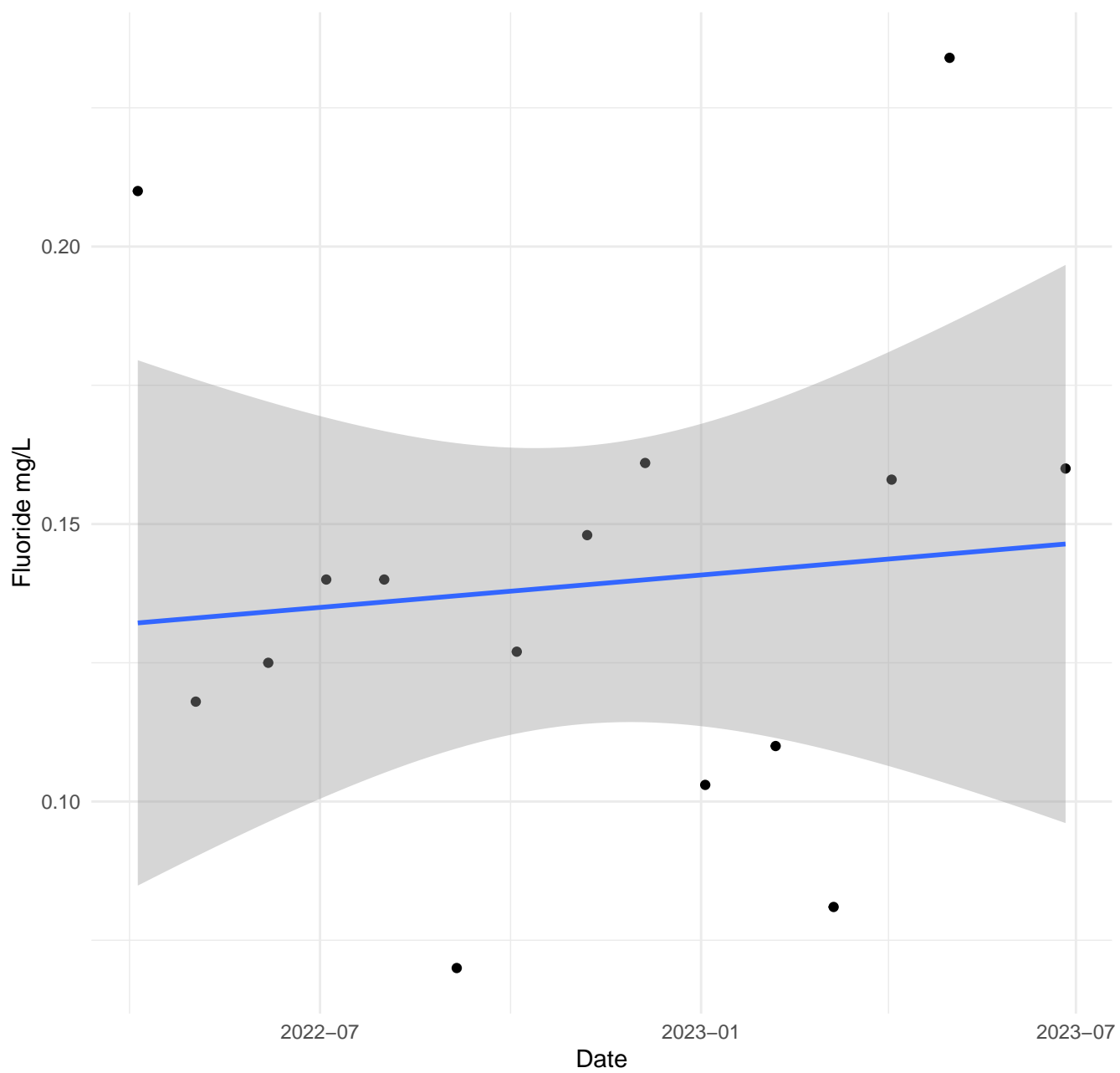
Fluoride at E



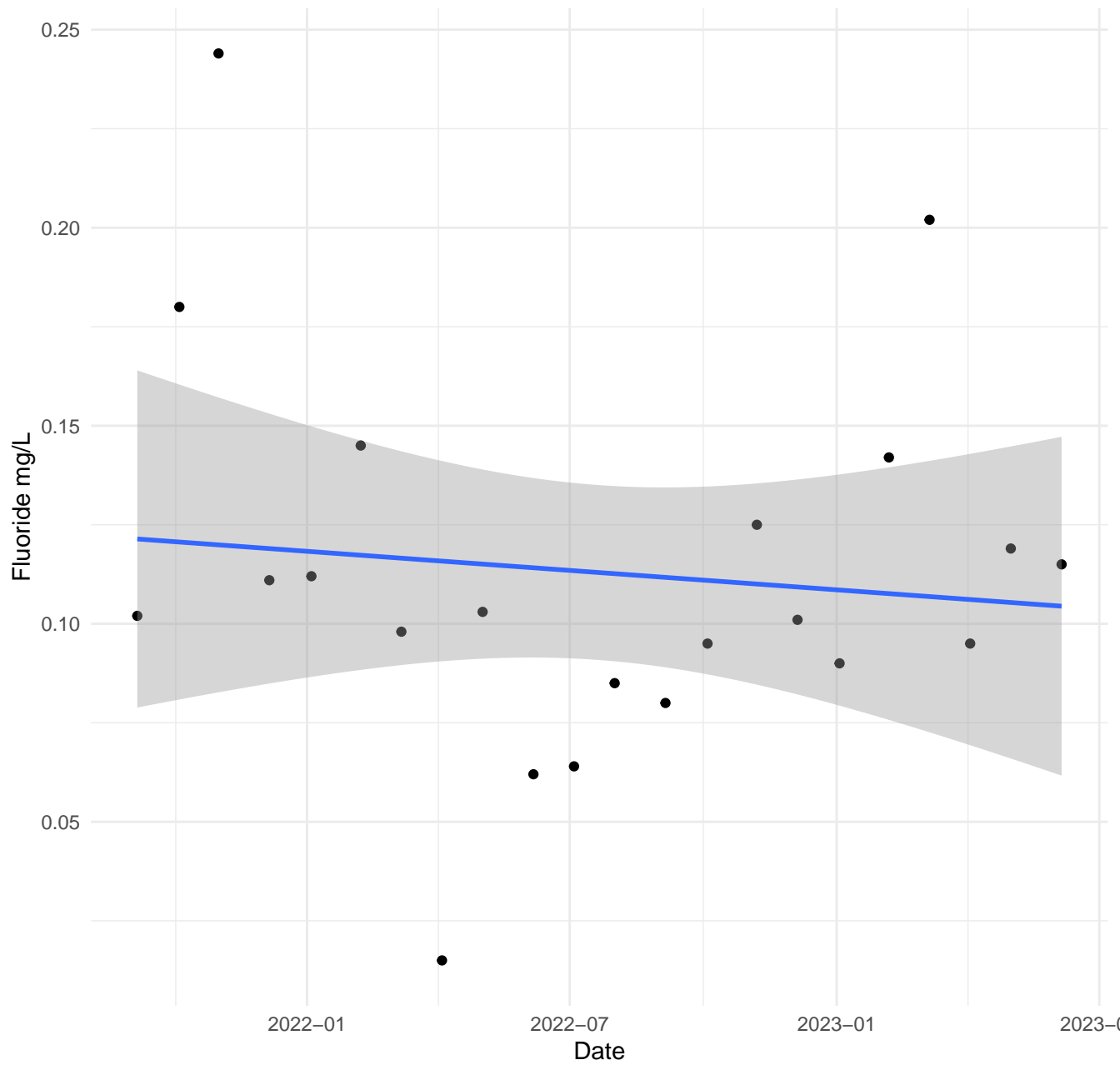
Fluoride at G



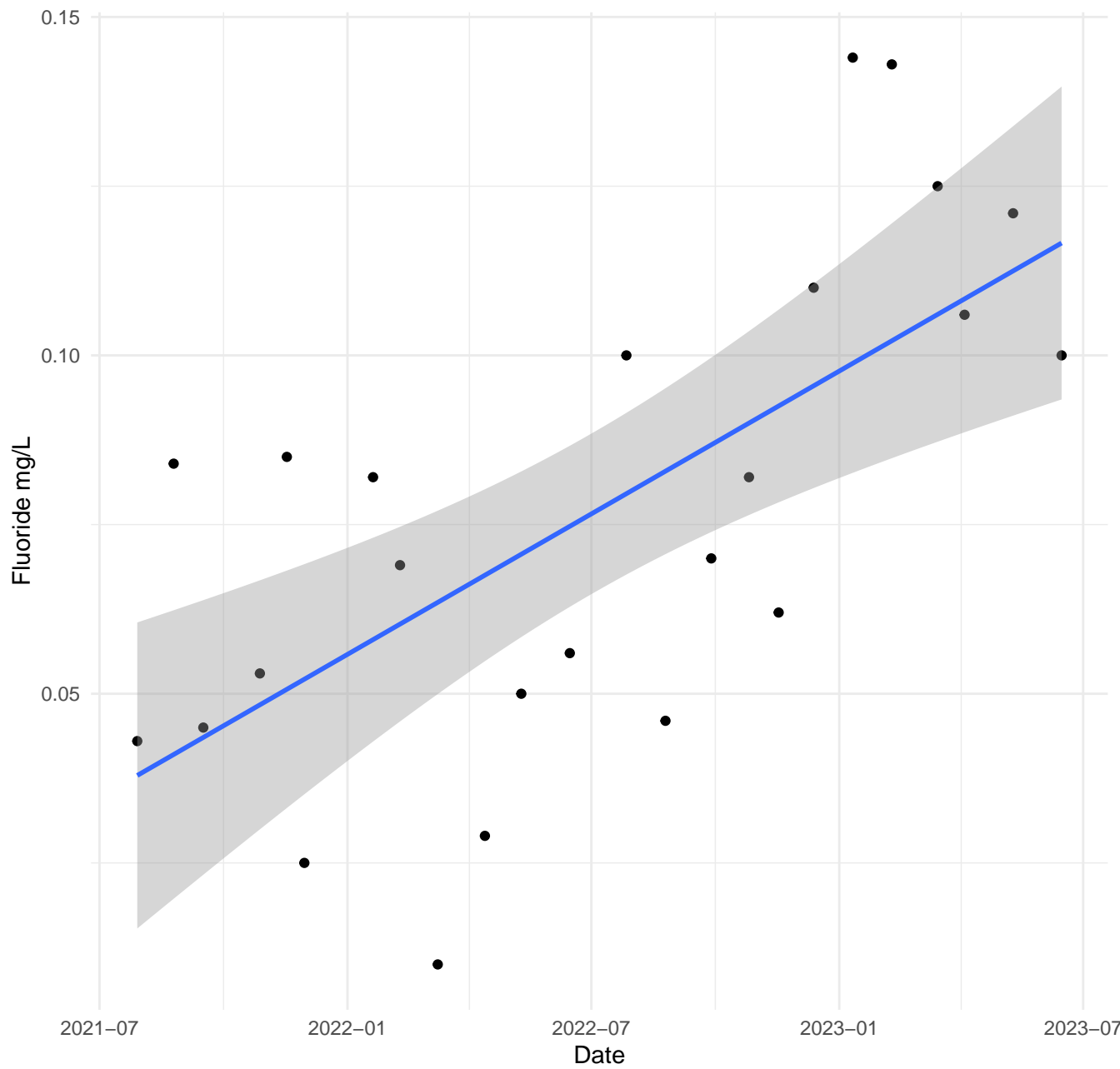
Fluoride at LDP01



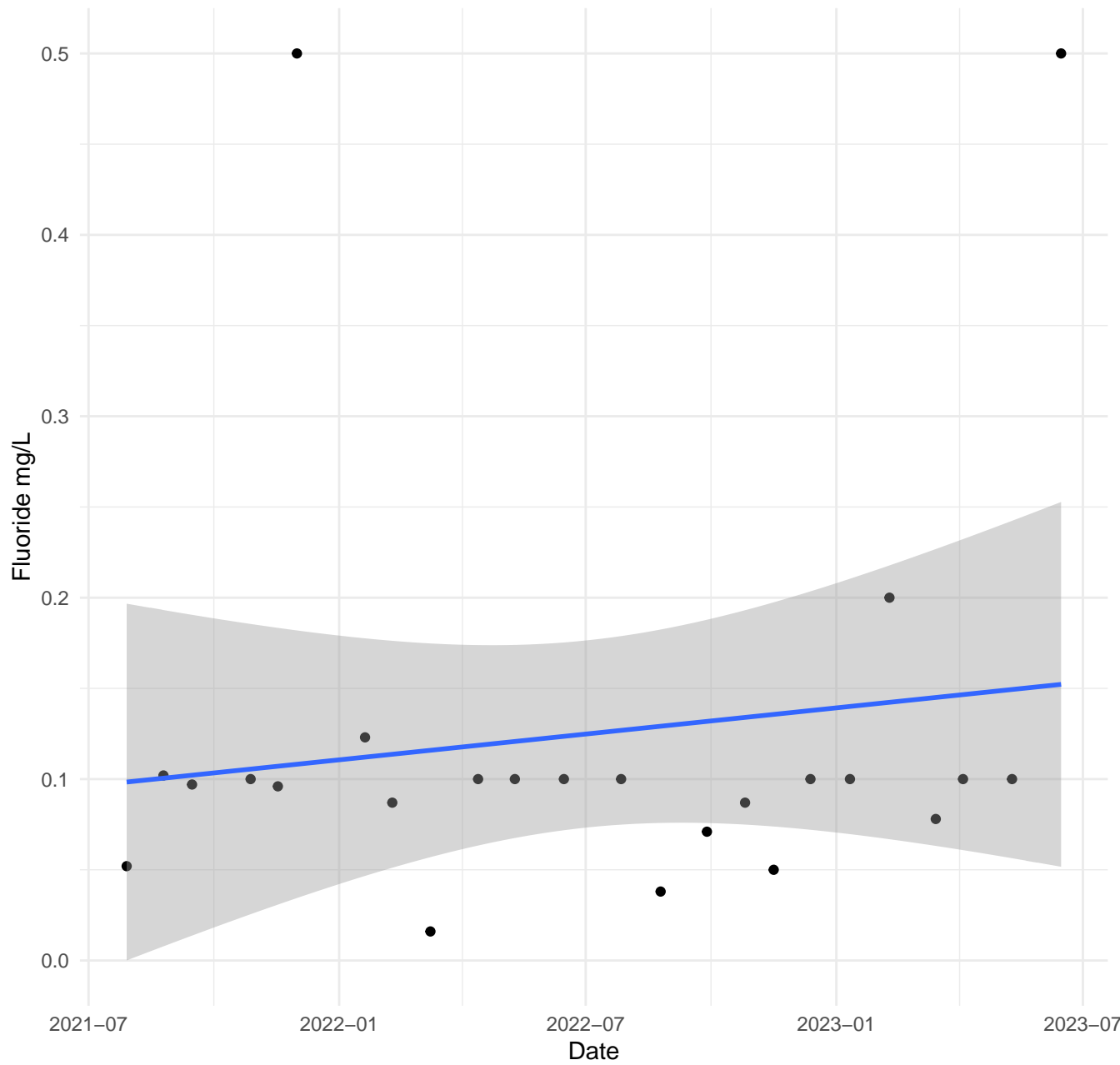
Fluoride at LMP01



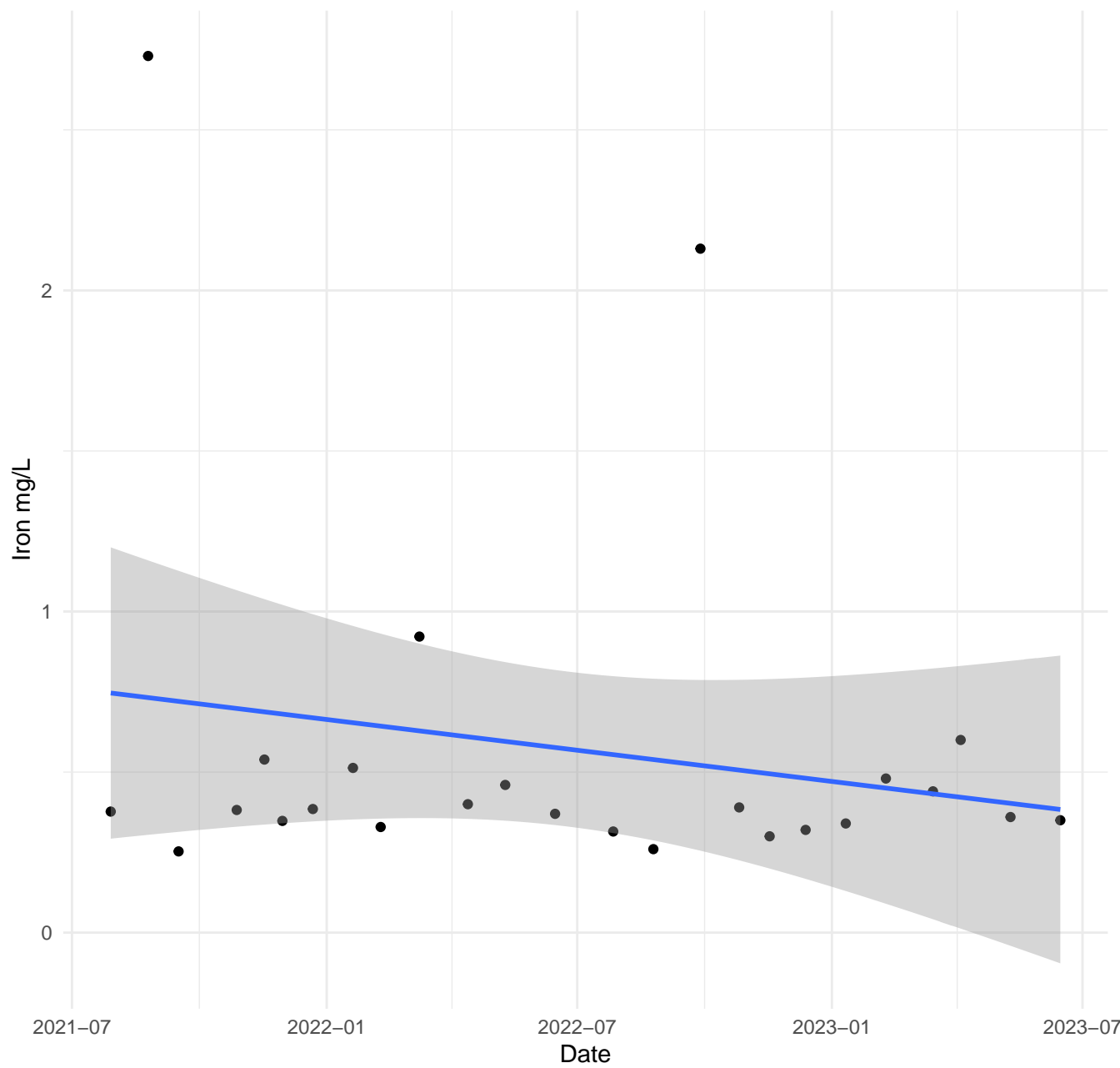
Fluoride at NC01



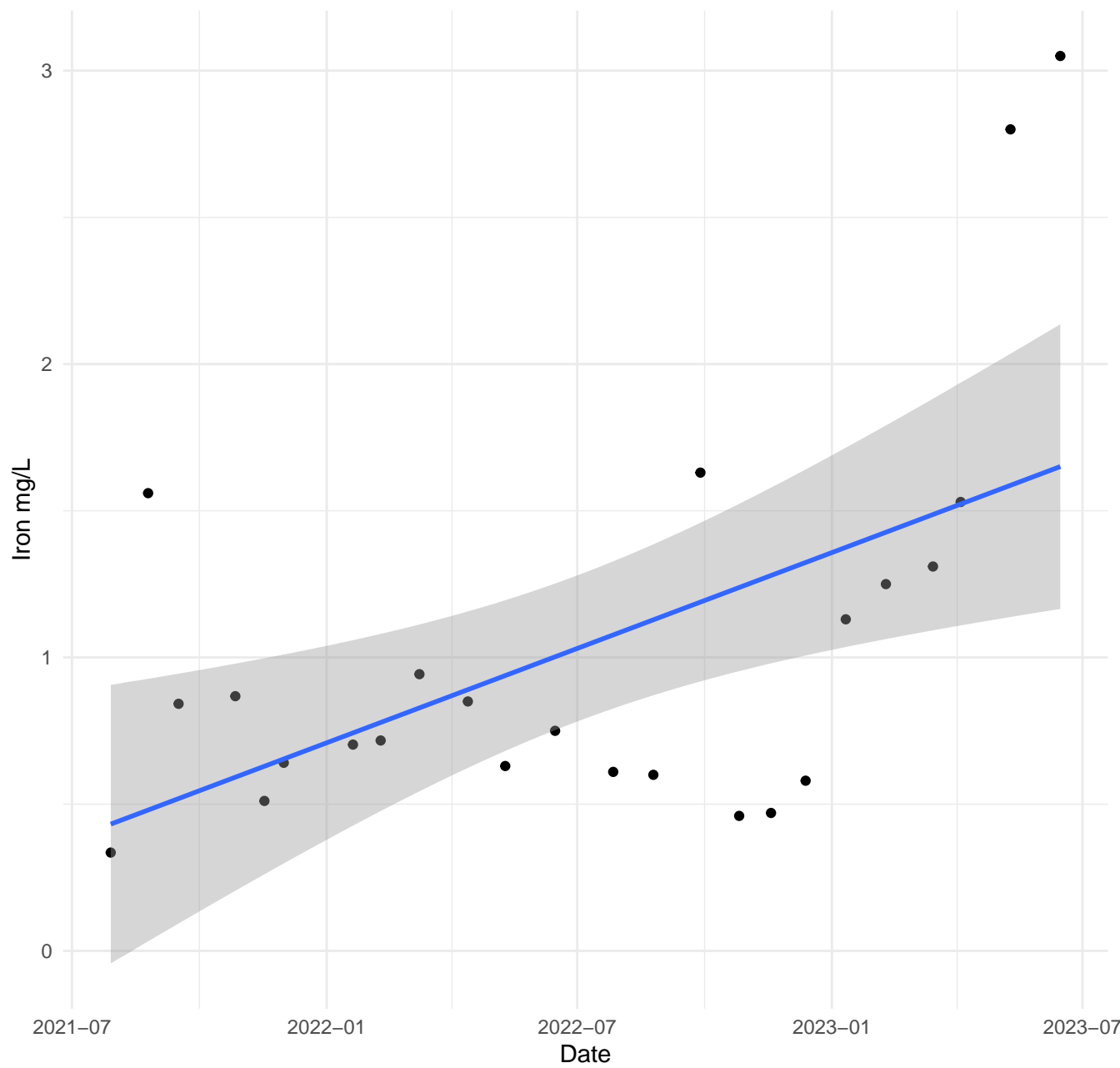
Fluoride at WX22



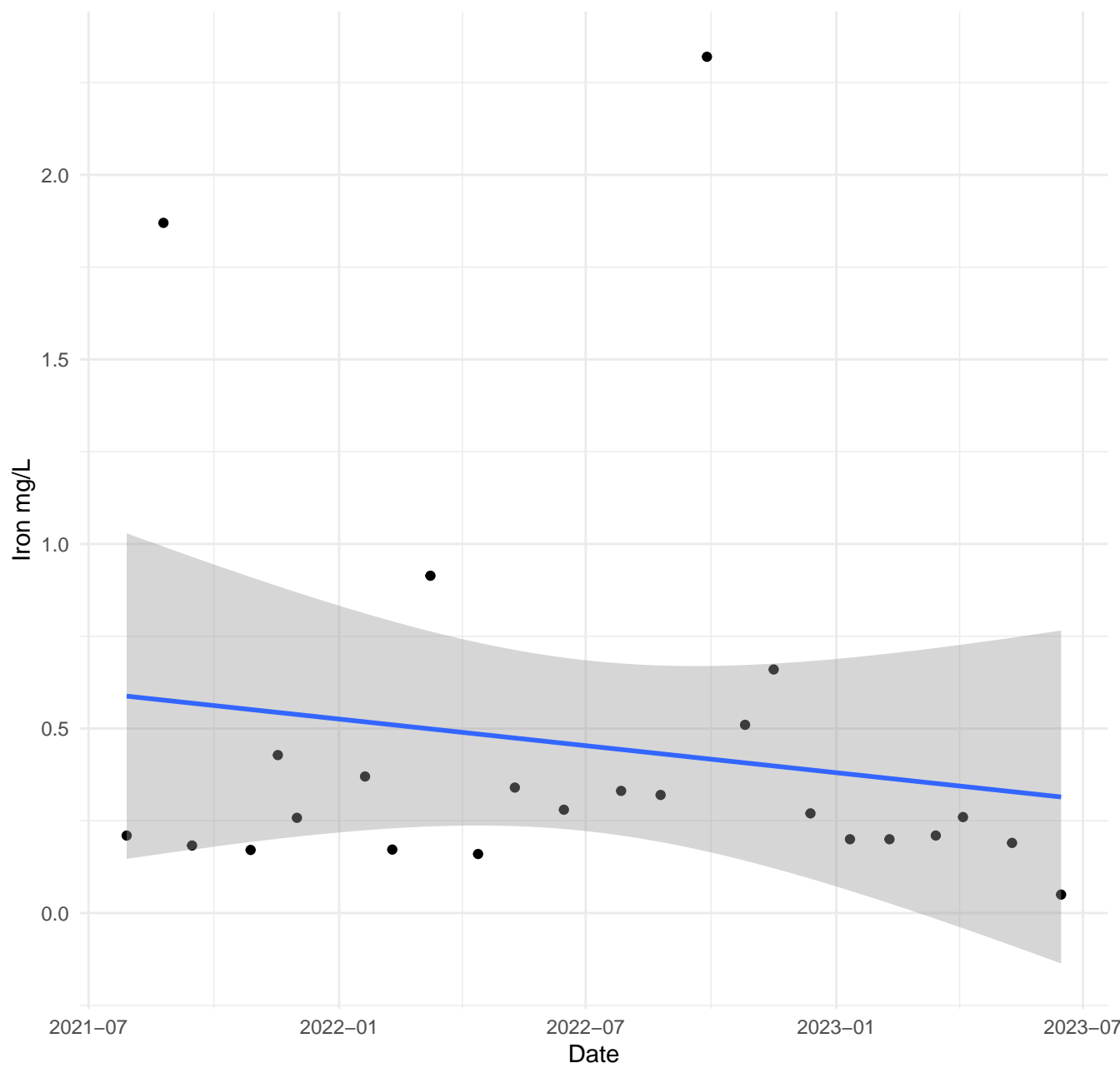
Iron at C



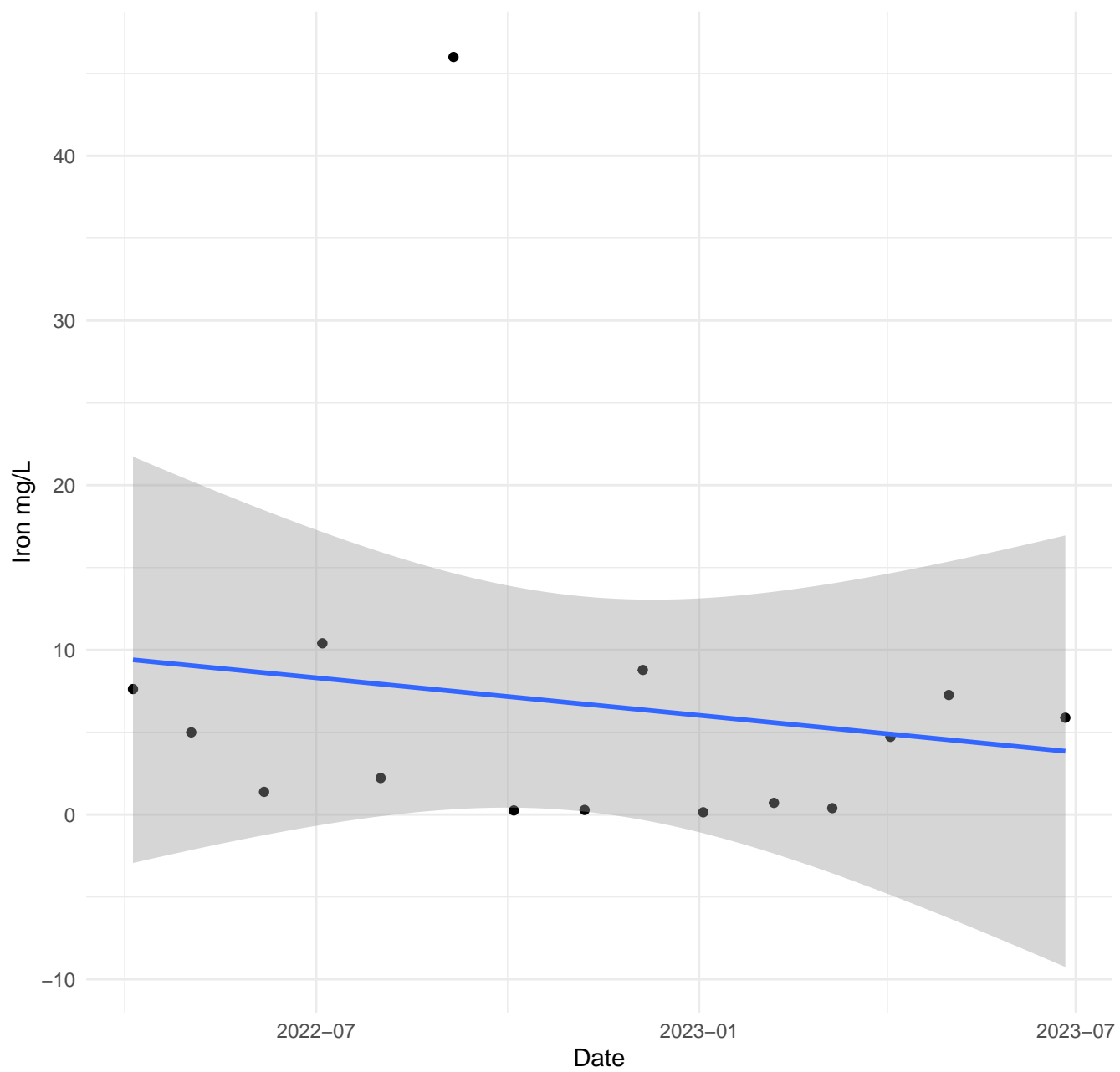
Iron at E



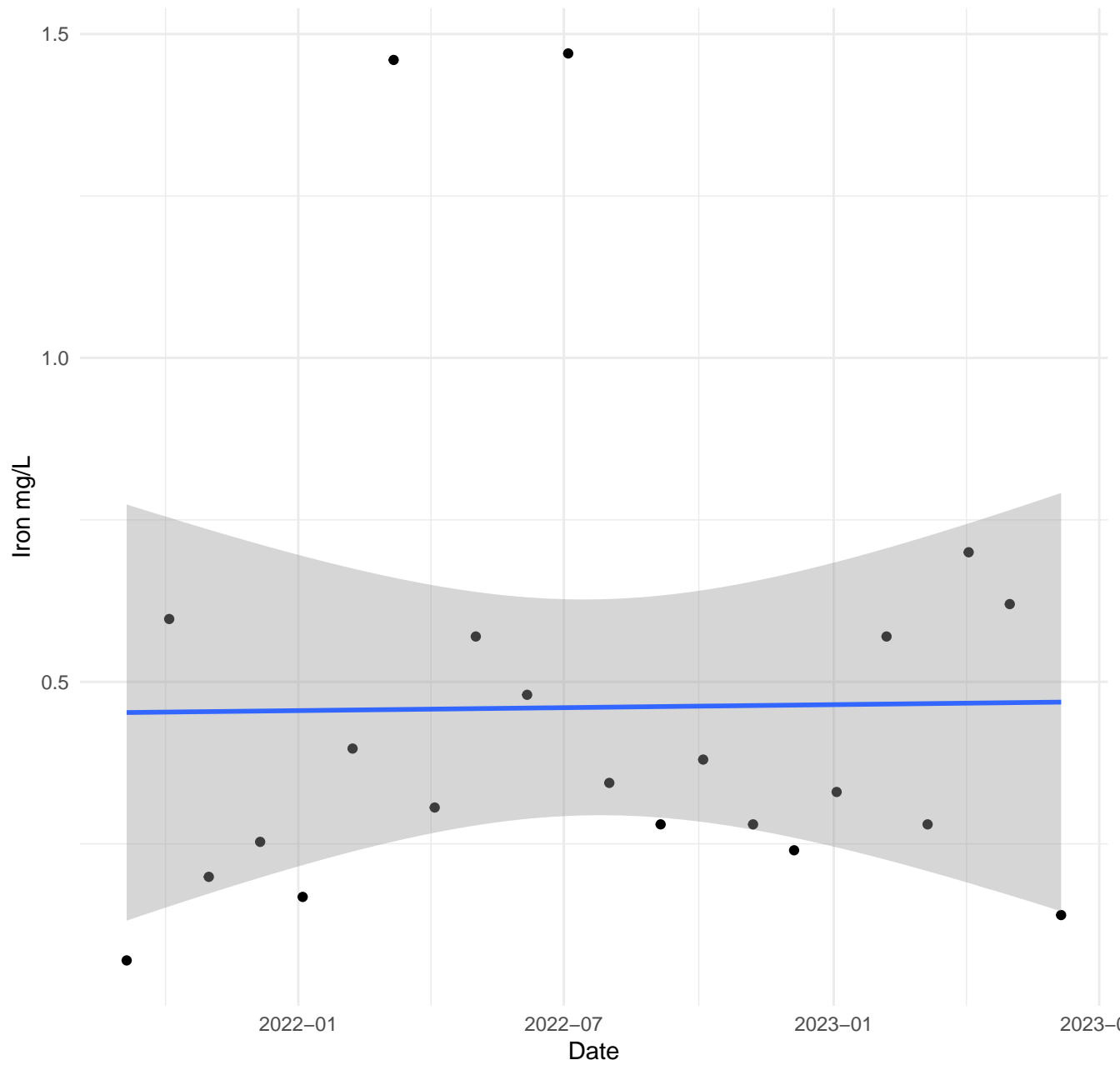
Iron at G



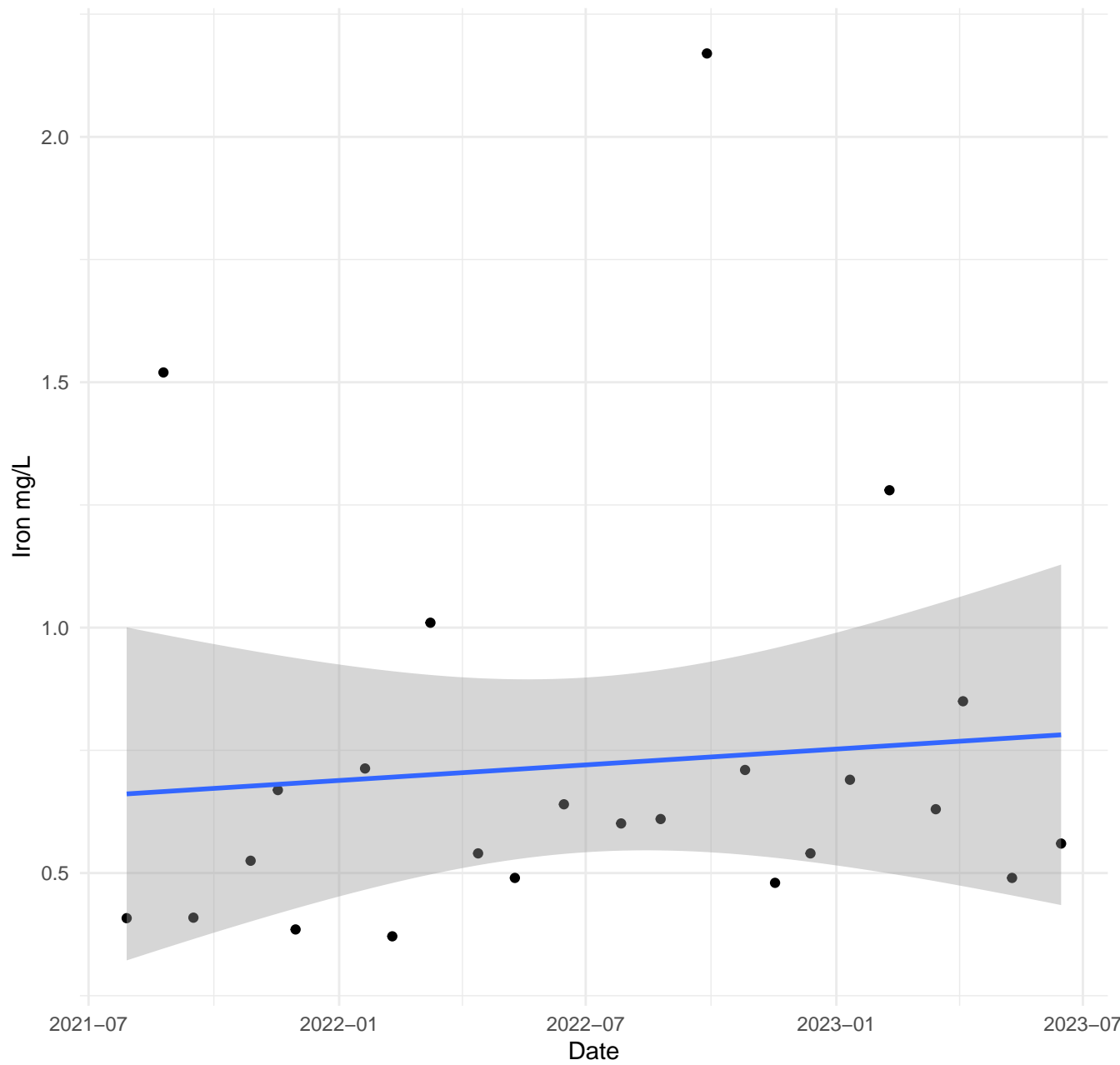
Iron at LDP01



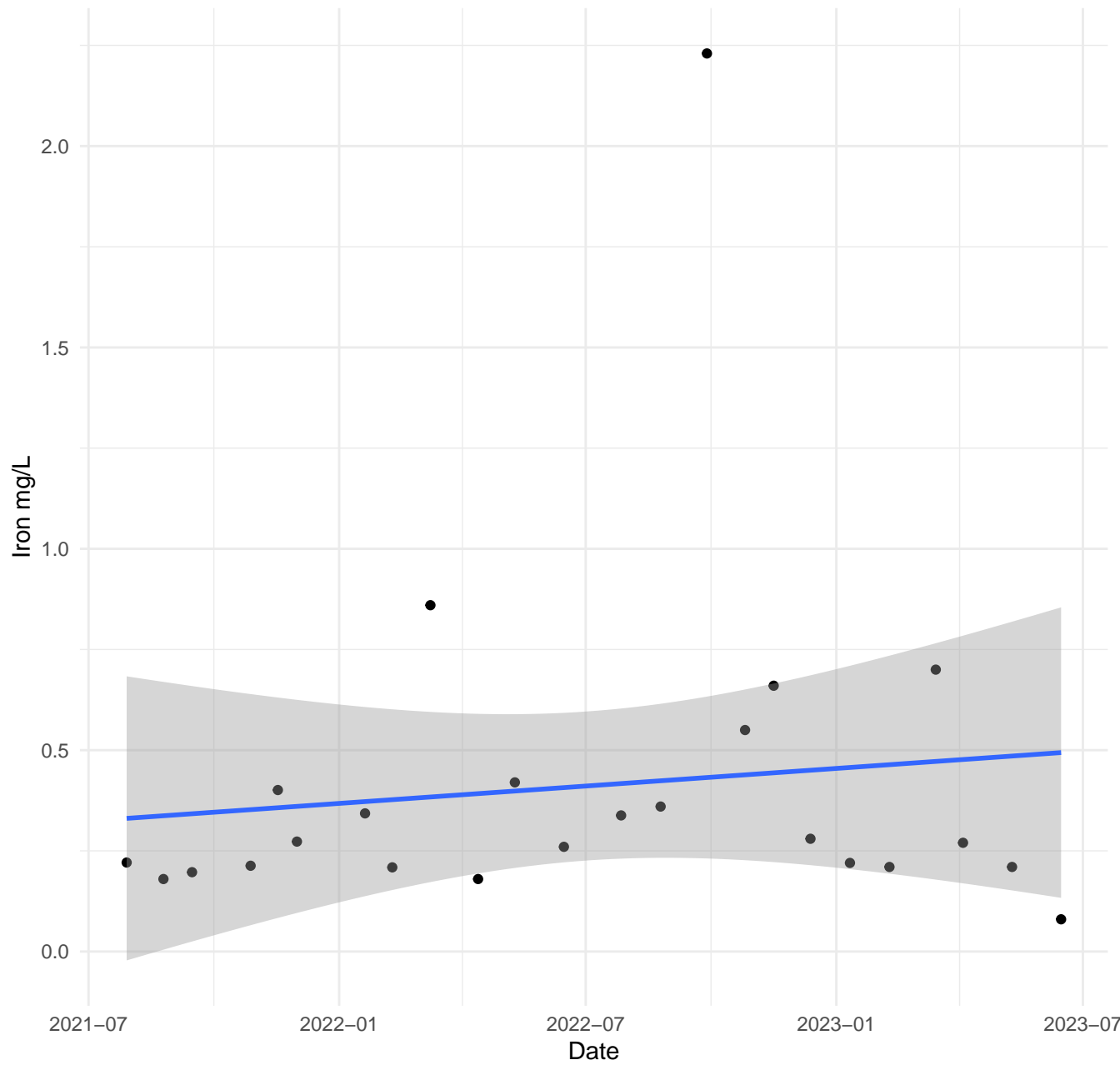
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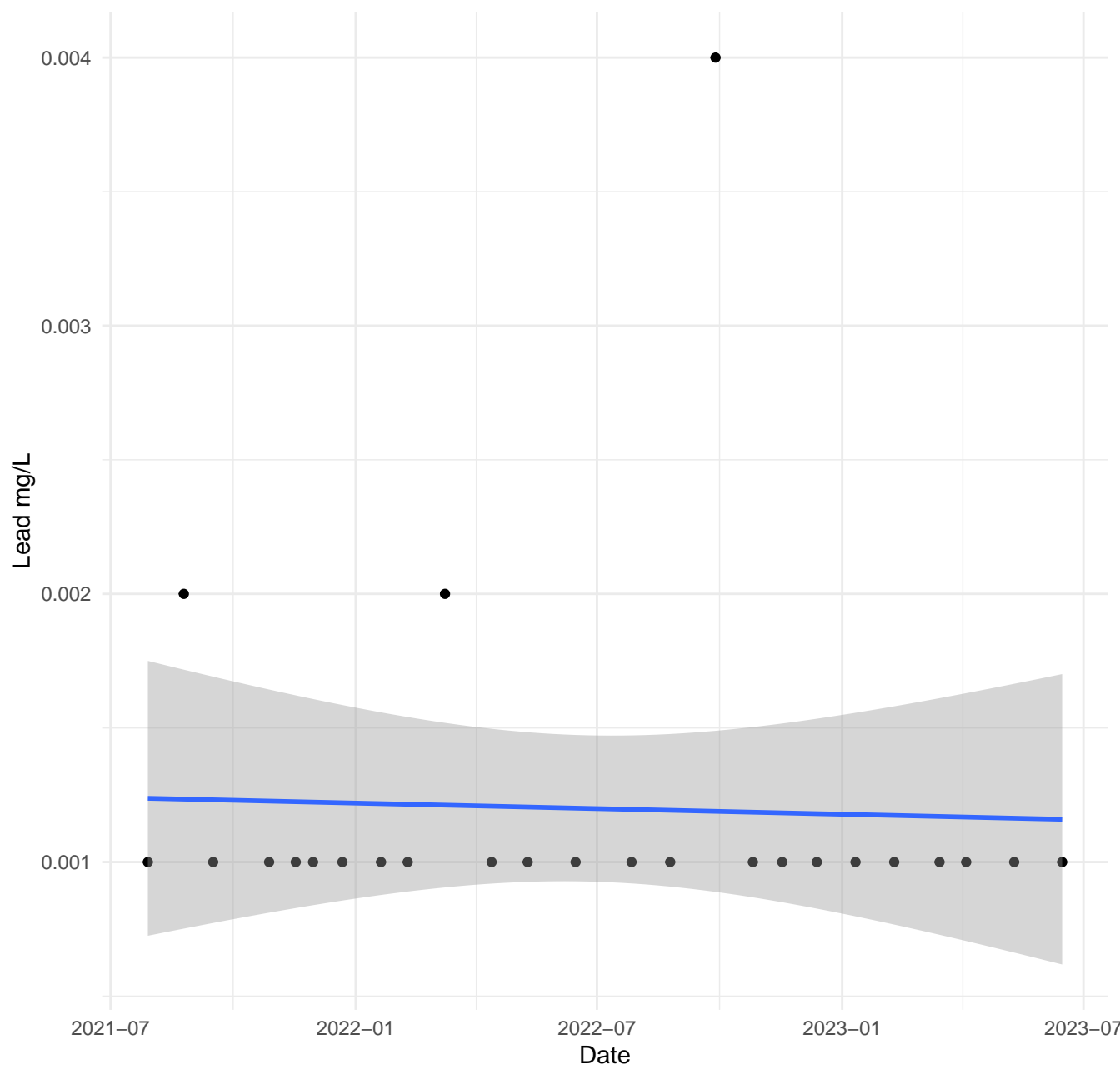
Iron at NC01



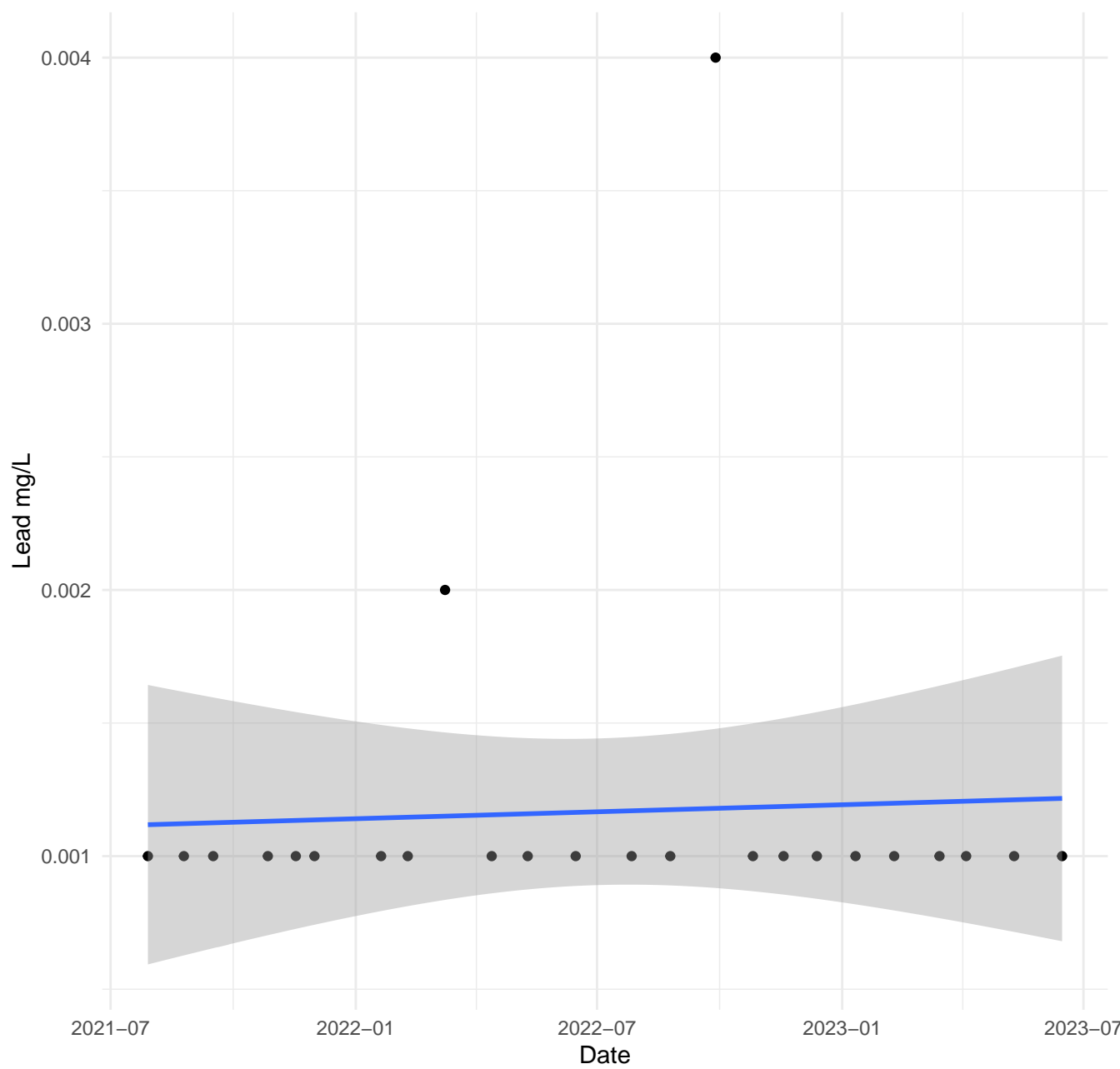
Iron at WX22



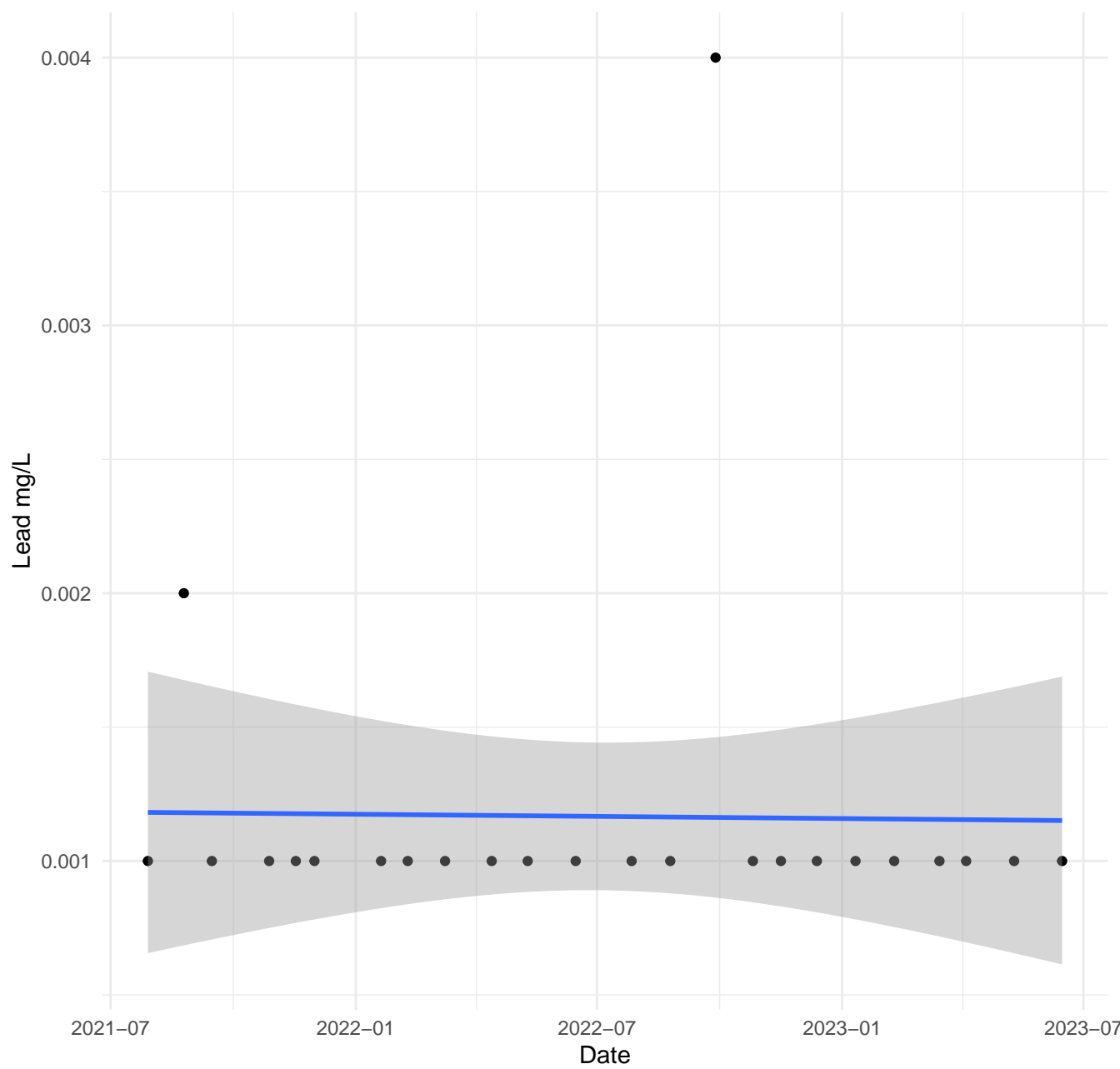
Lead at C



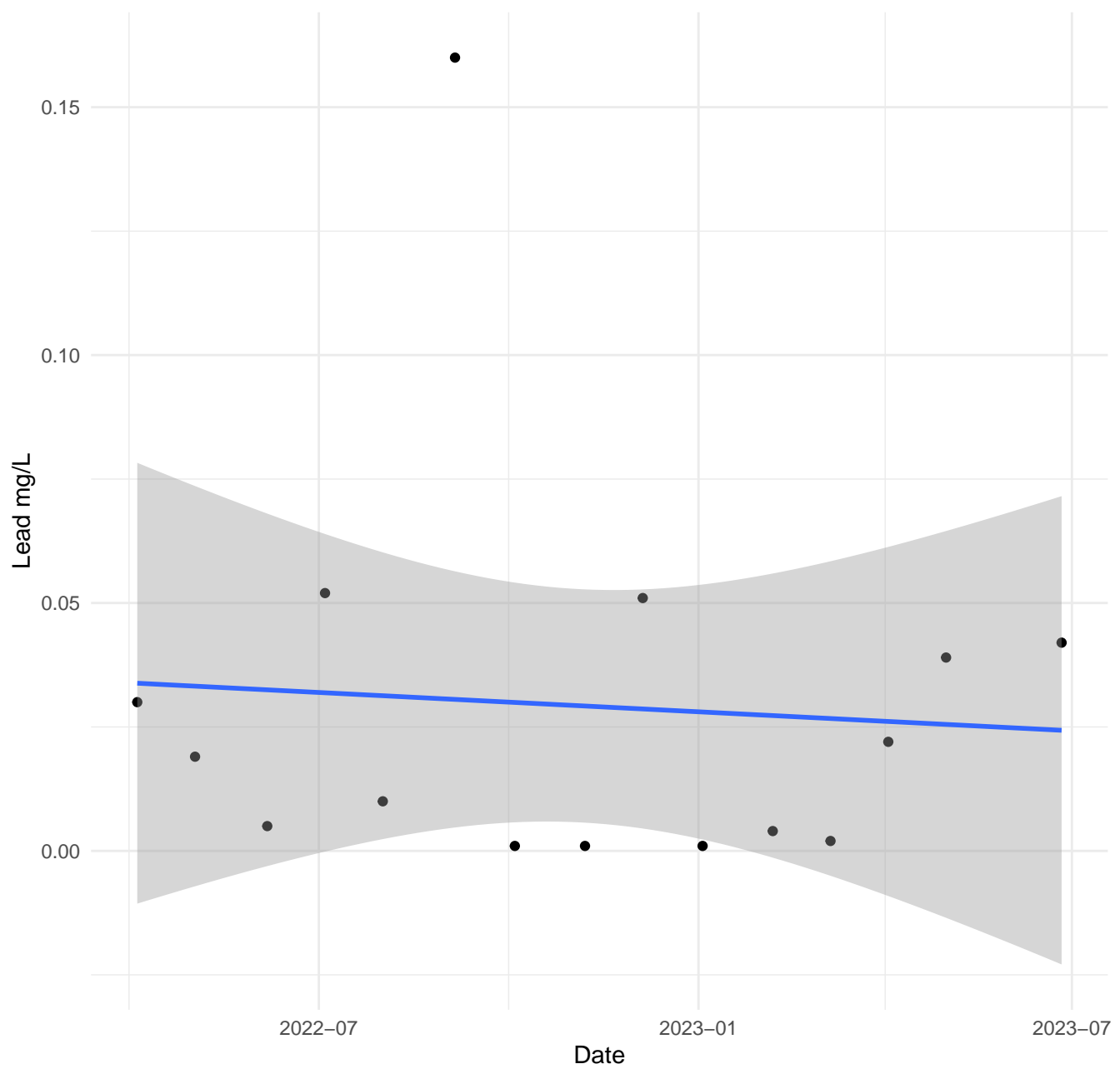
Lead at E



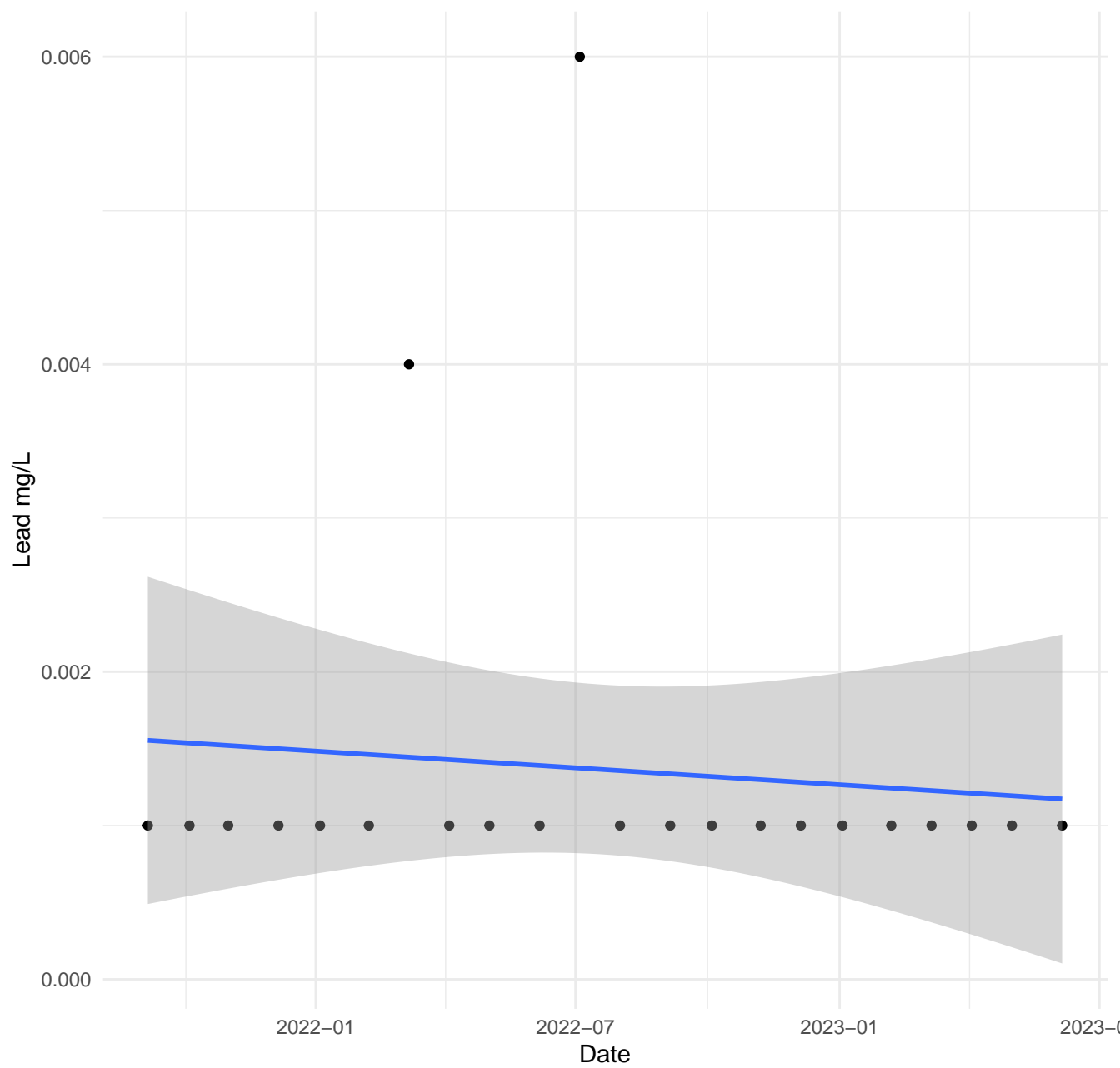
Lead at G



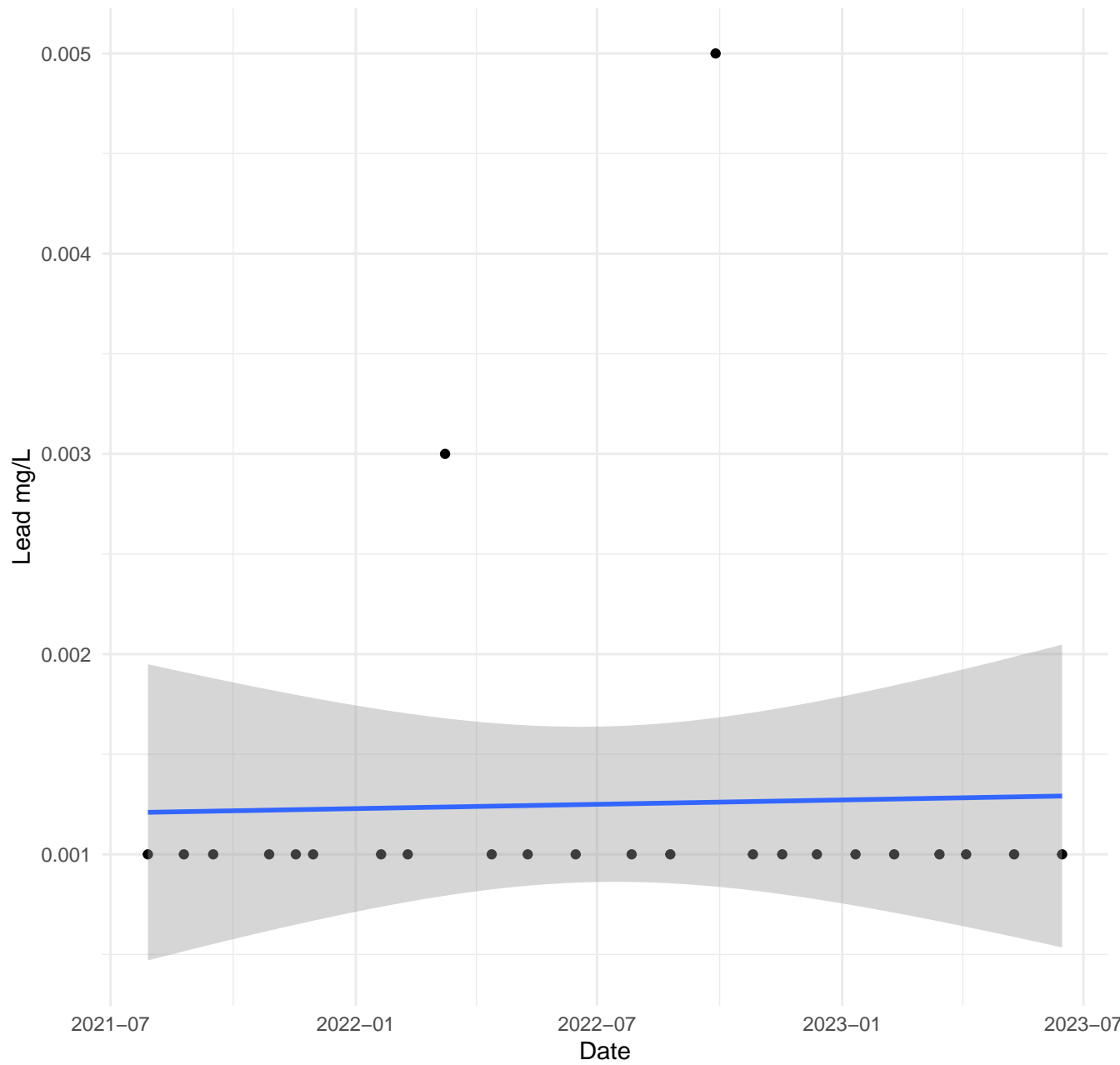
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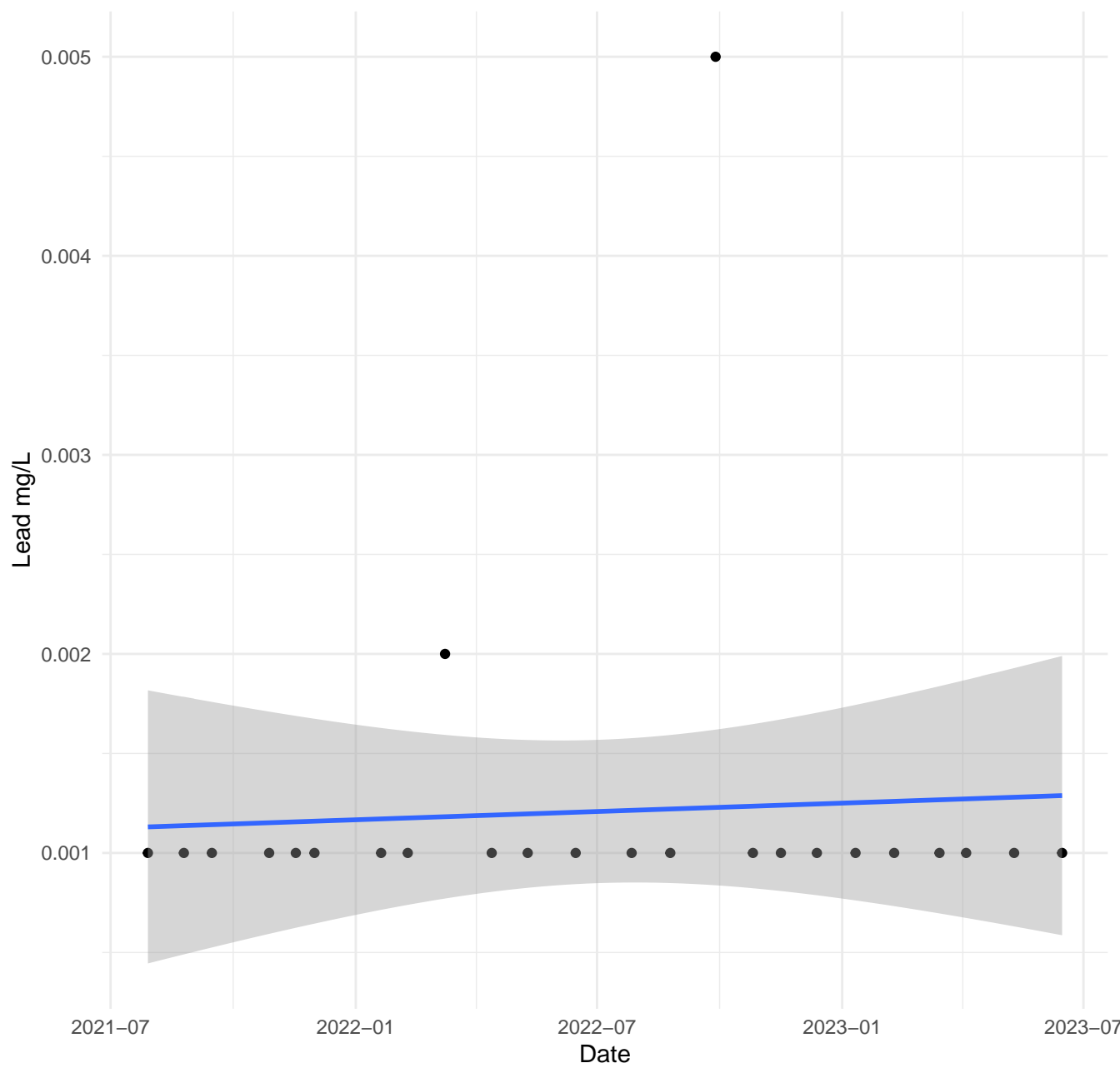
Lead at LMP01



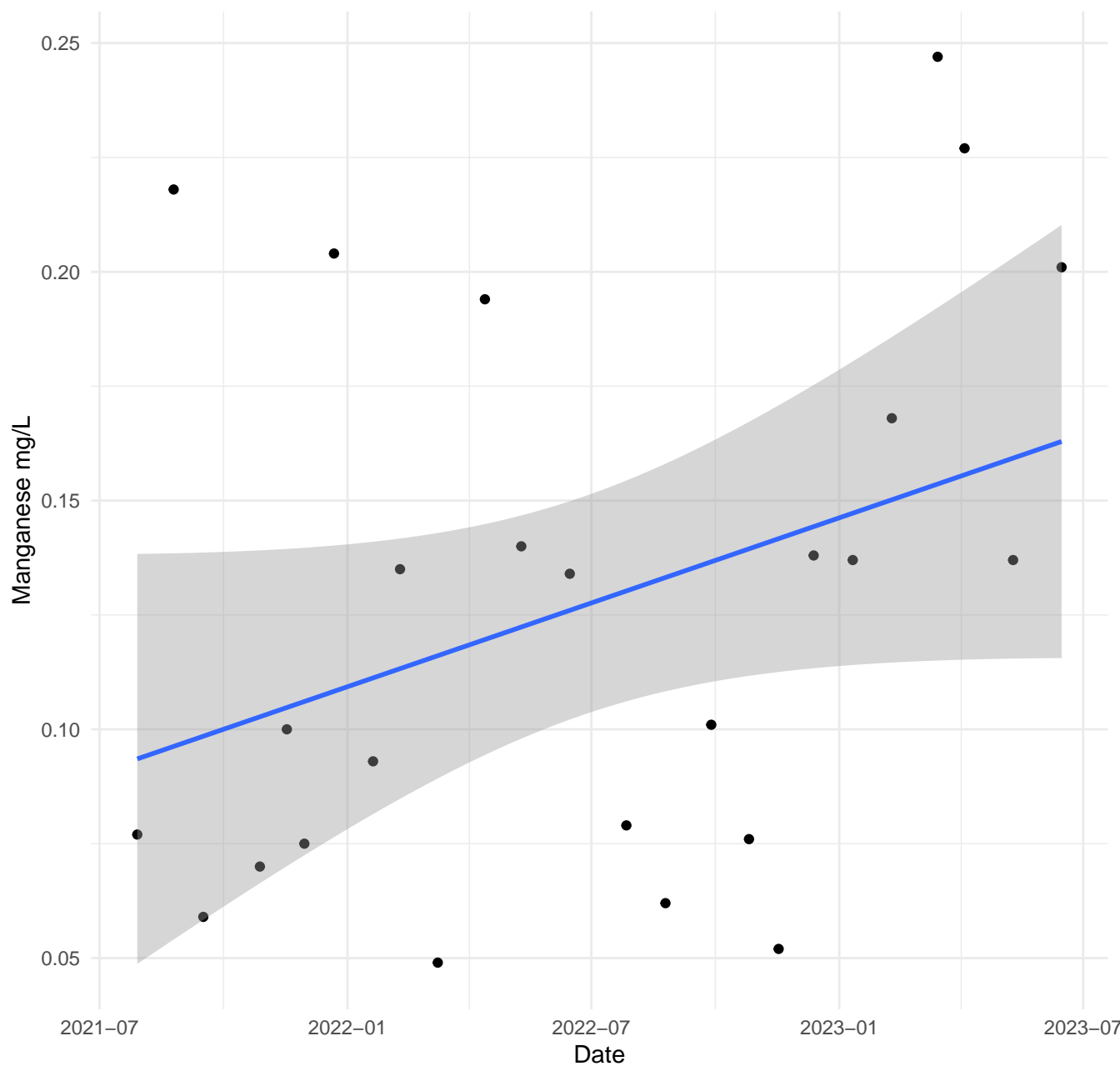
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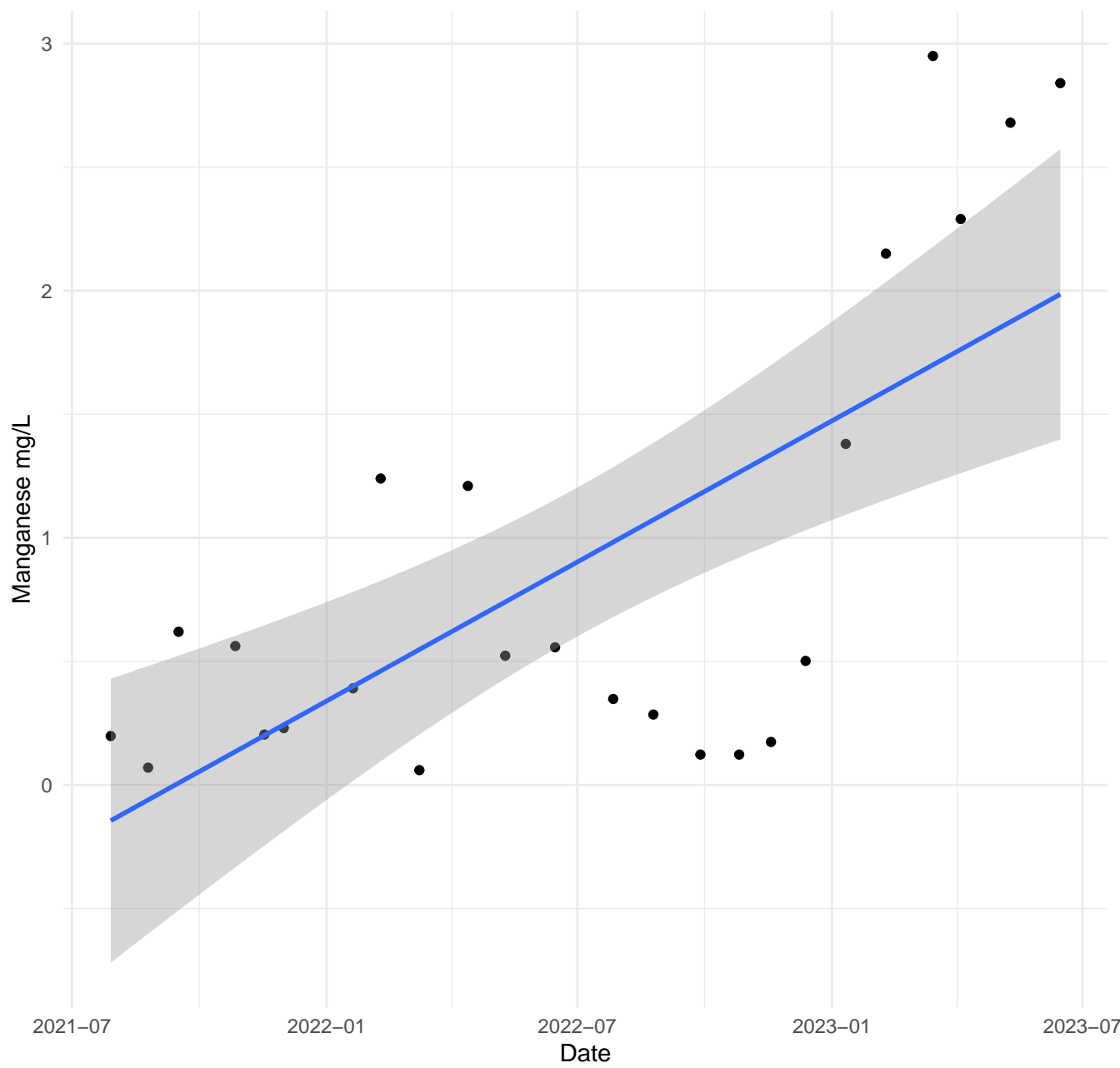
Lead at WX22



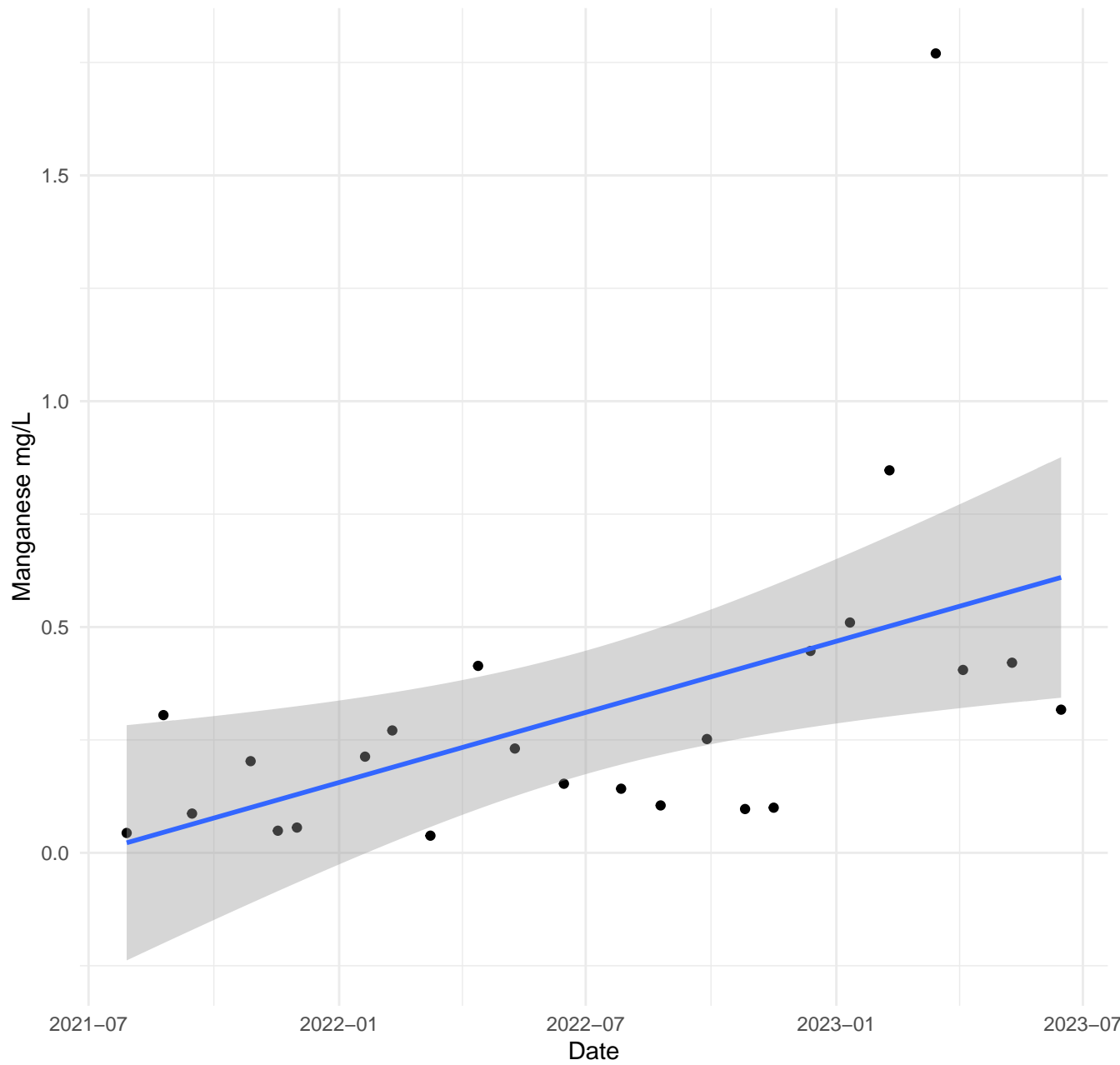
Manganese at C



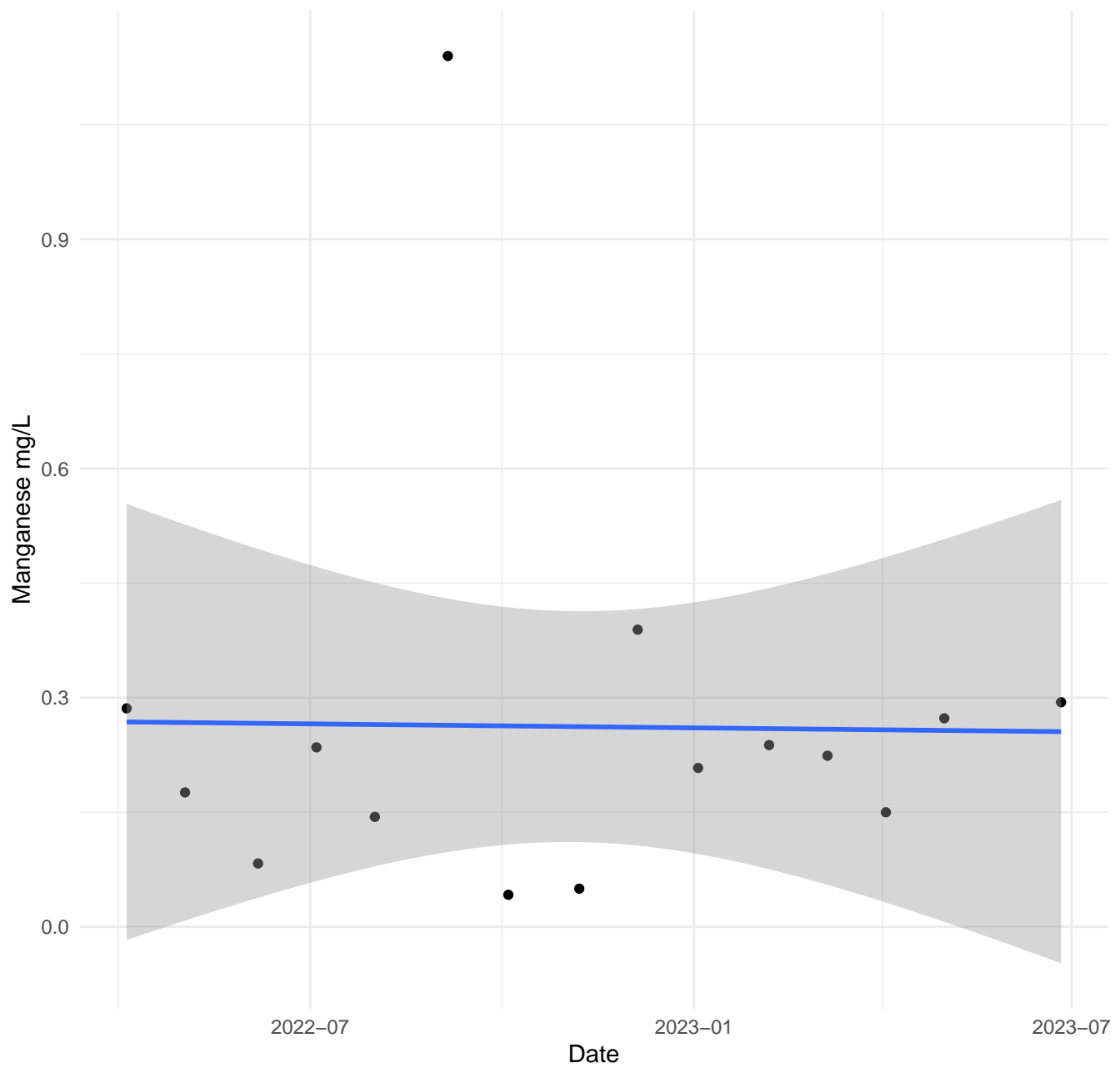
Manganese at E



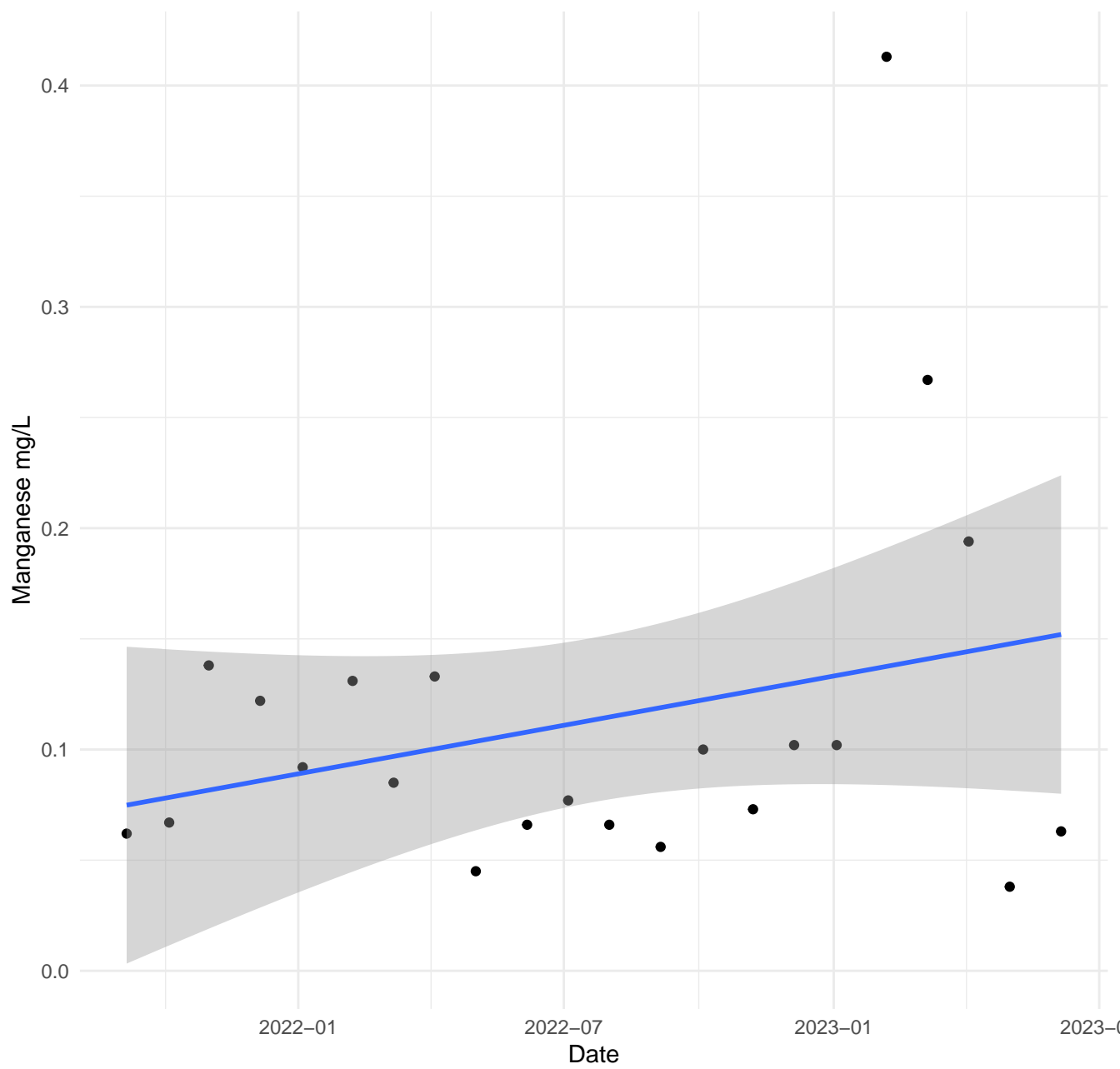
Manganese at G



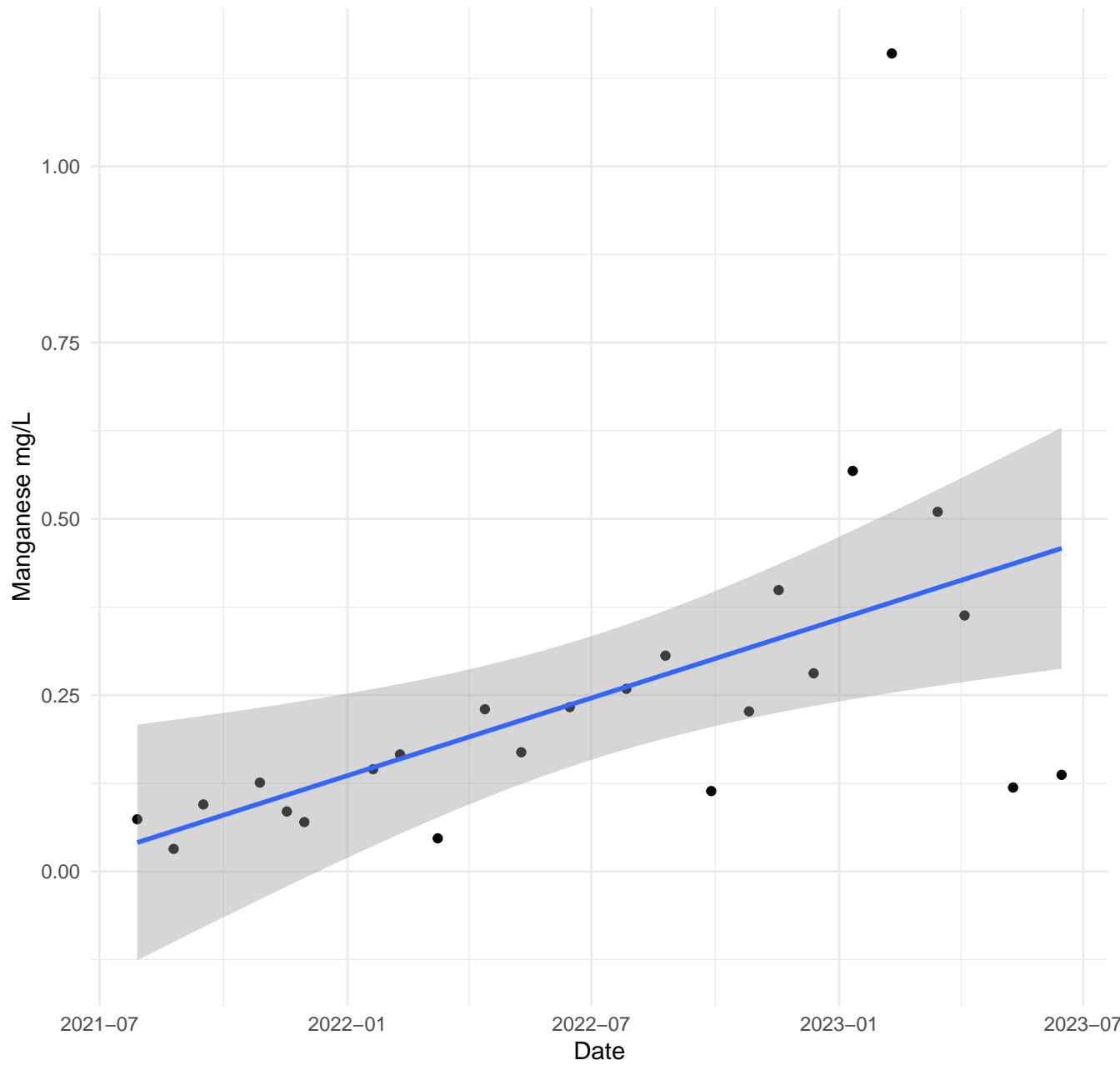
Manganese at LDP01



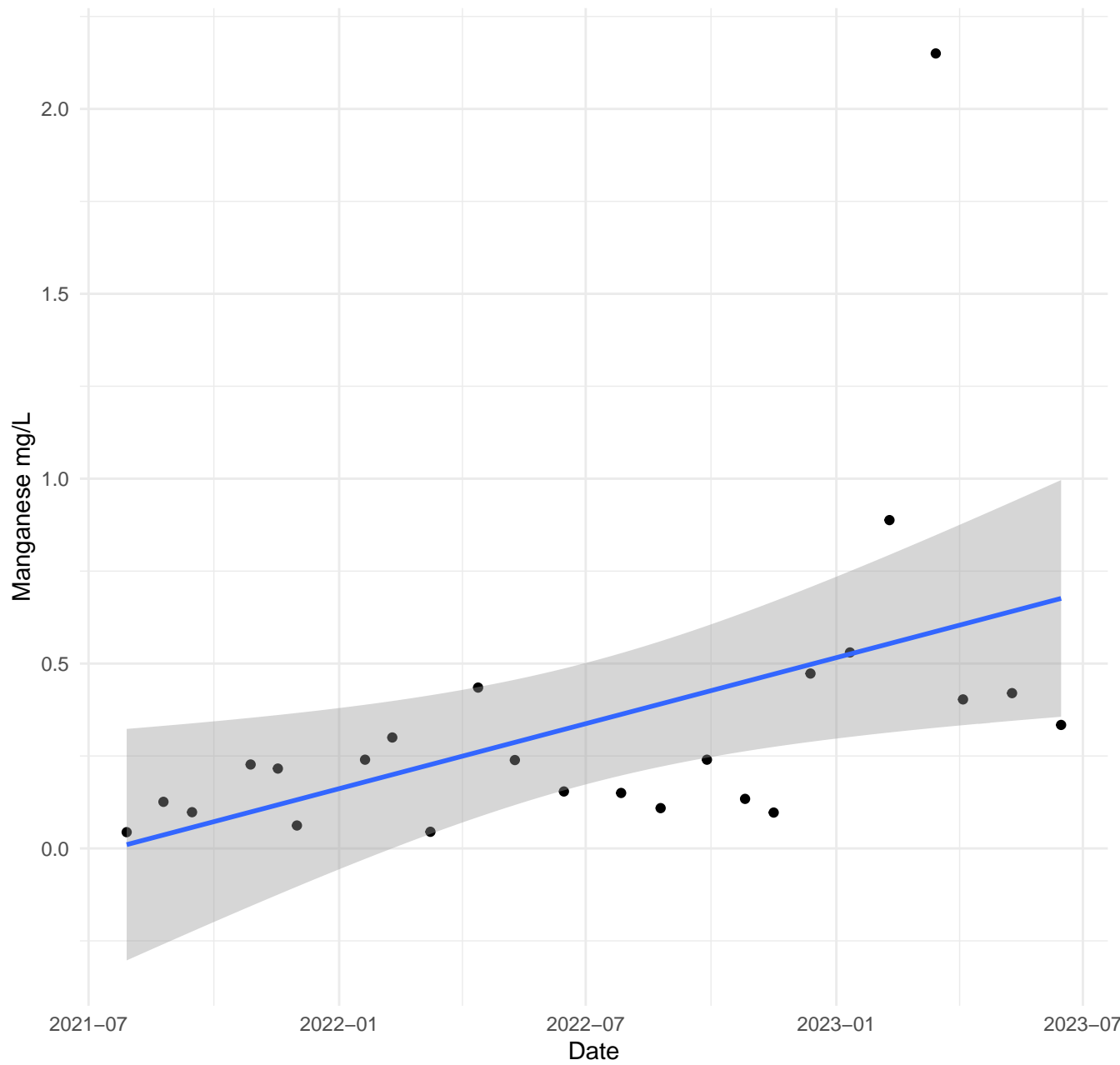
Manganese at LMP01



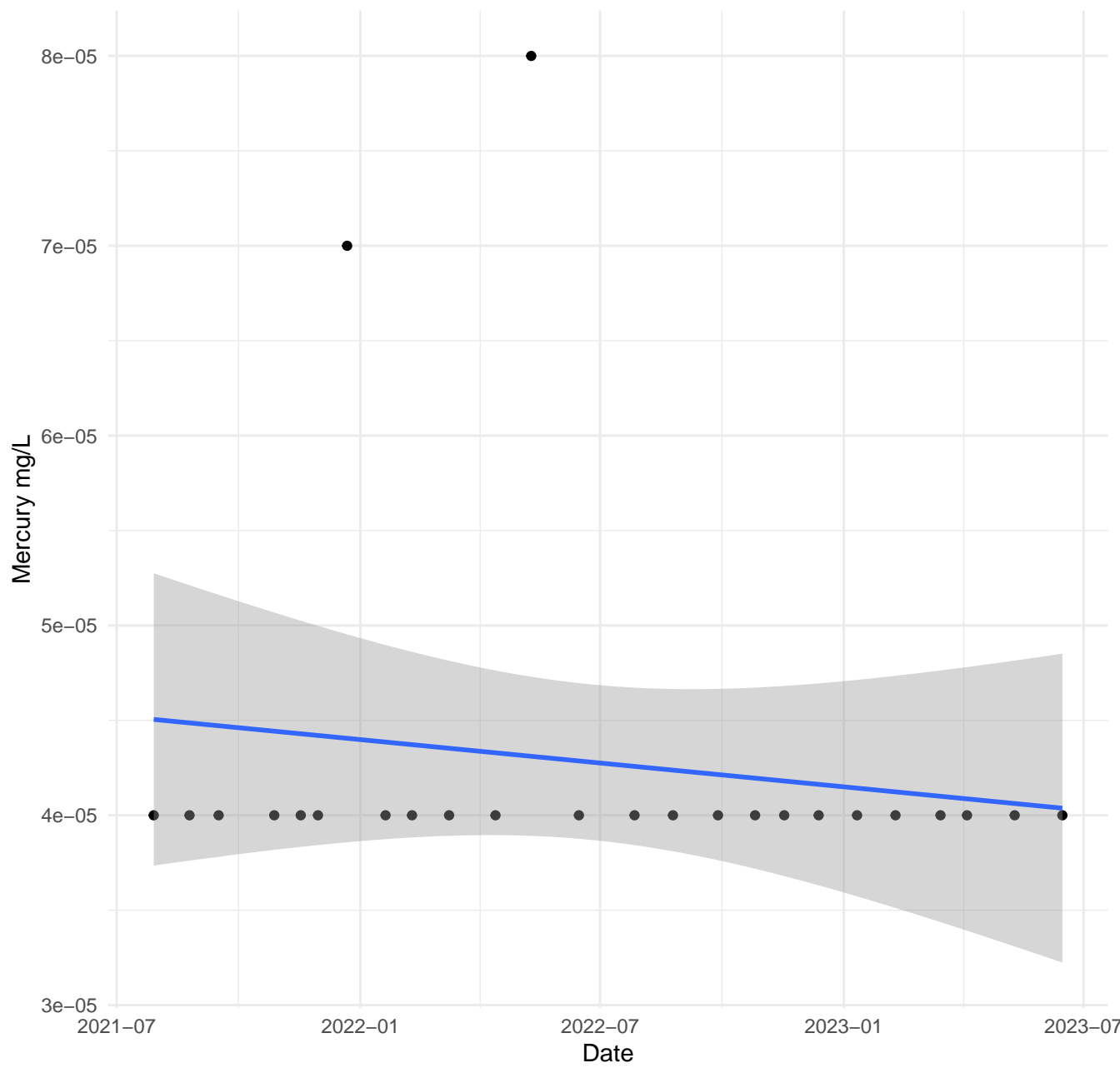
Manganese at NC01



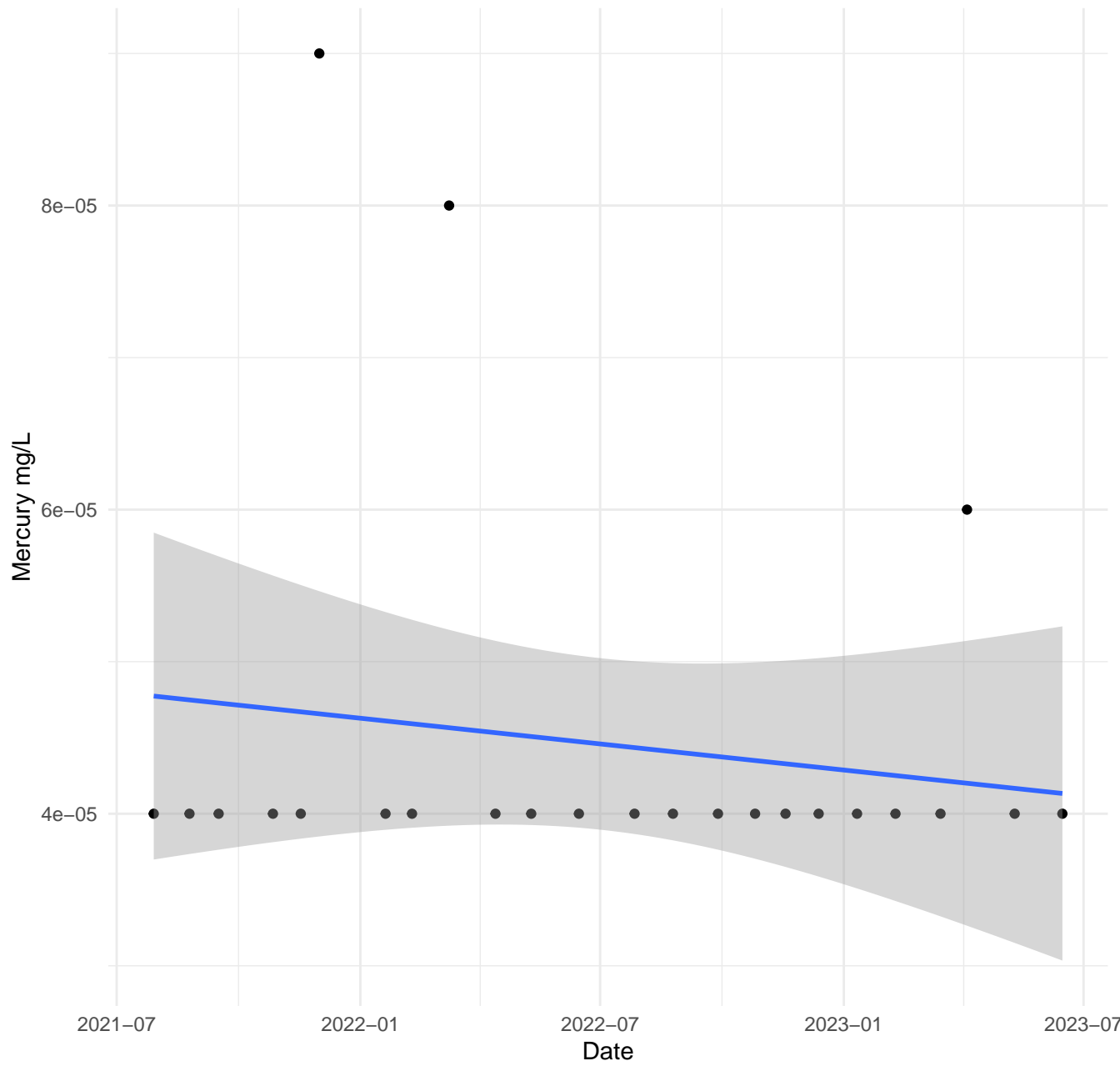
Manganese at WX22



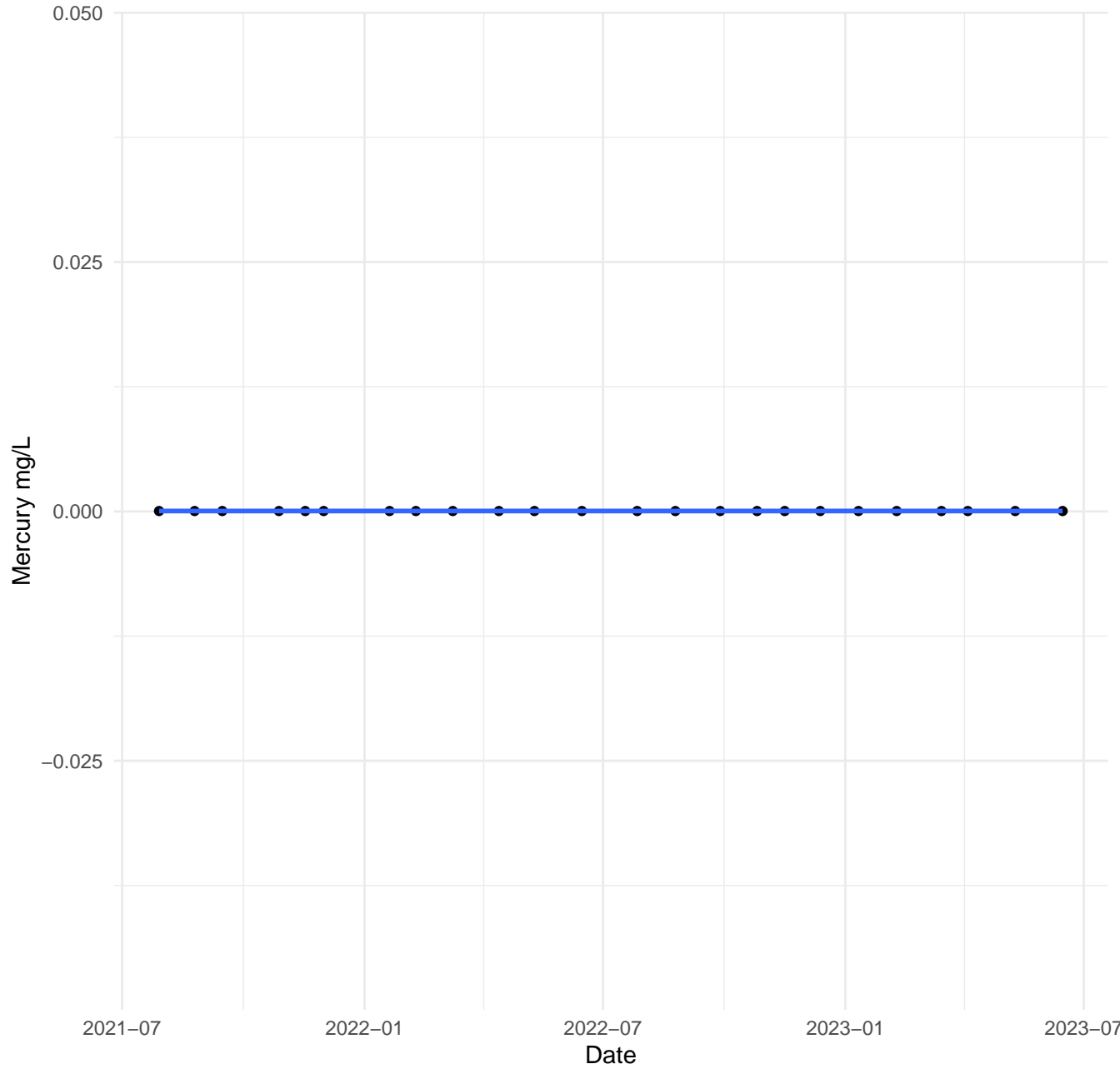
Mercury at C



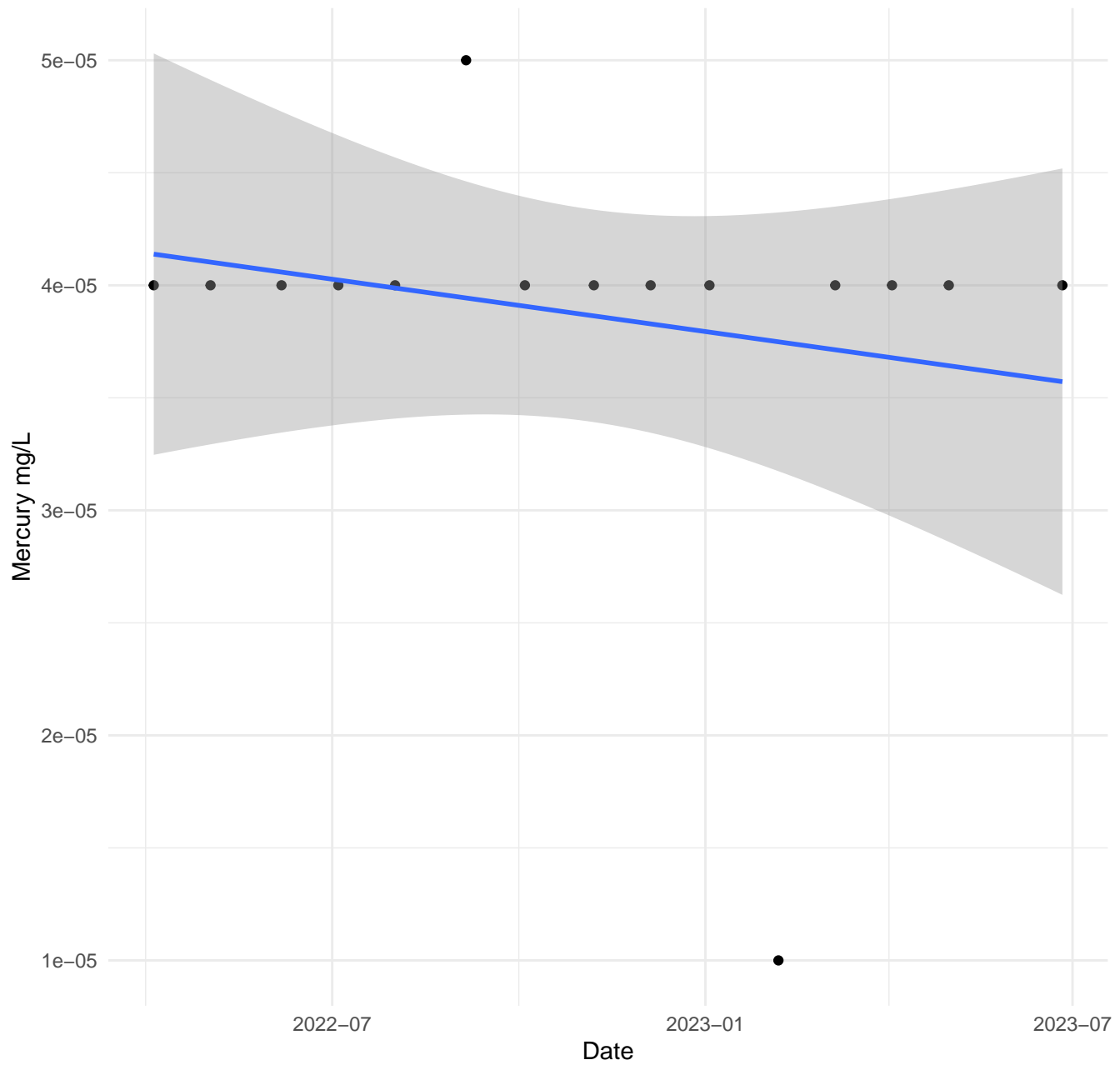
Mercury at E



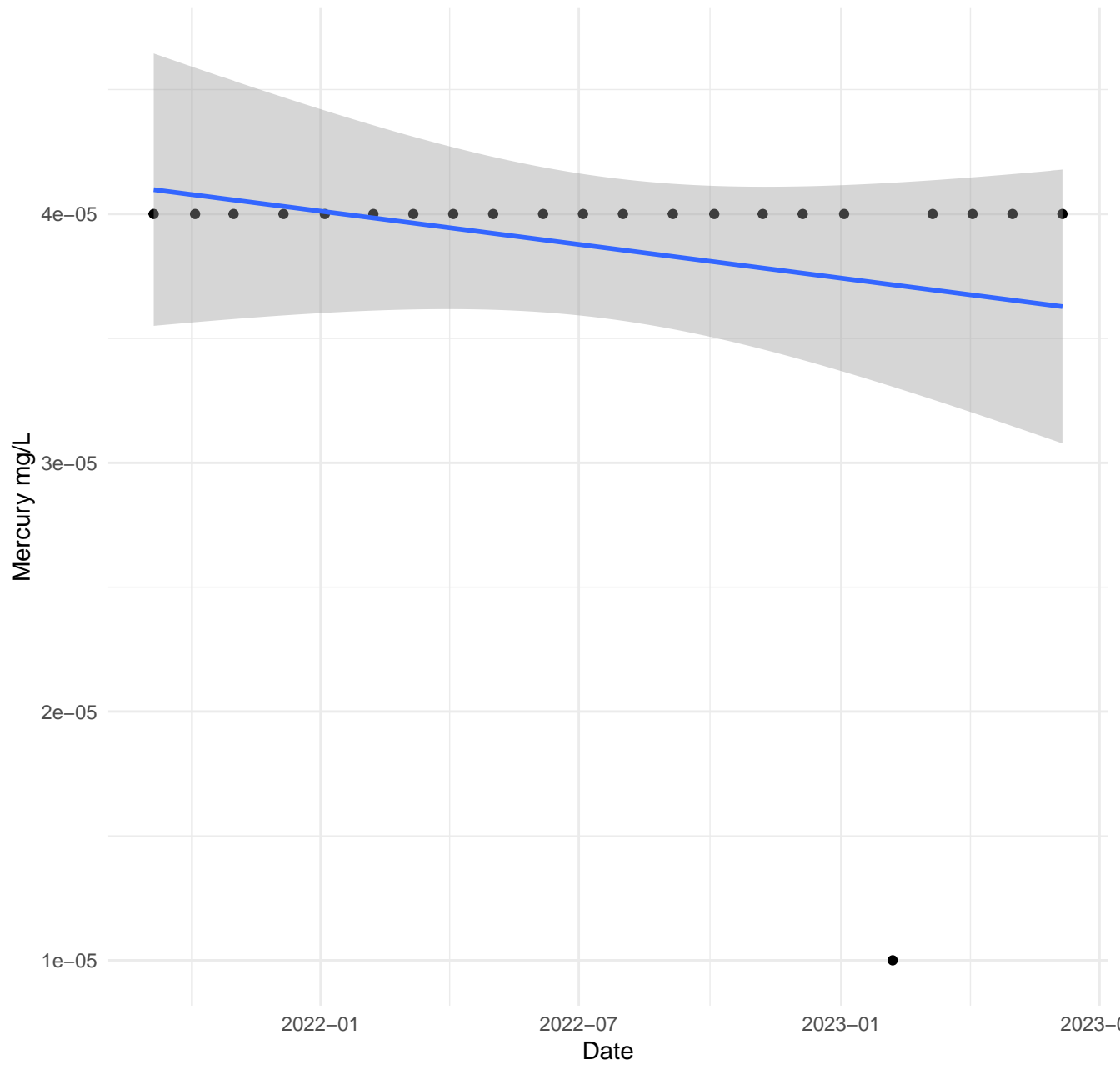
Mercury at G



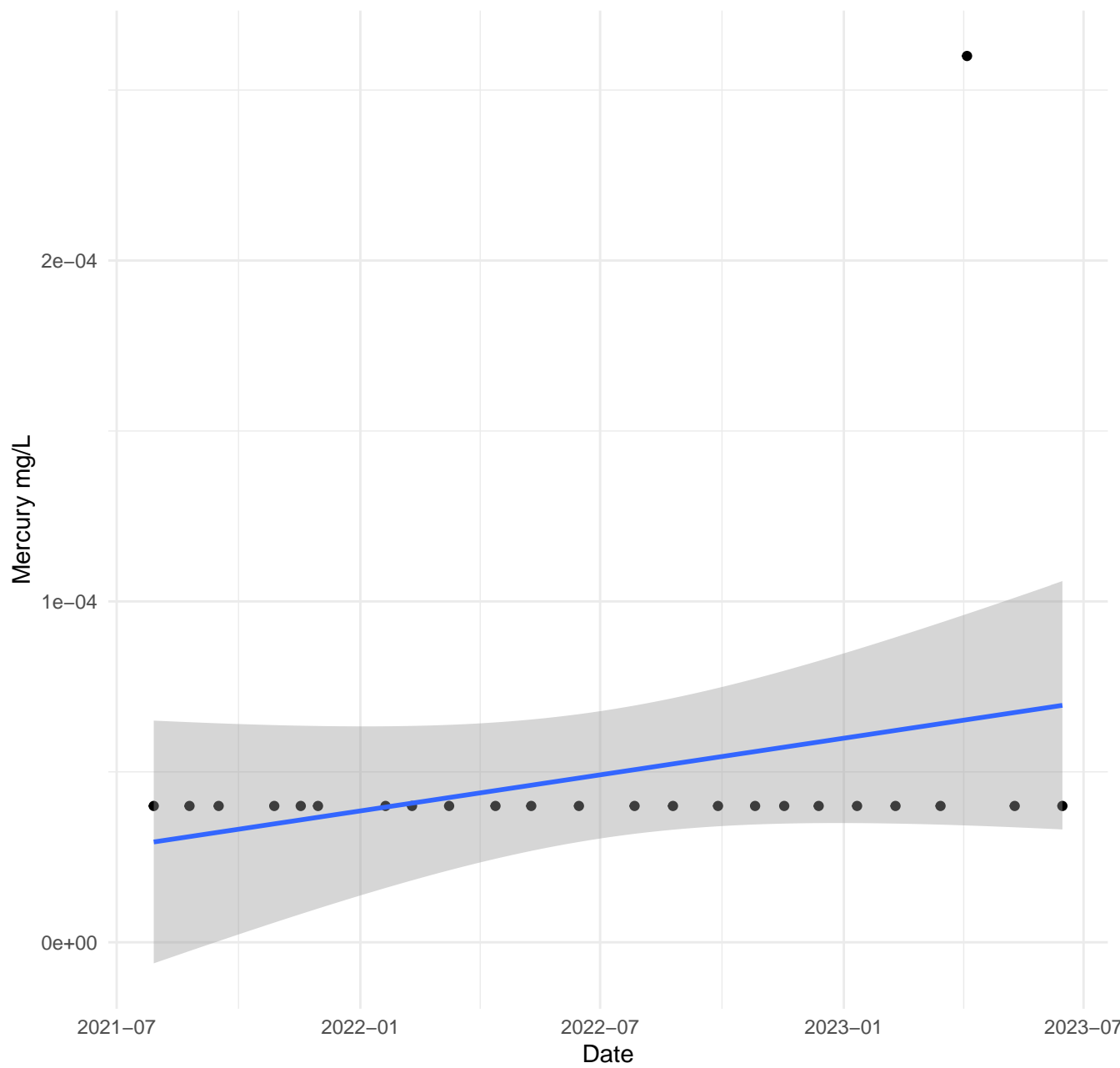
Mercury at LDP01



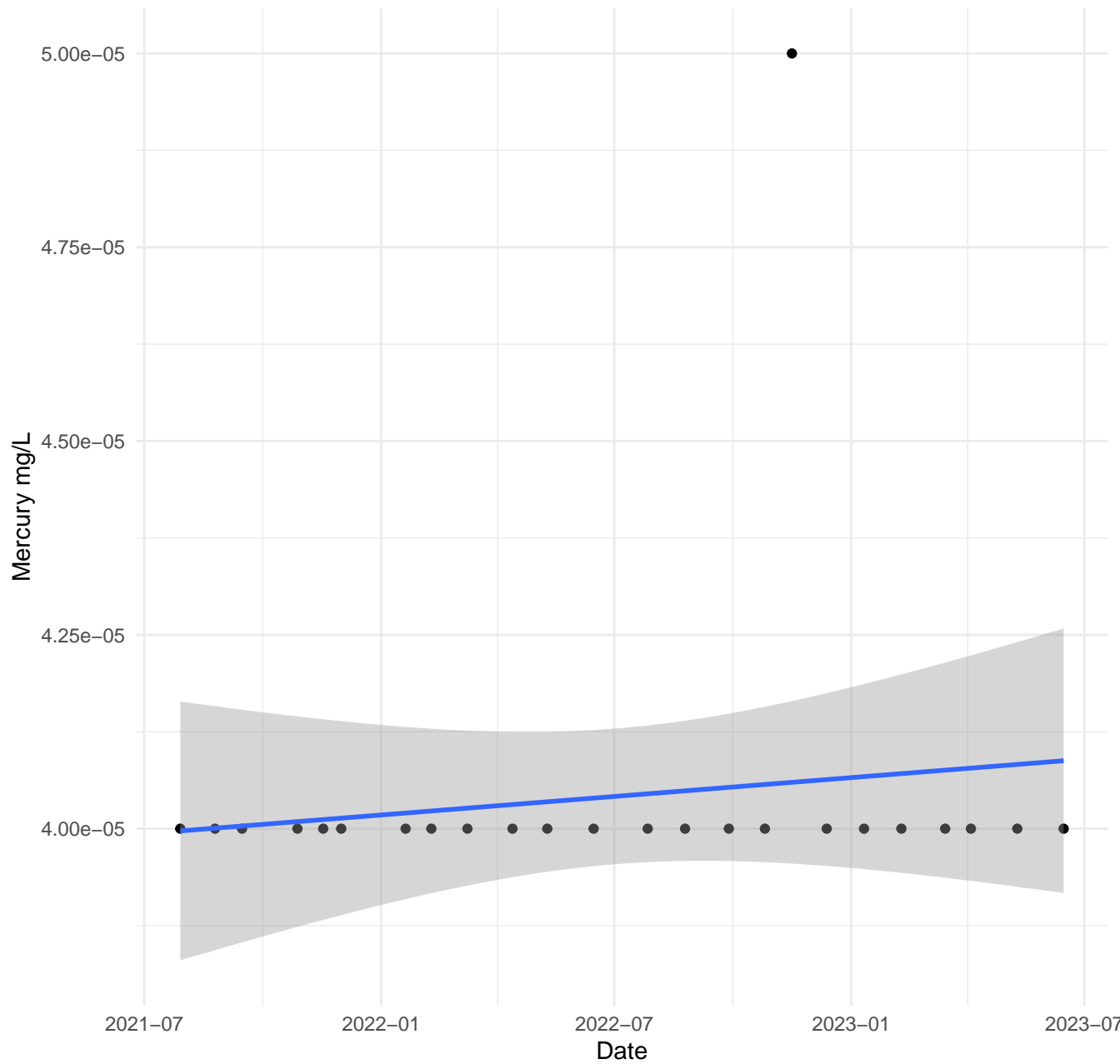
Mercury at LMP01



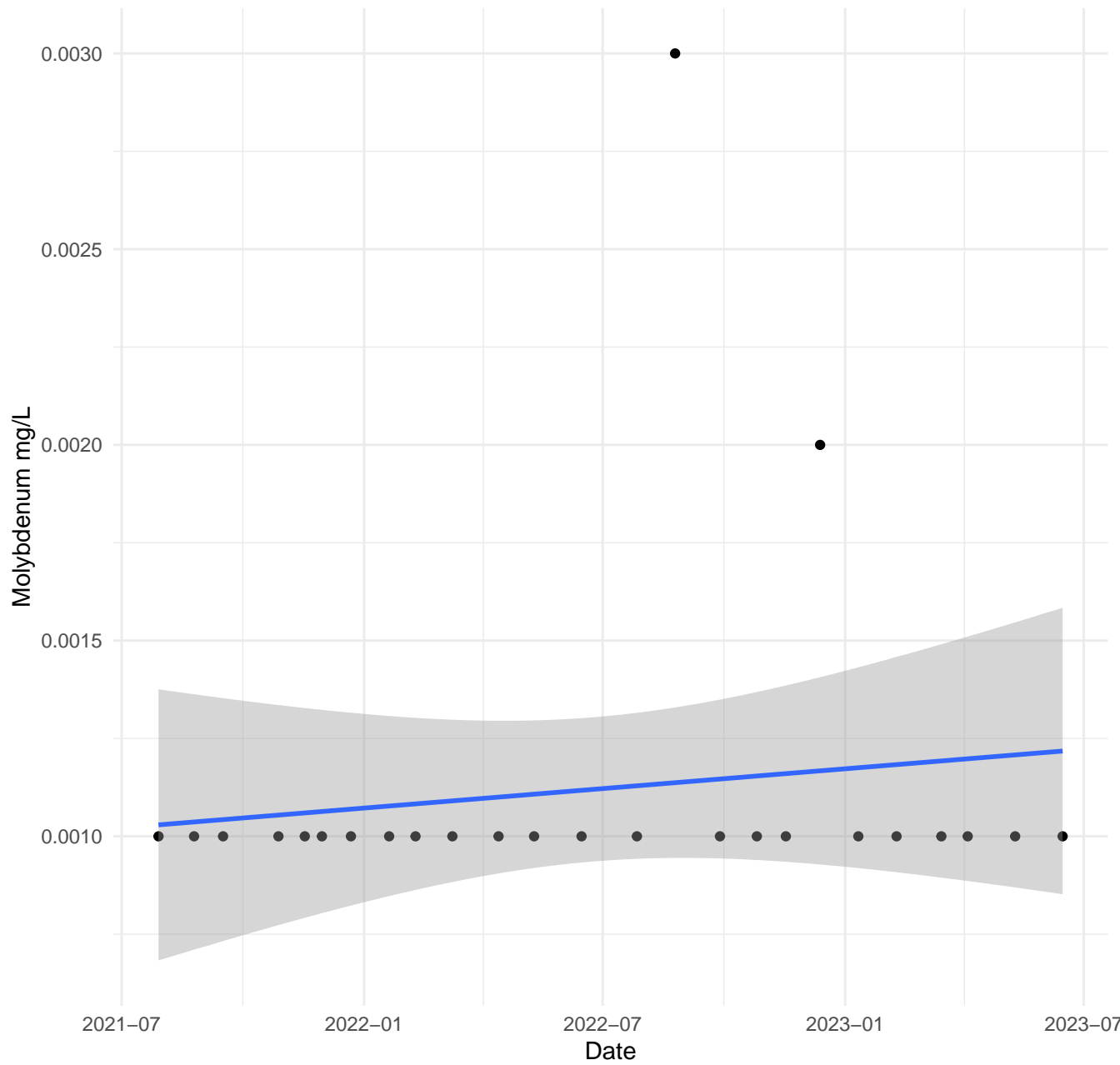
Mercury at NC01



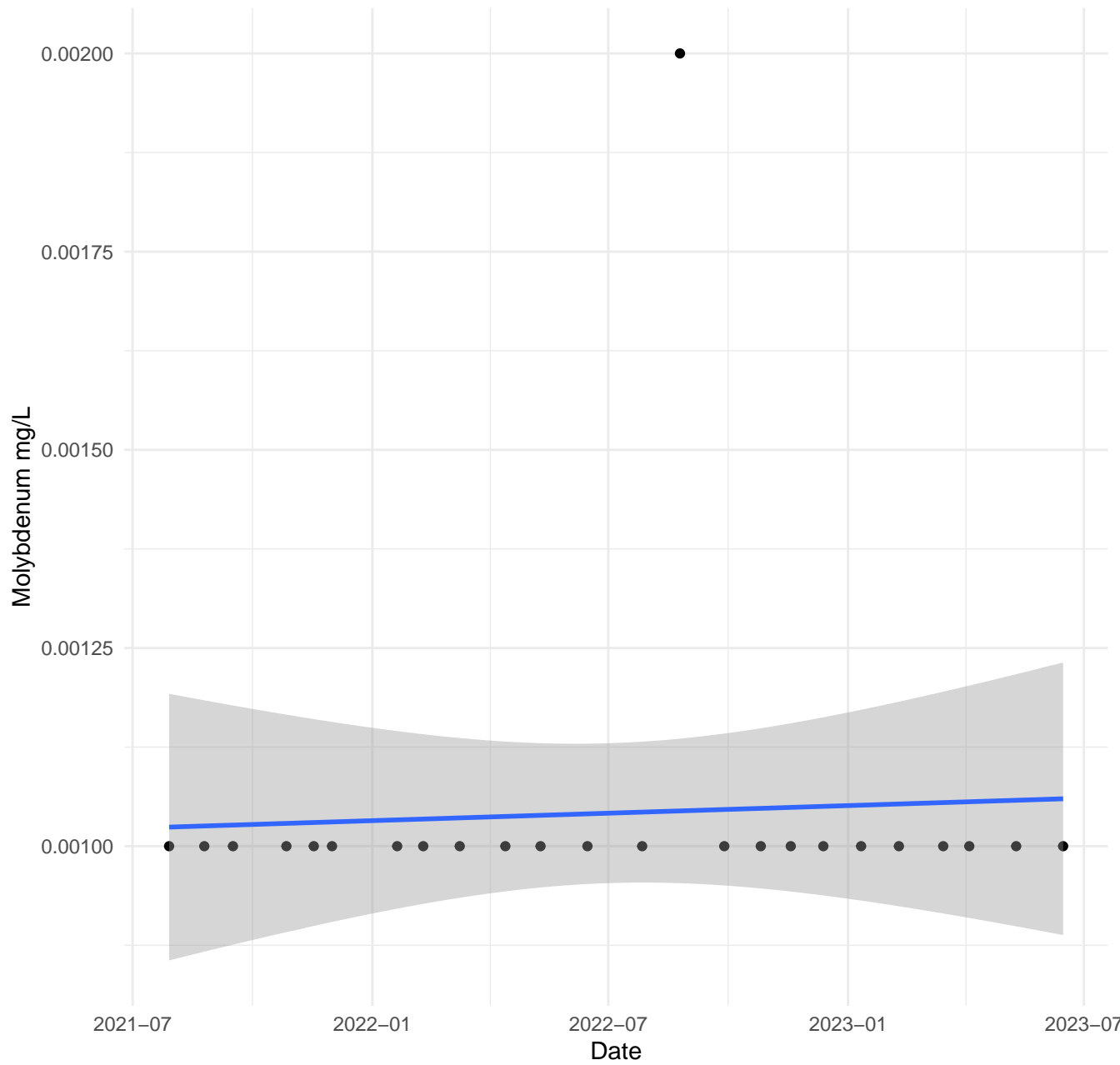
Mercury at WX22



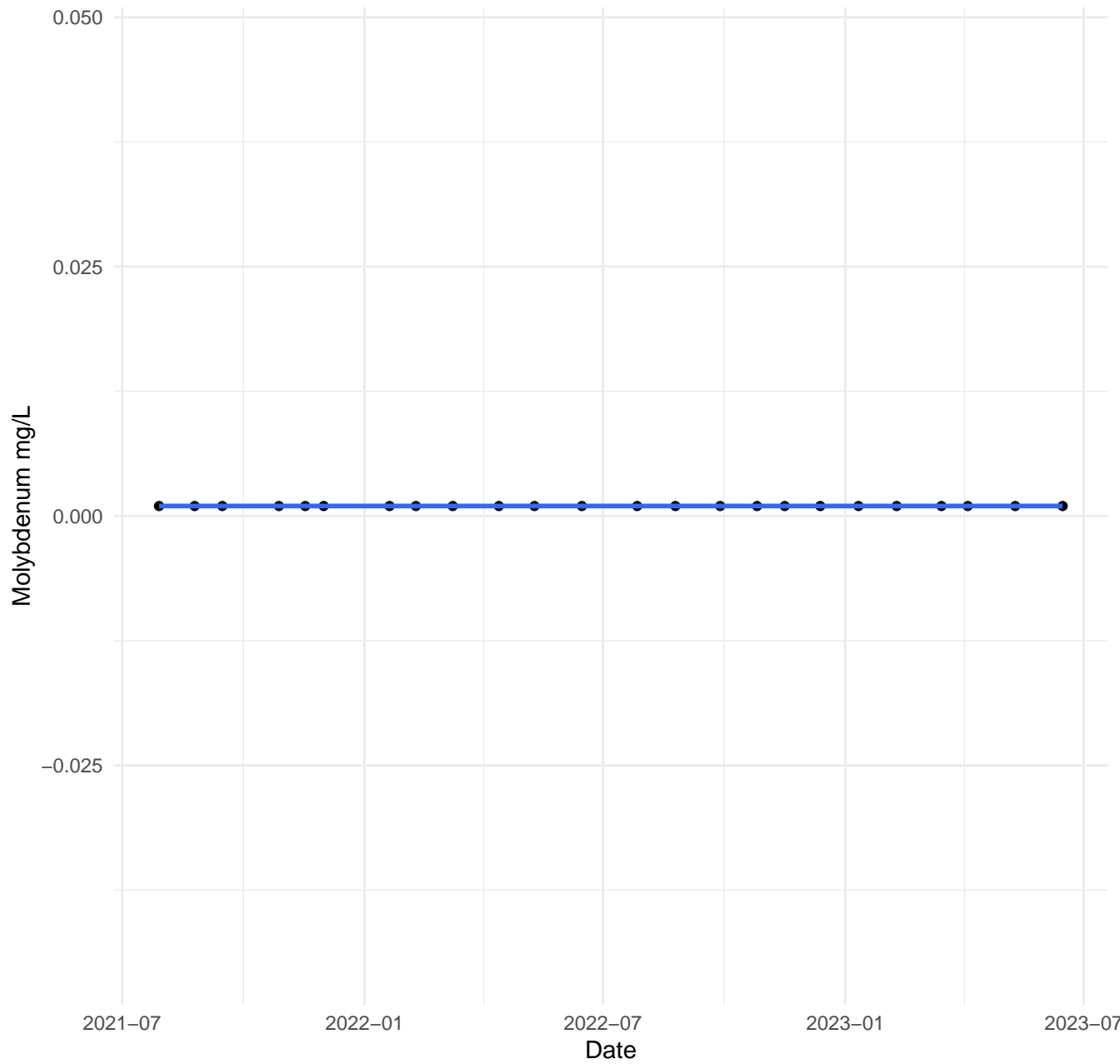
Molybdenum at C



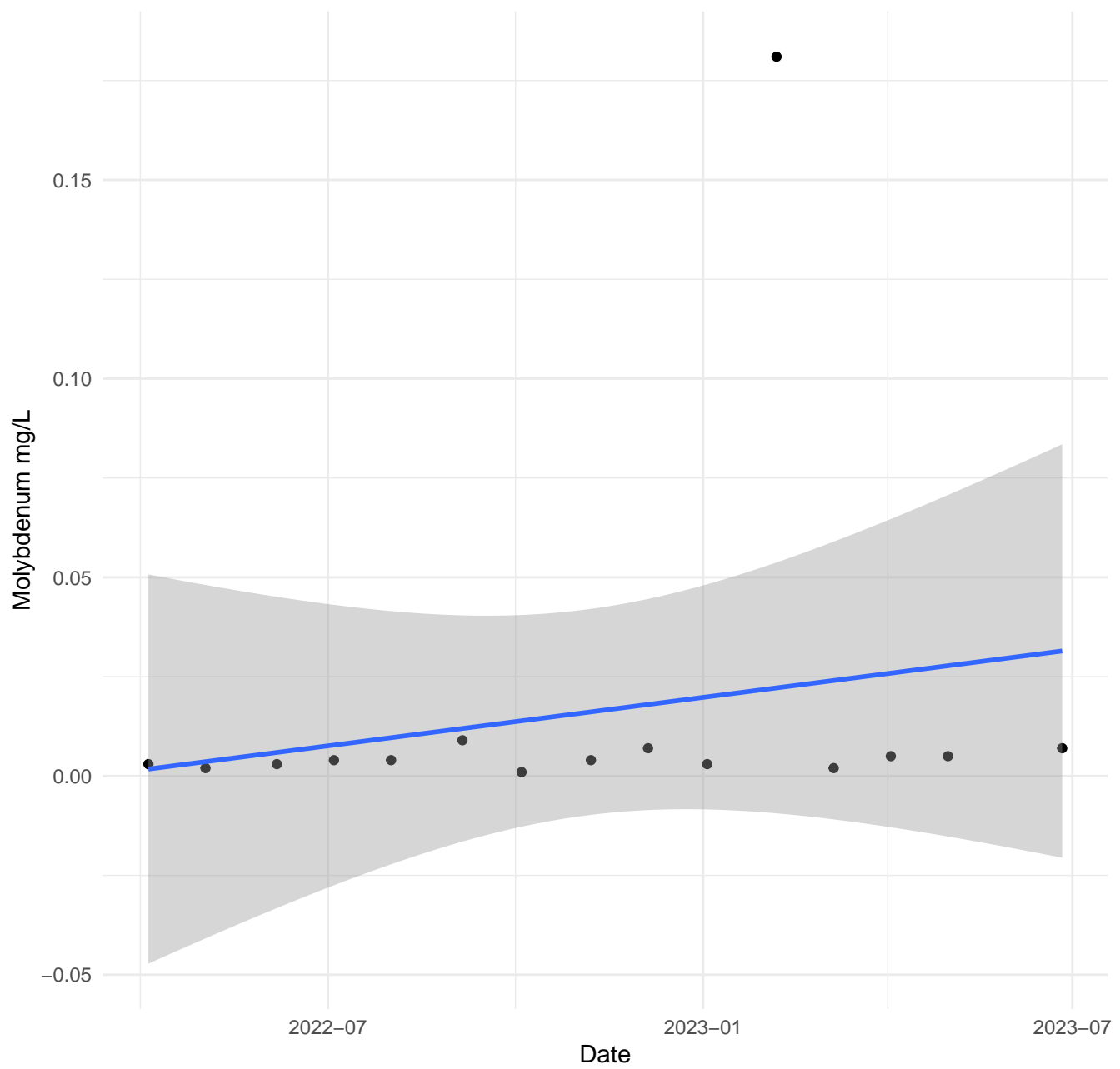
Molybdenum at E



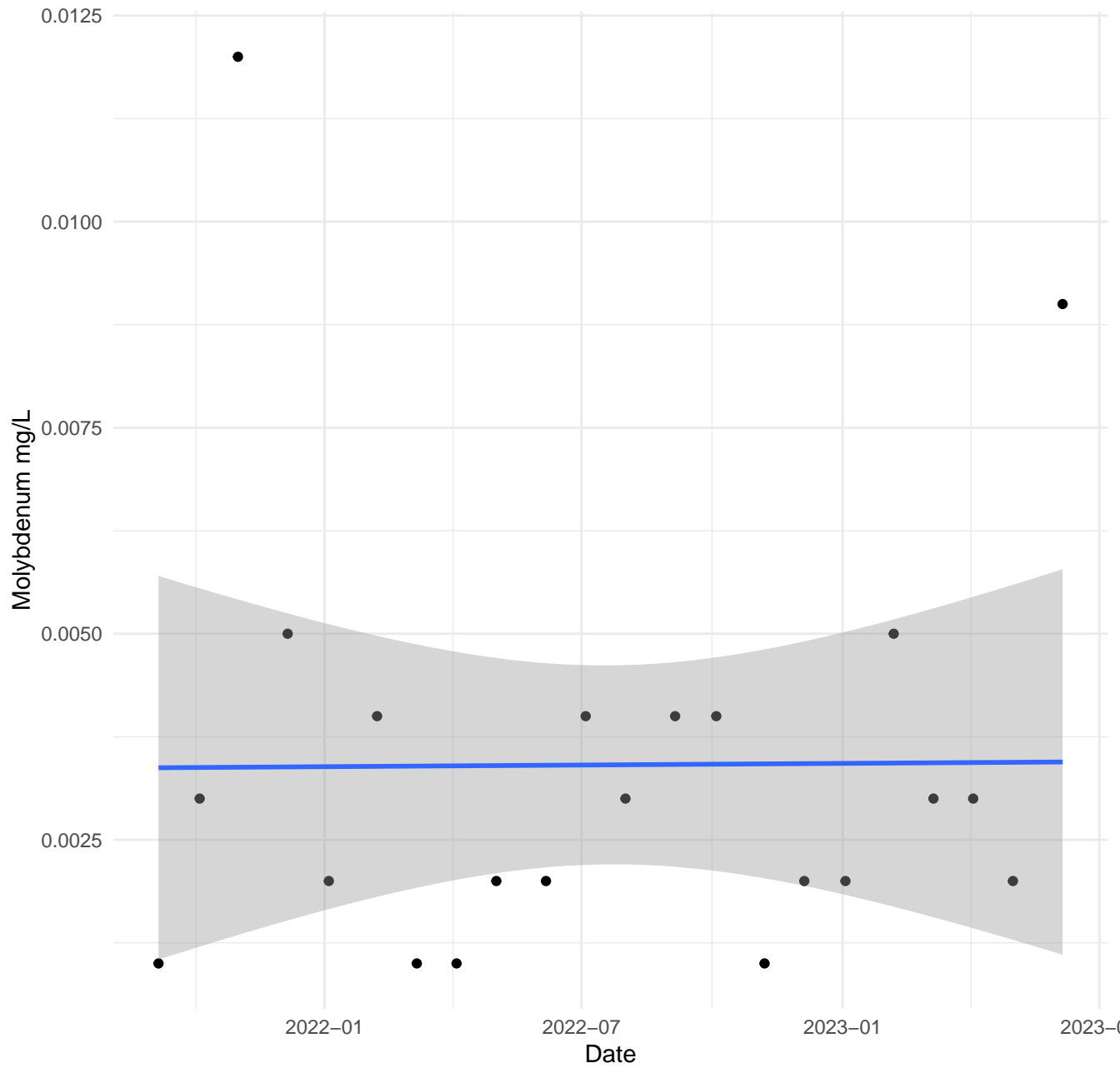
Molybdenum at G



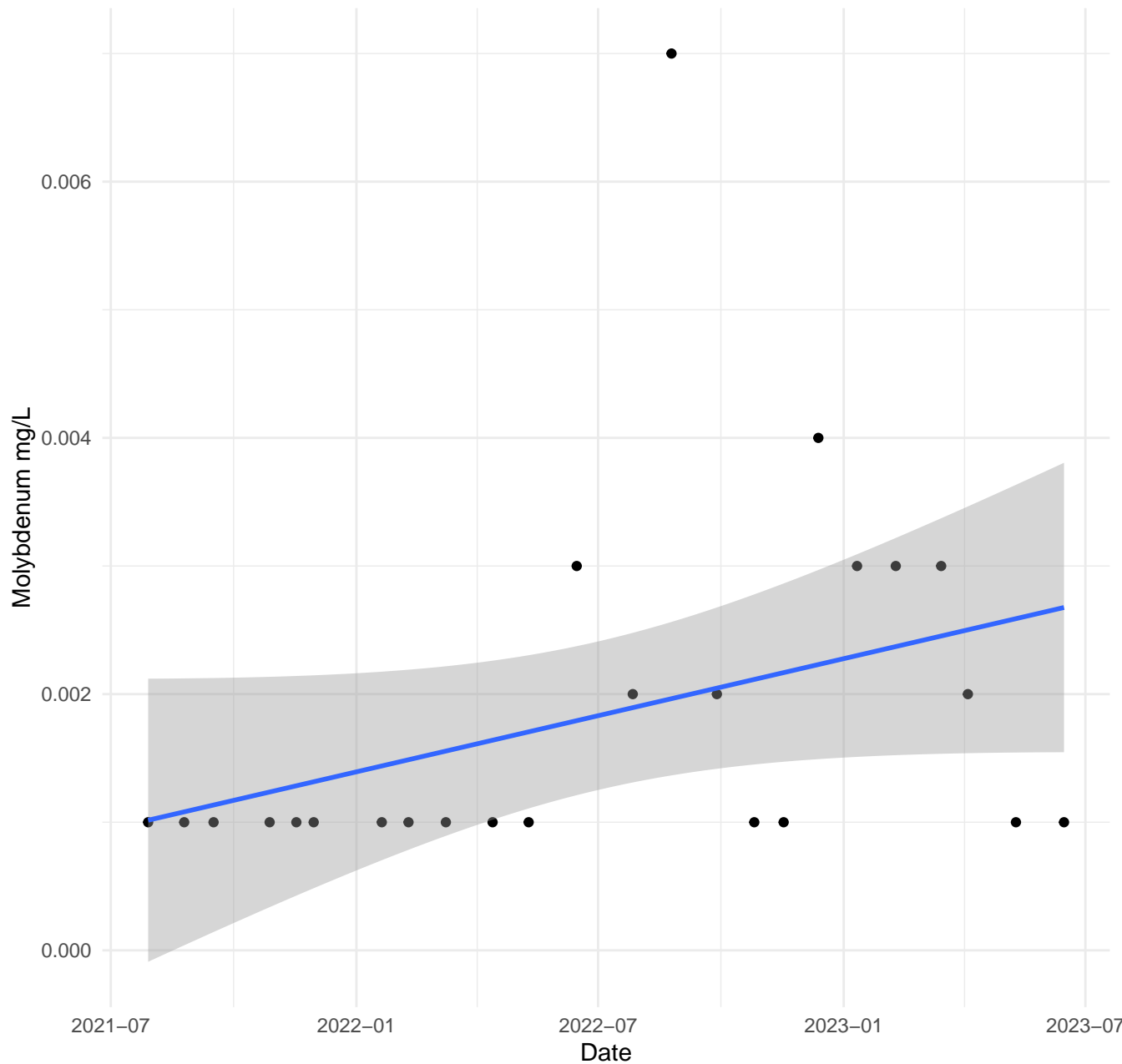
Molybdenum at LDP01



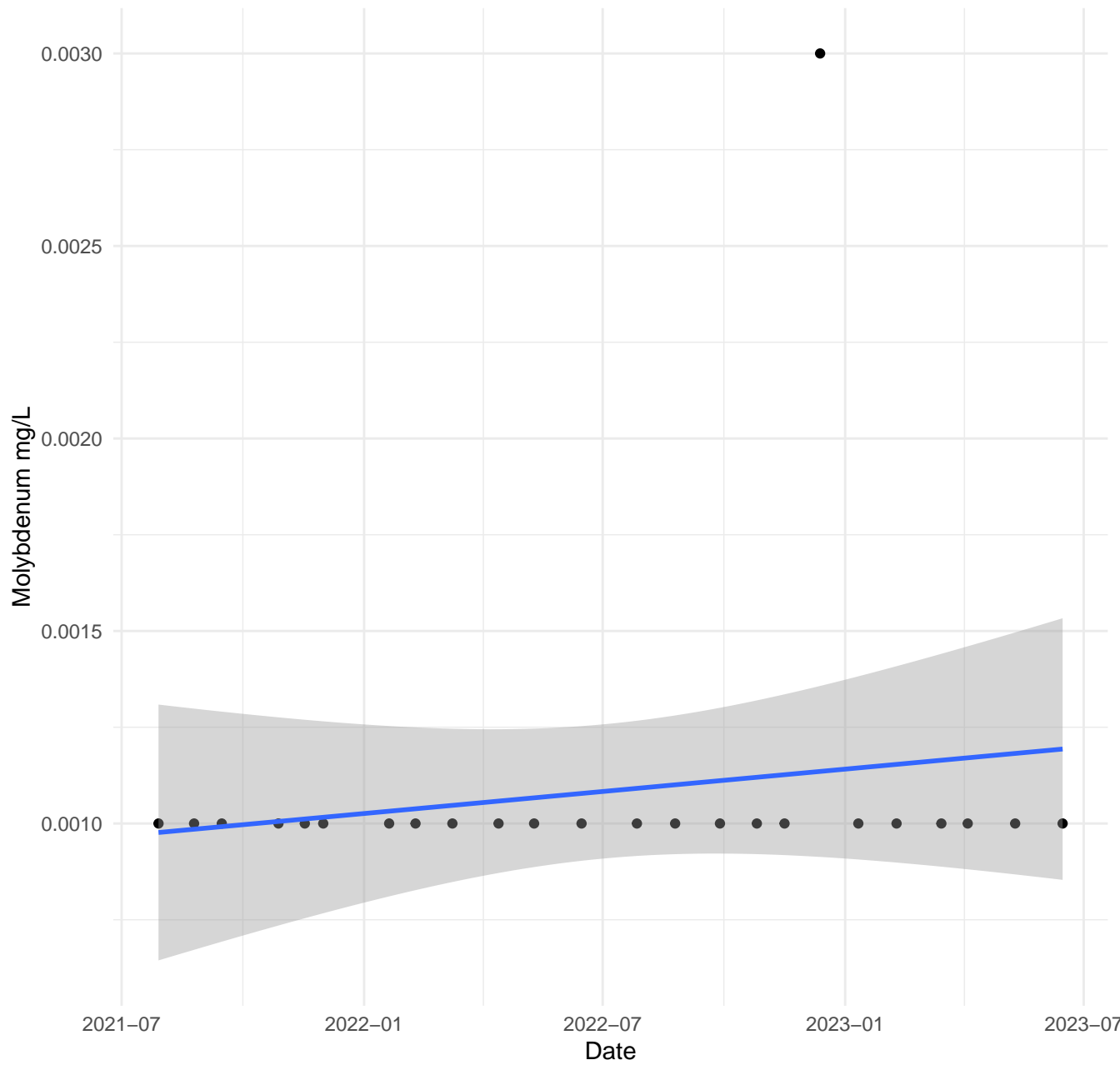
Molybdenum at LMP01



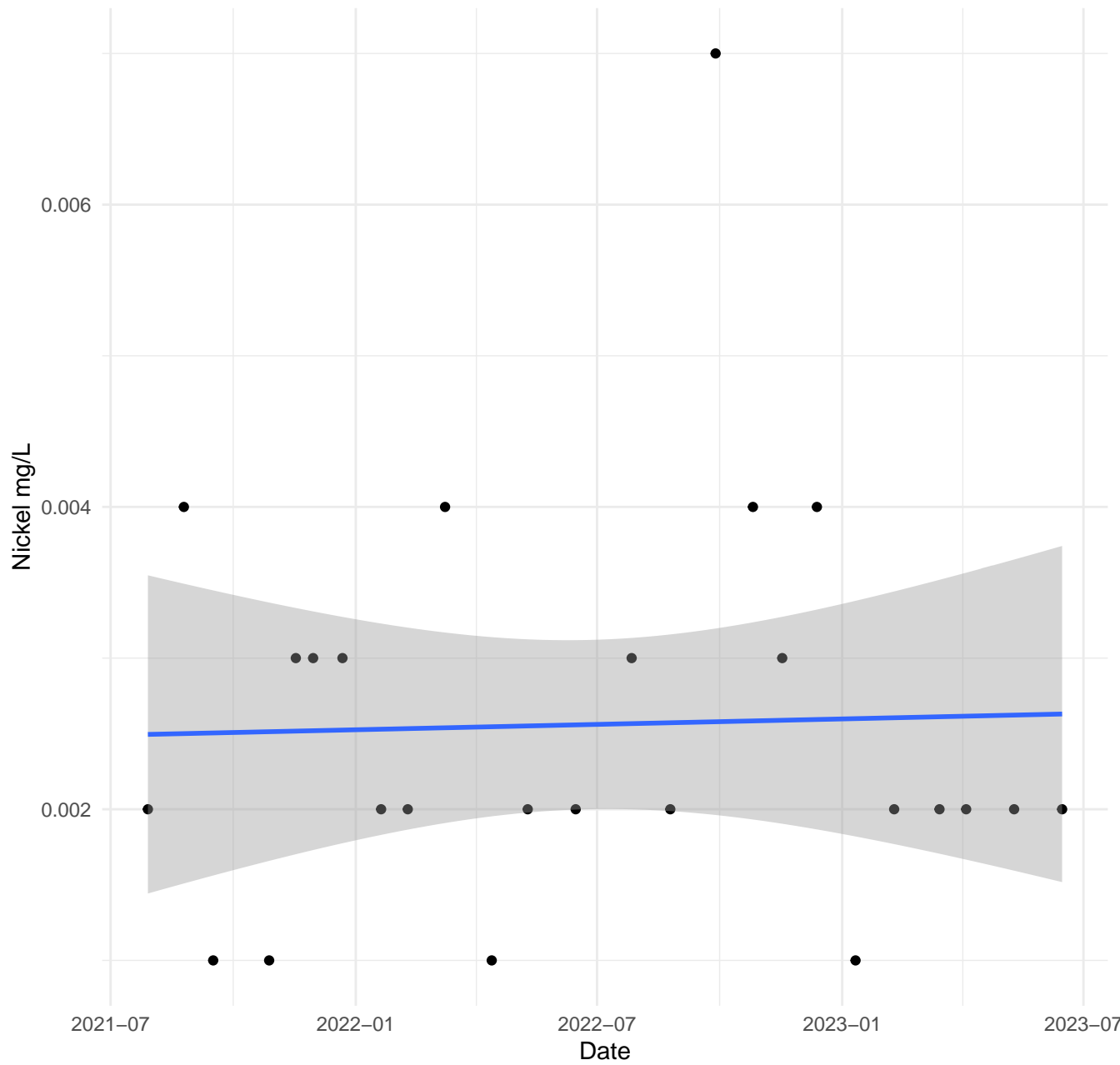
Molybdenum at NC01



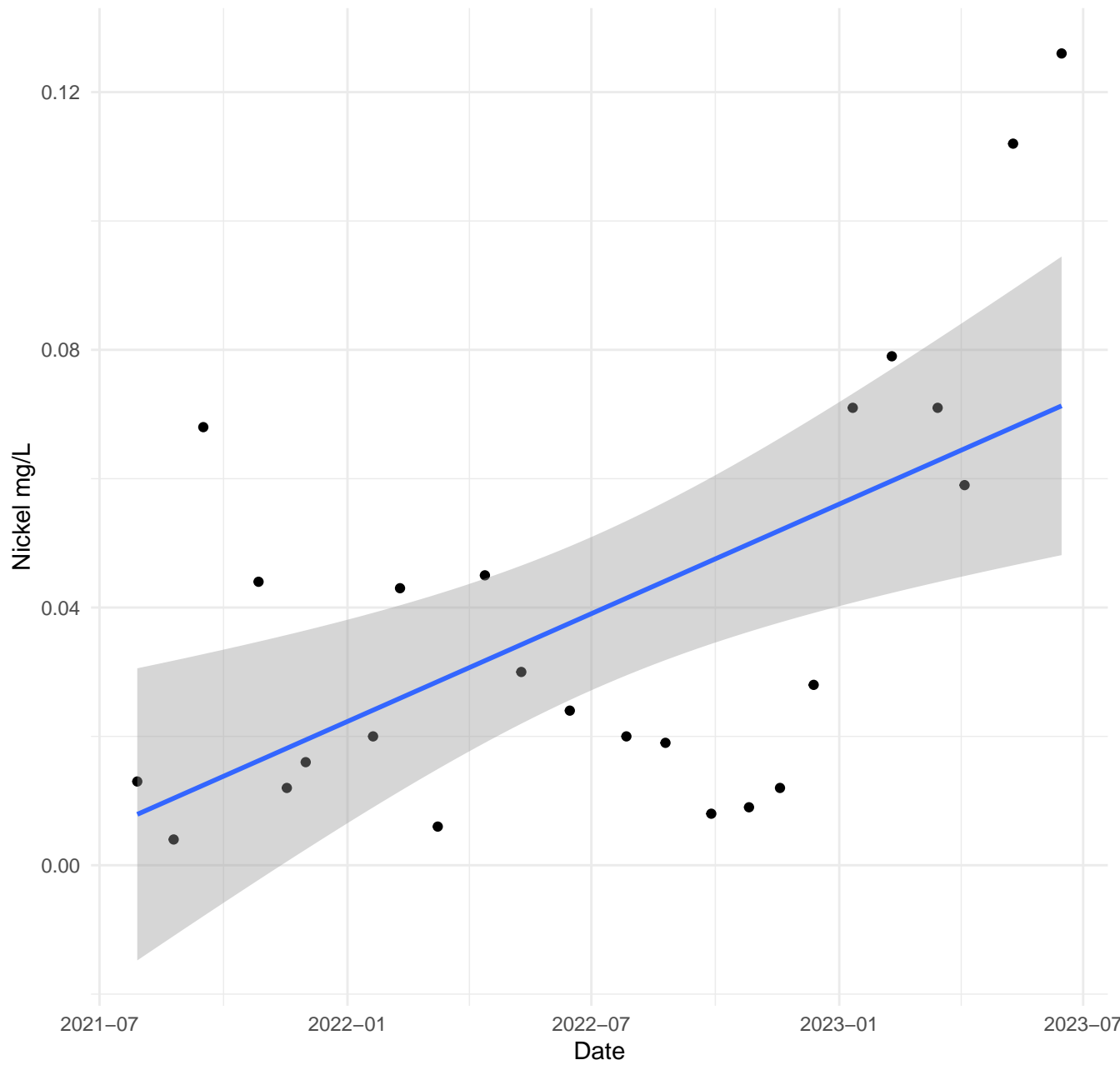
Molybdenum at WX22



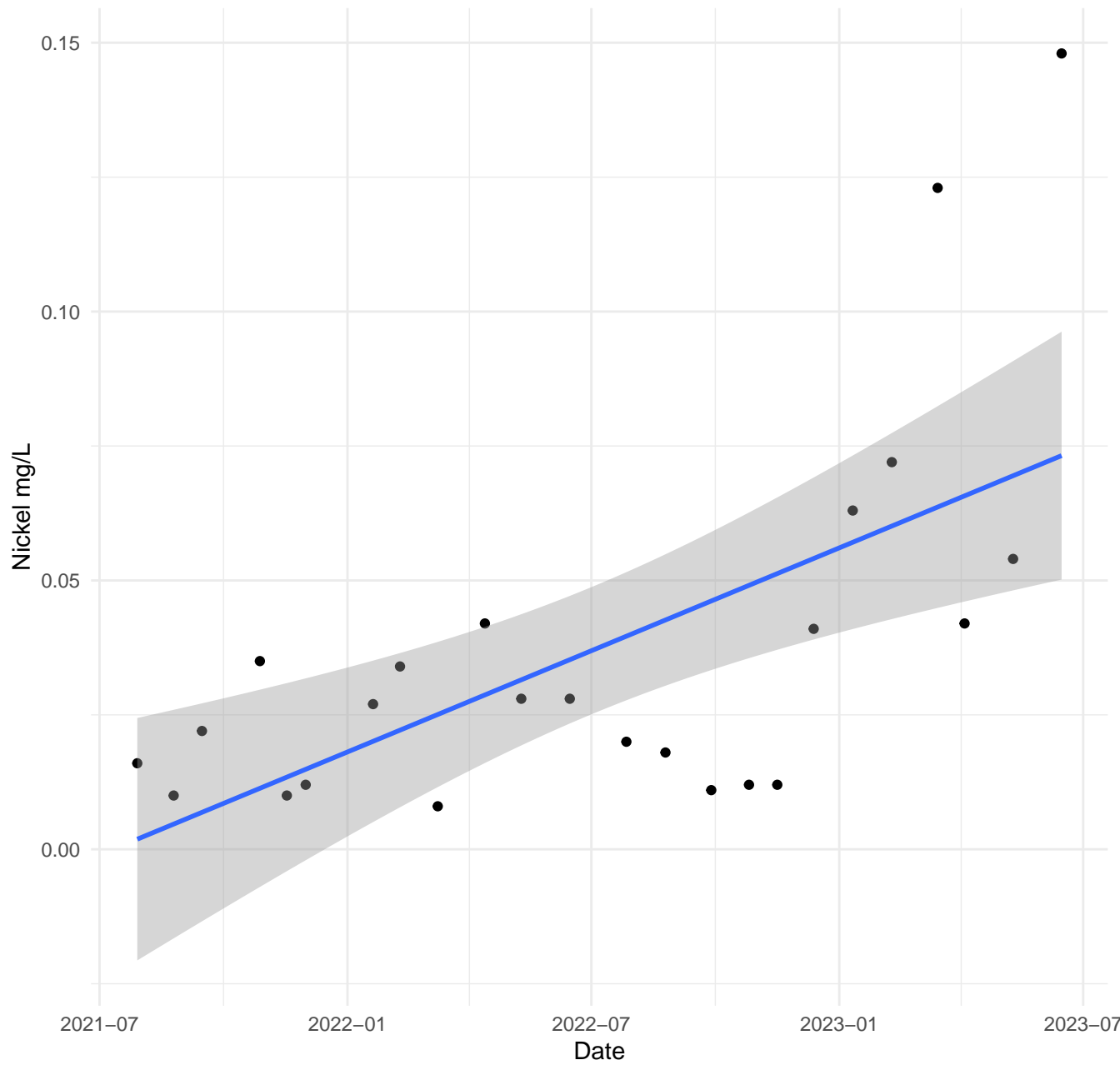
Nickel at C



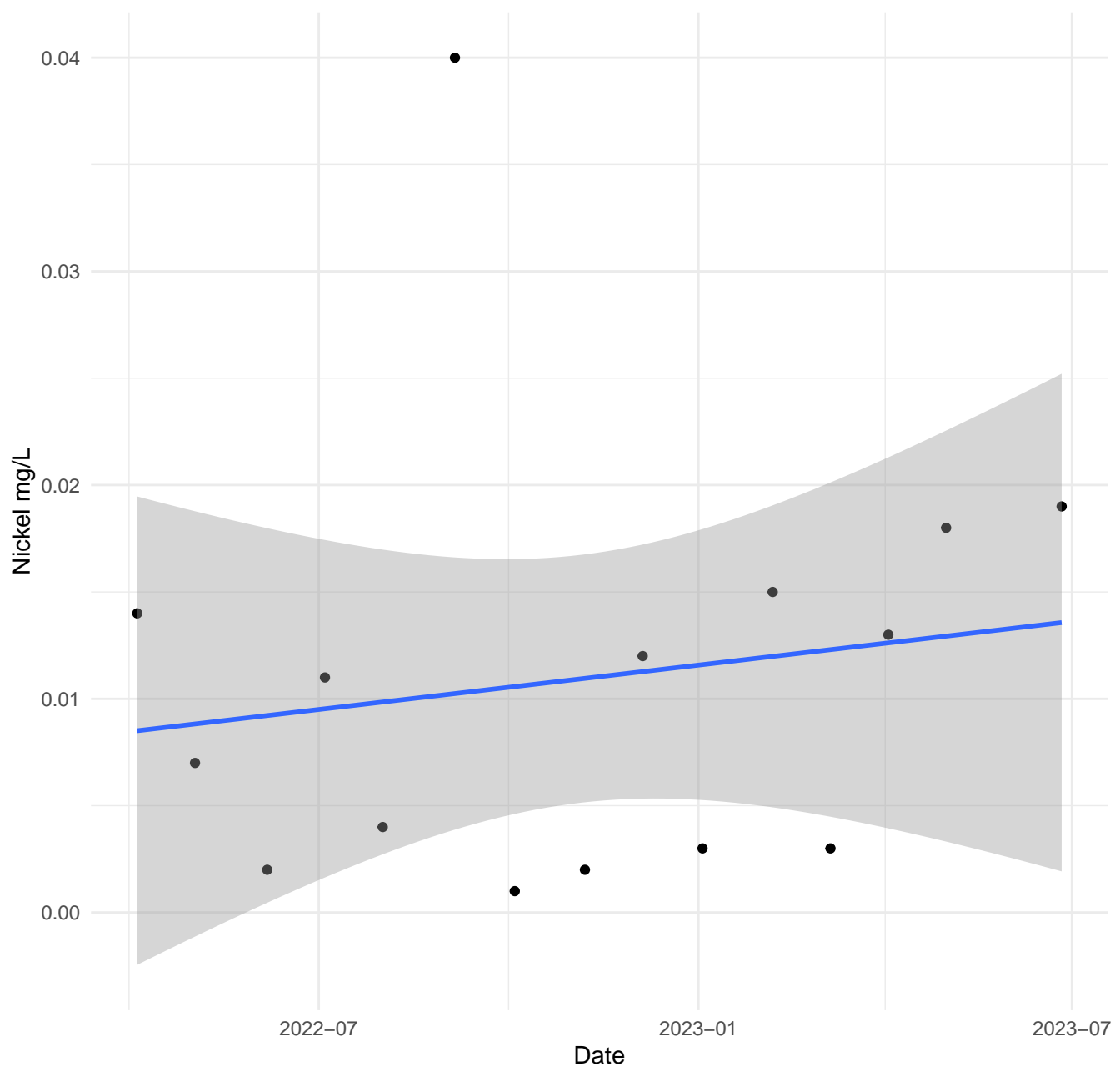
Nickel at E



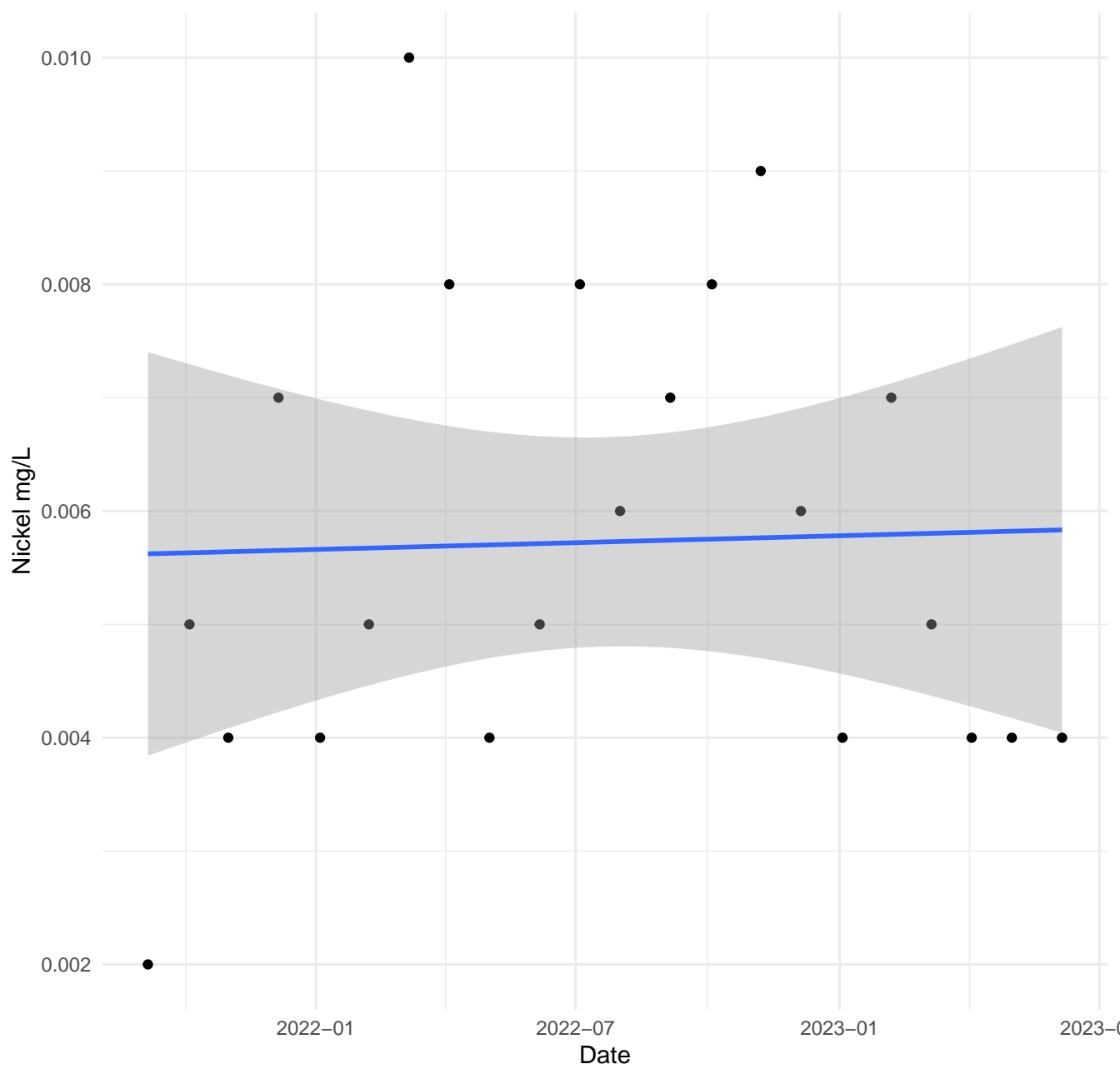
Nickel at G



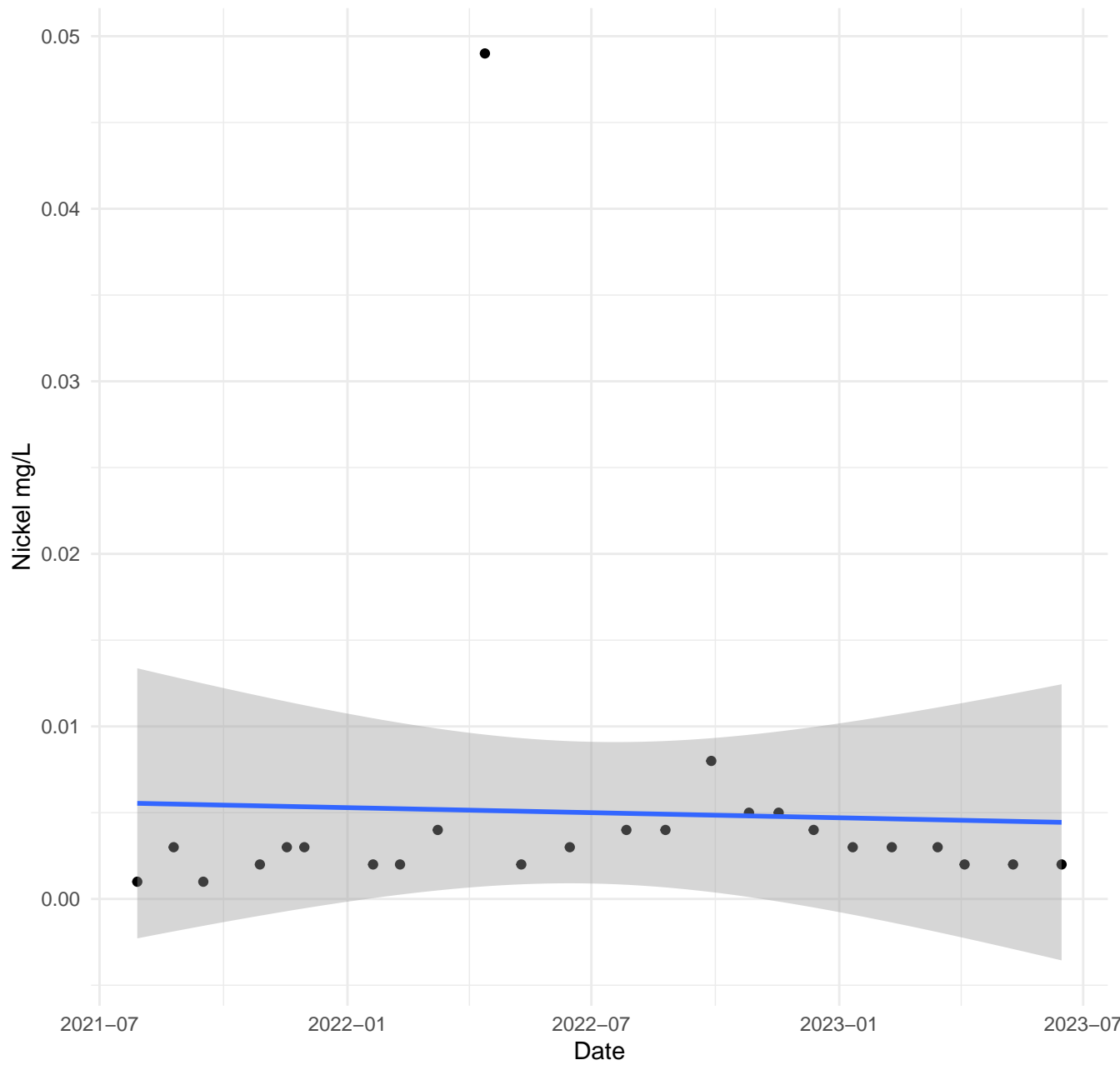
Nickel at LDP01



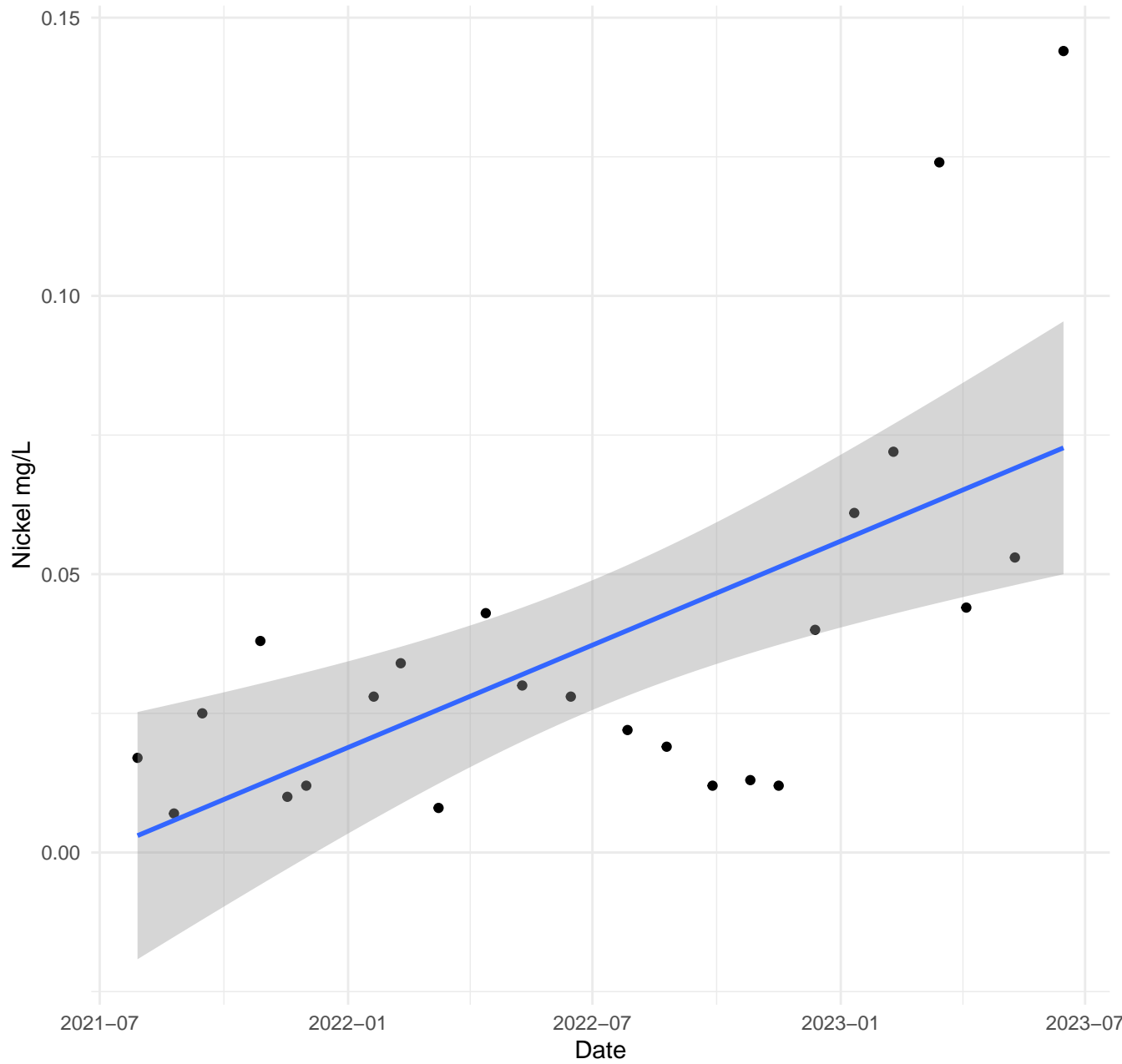
Nickel at LMP01



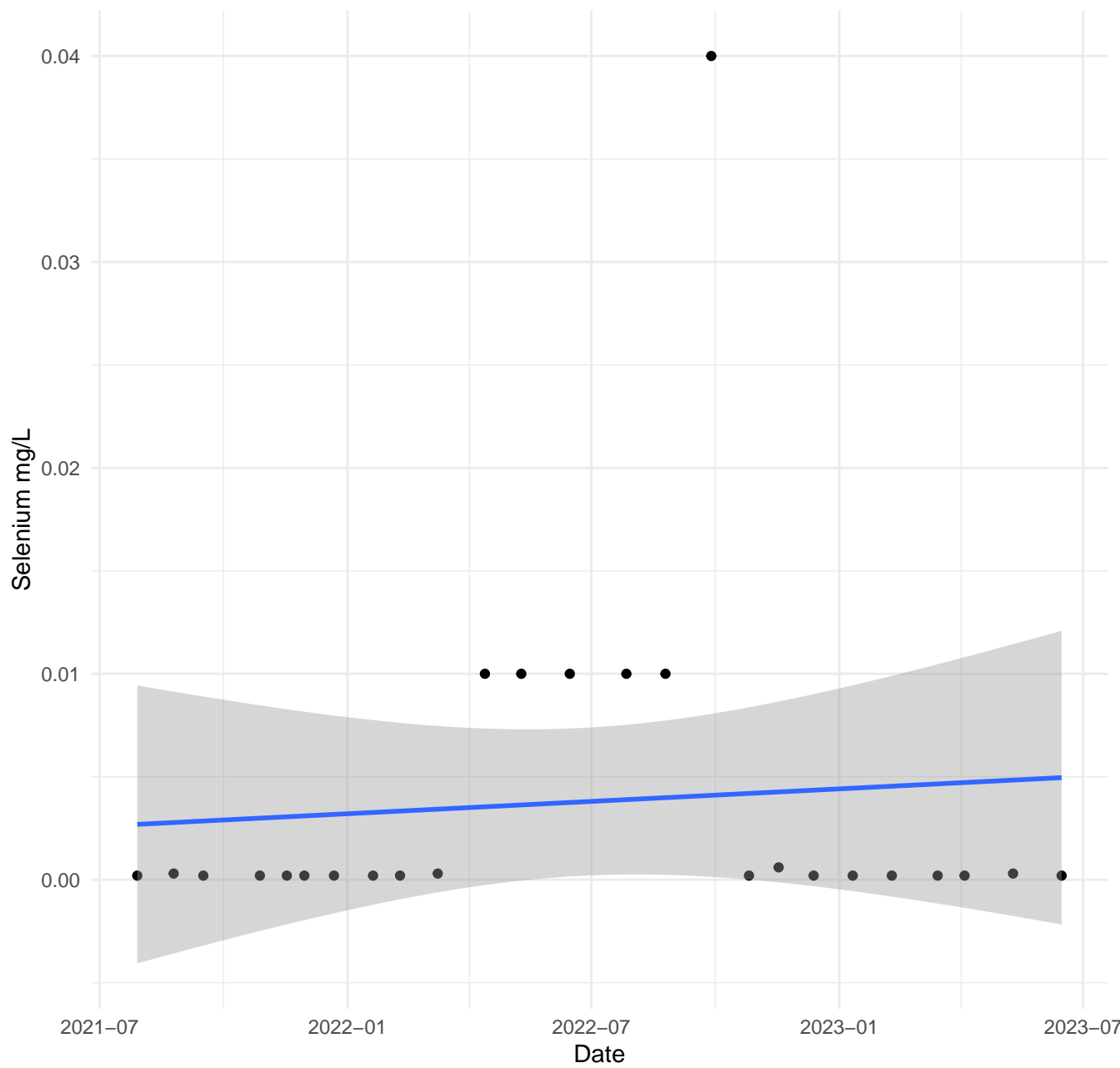
Nickel at NC01



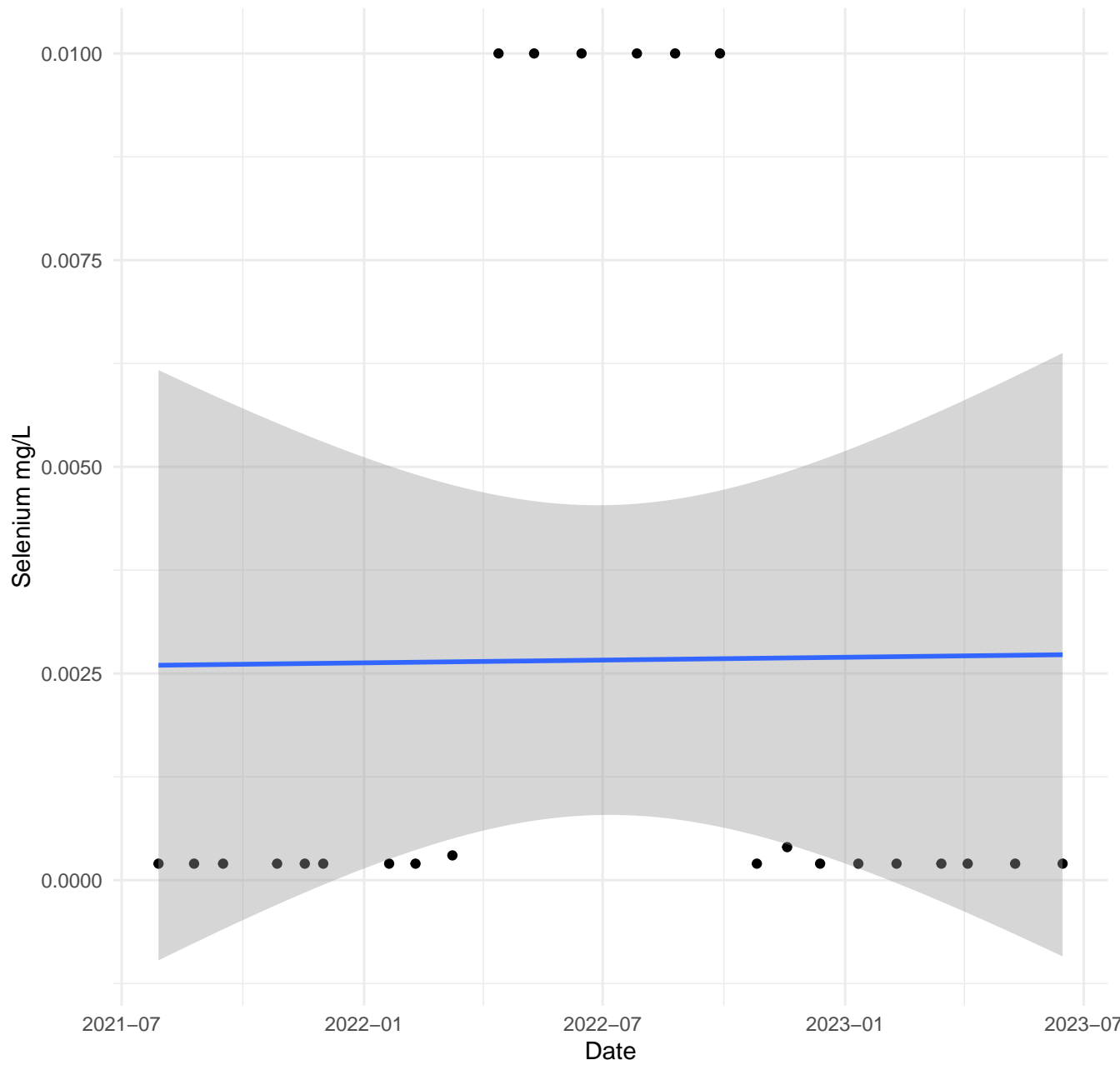
Nickel at WX22



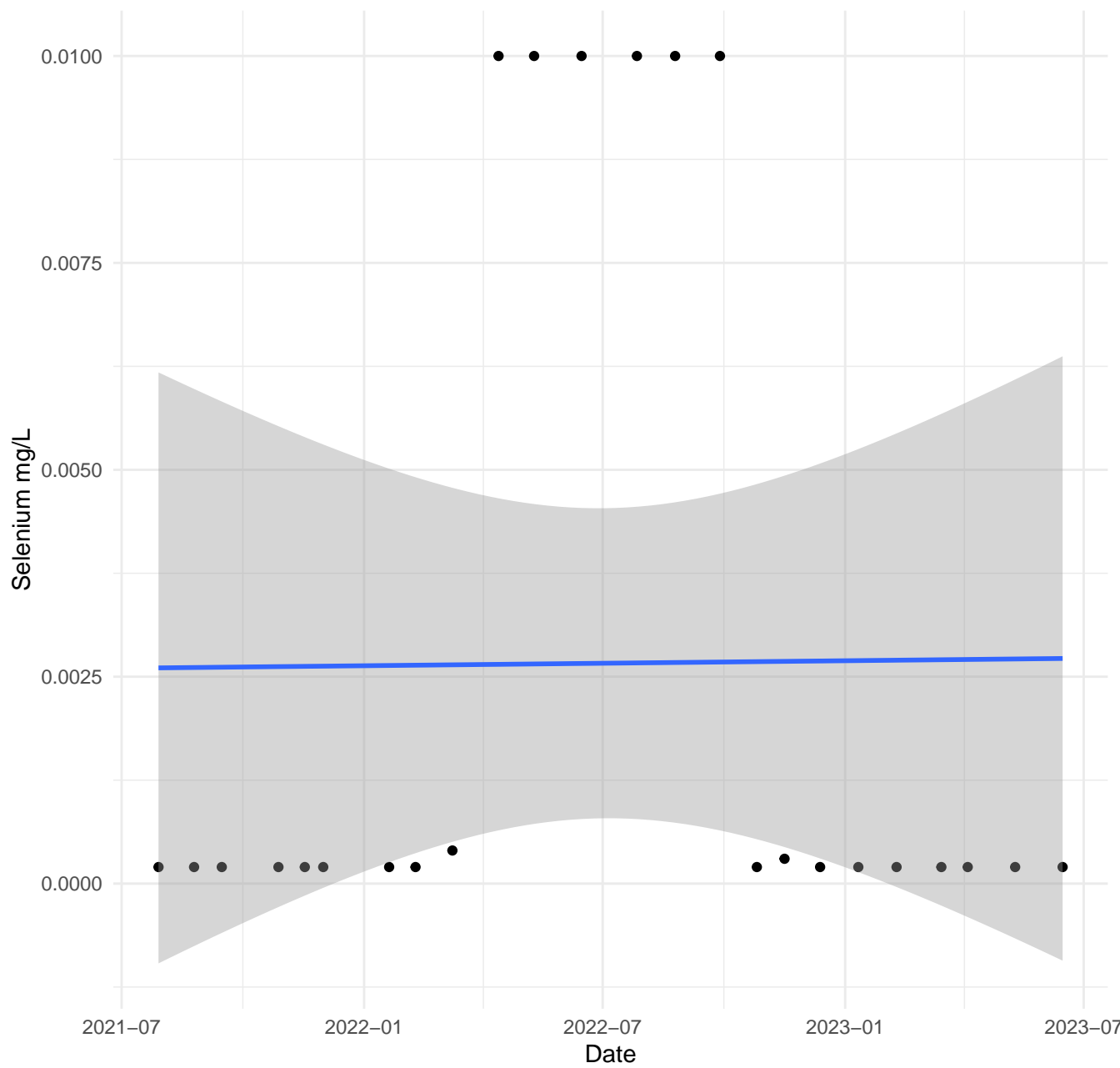
Selenium at C



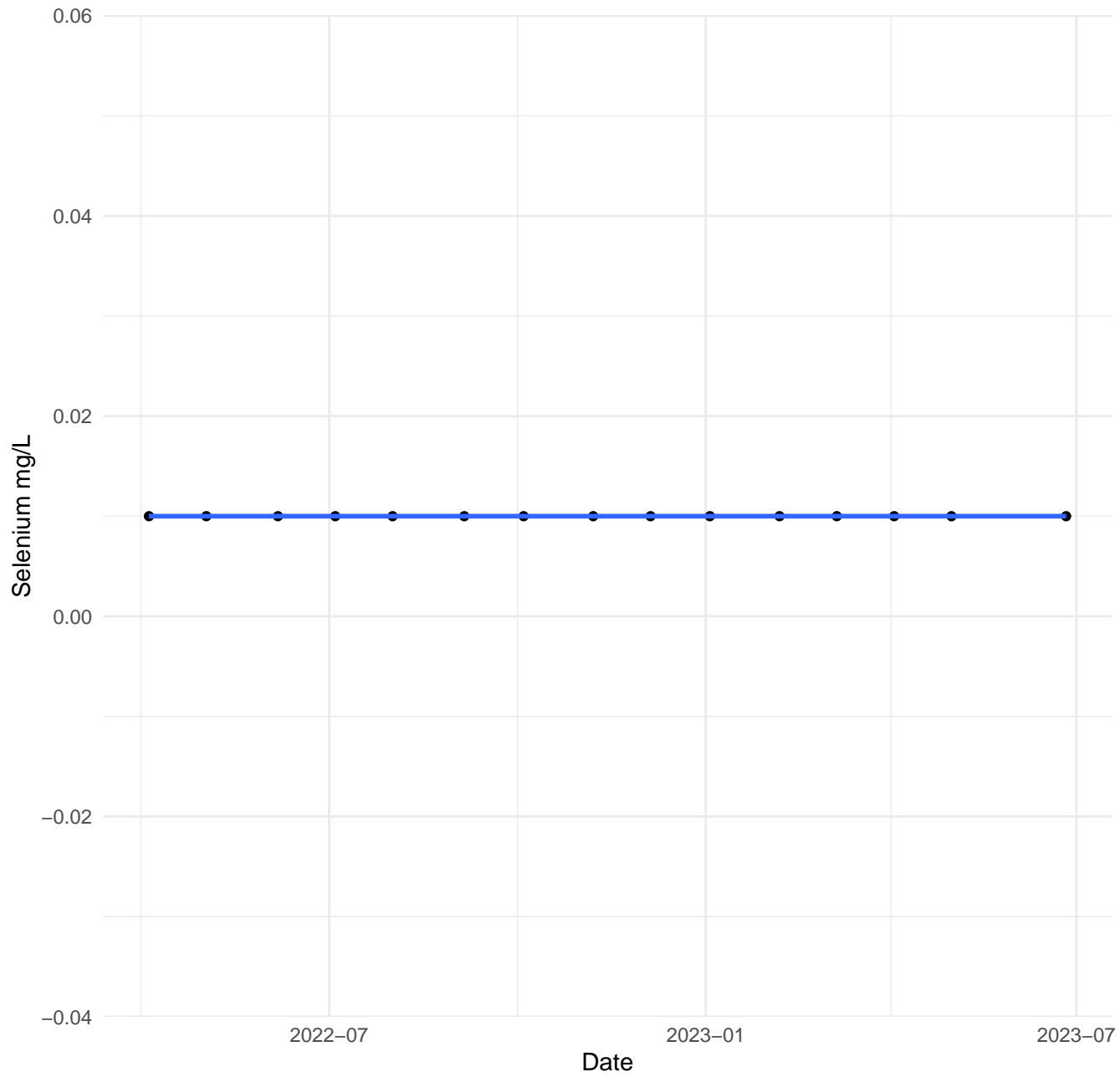
Selenium at E



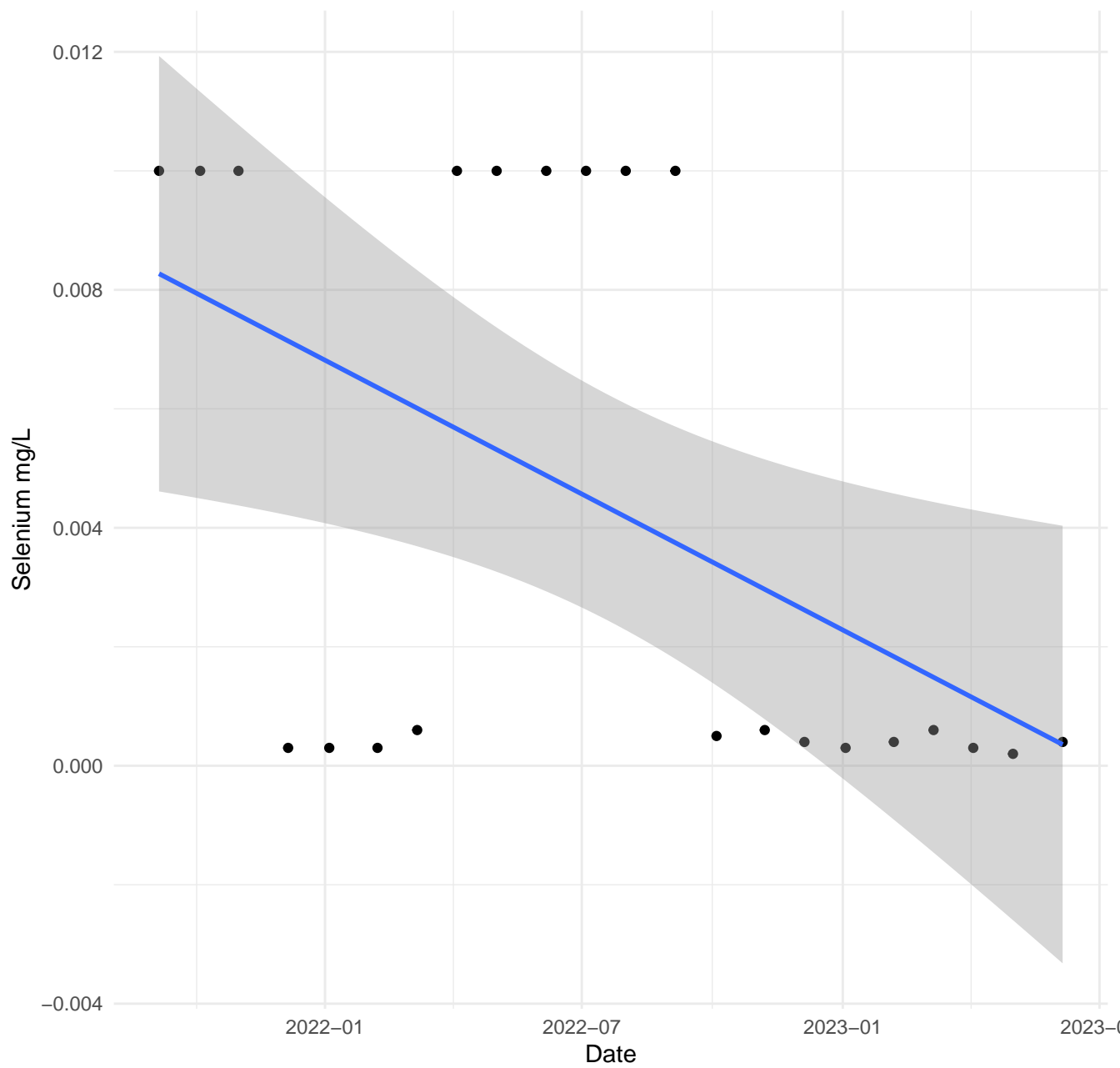
Selenium at G



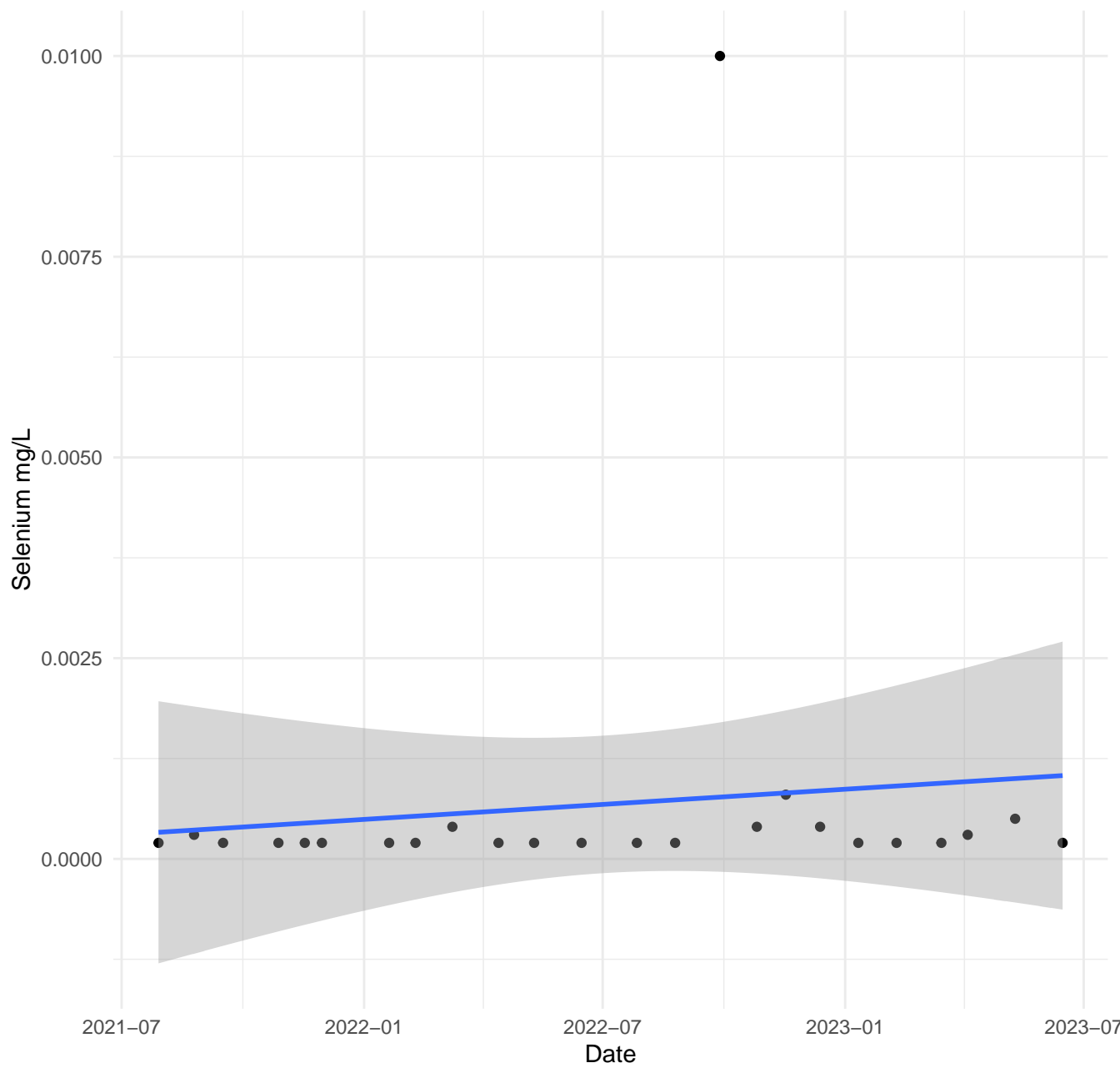
Selenium at LDP01



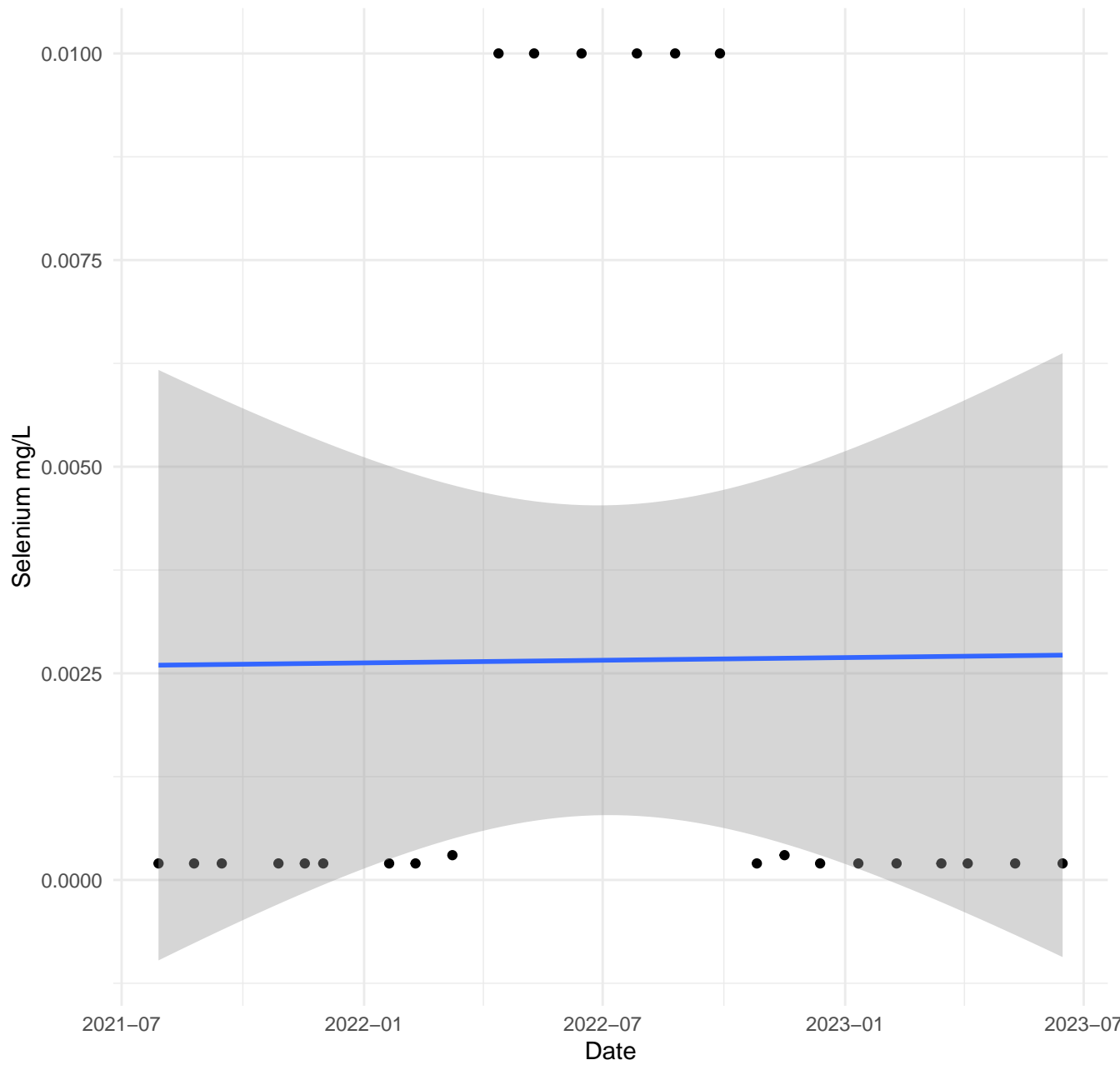
Selenium at LMP01



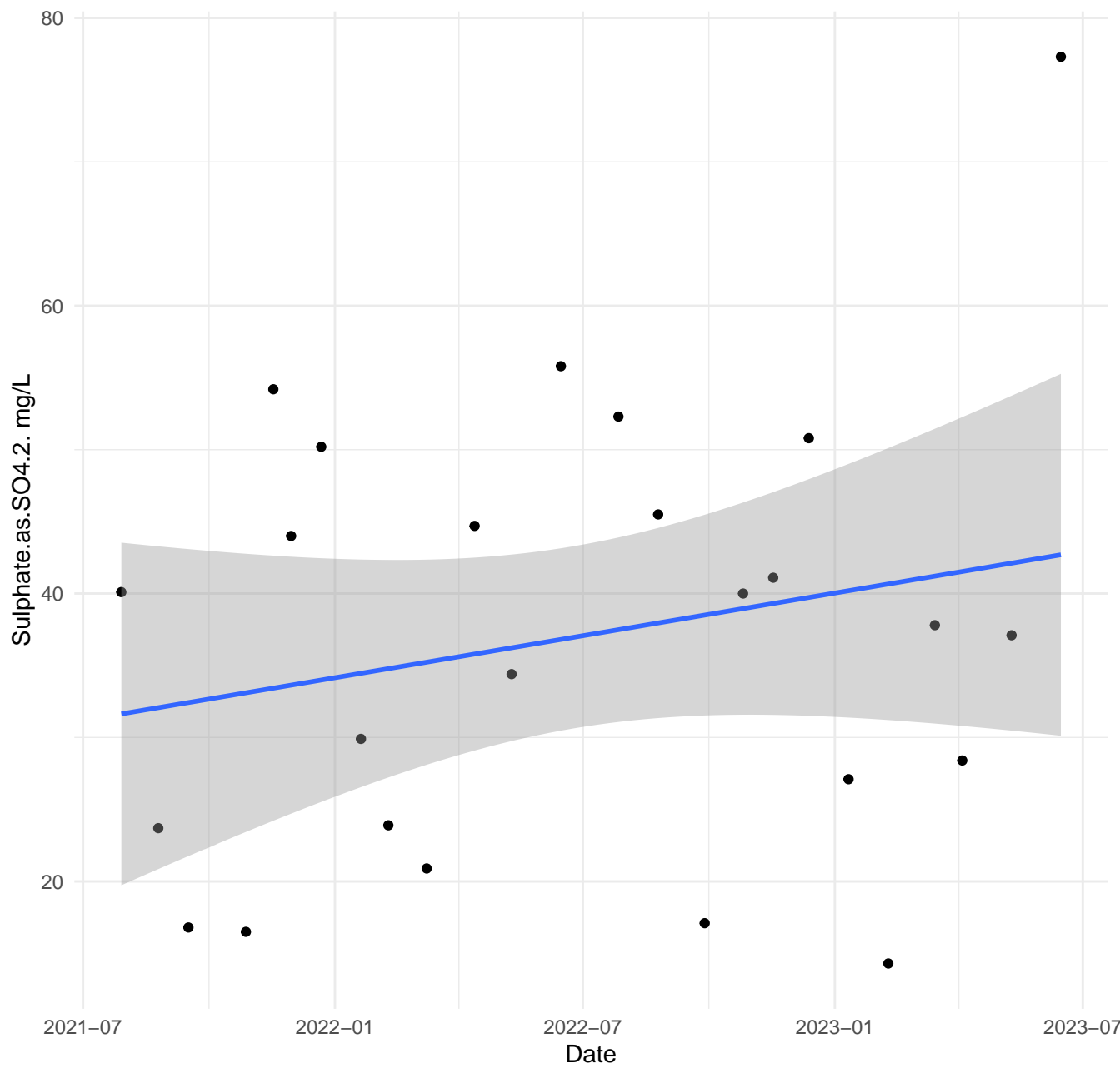
Selenium at NC01



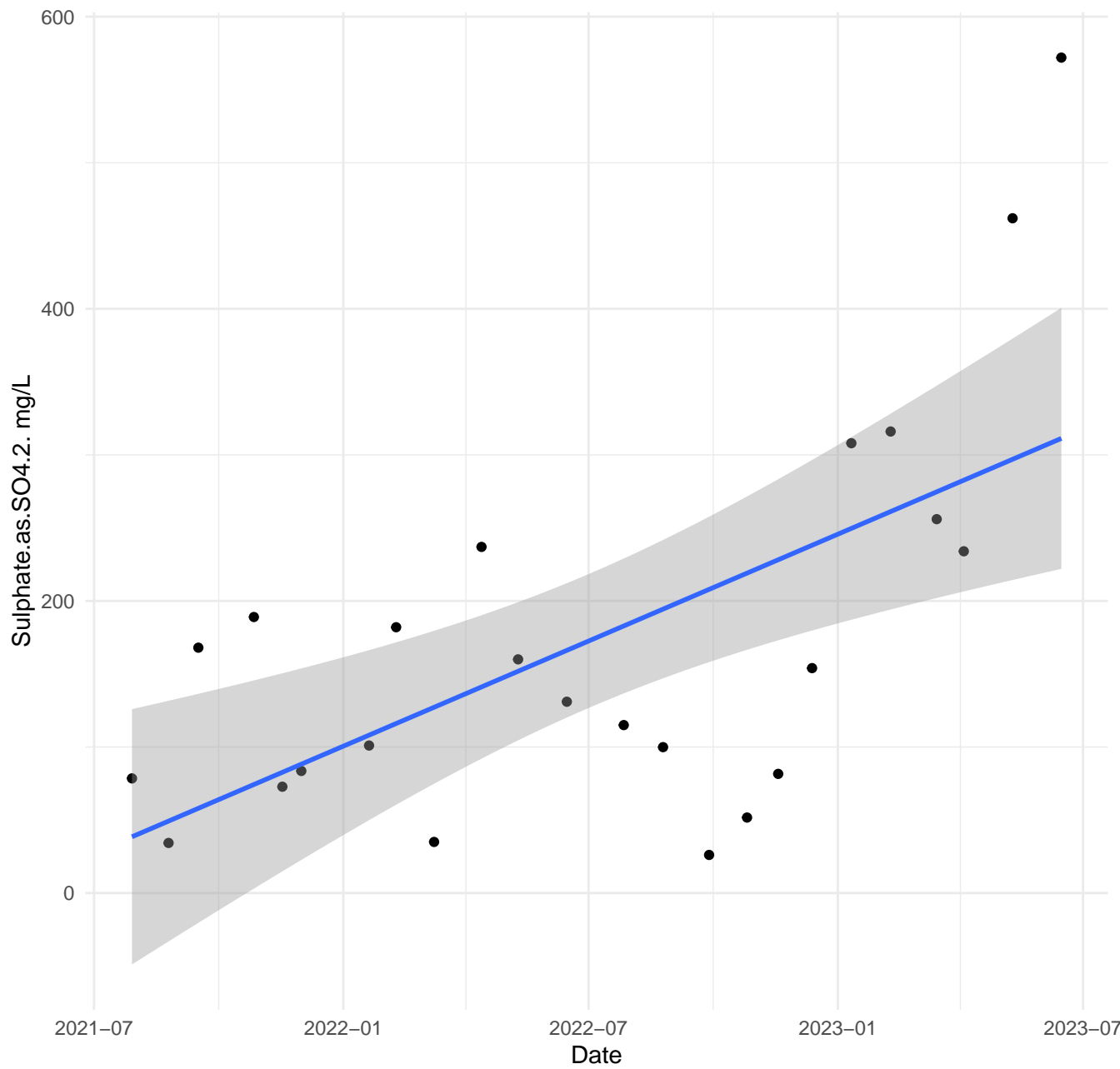
Selenium at WX22



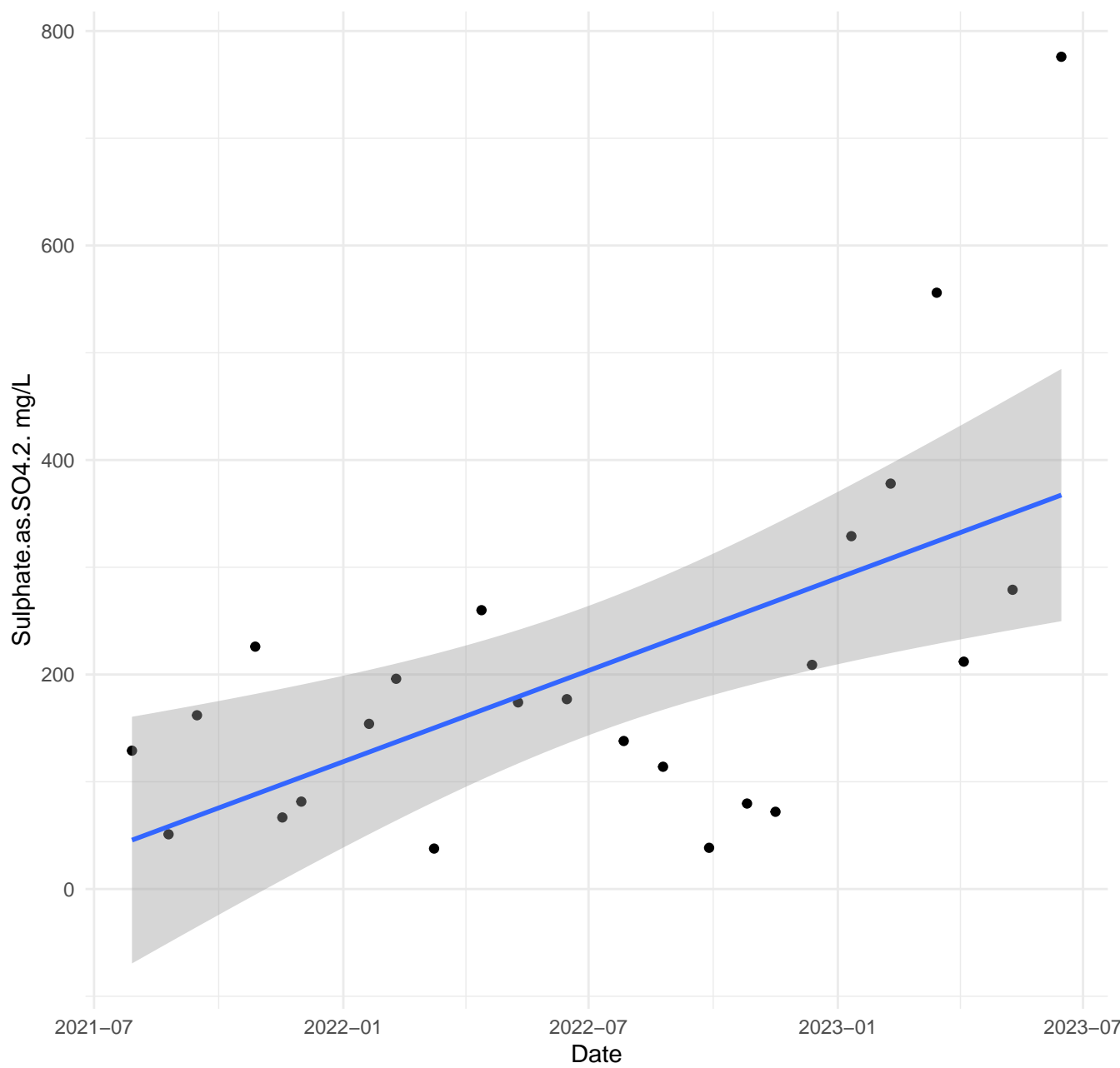
Sulphate.as.SO4.2. at C



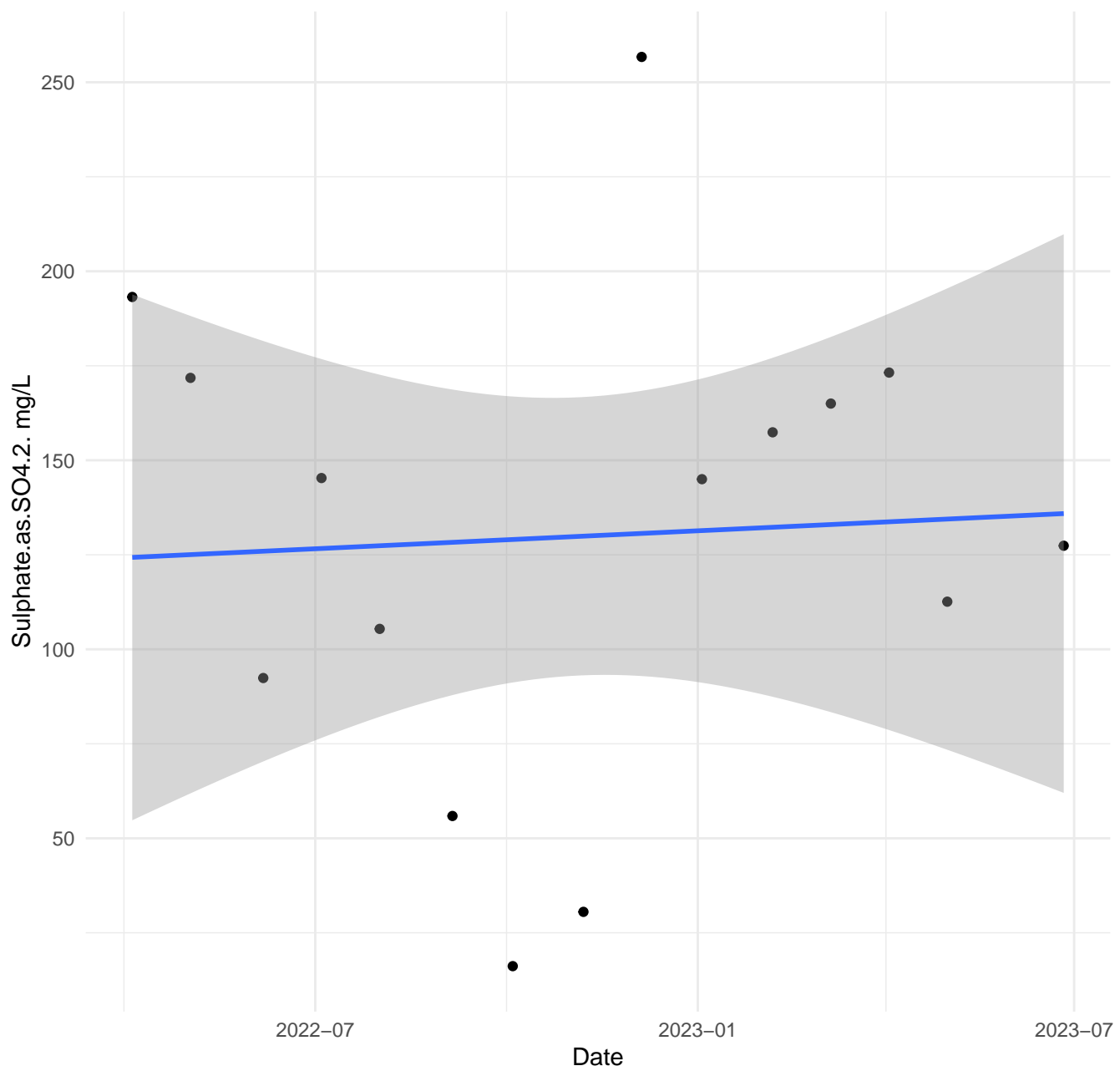
Sulphate.as.SO4.2. at E



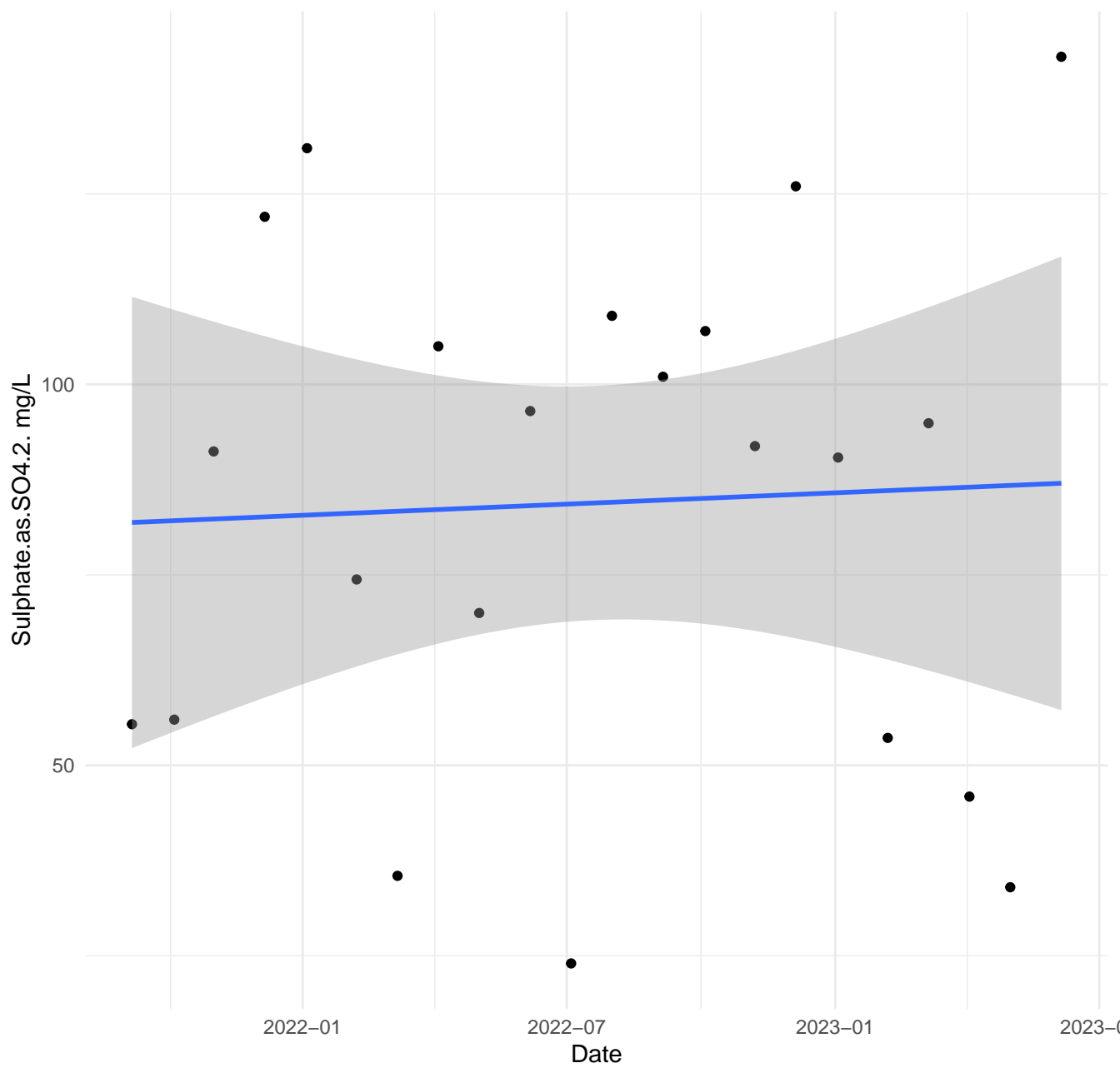
Sulphate.as.SO4.2. at G



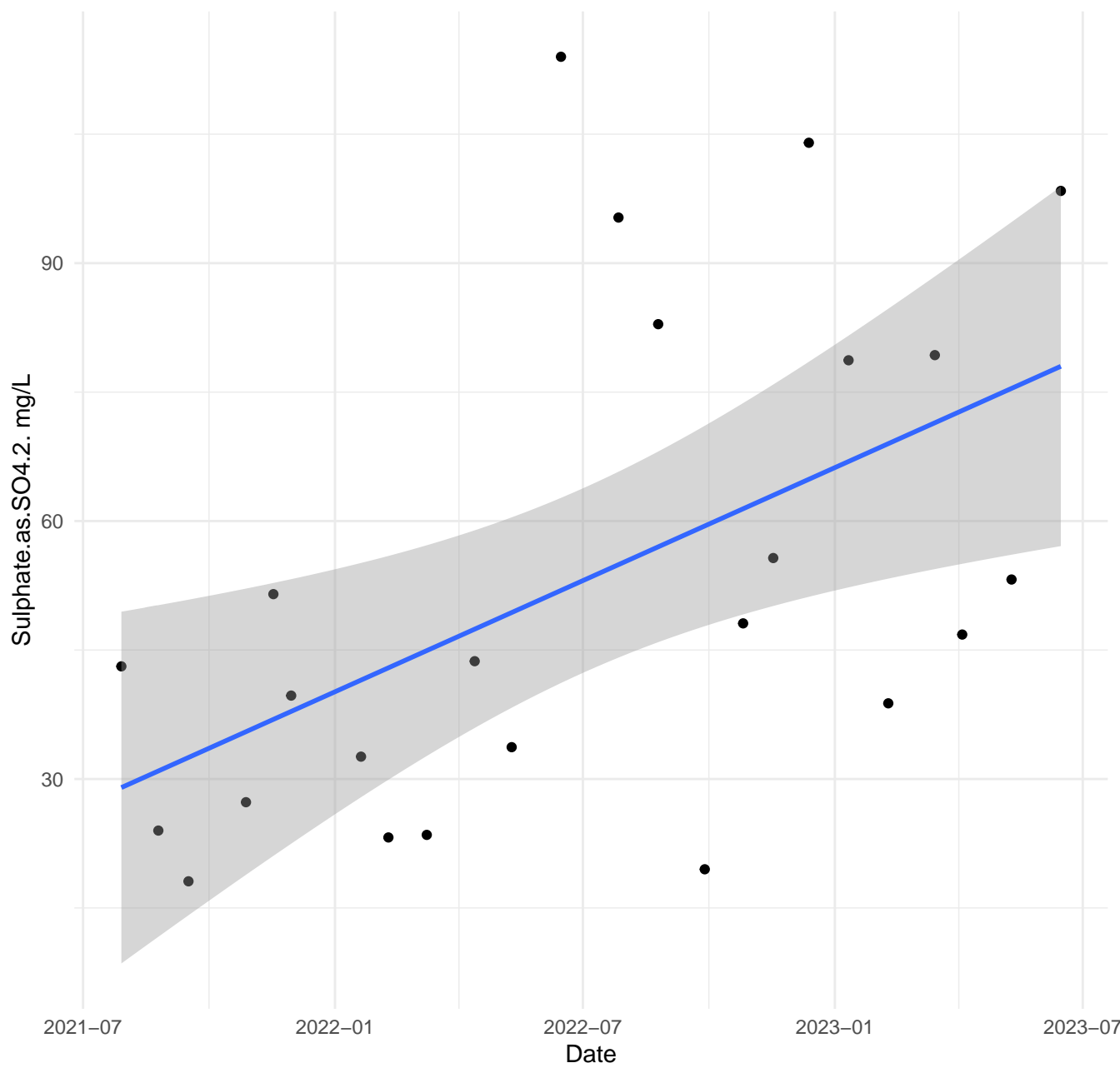
Sulphate.as.SO4.2. at LDP01



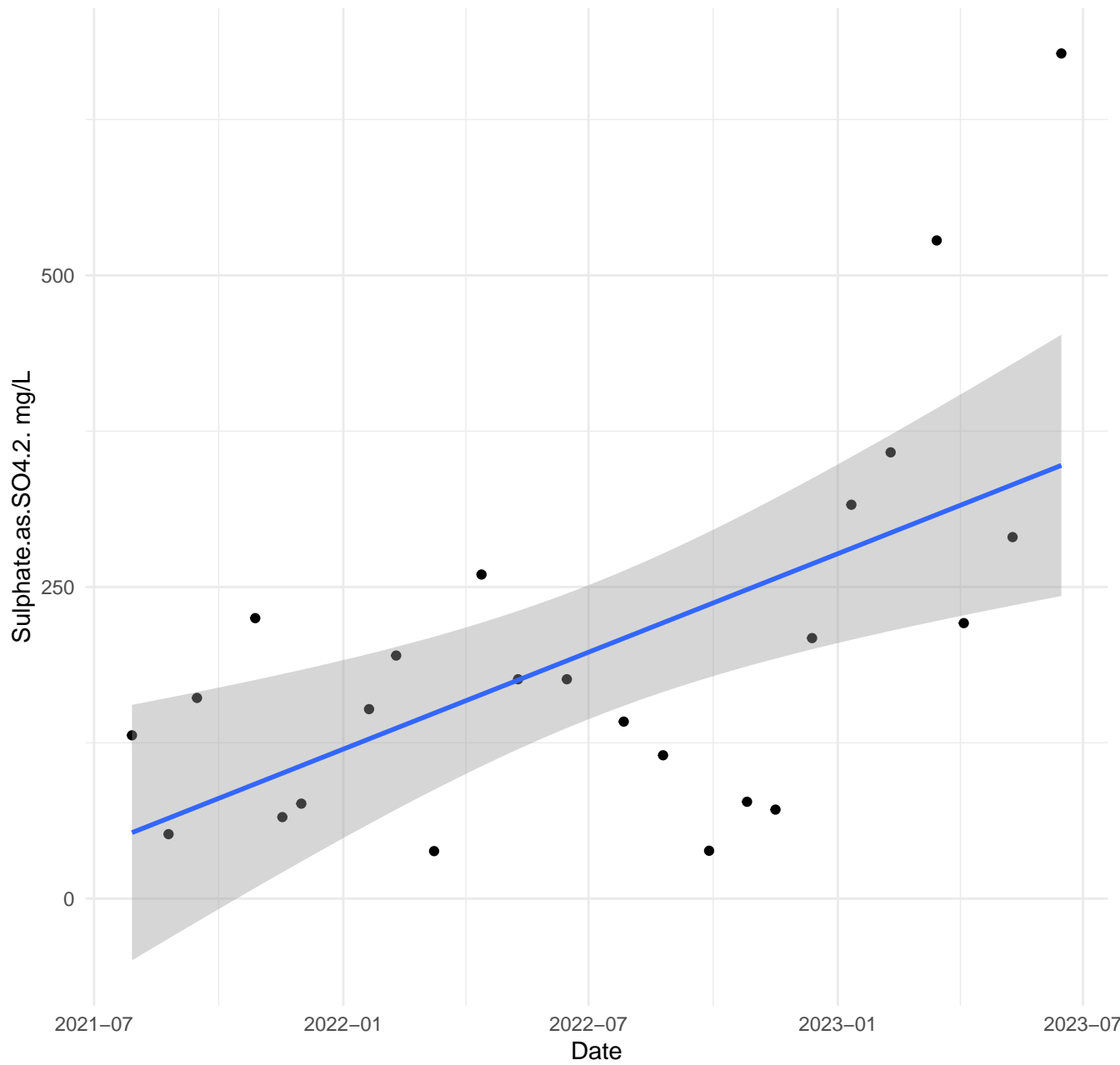
Sulphate.as.SO4.2. at LMP01



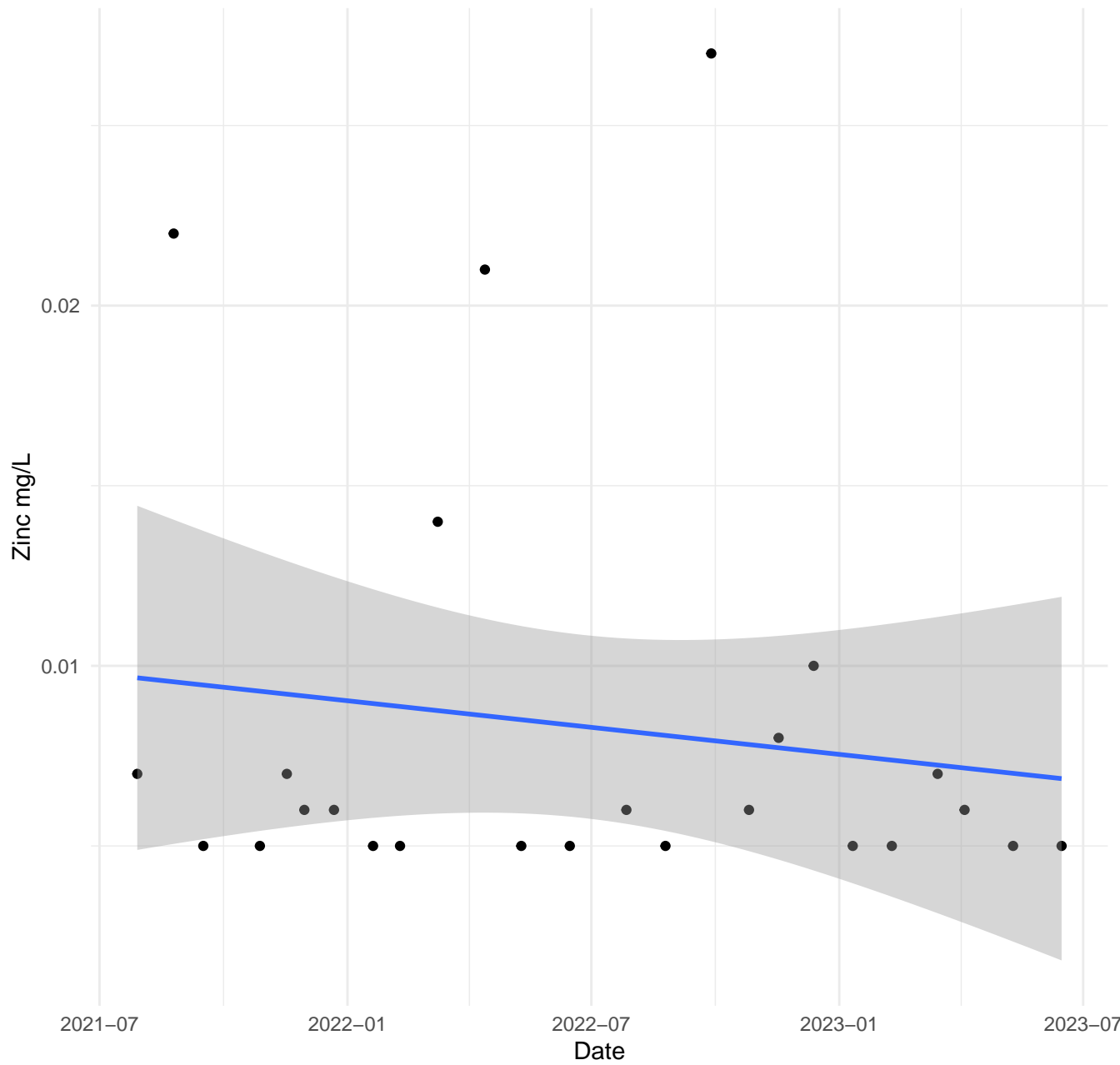
Sulphate.as.SO4.2. at NC01



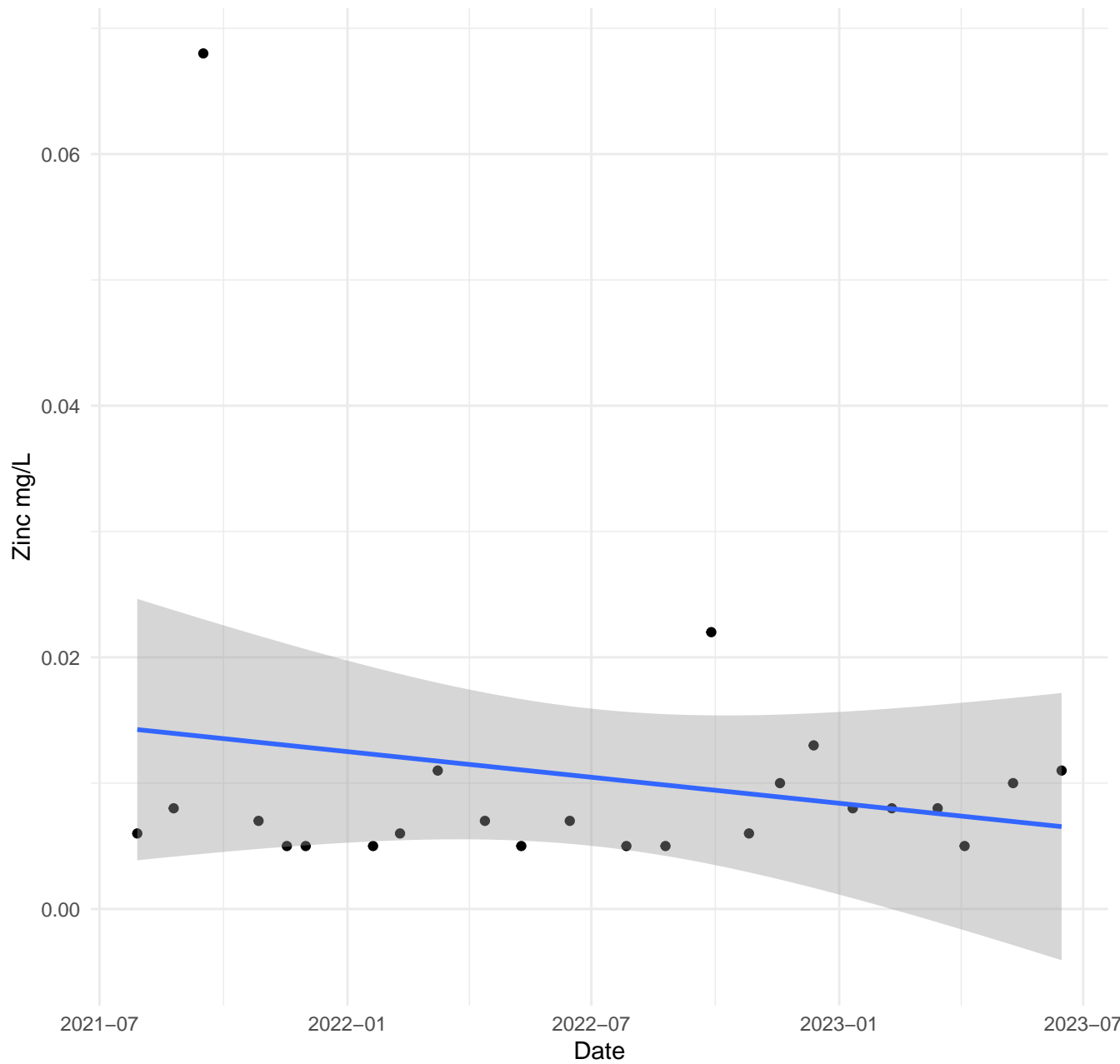
Sulphate.as.SO4.2. at WX22



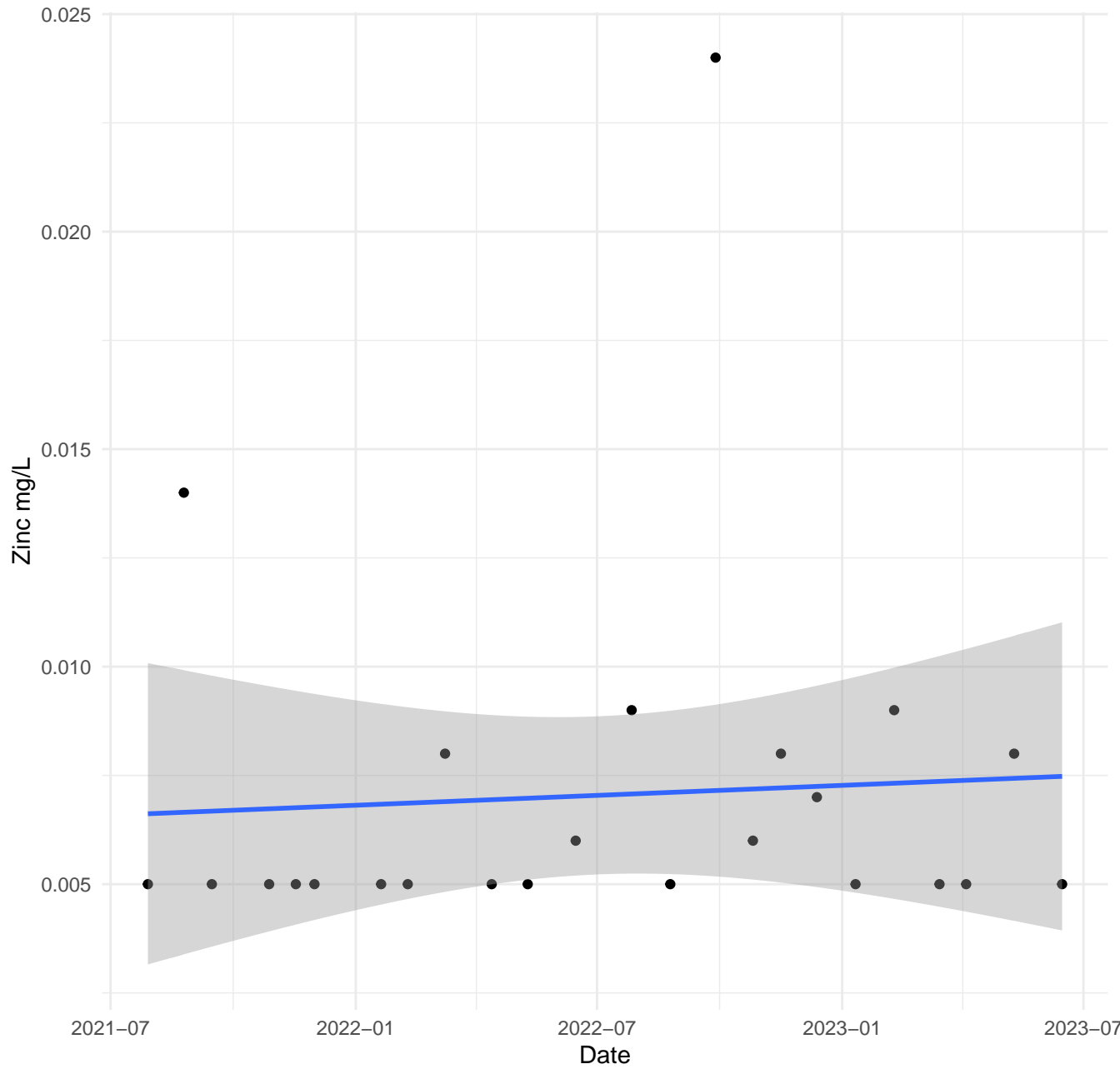
Zinc at C



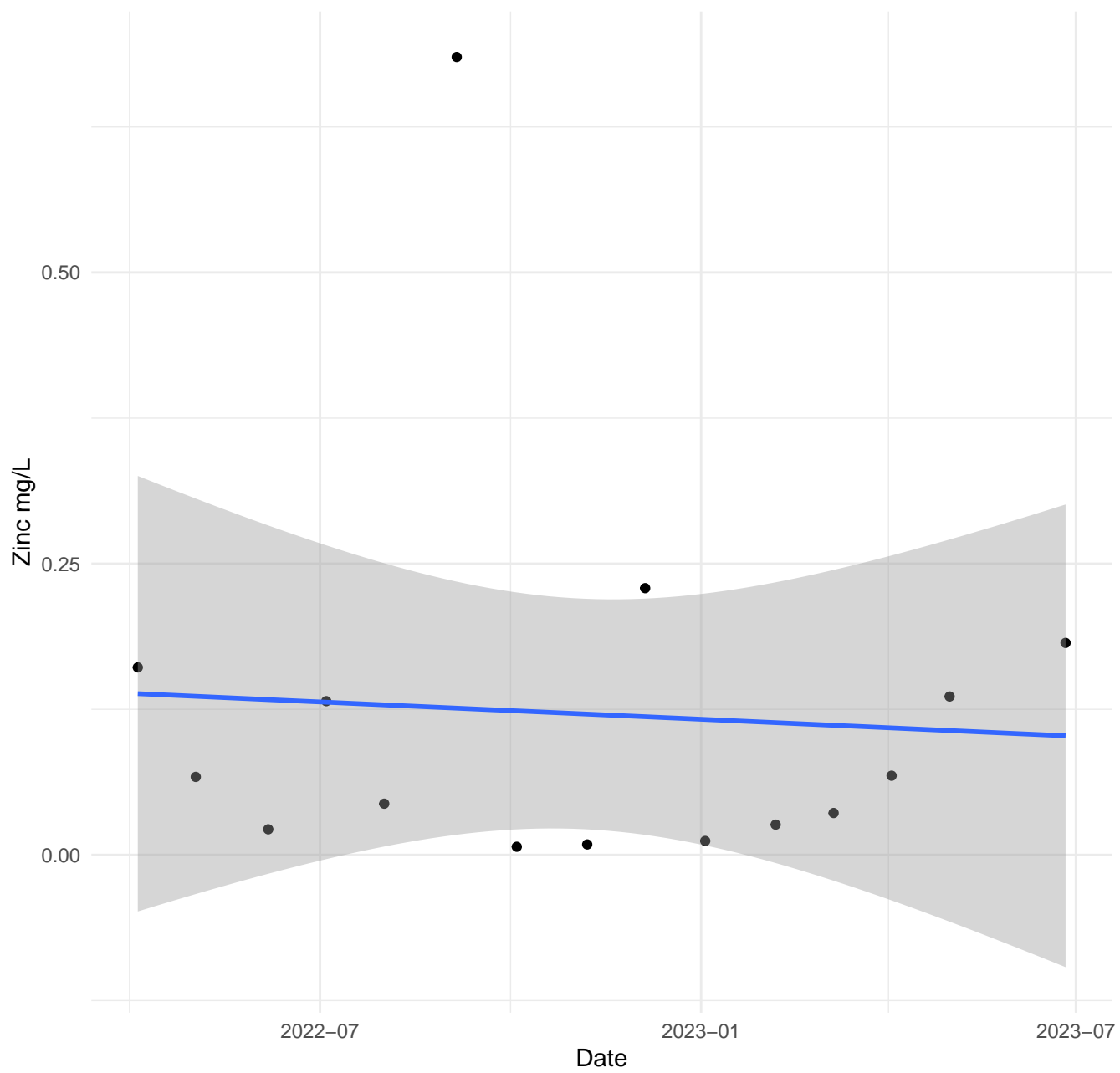
Zinc at E



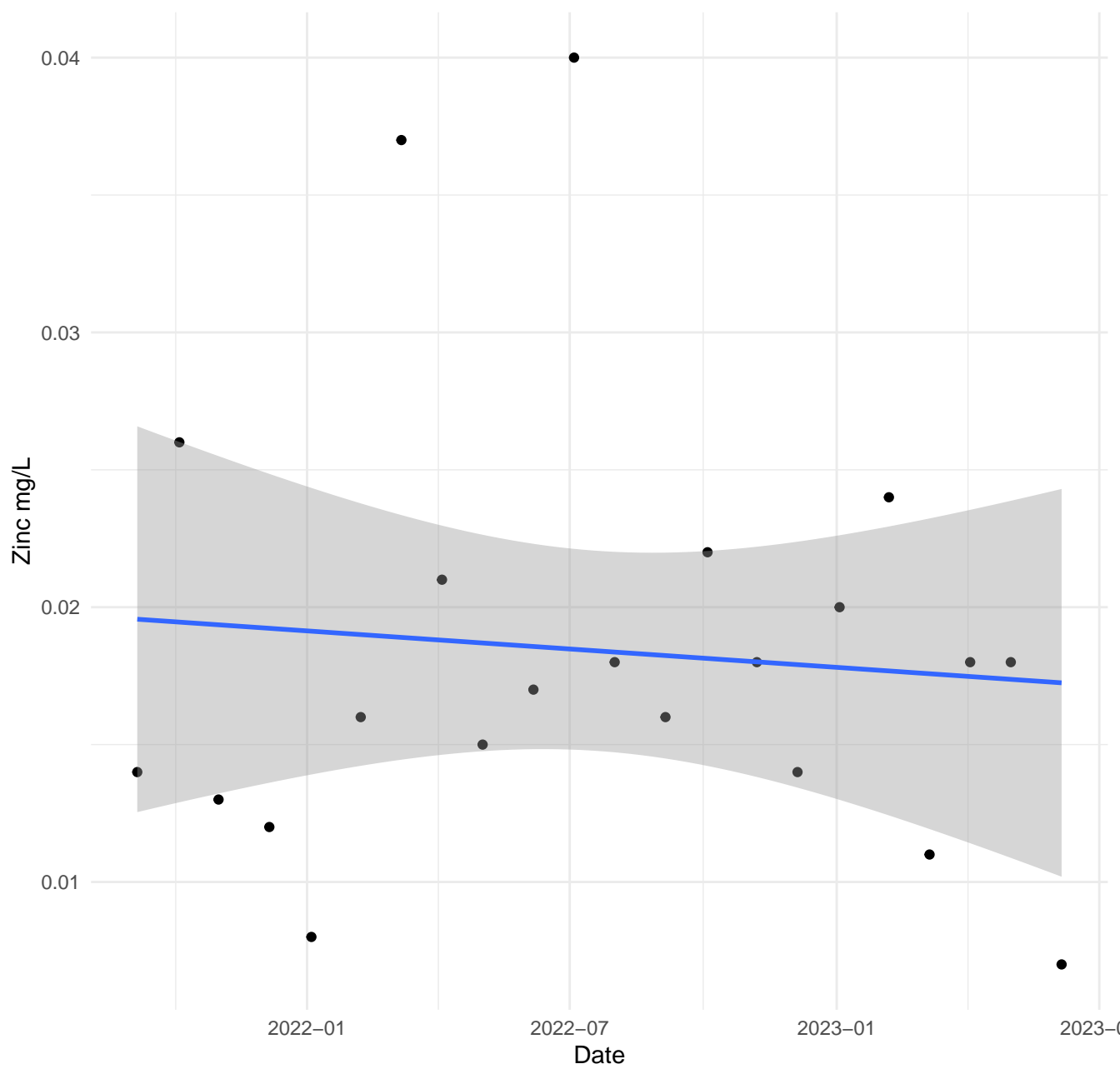
Zinc at G



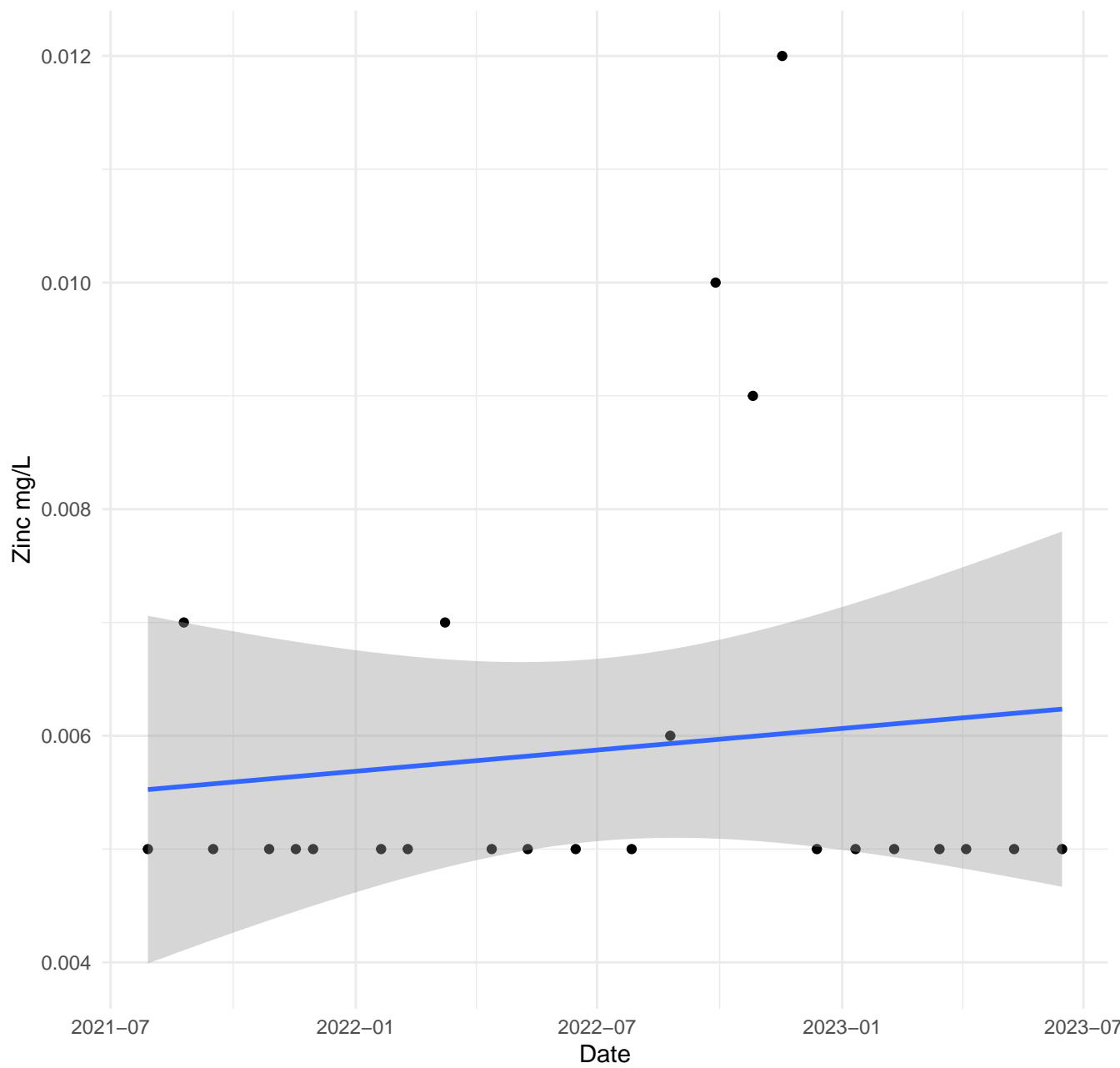
Zinc at LDP01



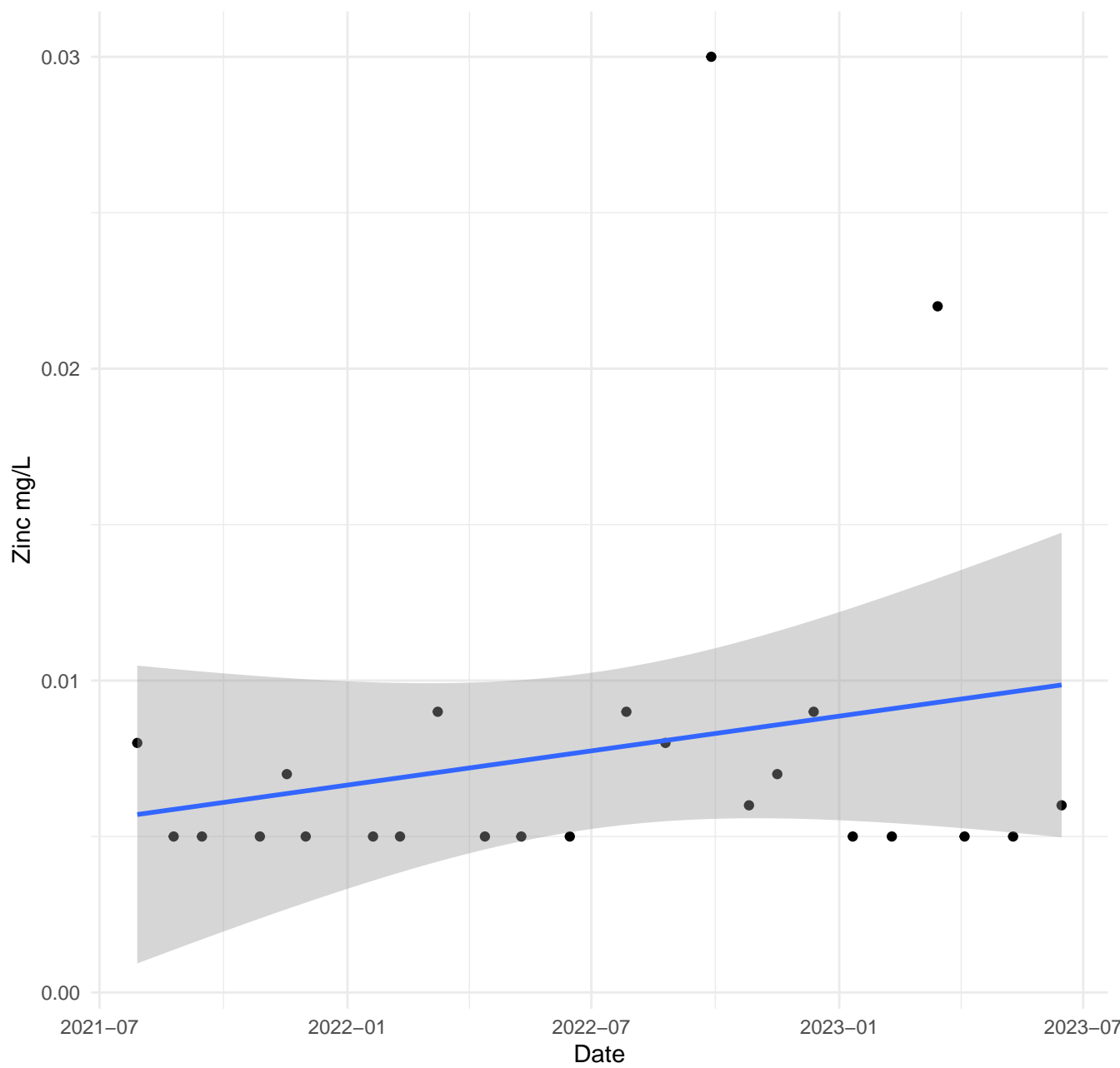
Zinc at LMP01



Zinc at NC01



Zinc at WX22

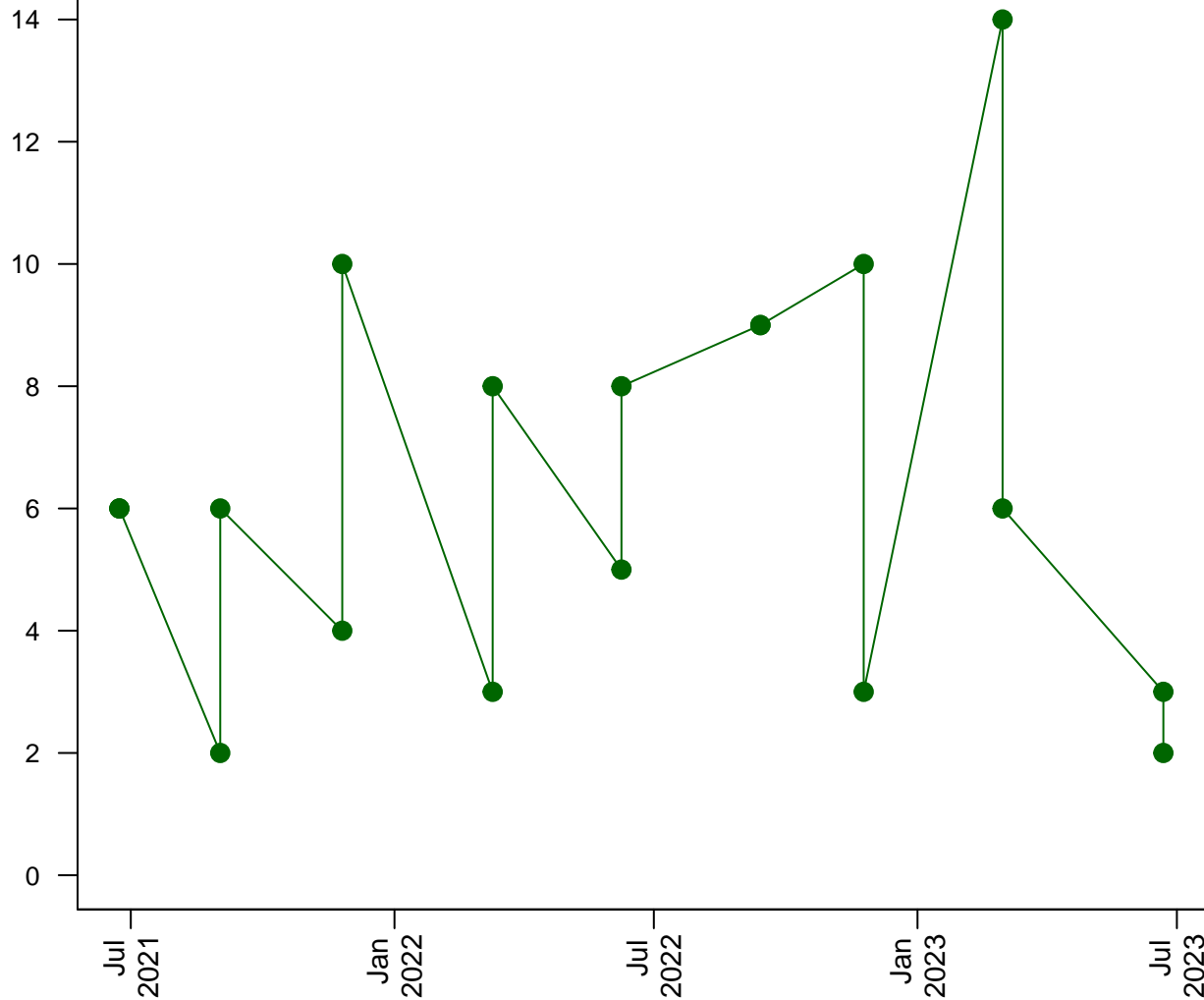


APPENDIX M MANN-KENDALL OUTPUTS

Scatterplots and Trend Analysis

D1, Arsenic

Concentration (µg/L)



Stats

N Data: 18
N Detect: 18
% Detect: 100

95% Confidence
MK Trend: NS
MK p-val: 0.787

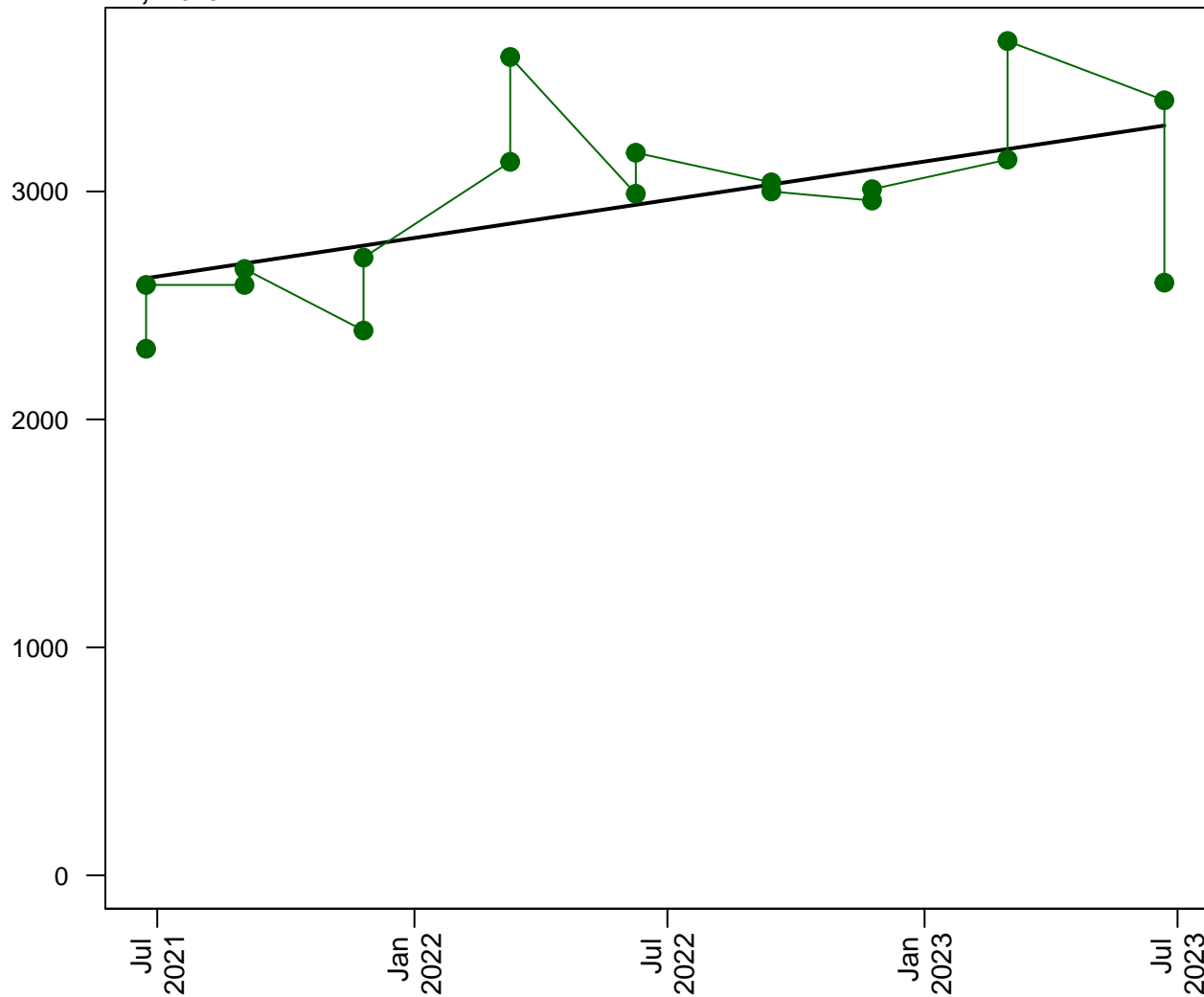
Shapes

● Detect
○ NonDetect
▼ Detect Limit

Scatterplots and Trend Analysis

D1, Boron

Concentration (µg/L)



Stats

N Data: 18
N Detect: 18
% Detect: 100

95% Confidence
MK Trend: Significant
MK p-val: 0.0106
Direction: Increasing

Lines

— Linear Fit

Shapes

● Detect
○ NonDetect
▼ Detect Limit

Scatterplots and Trend Analysis

D1, Cadmium

Concentration (µg/L)

0.10
0.08
0.06
0.04
0.02
0.00

Jul
2021

Jan
2022

Jul
2022

Jan
2023

Jul
2023

Stats

N Data: 9

N Detect: 0

% Detect: 0

MK criteria not met

Shapes



Detect



NonDetect



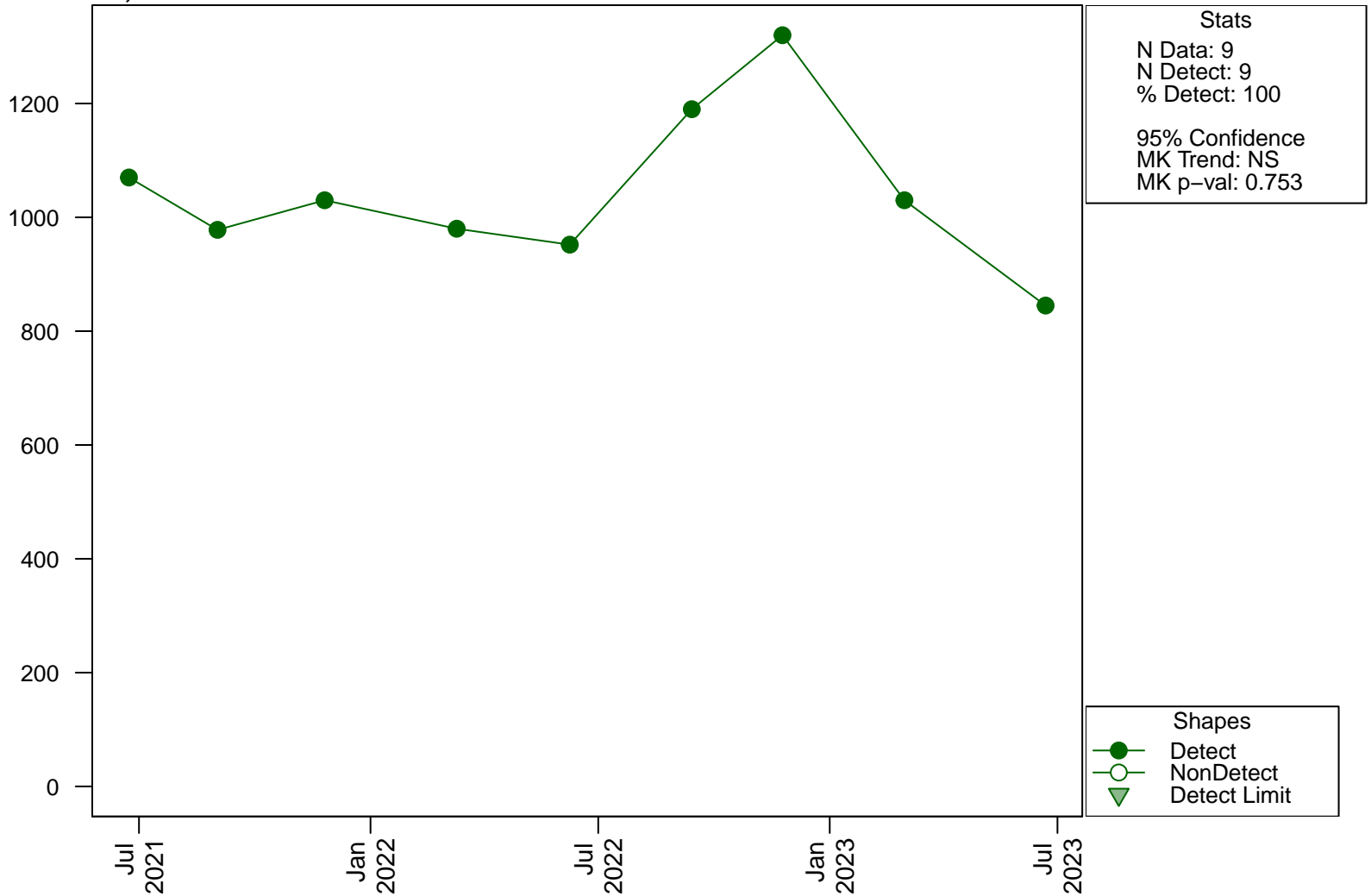
Detect Limit



Scatterplots and Trend Analysis

D1, Chloride

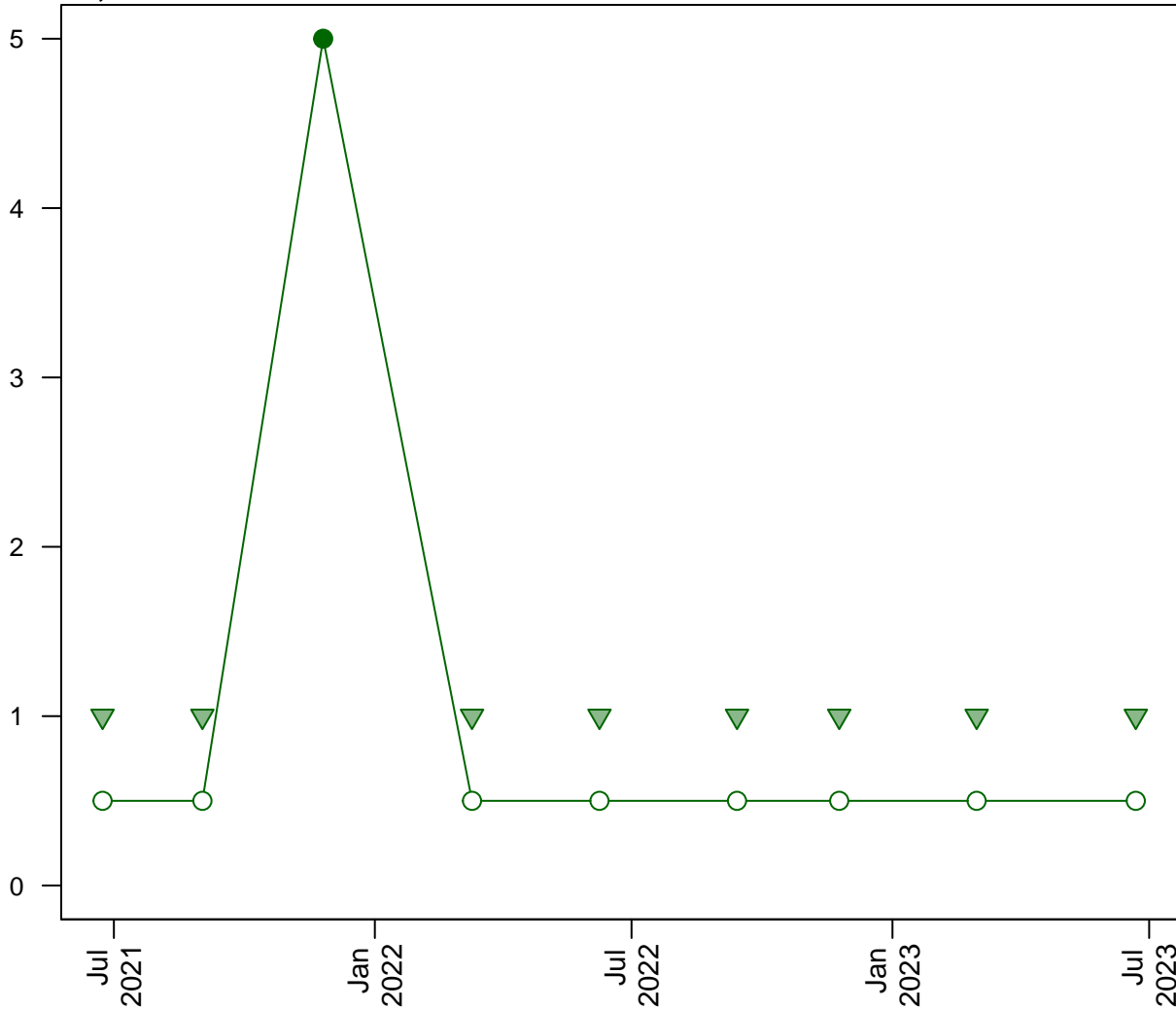
Concentration (mg/L)



Scatterplots and Trend Analysis

D1, Chromium

Concentration (µg/L)



Stats

N Data: 9

N Detect: 1

% Detect: 11

MK criteria not met

Shapes

● Detect

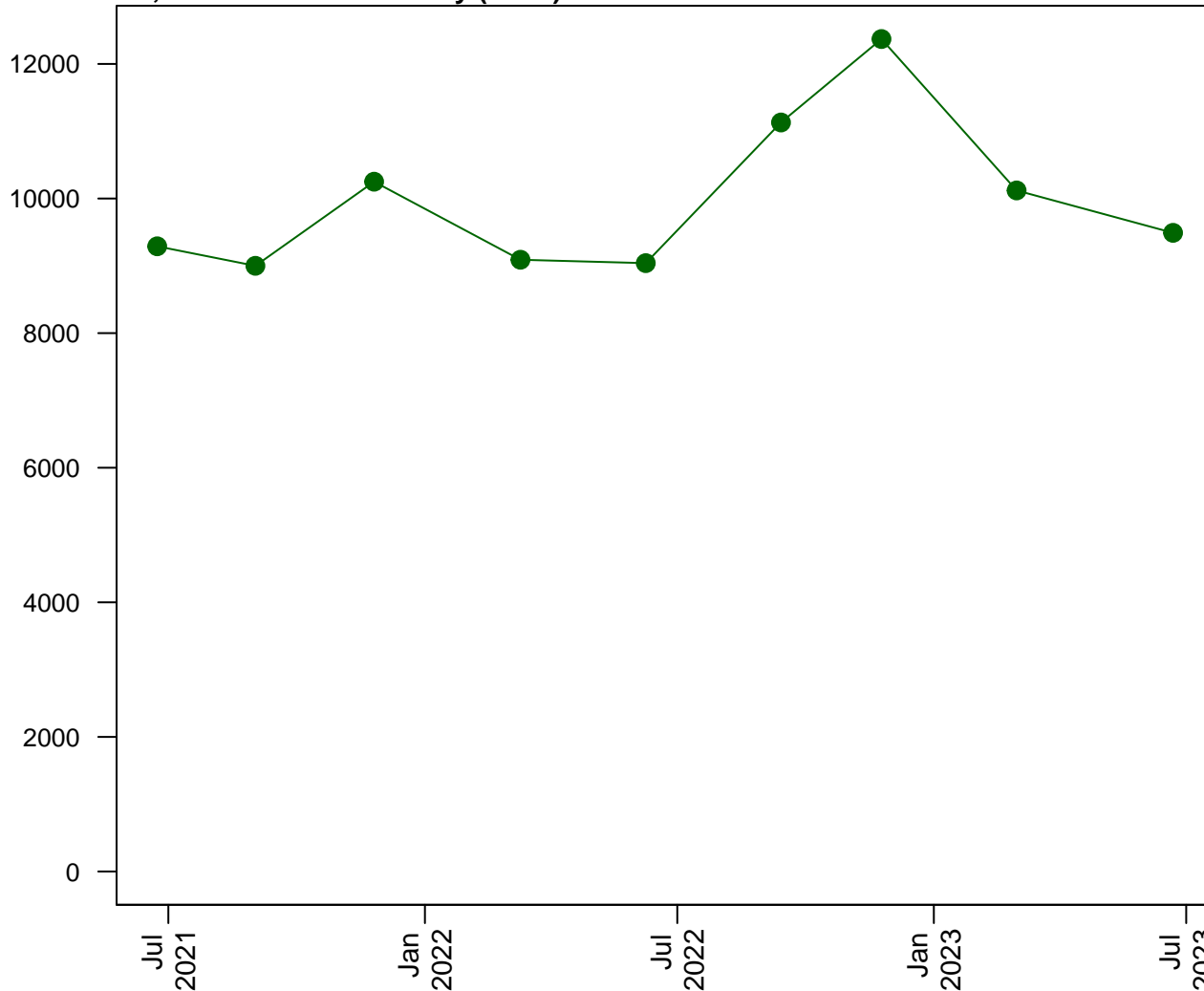
○ NonDetect

▼ Detect Limit

Scatterplots and Trend Analysis

D1, Electrical Conductivity (Field)

Concentration (uS/cm)



Stats

N Data: 9
N Detect: 9
% Detect: 100

95% Confidence
MK Trend: NS
MK p-val: 0.358

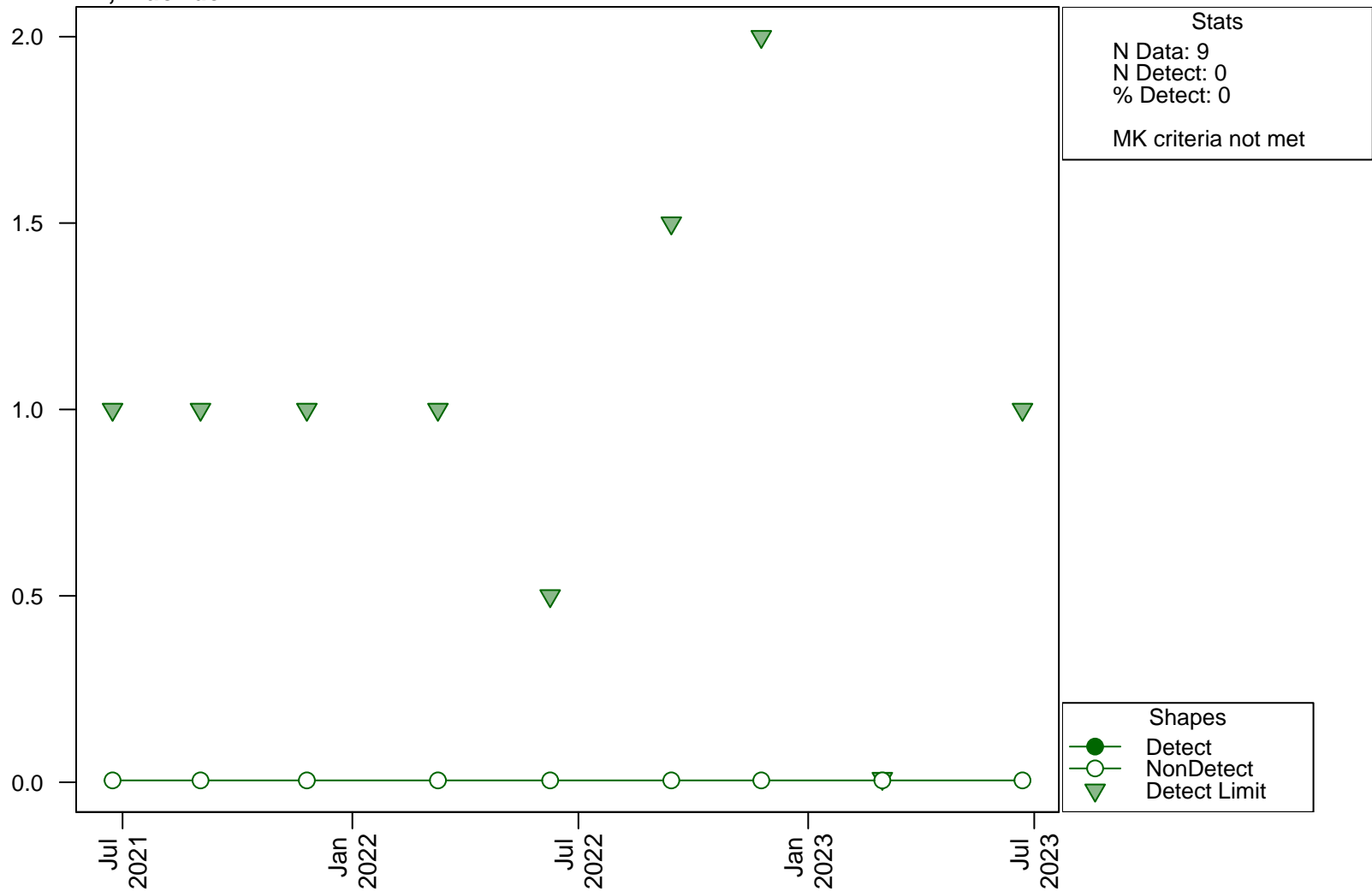
Shapes

● Detect
○ NonDetect
▼ Detect Limit

Scatterplots and Trend Analysis

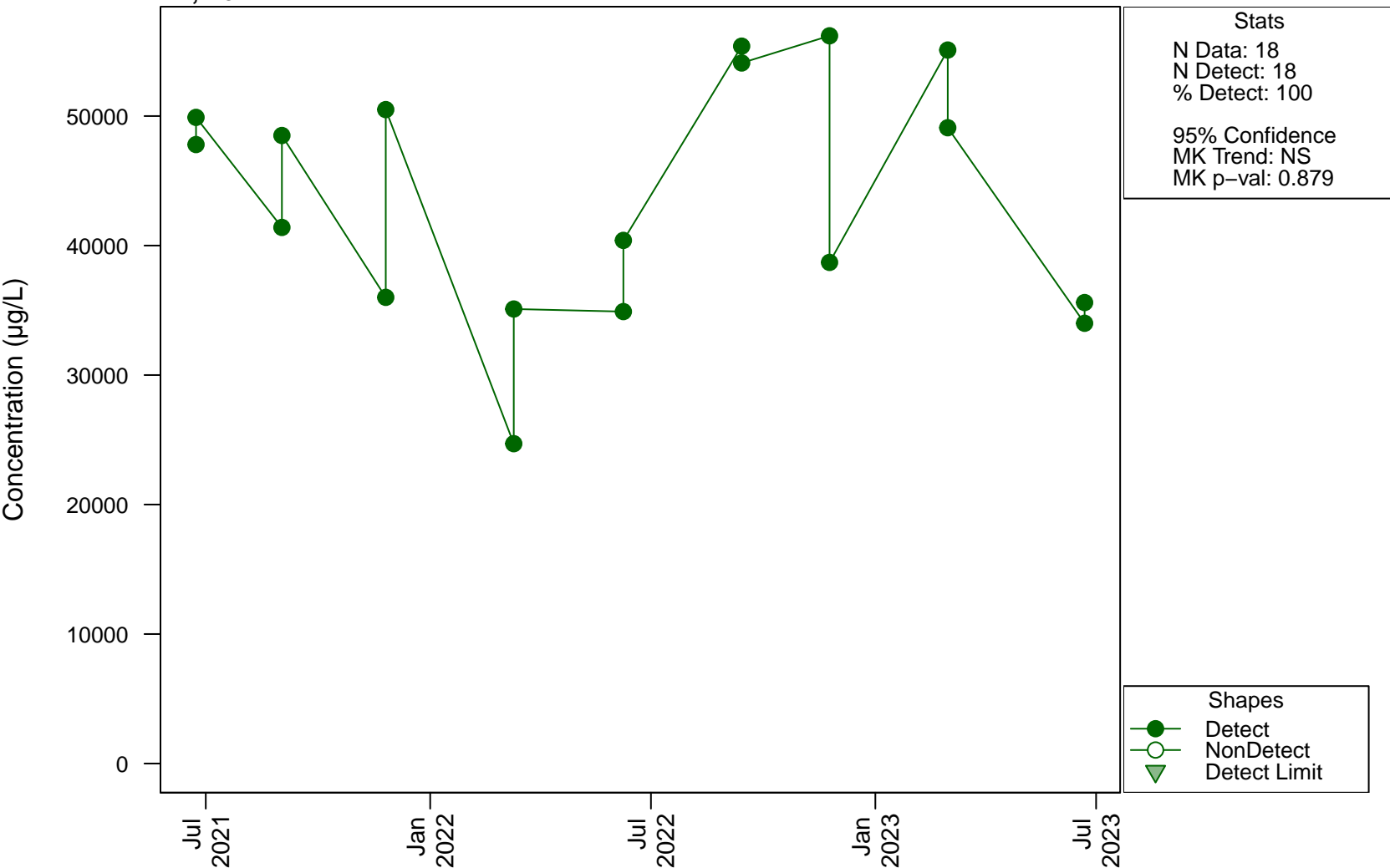
D1, Fluoride

Concentration (mg/L)



Scatterplots and Trend Analysis

D1, Iron



Scatterplots and Trend Analysis

D1, Lead

Concentration ($\mu\text{g/L}$)

12
10
8
6
4
2
0

Jul
2021

Jan
2022

Jul
2022

Jan
2023

Jul
2023

Stats

N Data: 9

N Detect: 1

% Detect: 11

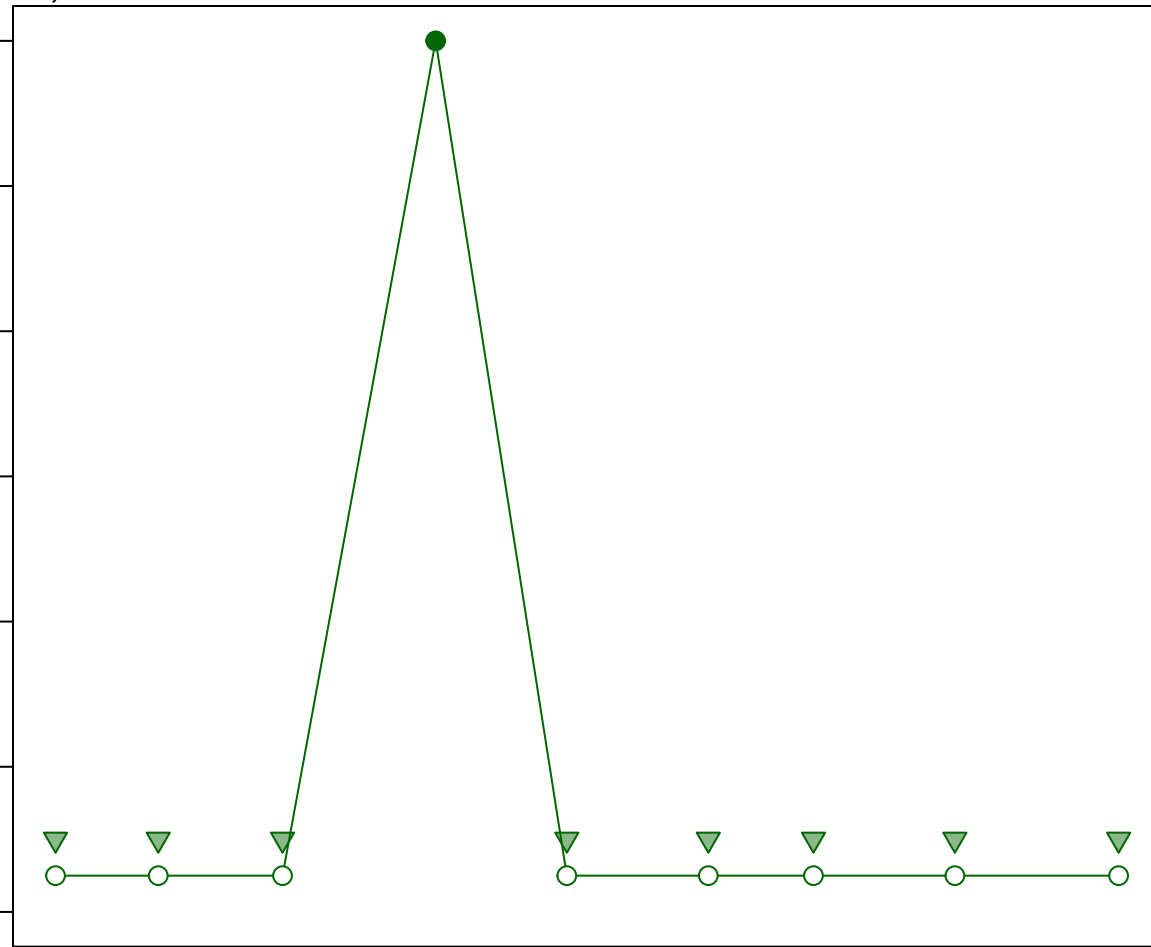
MK criteria not met

Shapes

● Detect

○ NonDetect

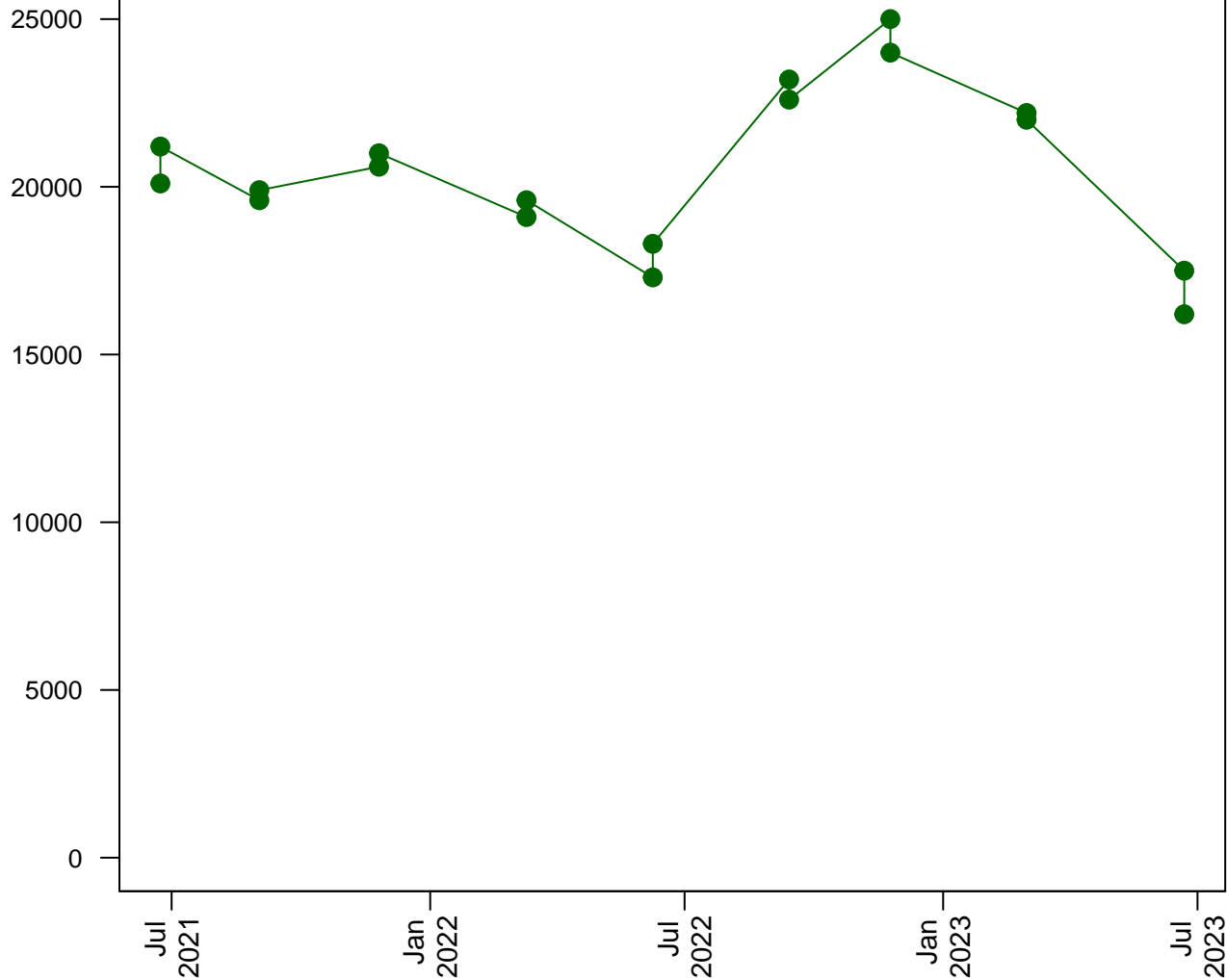
▼ Detect Limit



Scatterplots and Trend Analysis

D1, Manganese

Concentration (µg/L)



Stats

N Data: 18
N Detect: 18
% Detect: 100

95% Confidence
MK Trend: NS
MK p-val: 0.97

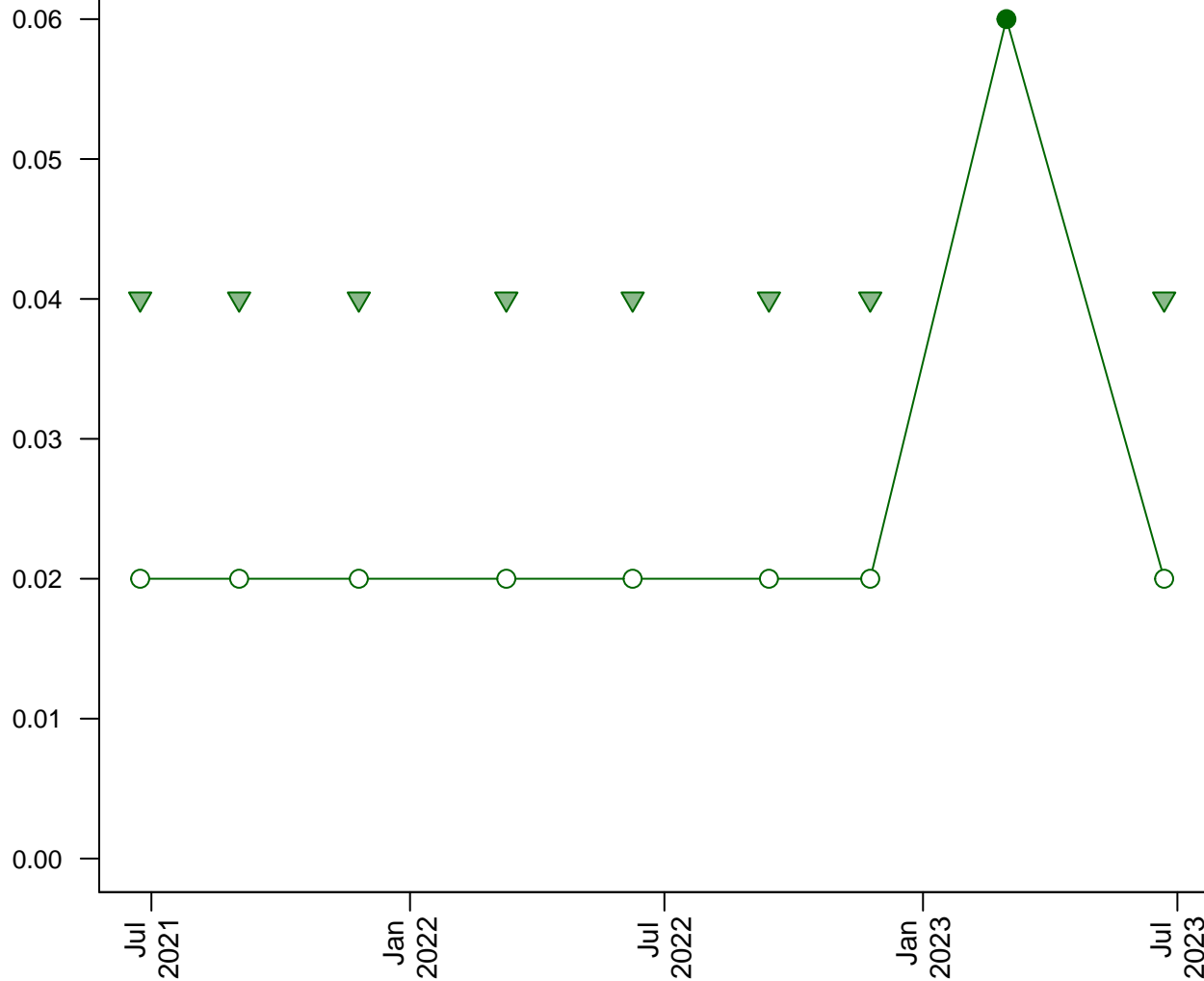
Shapes

● Detect
○ NonDetect
▼ Detect Limit

Scatterplots and Trend Analysis

D1, Mercury

Concentration (µg/L)



Stats

N Data: 9

N Detect: 1

% Detect: 11

MK criteria not met

Shapes

● Detect

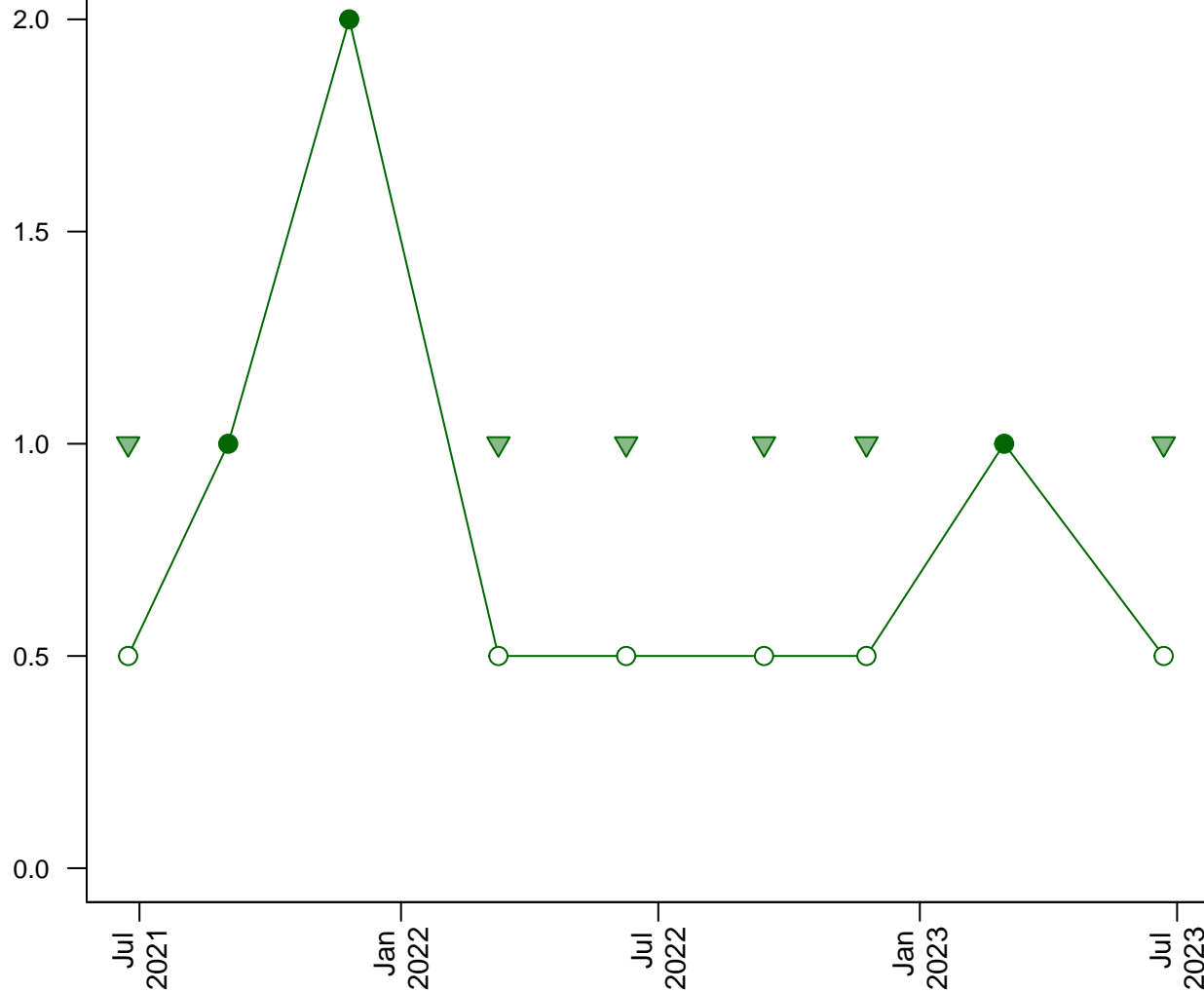
○ NonDetect

▼ Detect Limit

Scatterplots and Trend Analysis

D1, Molybdenum

Concentration (µg/L)



Stats

N Data: 9

N Detect: 3

% Detect: 33

MK criteria not met

Shapes

● Detect

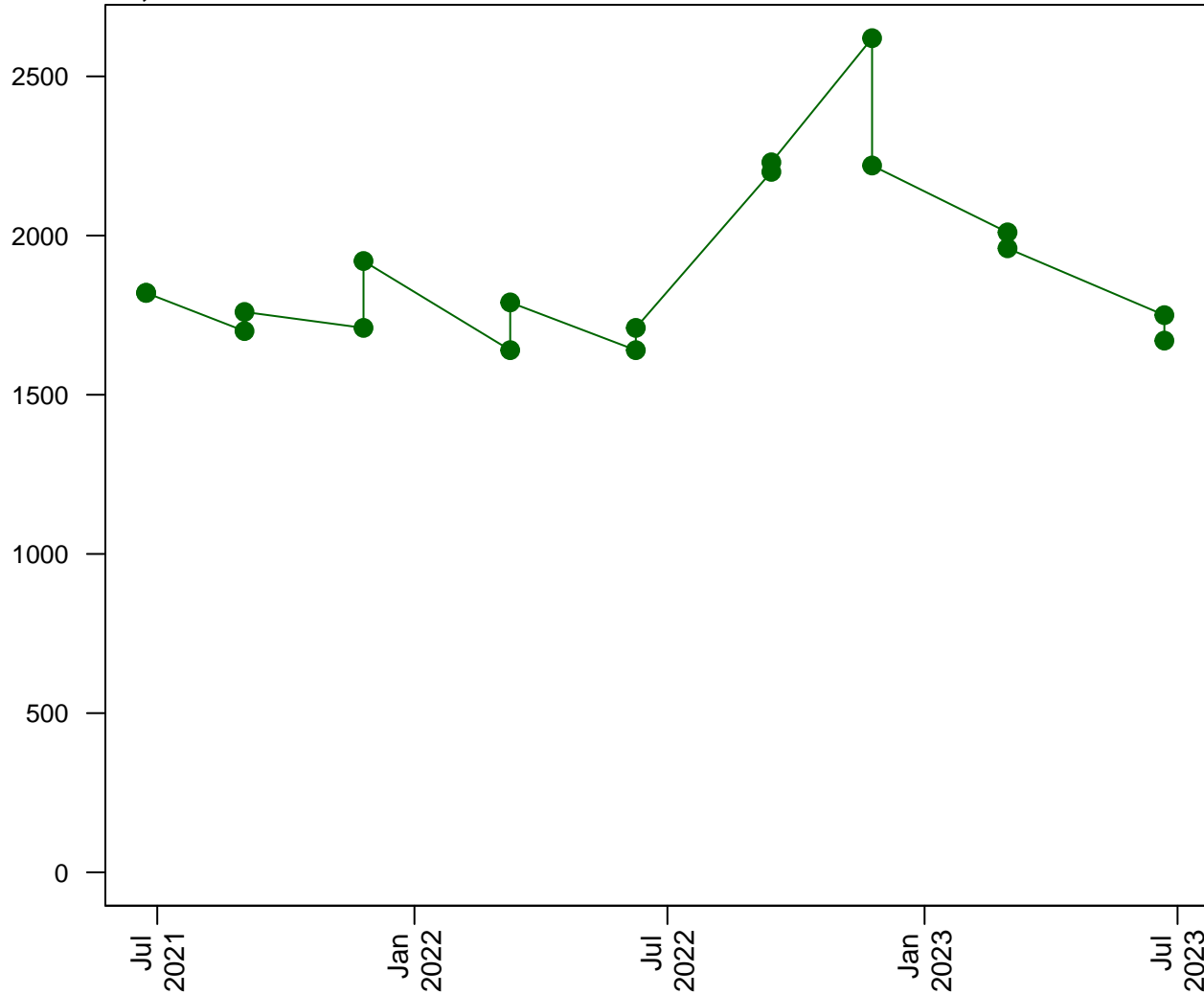
○ NonDetect

▼ Detect Limit

Scatterplots and Trend Analysis

D1, Nickel

Concentration (µg/L)



Stats

N Data: 18

N Detect: 18

% Detect: 100

95% Confidence

MK Trend: NS

MK p-val: 0.492

Shapes

● Detect

○ NonDetect

▼ Detect Limit

Scatterplots and Trend Analysis

D1, Selenium

Concentration (µg/L)

10
8
6
4
2
0

Jul
2021

Jan
2022

Jul
2022

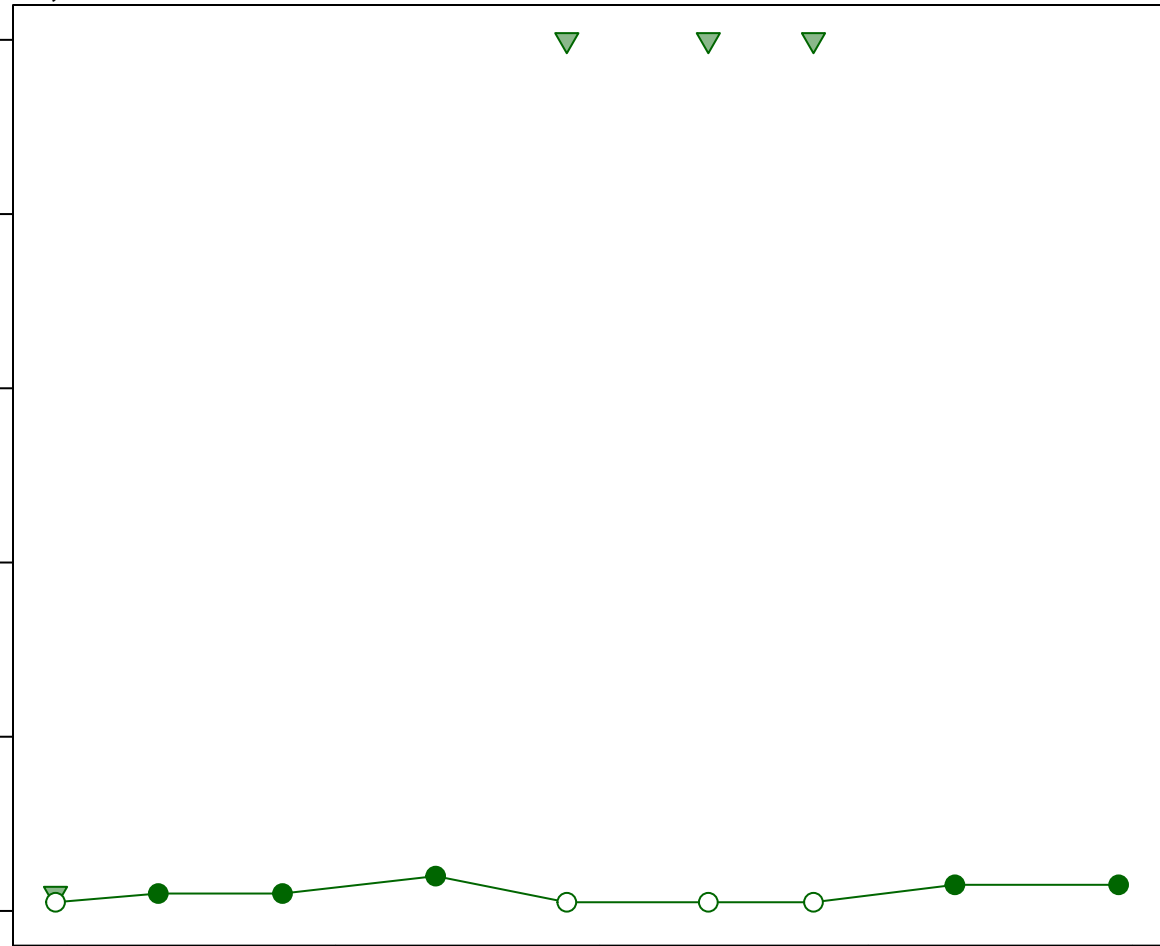
Jan
2023

Jul
2023

Stats
N Data: 9
N Detect: 5
% Detect: 56

95% Confidence
MK Trend: NS
MK p-val: 0.506

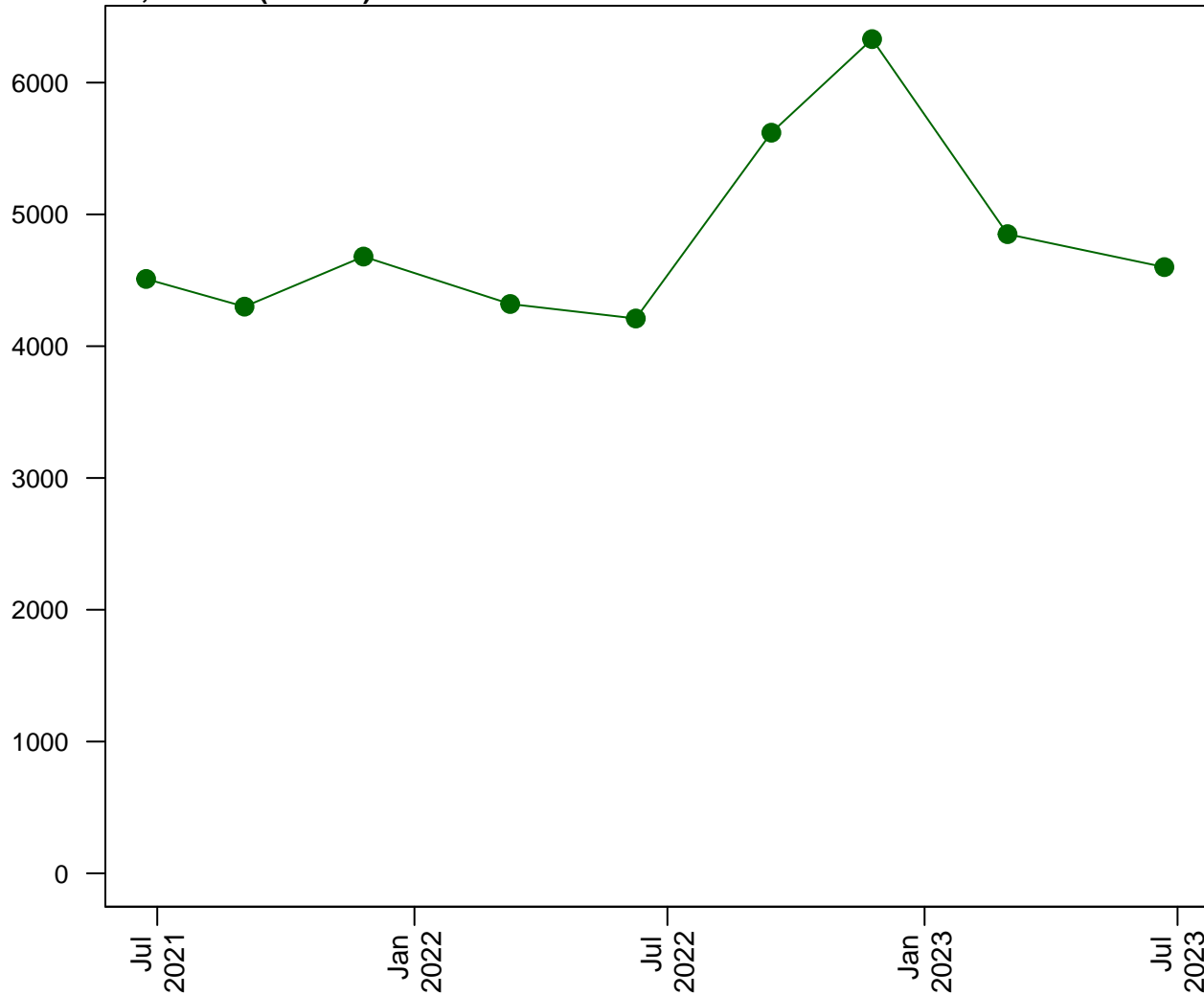
Shapes
● Detect
○ NonDetect
▼ Detect Limit



Scatterplots and Trend Analysis

D1, Sulfate (as SO4)

Concentration (mg/L)



Stats

N Data: 9
N Detect: 9
% Detect: 100

95% Confidence
MK Trend: NS
MK p-val: 0.358

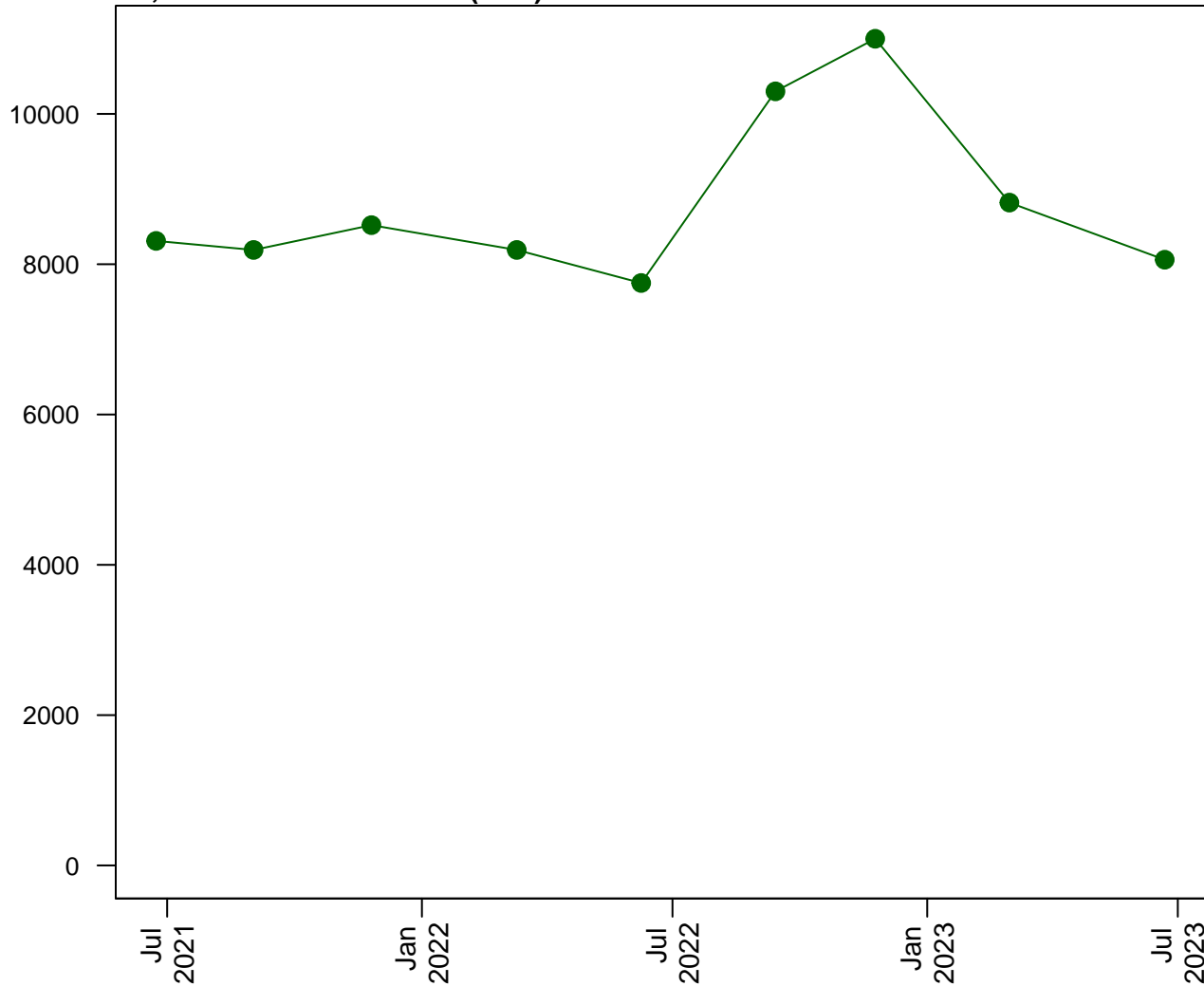
Shapes

● Detect
○ NonDetect
▼ Detect Limit

Scatterplots and Trend Analysis

D1, Total Dissolved Solids (TDS)

Concentration (mg/L)



Stats

N Data: 9

N Detect: 9

% Detect: 100

95% Confidence

MK Trend: NS

MK p-val: 0.753

Shapes

● Detect

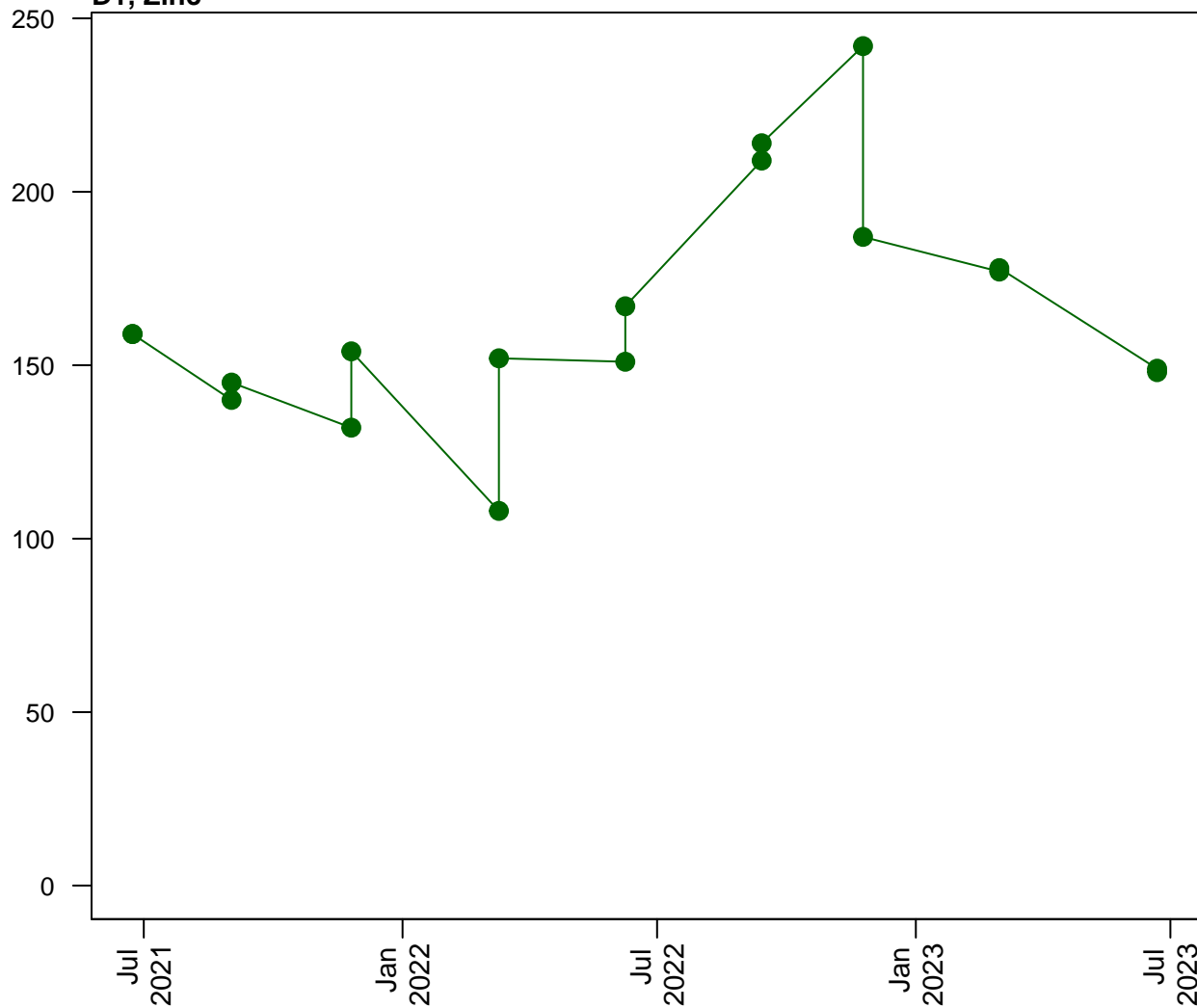
○ NonDetect

▼ Detect Limit

Scatterplots and Trend Analysis

D1, Zinc

Concentration (µg/L)



Stats

N Data: 18

N Detect: 18

% Detect: 100

95% Confidence

MK Trend: NS

MK p-val: 0.252

Shapes



Detect



NonDetect

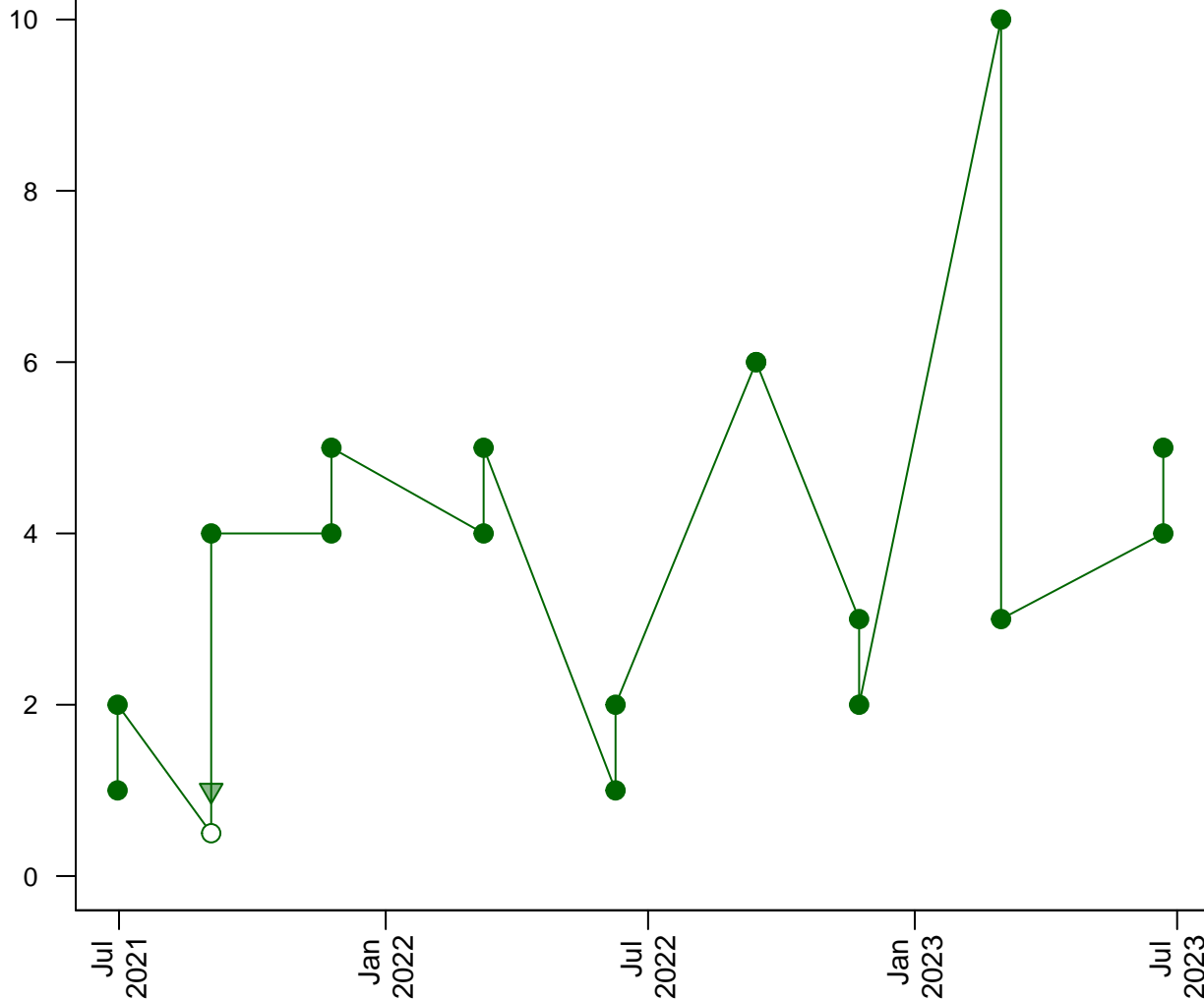


Detect Limit

Scatterplots and Trend Analysis

D10, Arsenic

Concentration (µg/L)



Stats

N Data: 18

N Detect: 17

% Detect: 94

95% Confidence

MK Trend: NS

MK p-val: 0.0891

Shapes



Detect



NonDetect

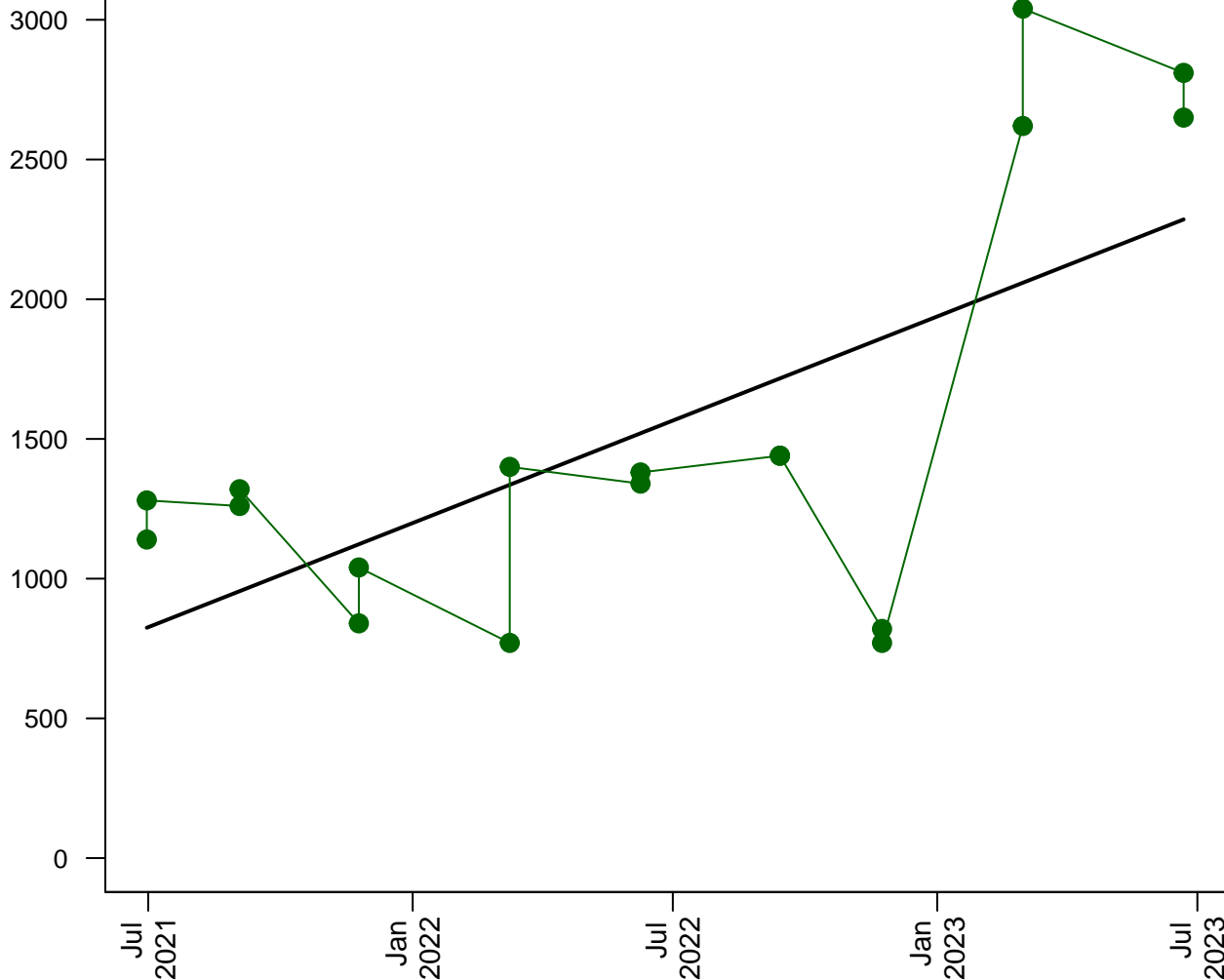


Detect Limit

Scatterplots and Trend Analysis

D10, Boron

Concentration (µg/L)



Stats

N Data: 18
N Detect: 18
% Detect: 100

95% Confidence
MK Trend: Significant
MK p-val: 0.0199
Direction: Increasing

Lines

— Linear Fit

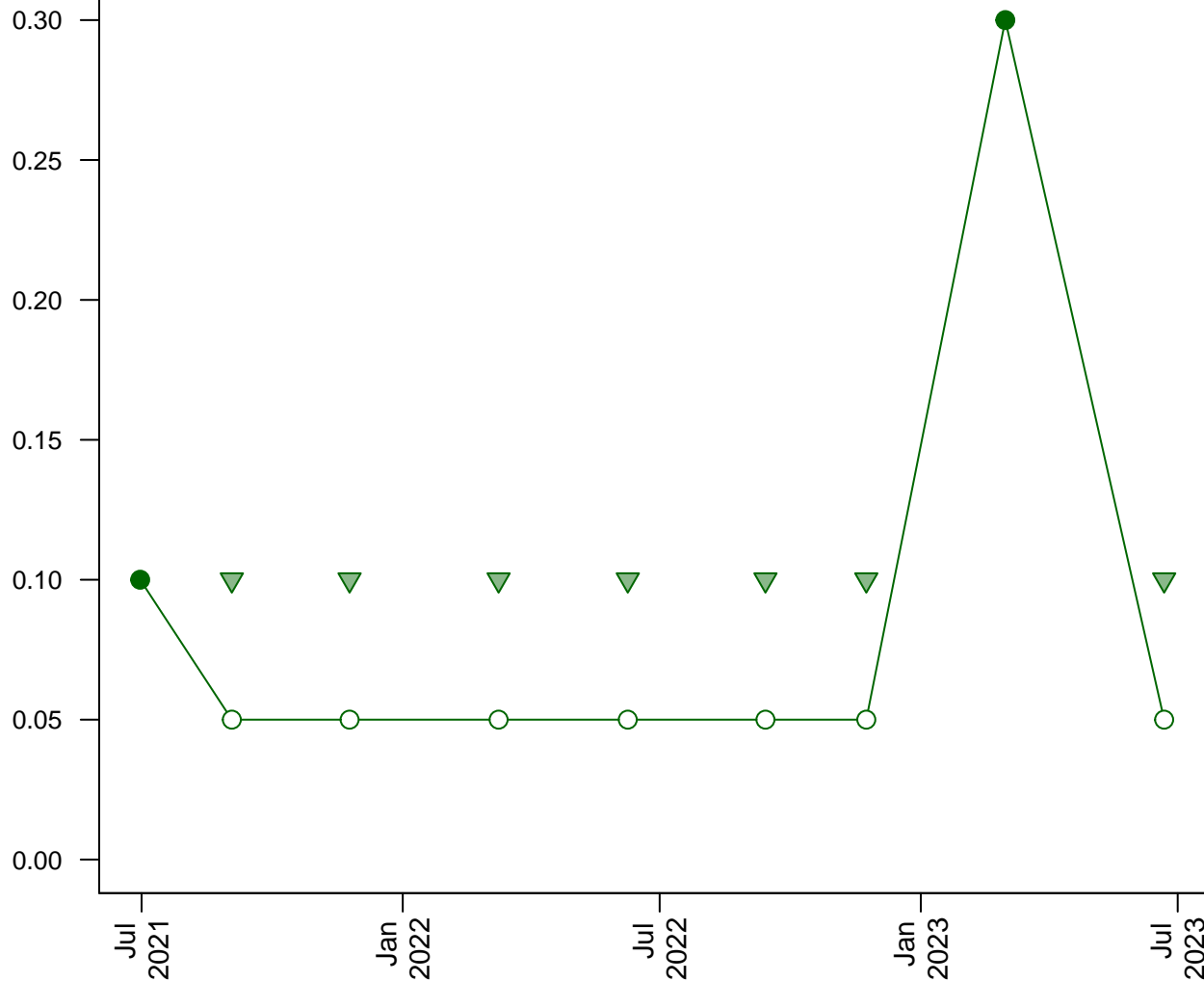
Shapes

● Detect
○ NonDetect
▼ Detect Limit

Scatterplots and Trend Analysis

D10, Cadmium

Concentration (µg/L)



Stats

N Data: 9

N Detect: 2

% Detect: 22

MK criteria not met

Shapes



Detect



NonDetect

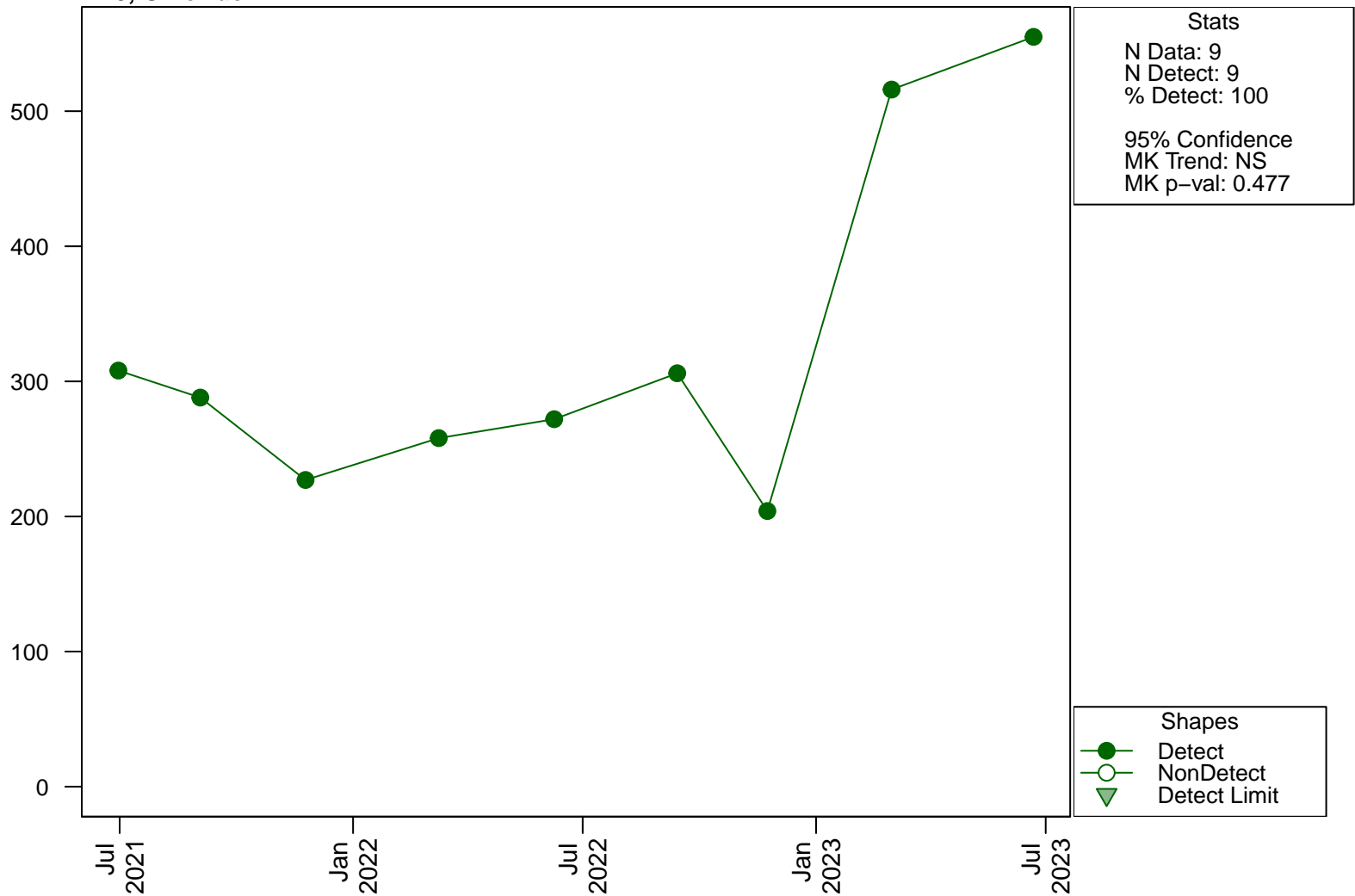


Detect Limit

Scatterplots and Trend Analysis

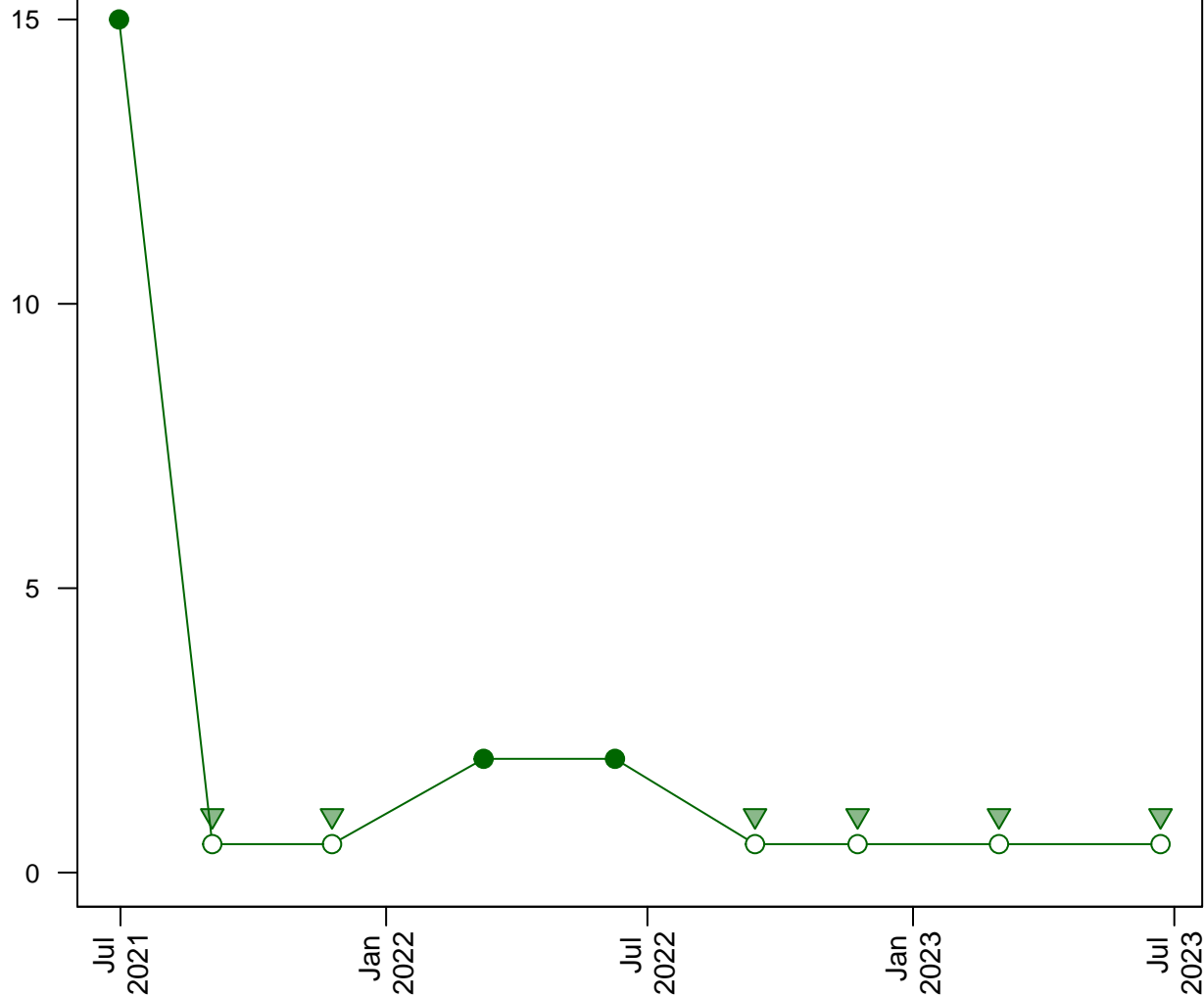
D10, Chloride

Concentration (mg/L)



Scatterplots and Trend Analysis D10, Chromium

Concentration (µg/L)



Stats

N Data: 9

N Detect: 3

% Detect: 33

MK criteria not met

Shapes



Detect



NonDetect



Detect Limit

Scatterplots and Trend Analysis

D10, Electrical Conductivity (Field)

Concentration (uS/cm)

8000
6000
4000
2000
0

Jul 2021 Jan 2022 Jul 2022 Jan 2023 Jul 2023

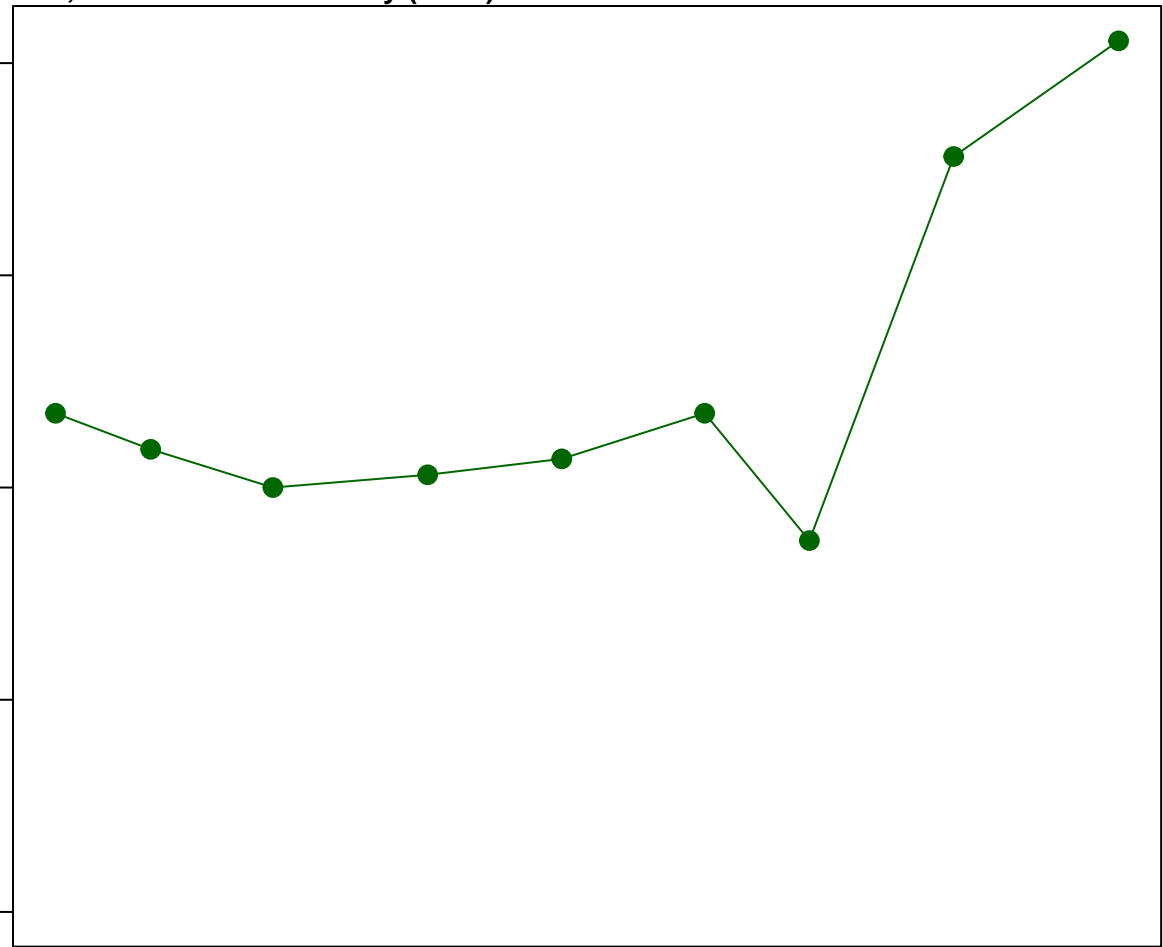
Stats

N Data: 9
N Detect: 9
% Detect: 100

95% Confidence
MK Trend: NS
MK p-val: 0.345

Shapes

● Detect
○ NonDetect
▼ Detect Limit



Scatterplots and Trend Analysis

D10, Fluoride

Concentration (mg/L)

1.0
0.8
0.6
0.4
0.2
0.0

Jul
2021

Jan
2022

Jul
2022

Jan
2023

Jul
2023

Stats

N Data: 9

N Detect: 2

% Detect: 22

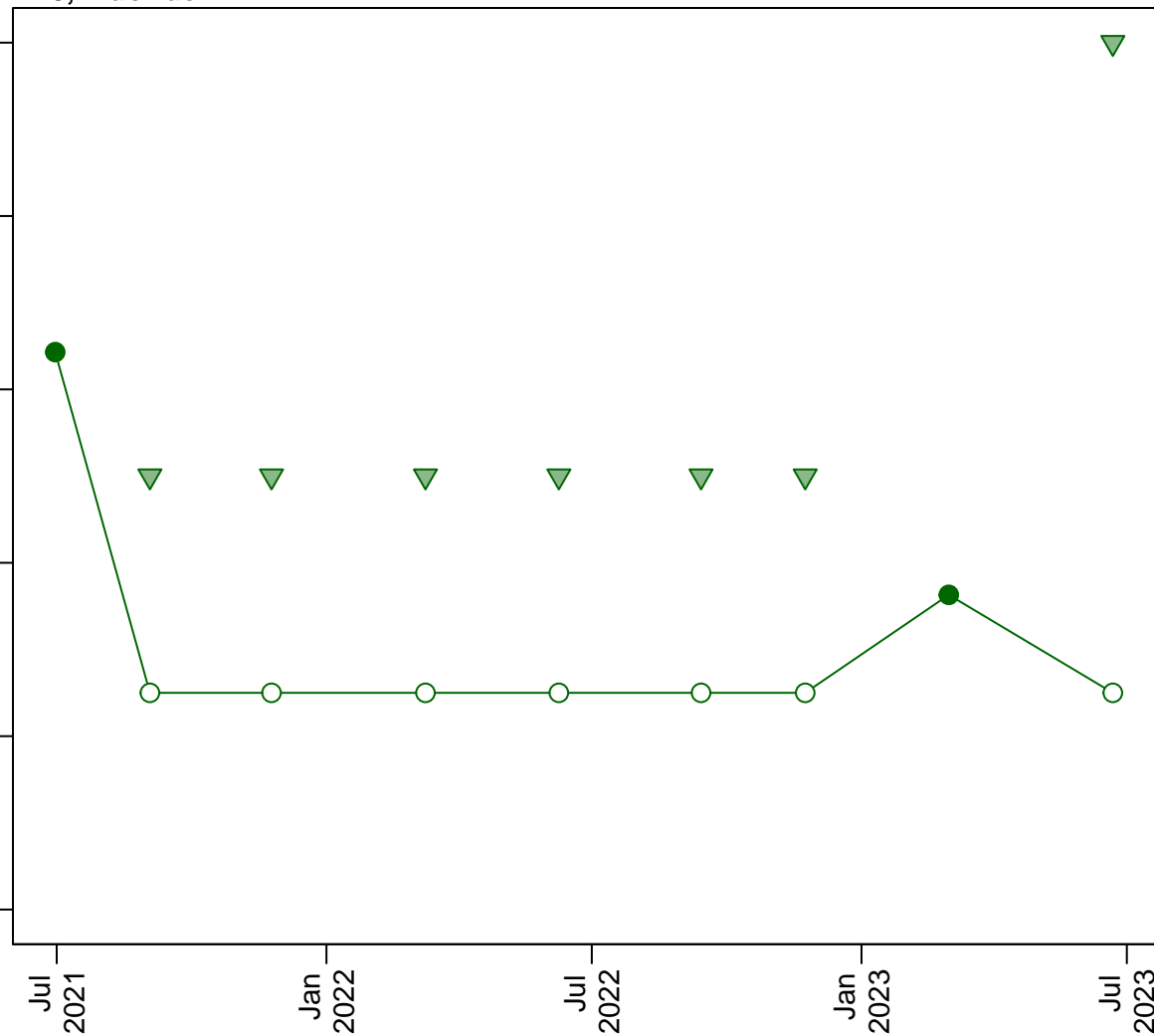
MK criteria not met

Shapes

● Detect

○ NonDetect

▼ Detect Limit



Scatterplots and Trend Analysis

D10, Iron

Concentration (µg/L)

15000
10000
5000
0

Jul
2021

Jan
2022

Jul
2022

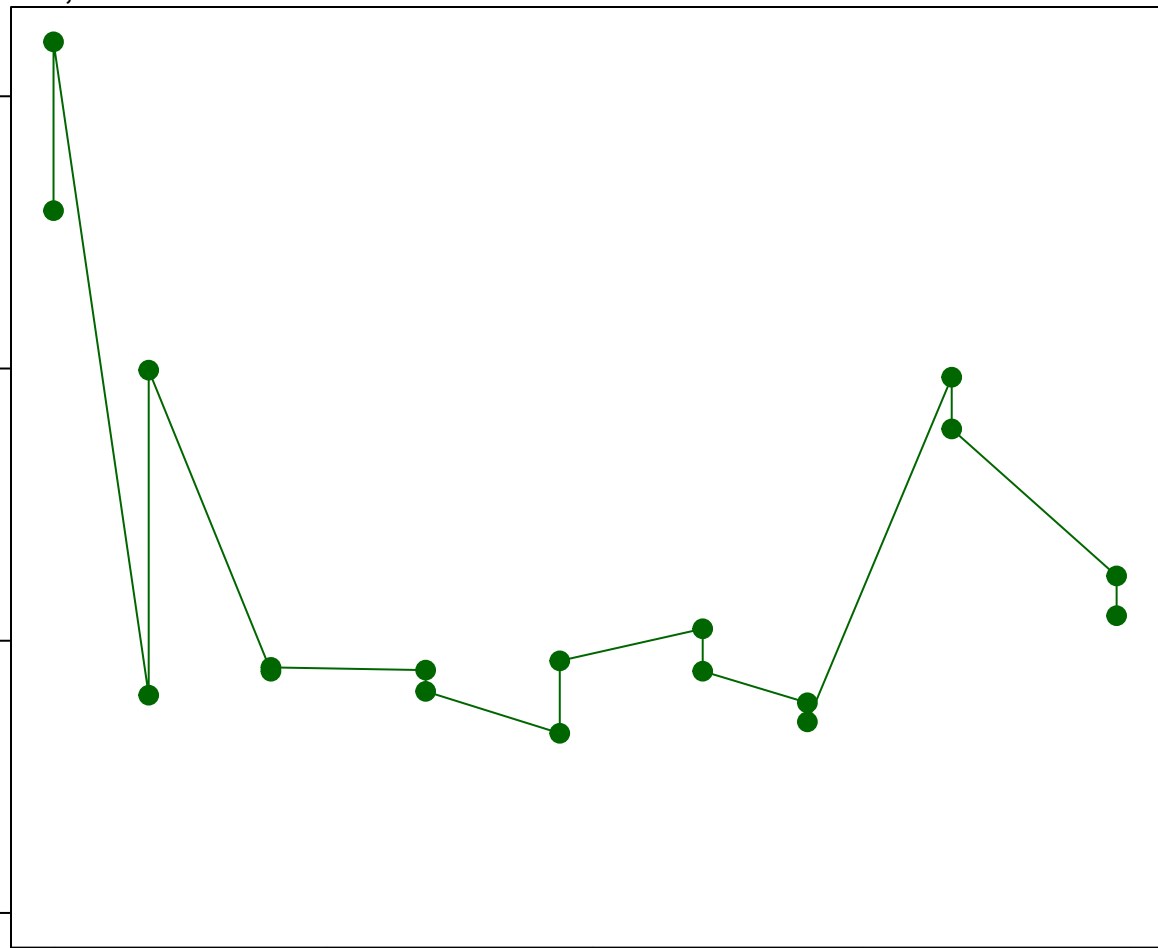
Jan
2023

Jul
2023

Stats
N Data: 18
N Detect: 18
% Detect: 100

95% Confidence
MK Trend: NS
MK p-val: 0.675

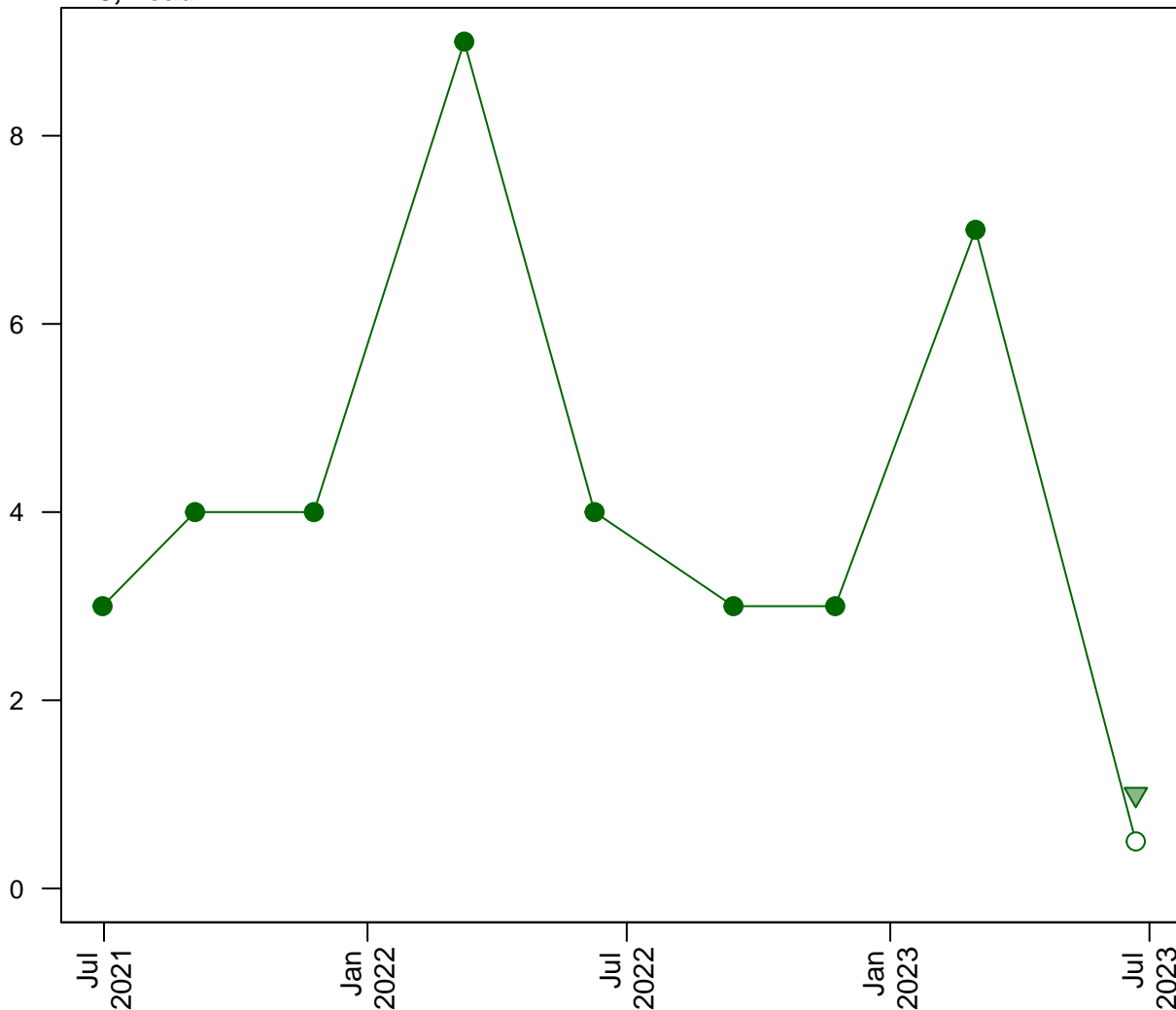
Shapes
Detect
NonDetect
Detect Limit



Scatterplots and Trend Analysis

D10, Lead

Concentration (µg/L)



Stats

N Data: 9

N Detect: 8

% Detect: 89

95% Confidence

MK Trend: NS

MK p-val: 0.514

Shapes



Detect



NonDetect



Detect Limit

Scatterplots and Trend Analysis D10, Manganese

Concentration (µg/L)

6000
4000
2000
0

Jul
2021

Jan
2022

Jul
2022

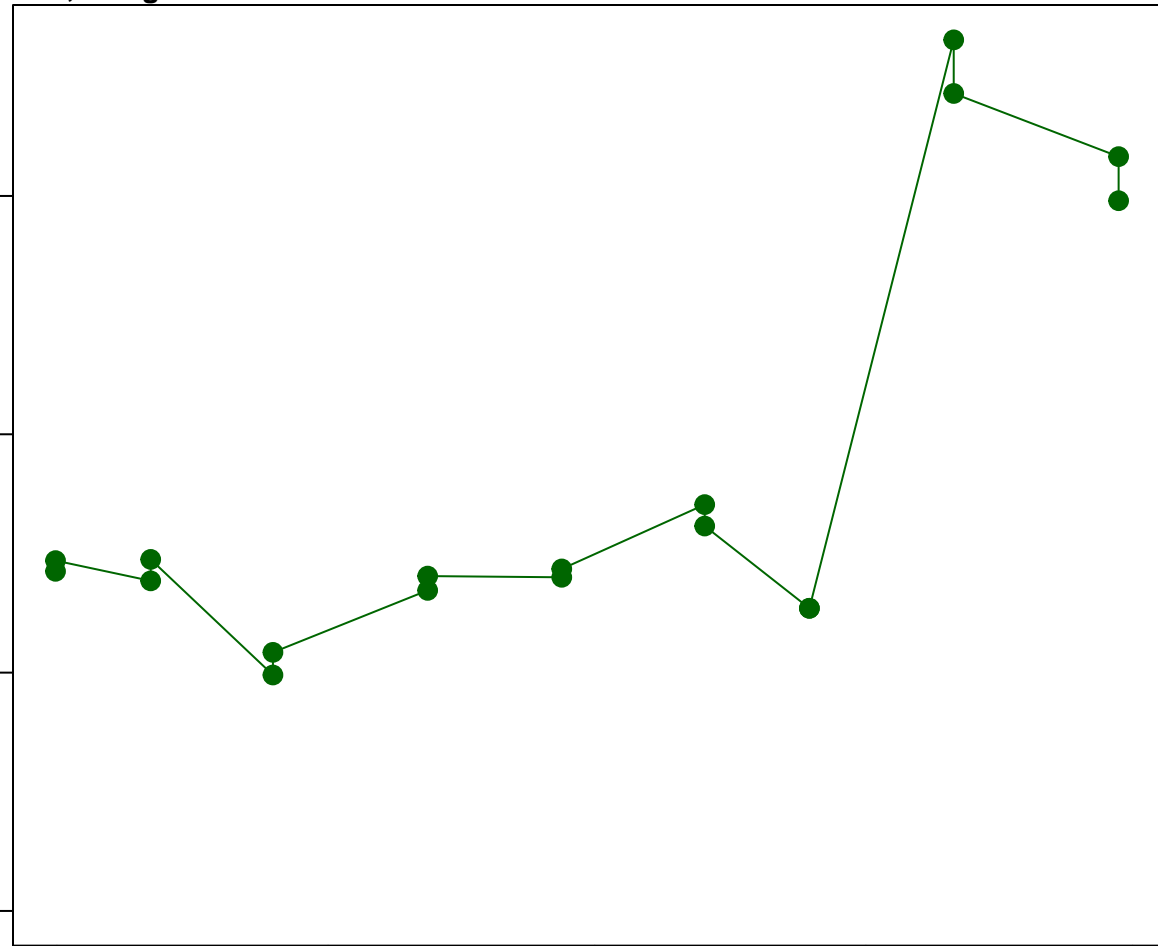
Jan
2023

Jul
2023

Stats
N Data: 18
N Detect: 18
% Detect: 100

95% Confidence
MK Trend: NS
MK p-val: 0.0565

Shapes
● Detect
○ NonDetect
▼ Detect Limit



Scatterplots and Trend Analysis

D10, Mercury

Concentration ($\mu\text{g/L}$)

0.04
0.03
0.02
0.01
0.00

Jul
2021

Jan
2022

Jul
2022

Jan
2023

Jul
2023

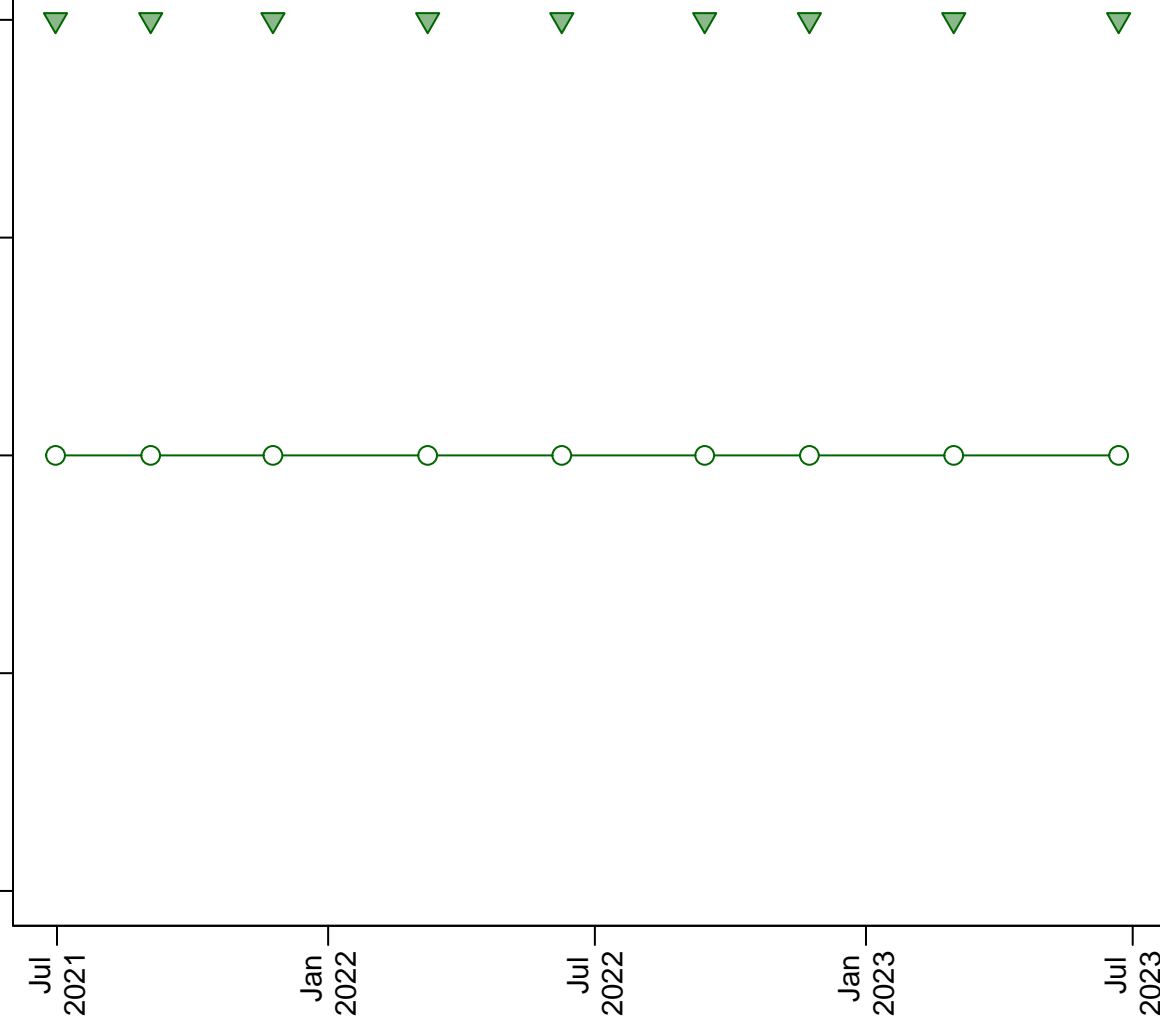
Stats

N Data: 9
N Detect: 0
% Detect: 0

MK criteria not met

Shapes

● Detect
○ NonDetect
▼ Detect Limit



Scatterplots and Trend Analysis D10, Molybdenum

Concentration (µg/L)

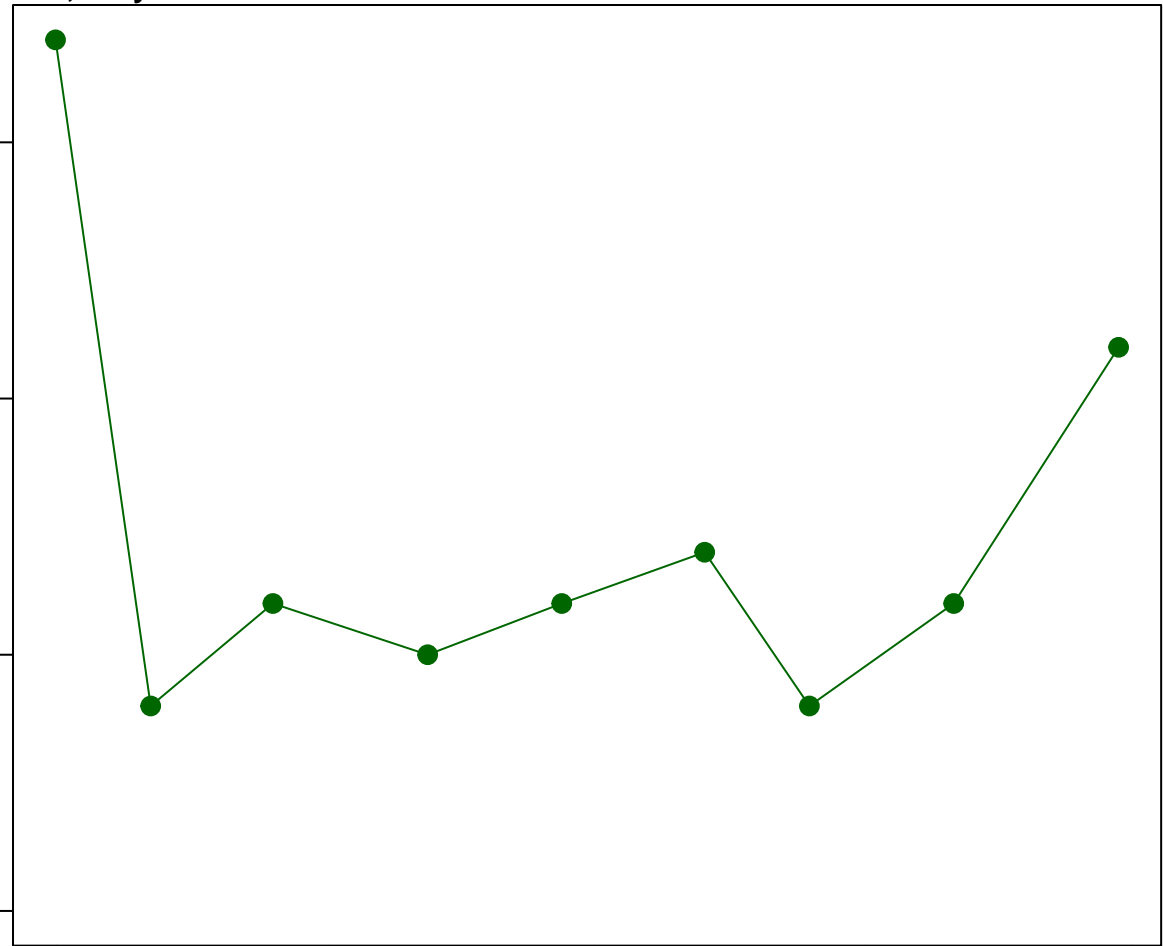
15
10
5
0

Jul 2021 Jan 2022 Jul 2022 Jan 2023 Jul 2023

Stats
N Data: 9
N Detect: 9
% Detect: 100

95% Confidence
MK Trend: NS
MK p-val: 0.669

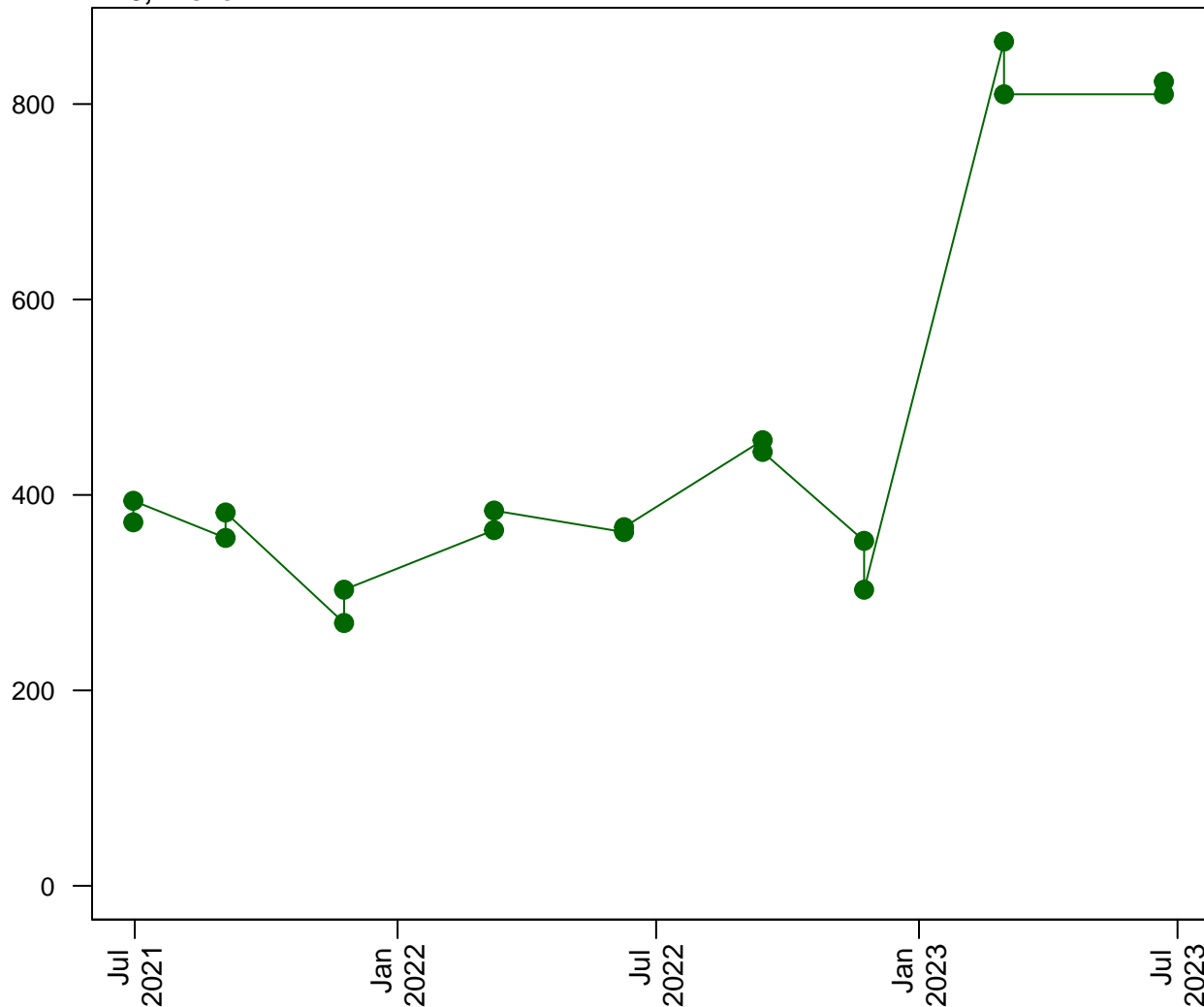
Shapes
Detect
NonDetect
Detect Limit



Scatterplots and Trend Analysis

D10, Nickel

Concentration (µg/L)



Stats

N Data: 18

N Detect: 18

% Detect: 100

95% Confidence

MK Trend: NS

MK p-val: 0.0563

Shapes



Detect



NonDetect

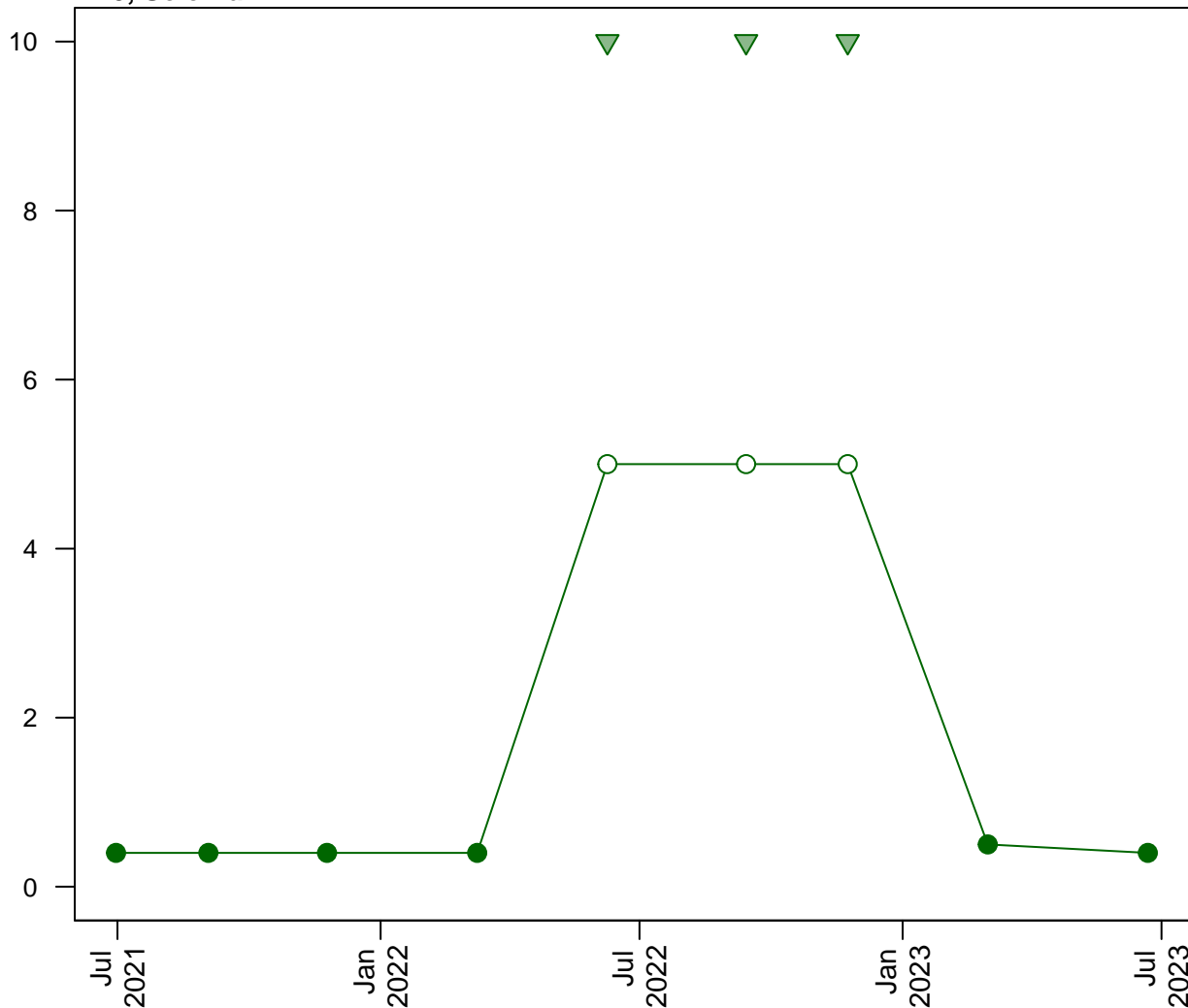


Detect Limit

Scatterplots and Trend Analysis

D10, Selenium

Concentration (µg/L)



Stats

N Data: 9
N Detect: 6
% Detect: 67

95% Confidence
MK Trend: NS
MK p-val: 0.288

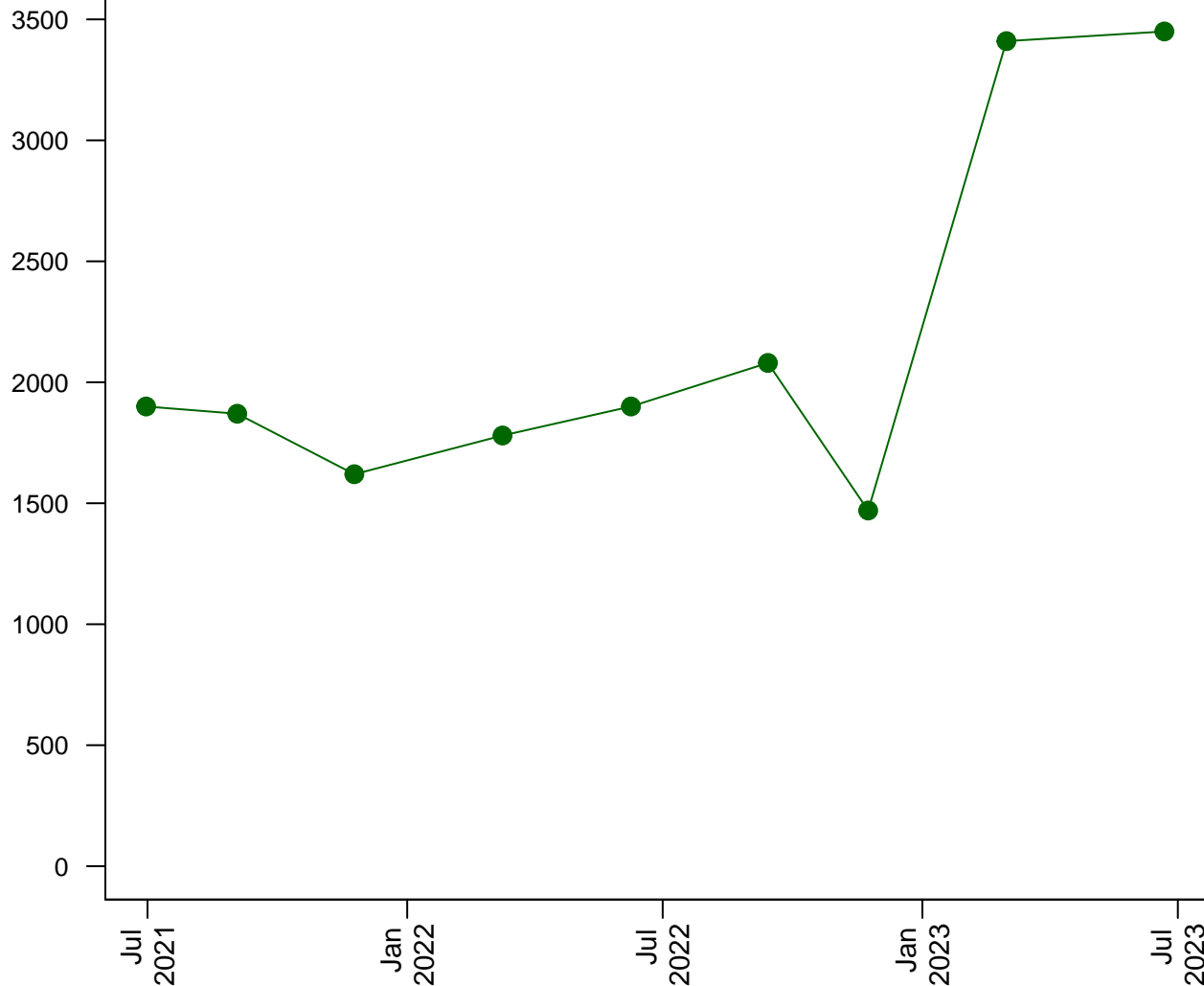
Shapes

● Detect
○ NonDetect
▼ Detect Limit

Scatterplots and Trend Analysis

D10, Sulfate (as SO4)

Concentration (mg/L)



Stats

N Data: 9
N Detect: 9
% Detect: 100

95% Confidence
MK Trend: NS
MK p-val: 0.173

Shapes

● Detect
○ NonDetect
▼ Detect Limit

Scatterplots and Trend Analysis

D10, Total Dissolved Solids (TDS)

Concentration (mg/L)

6000
5000
4000
3000
2000
1000
0

Jul
2021

Jan
2022

Jul
2022

Jan
2023

Jul
2023

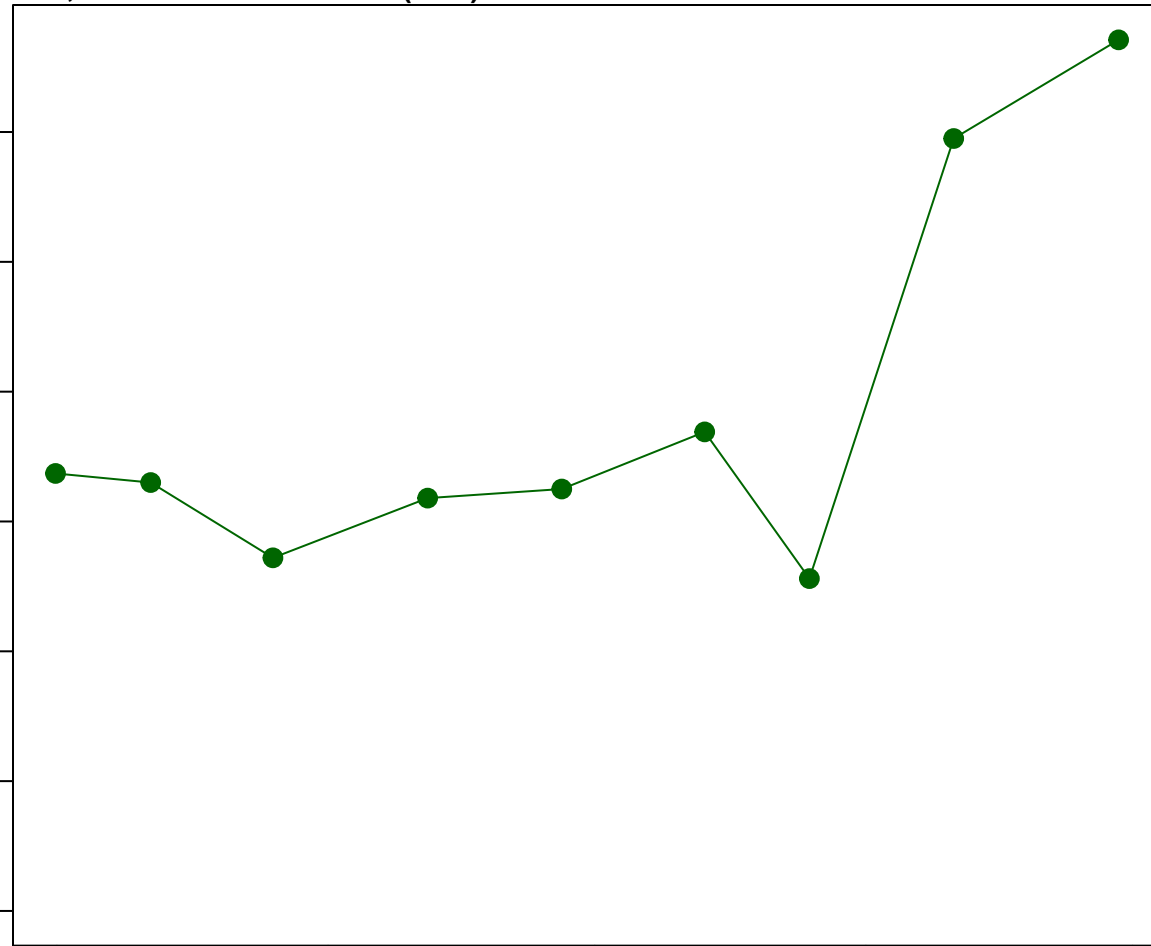
Stats

N Data: 9
N Detect: 9
% Detect: 100

95% Confidence
MK Trend: NS
MK p-val: 0.358

Shapes

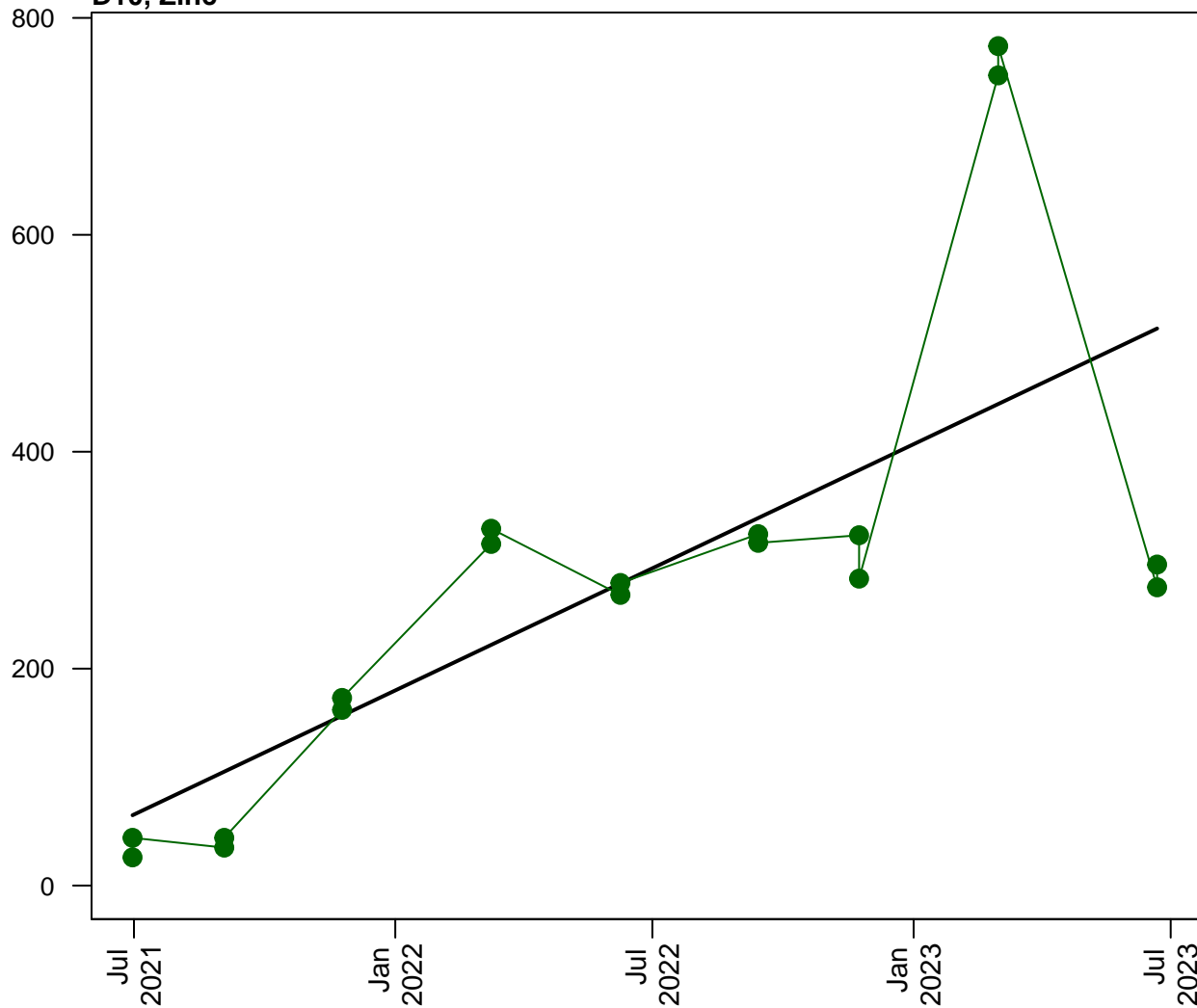
● Detect
○ NonDetect
▼ Detect Limit



Scatterplots and Trend Analysis

D10, Zinc

Concentration (µg/L)



Stats

N Data: 18

N Detect: 18

% Detect: 100

95% Confidence

MK Trend: Significant

MK p-val: 0.00118

Direction: Increasing

Lines

Linear Fit

Shapes

● Detect

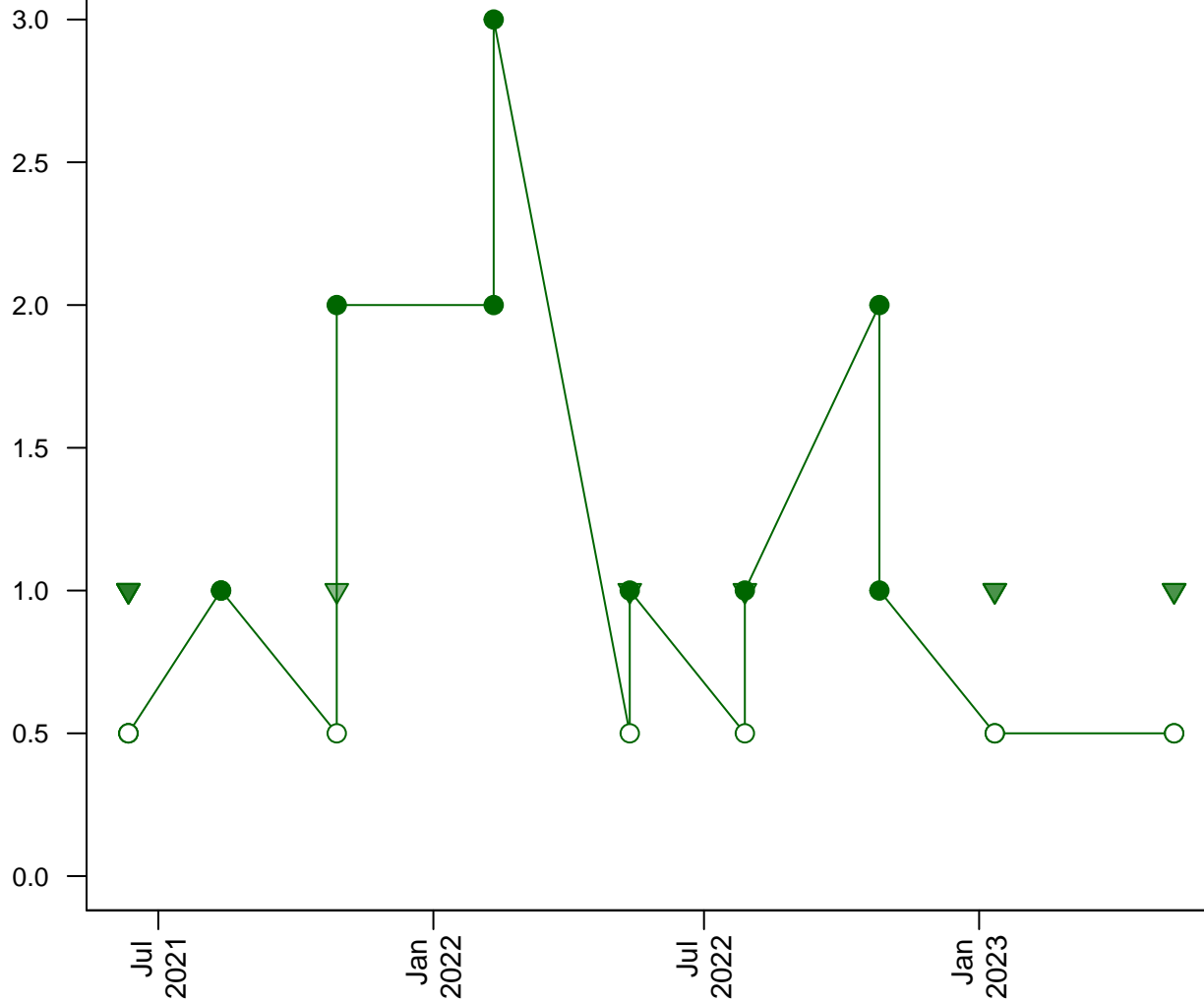
○ NonDetect

▼ Detect Limit

Scatterplots and Trend Analysis

D102, Arsenic

Concentration (µg/L)



Stats

N Data: 19

N Detect: 9

% Detect: 47

MK criteria not met

Shapes

● Detect

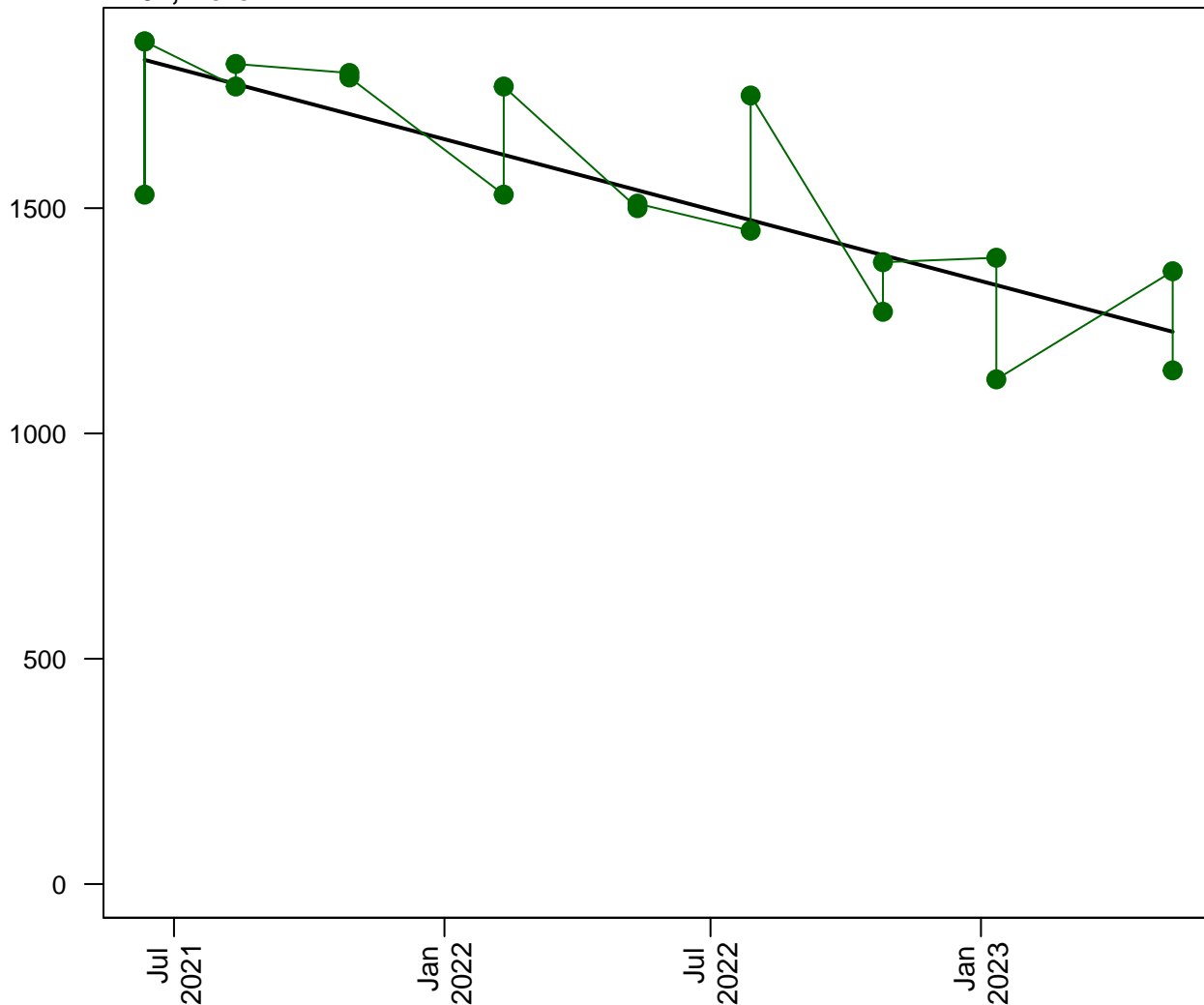
○ NonDetect

▼ Detect Limit

Scatterplots and Trend Analysis

D102, Boron

Concentration (µg/L)



Stats

N Data: 19
N Detect: 19
% Detect: 100

95% Confidence
MK Trend: Significant
MK p-val: <0.001
Direction: Decreasing

Lines

Linear Fit

Shapes



Detect



NonDetect



Detect Limit

Scatterplots and Trend Analysis

D102, Cadmium

Concentration (µg/L)

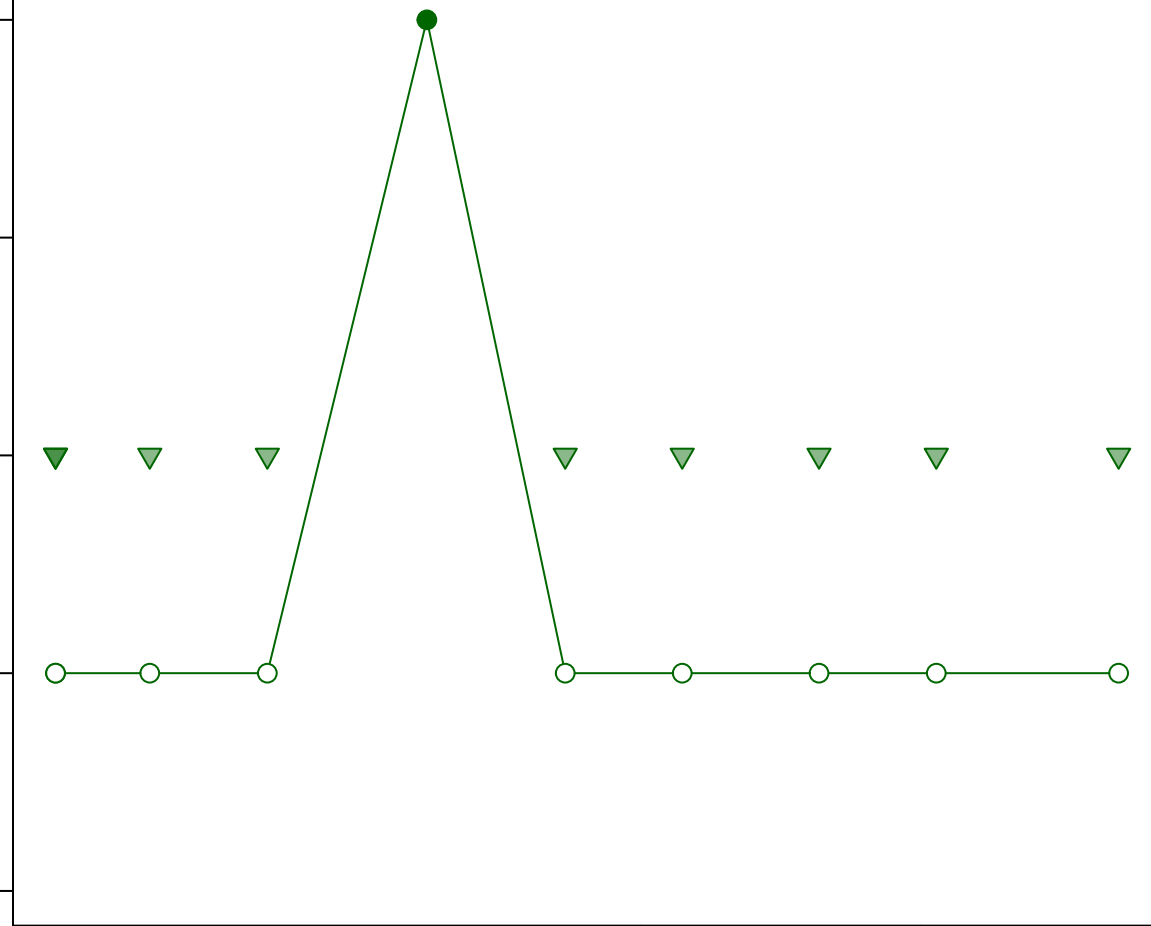
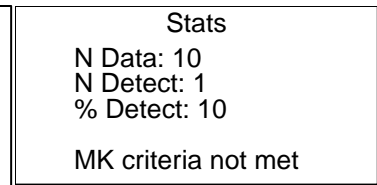
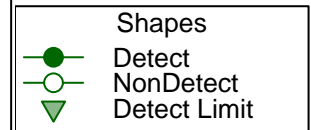
0.20
0.15
0.10
0.05
0.00

Jul
2021

Jan
2022

Jul
2022

Jan
2023



Scatterplots and Trend Analysis

D102, Chloride

Concentration (mg/L)

1500
1000
500
0

Jul
2021

Jan
2022

Jul
2022

Jan
2023

Stats

N Data: 10
N Detect: 10
% Detect: 100

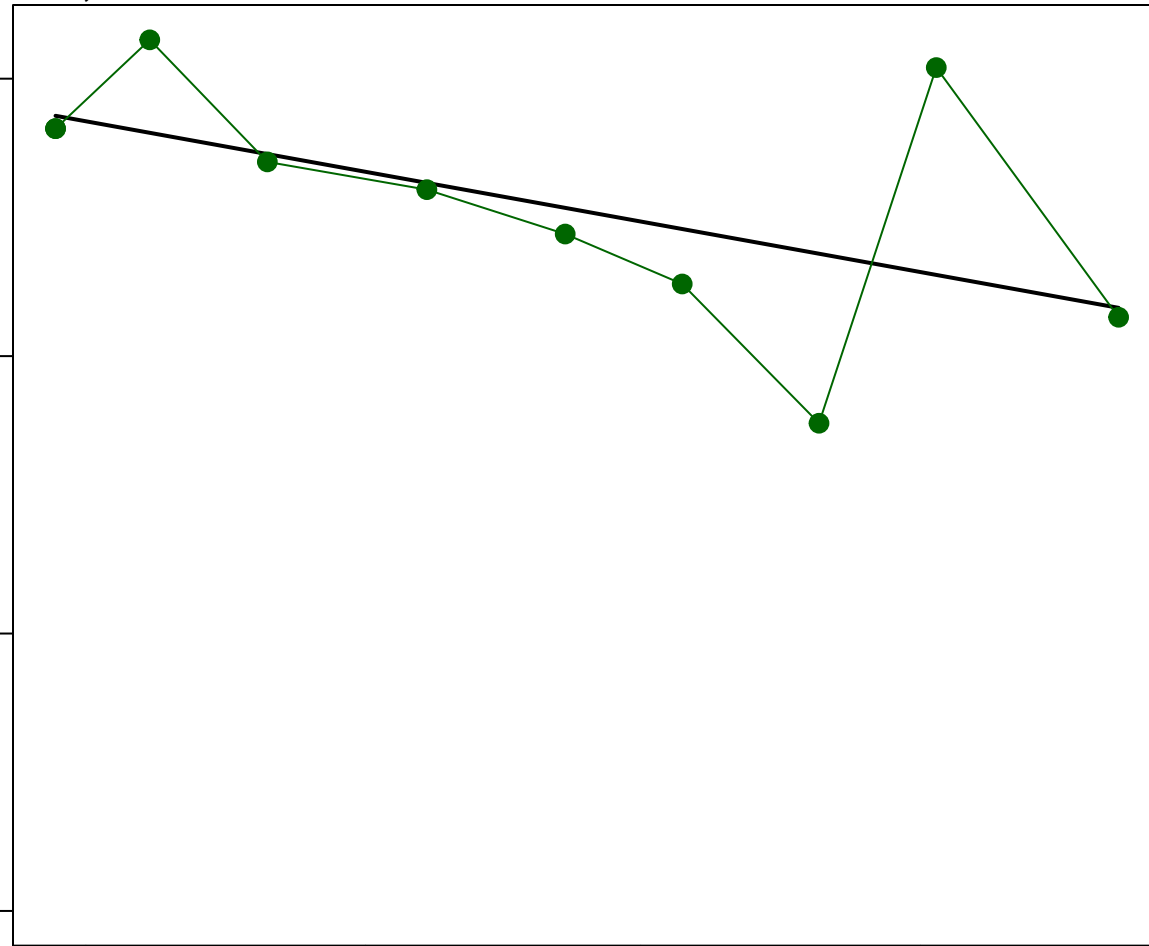
95% Confidence
MK Trend: Significant
MK p-val: 0.0305
Direction: Decreasing

Lines

Linear Fit

Shapes

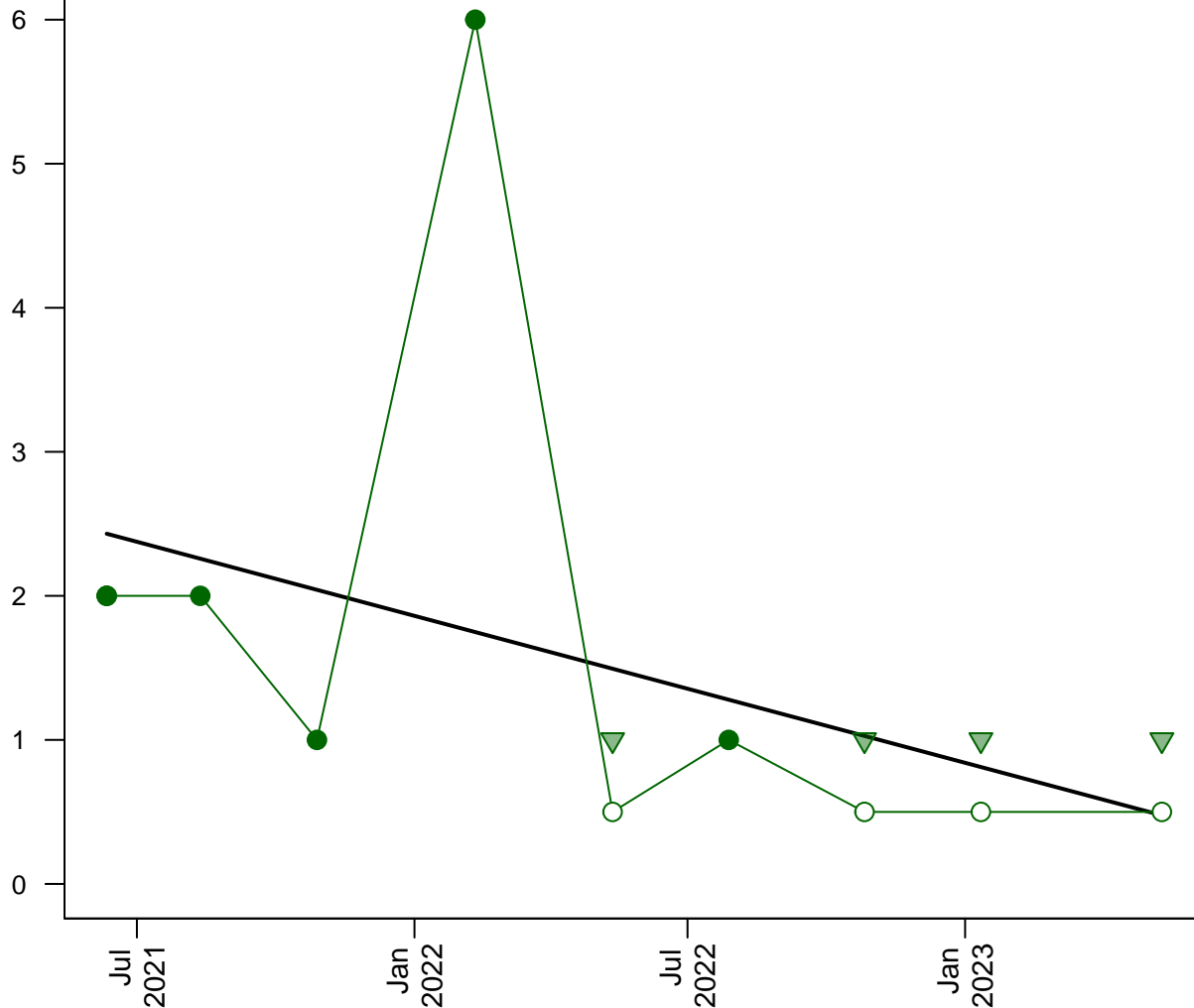
● Detect
○ NonDetect
▼ Detect Limit



Scatterplots and Trend Analysis

D102, Chromium

Concentration (µg/L)



Stats

N Data: 10
N Detect: 6
% Detect: 60

95% Confidence
MK Trend: Significant
MK p-val: 0.0176
Direction: Decreasing

Lines

— Linear Fit

Shapes

● Detect
○ NonDetect
▼ Detect Limit

Scatterplots and Trend Analysis

D102, Electrical Conductivity (Field)

Concentration (uS/cm)

10000
8000
6000
4000
2000
0

Jul
2021

Jan
2022

Jul
2022

Jan
2023

Stats

N Data: 10
N Detect: 10
% Detect: 100

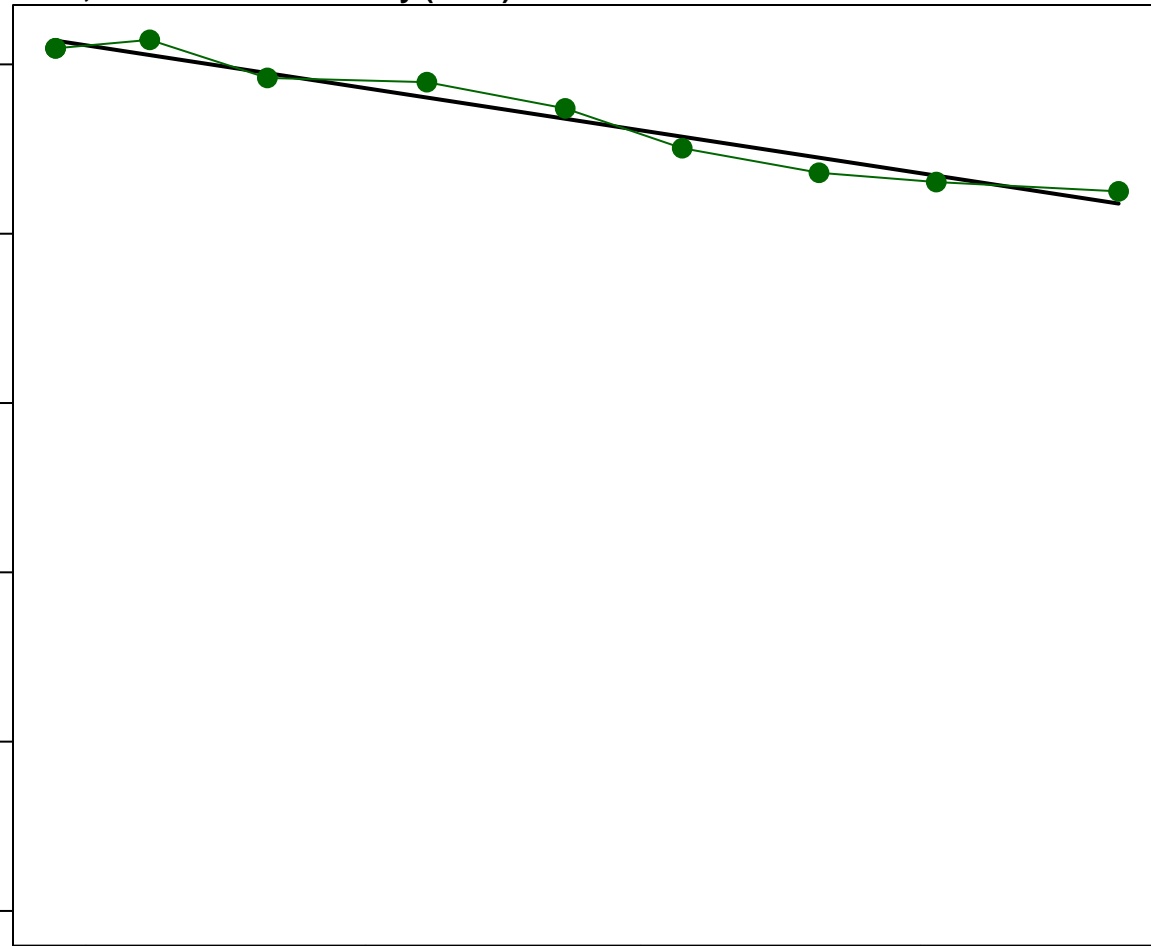
95% Confidence
MK Trend: Significant
MK p-val: <0.001
Direction: Decreasing

Lines

Linear Fit

Shapes

Detect
NonDetect
Detect Limit



Scatterplots and Trend Analysis

D102, Fluoride

Concentration (mg/L)

2.0
1.5
1.0
0.5
0.0

Jul
2021

Jan
2022

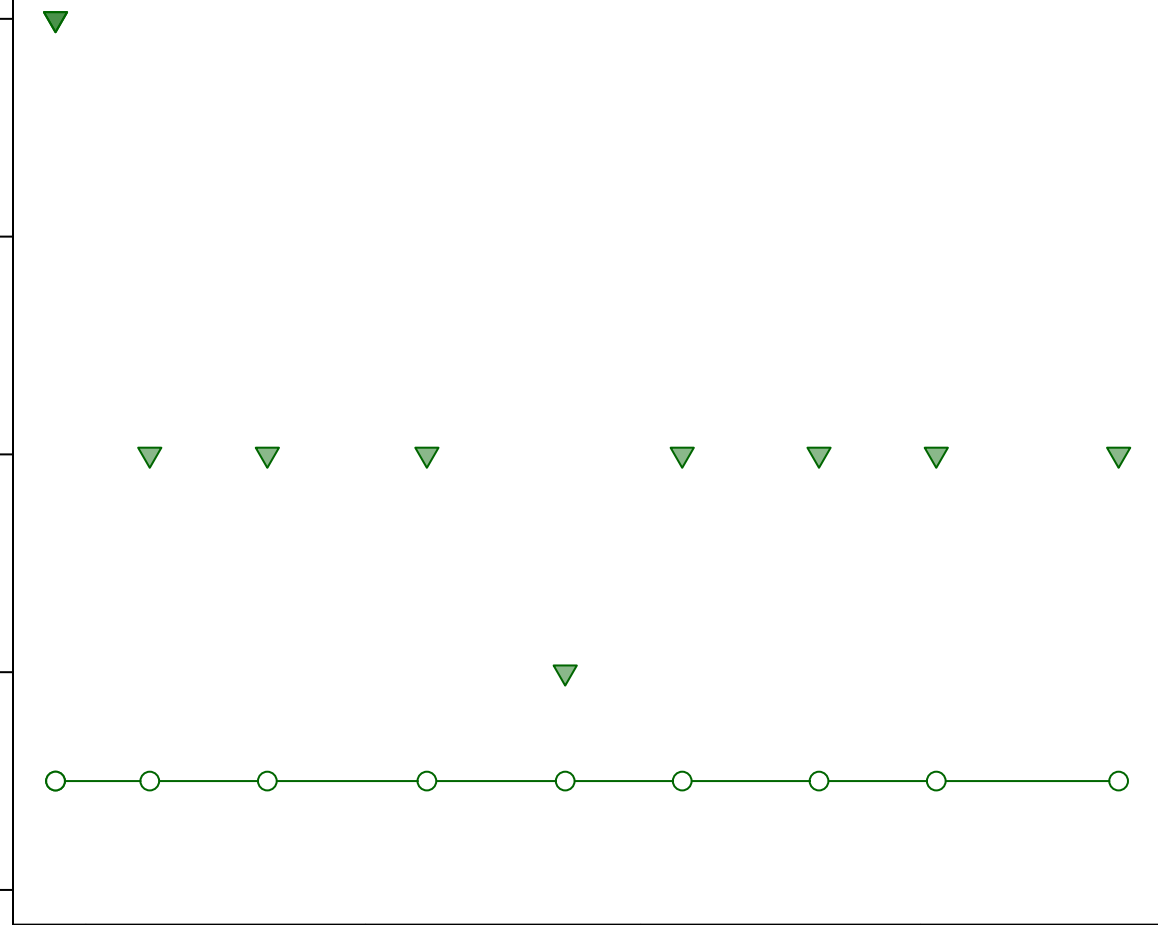
Jul
2022

Jan
2023

Stats
N Data: 10
N Detect: 0
% Detect: 0

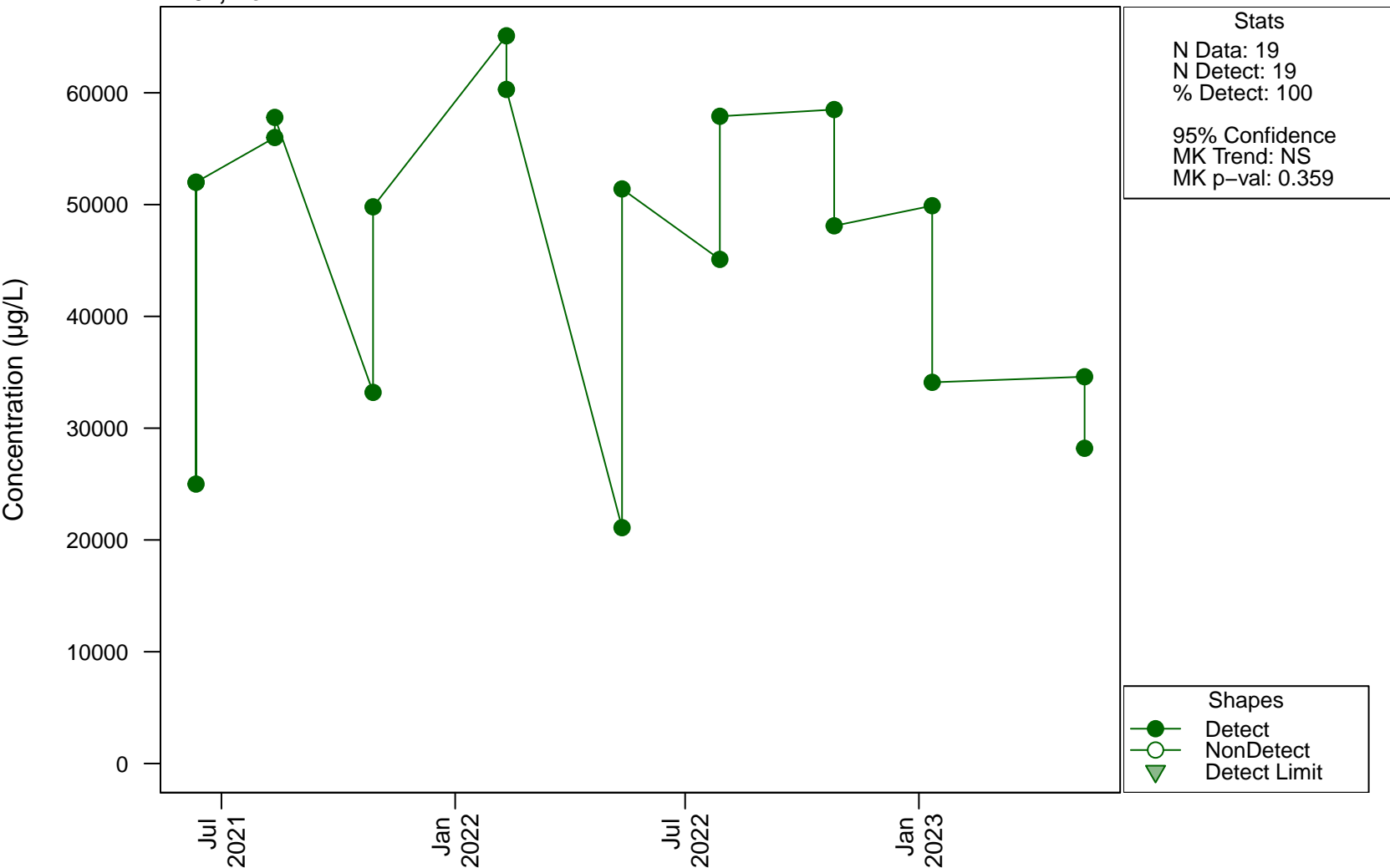
MK criteria not met

Shapes
● Detect
○ NonDetect
▼ Detect Limit



Scatterplots and Trend Analysis

D102, Iron



Scatterplots and Trend Analysis

D102, Lead

Concentration (µg/L)

1.0
0.8
0.6
0.4
0.2
0.0

Jul
2021

Jan
2022

Jul
2022

Jan
2023

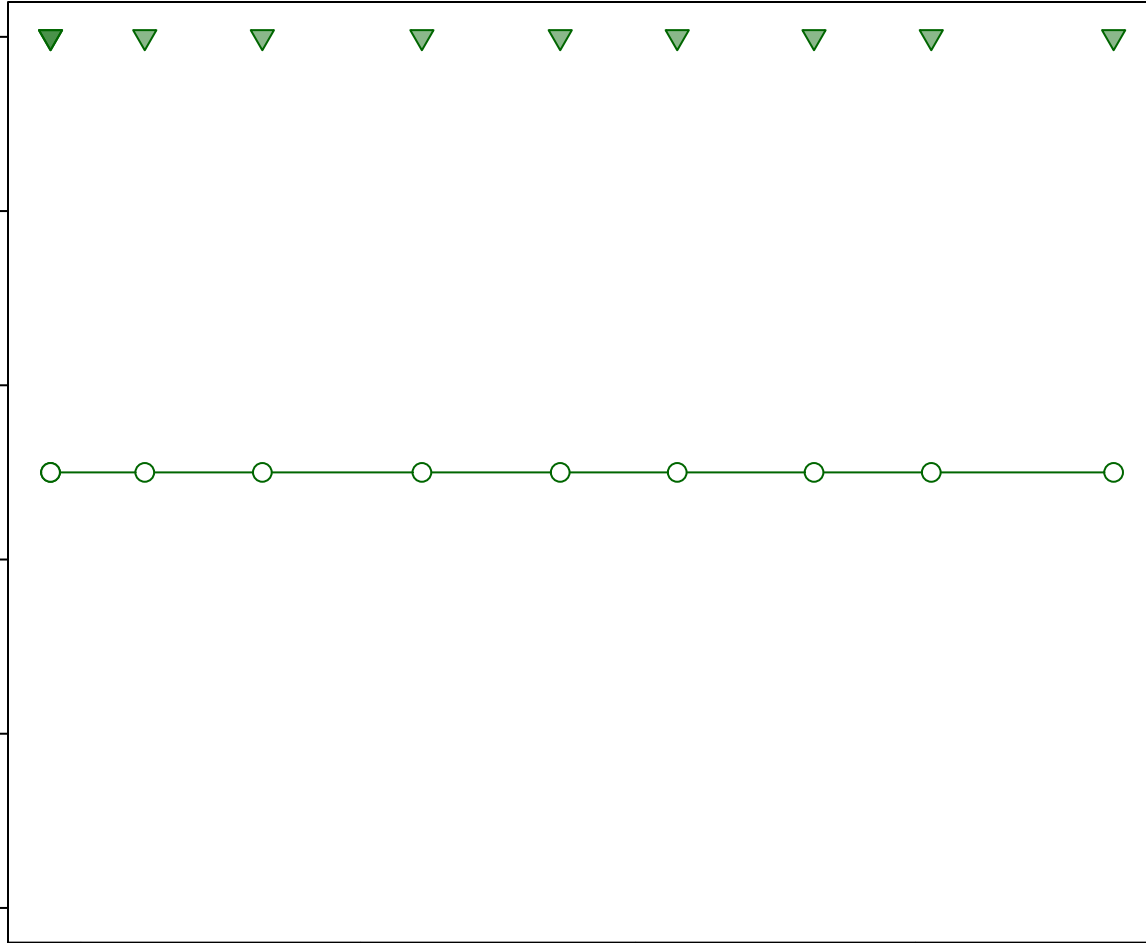
Stats

N Data: 10
N Detect: 0
% Detect: 0

MK criteria not met

Shapes

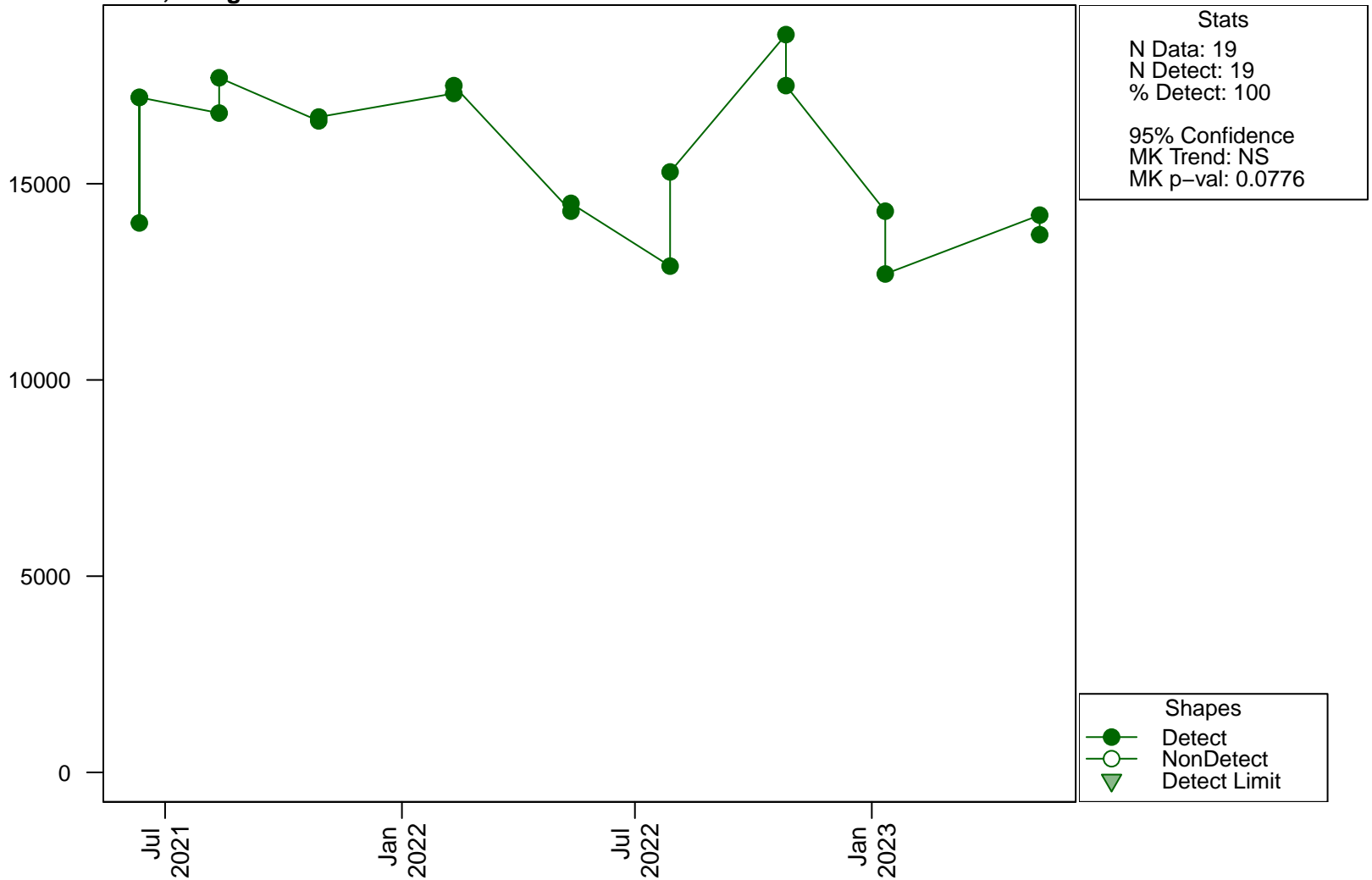
● Detect
○ NonDetect
▼ Detect Limit



Scatterplots and Trend Analysis

D102, Manganese

Concentration (µg/L)



Scatterplots and Trend Analysis

D102, Mercury

Concentration ($\mu\text{g/L}$)

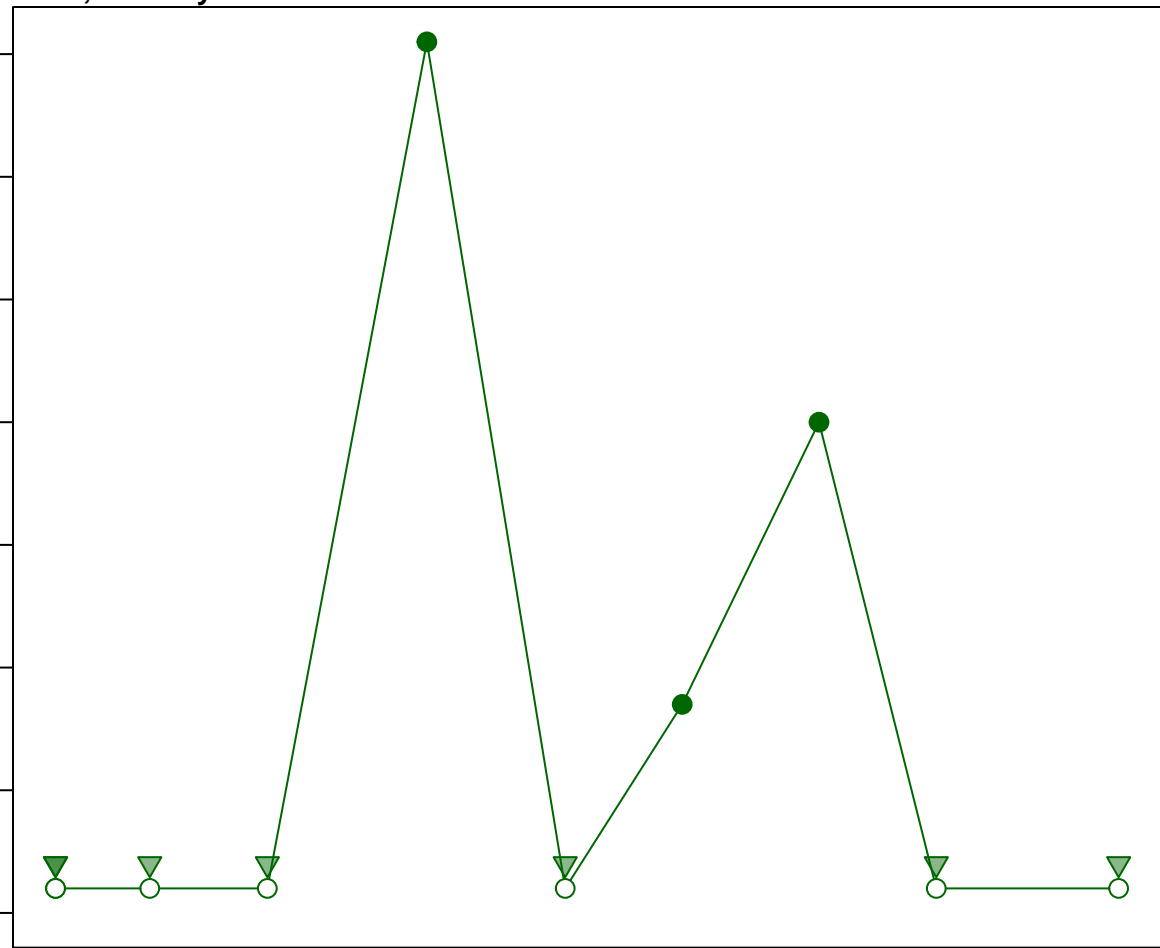
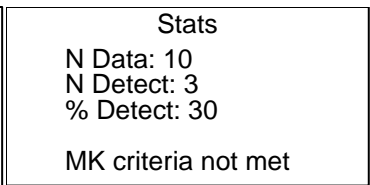
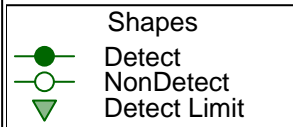
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0.0

Jul
2021

Jan
2022

Jul
2022

Jan
2023



Scatterplots and Trend Analysis

D102, Molybdenum

Concentration (µg/L)

1.0
0.8
0.6
0.4
0.2
0.0

Jul
2021

Jan
2022

Jul
2022

Jan
2023

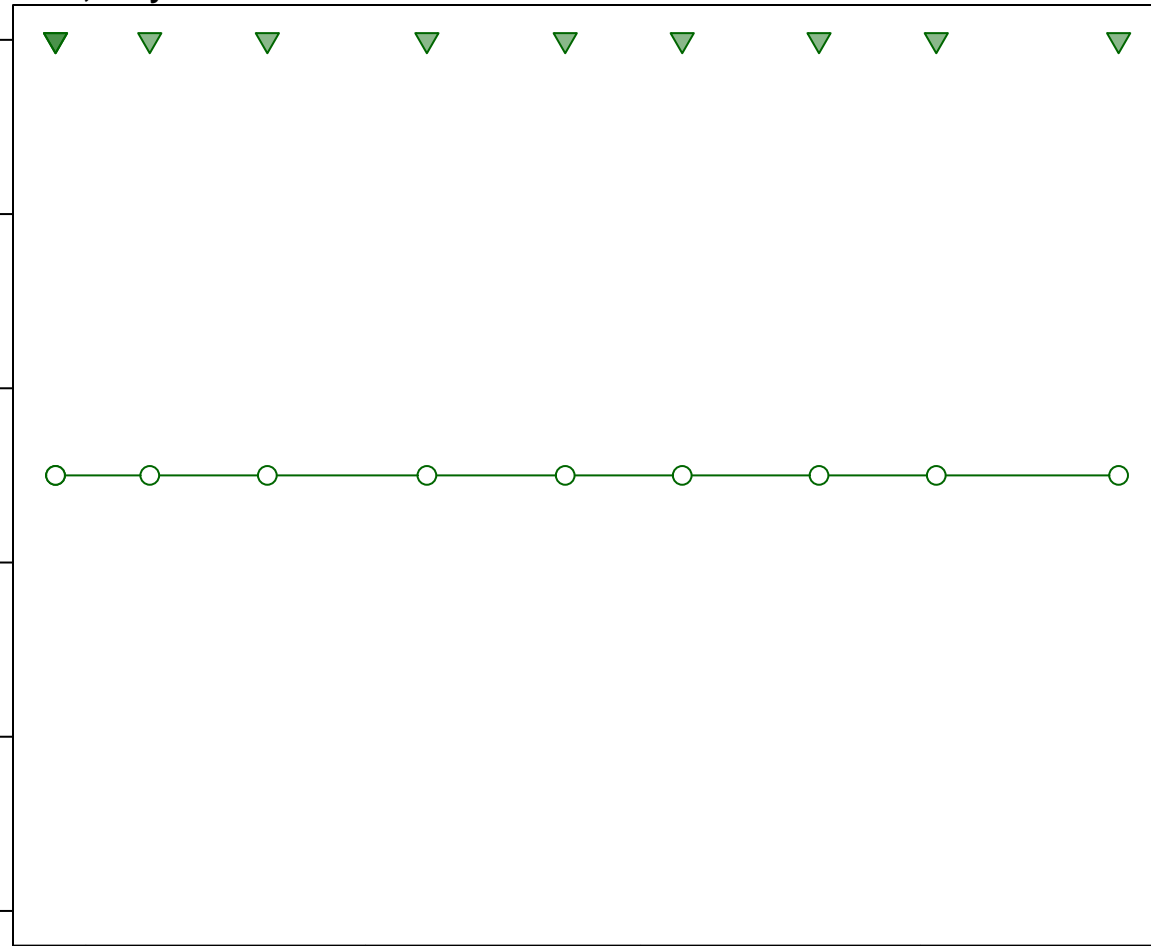
Stats

N Data: 10
N Detect: 0
% Detect: 0

MK criteria not met

Shapes

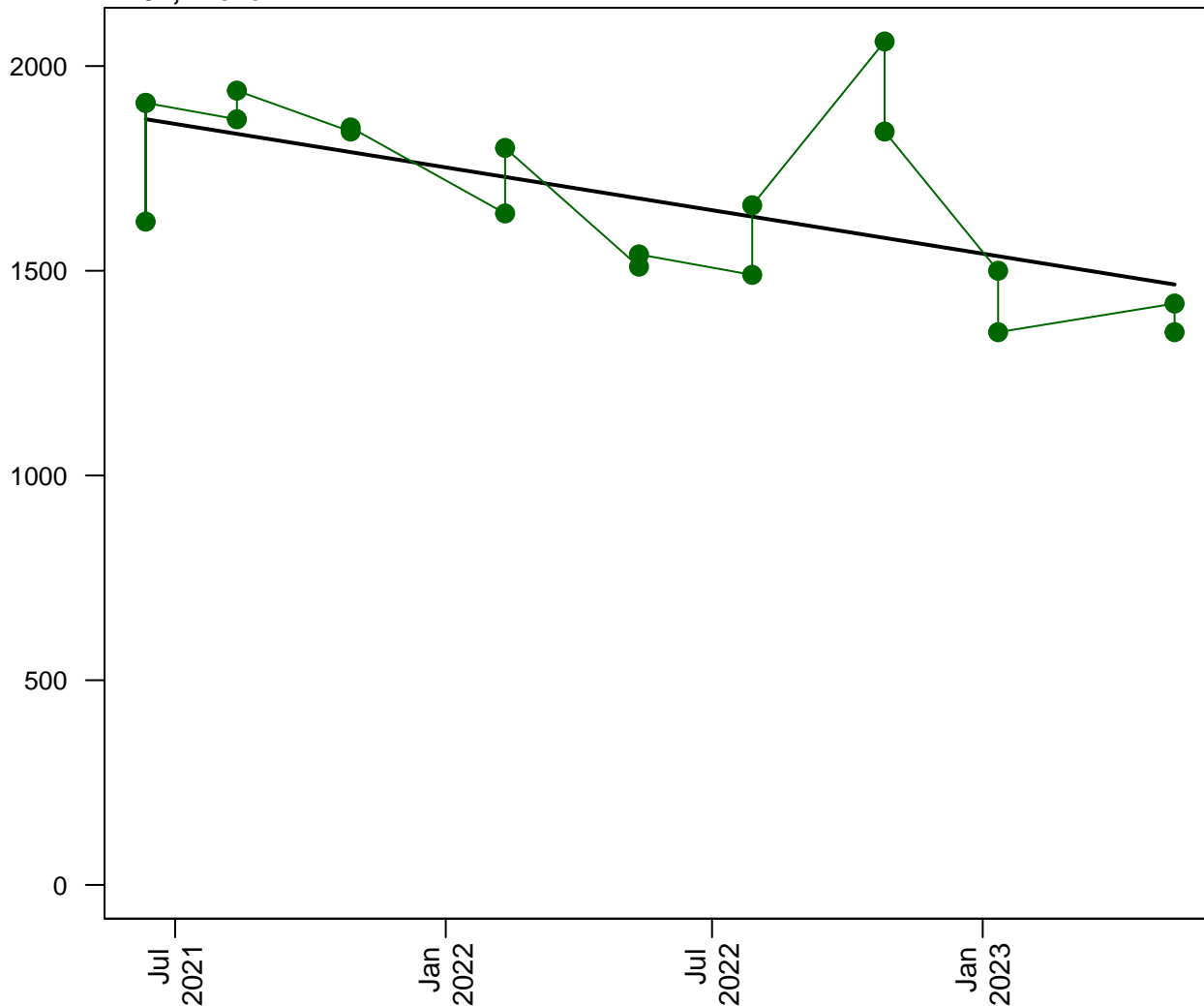
● Detect
○ NonDetect
▼ Detect Limit



Scatterplots and Trend Analysis

D102, Nickel

Concentration (µg/L)



Stats

N Data: 19
N Detect: 19
% Detect: 100

95% Confidence
MK Trend: Significant
MK p-val: 0.00149
Direction: Decreasing

Lines

— Linear Fit

Shapes

● Detect
○ NonDetect
▼ Detect Limit

Scatterplots and Trend Analysis

D102, Selenium

Concentration (µg/L)

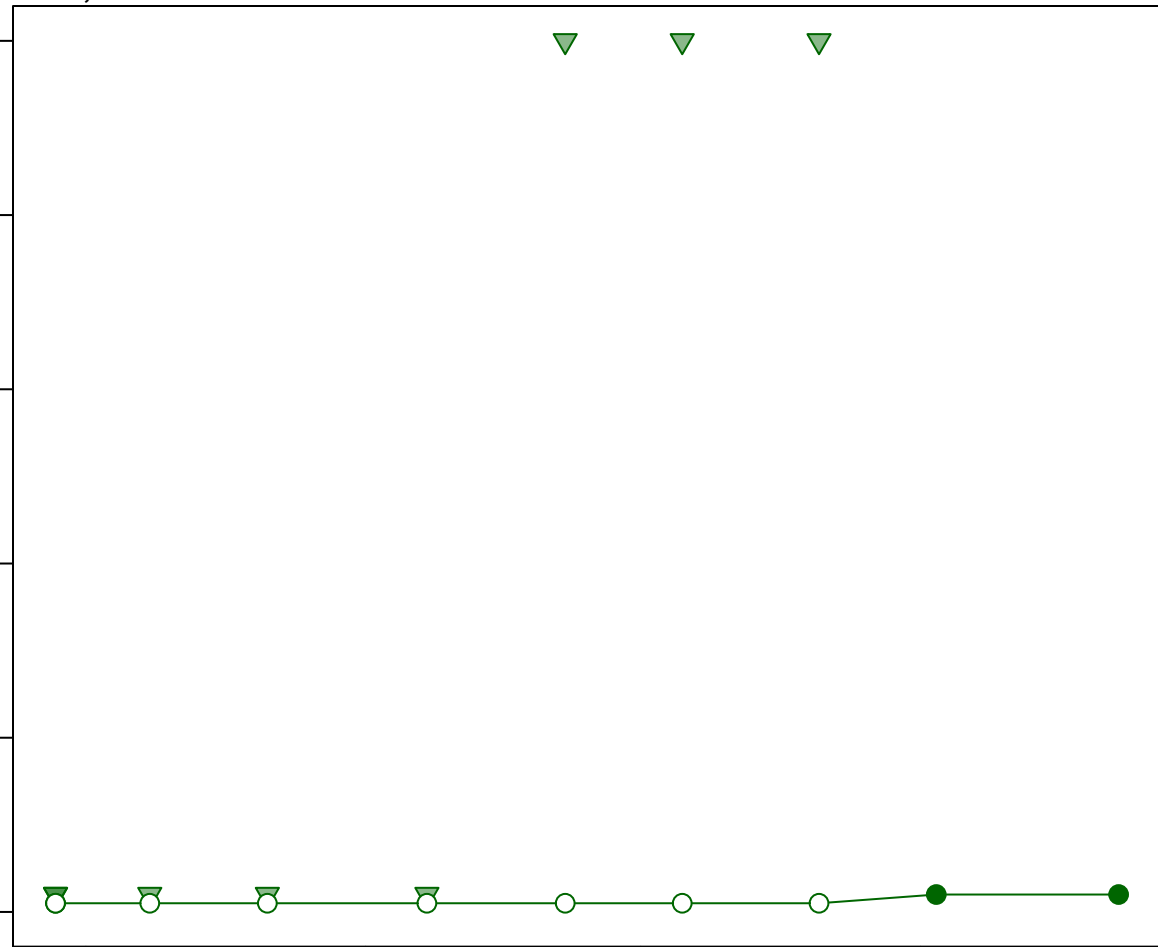
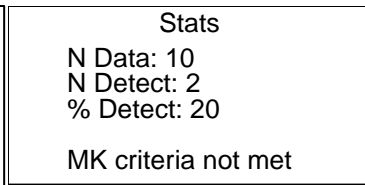
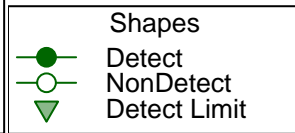
10
8
6
4
2
0

Jul
2021

Jan
2022

Jul
2022

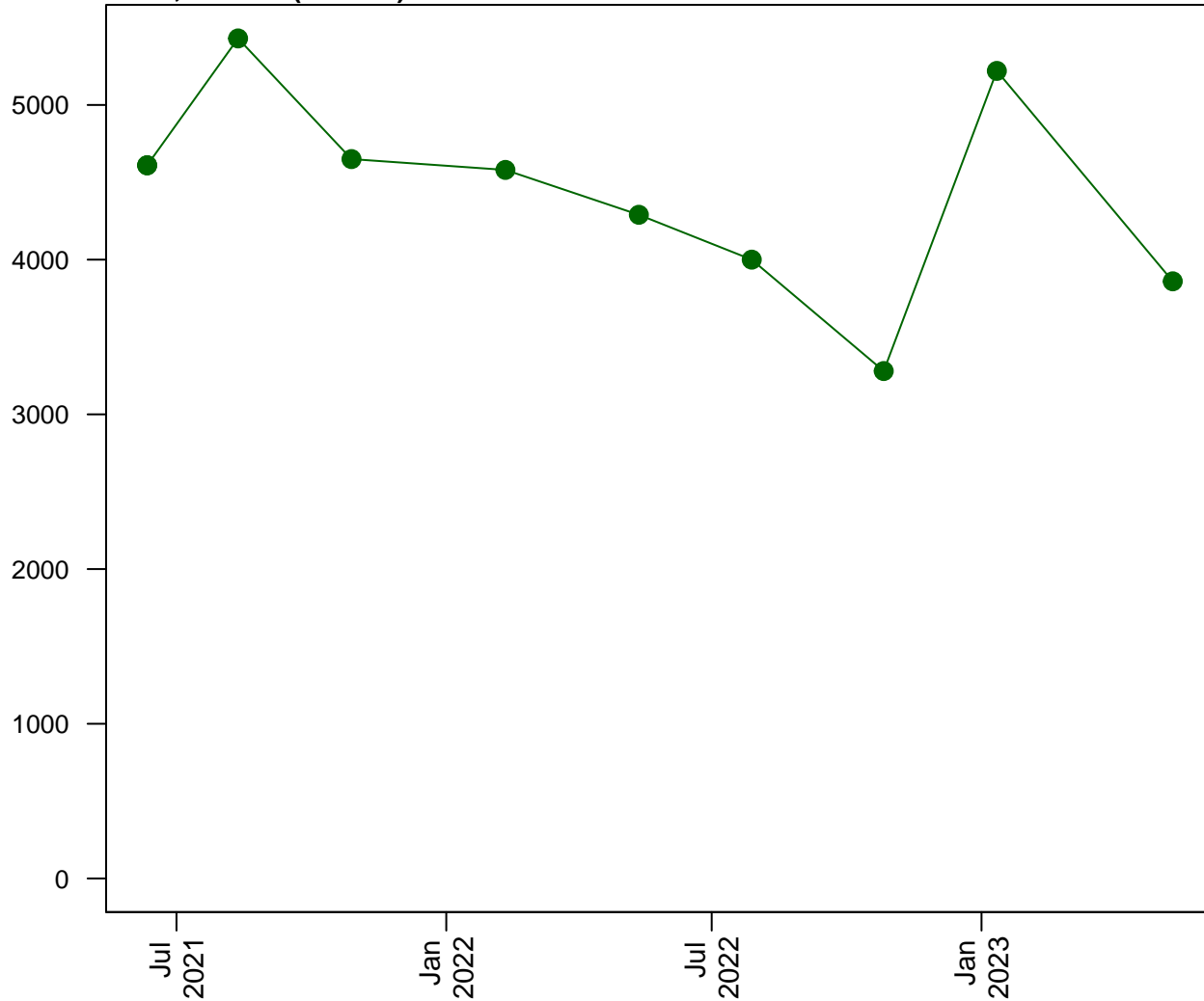
Jan
2023



Scatterplots and Trend Analysis

D102, Sulfate (as SO4)

Concentration (mg/L)



Stats

N Data: 10
N Detect: 10
% Detect: 100

95% Confidence
MK Trend: NS
MK p-val: 0.0714

Shapes

● Detect
○ NonDetect
▼ Detect Limit

Scatterplots and Trend Analysis

D102, Total Dissolved Solids (TDS)

Concentration (mg/L)

8000
6000
4000
2000
0

Jul
2021

Jan
2022

Jul
2022

Jan
2023

Stats

N Data: 11

N Detect: 11

% Detect: 100

95% Confidence

MK Trend: Significant

MK p-val: <0.001

Direction: Decreasing

Lines

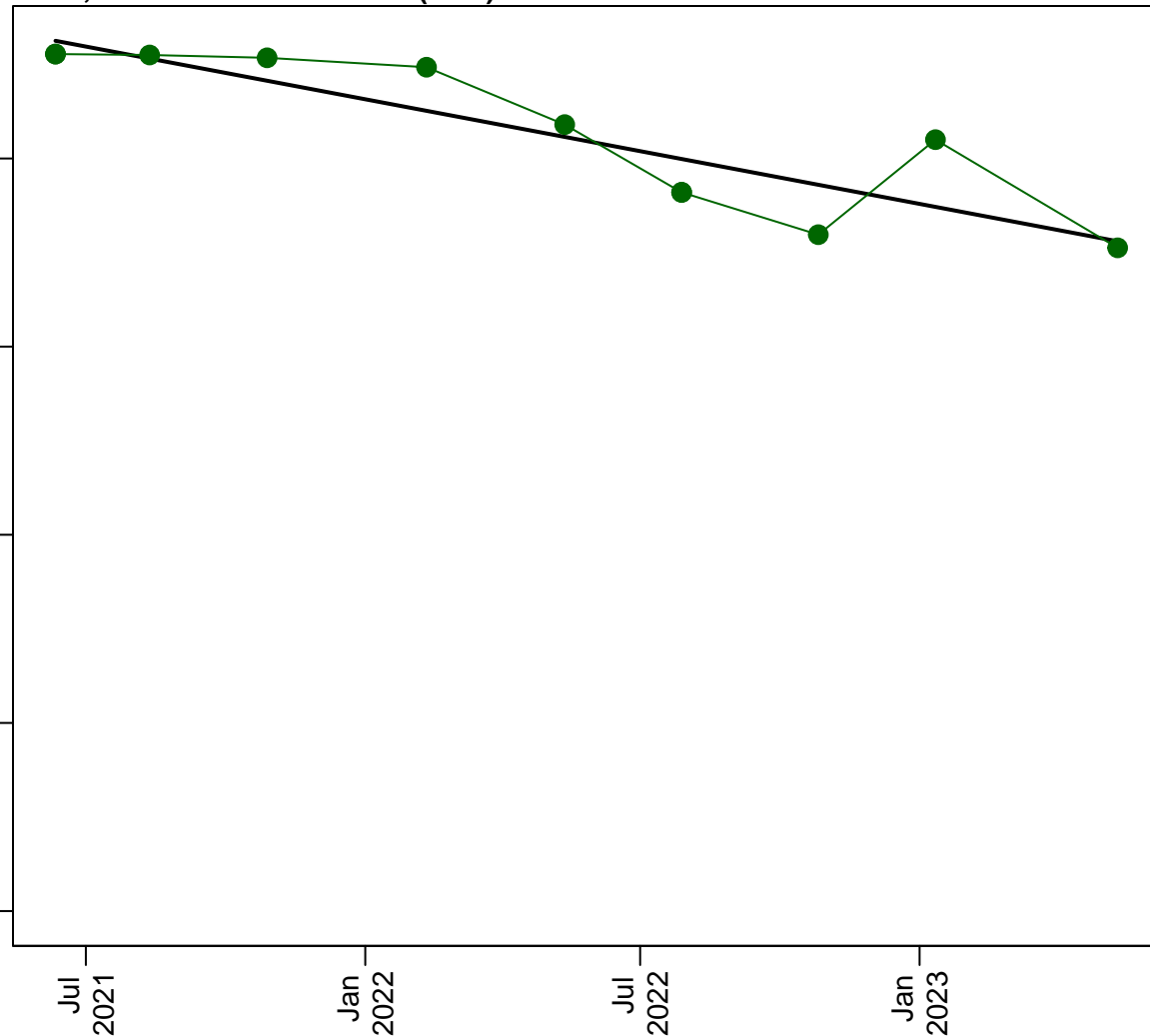
Linear Fit

Shapes

● Detect

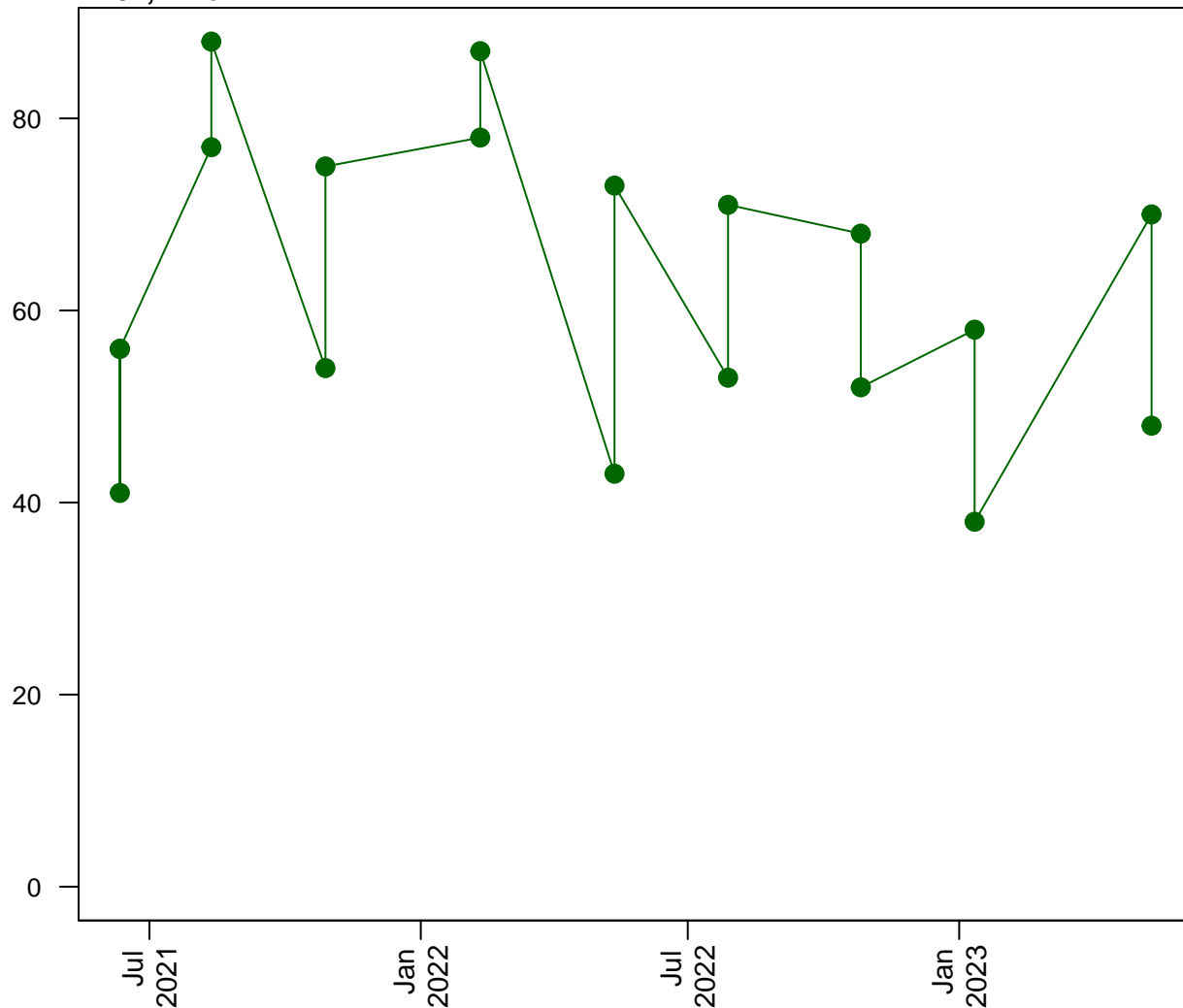
○ NonDetect

▼ Detect Limit



Scatterplots and Trend Analysis D102, Zinc

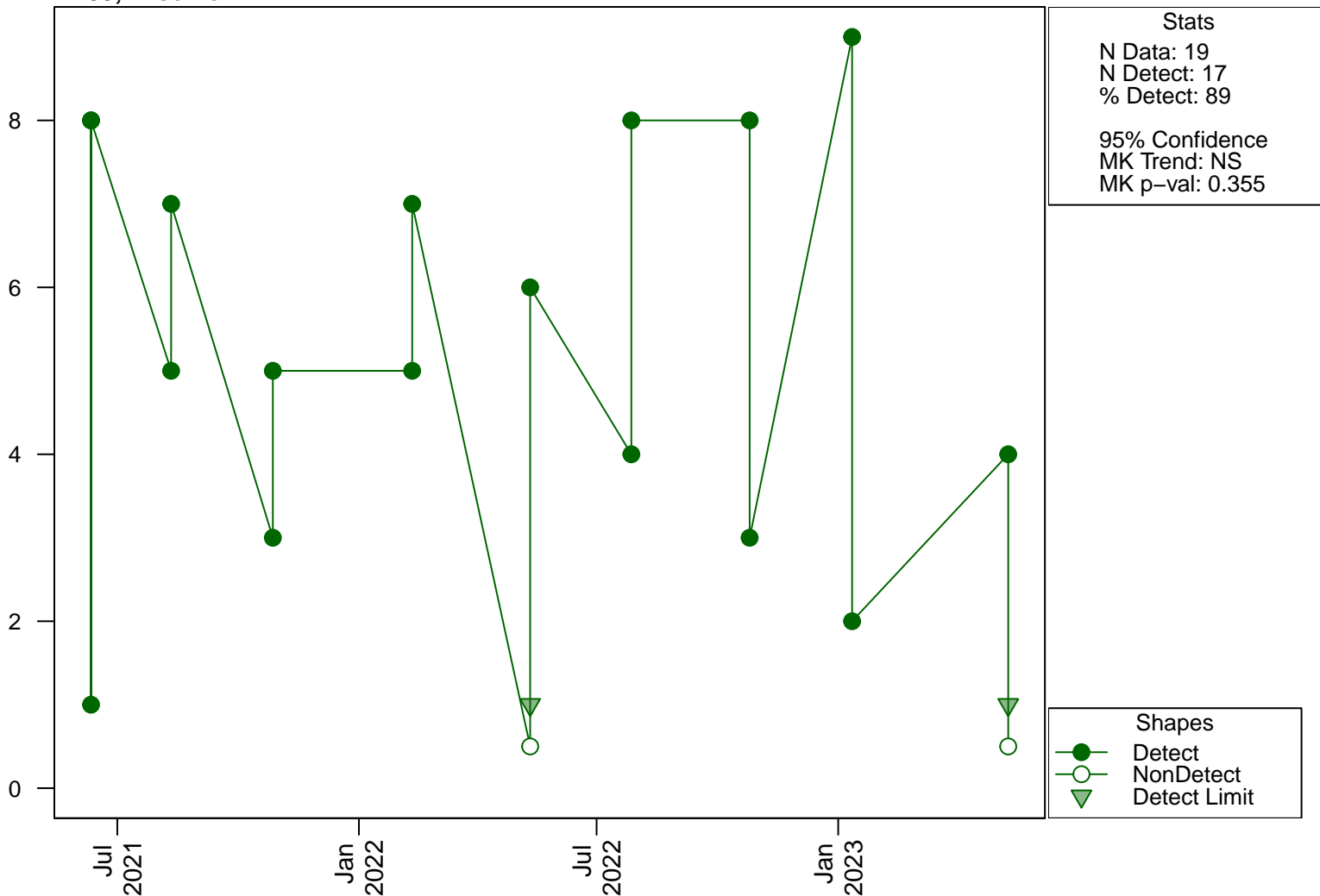
Concentration (µg/L)



Scatterplots and Trend Analysis

D103, Arsenic

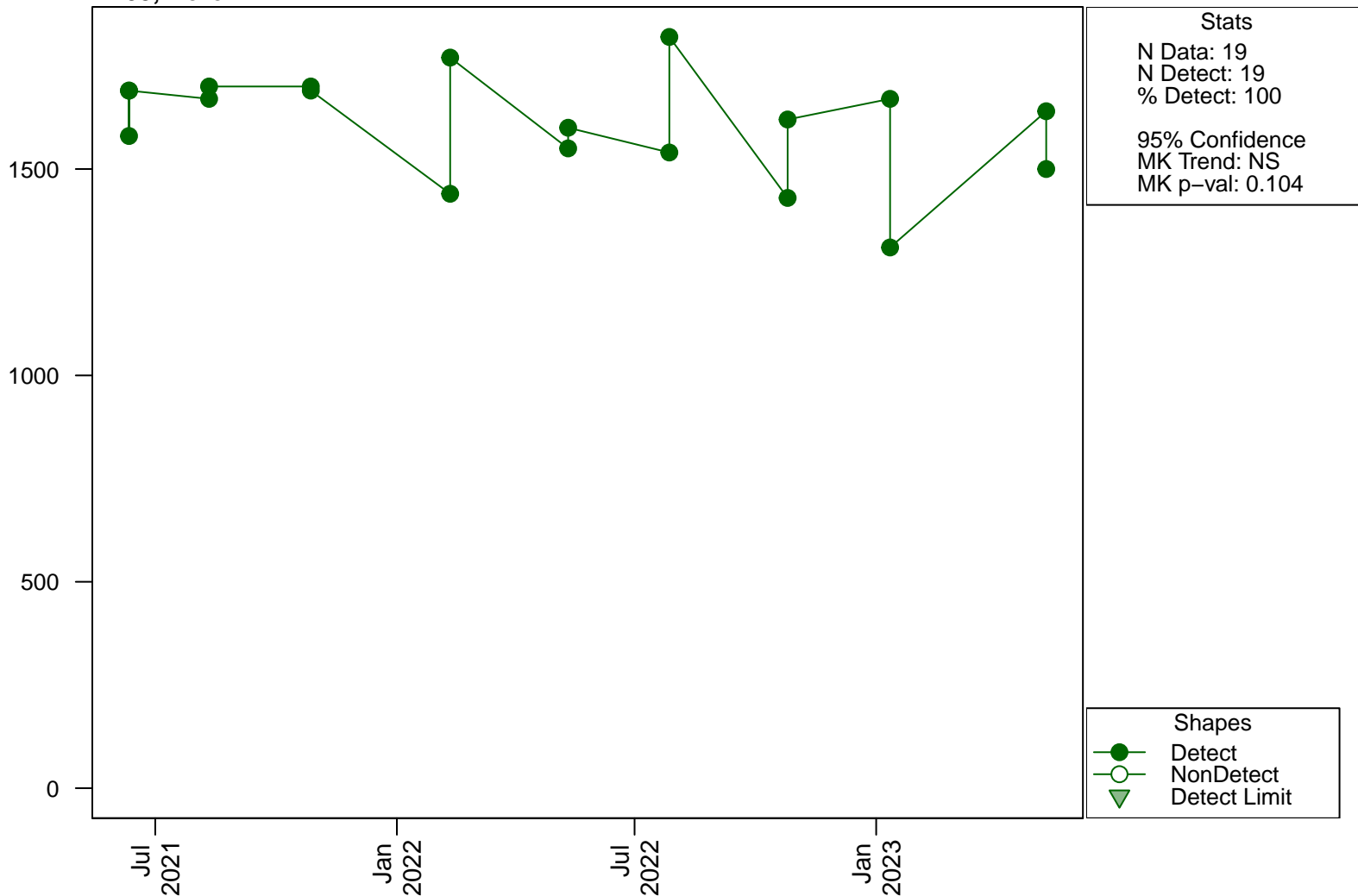
Concentration (µg/L)



Scatterplots and Trend Analysis

D103, Boron

Concentration (µg/L)



Scatterplots and Trend Analysis

D103, Cadmium

Concentration (µg/L)

0.10
0.08
0.06
0.04
0.02
0.00

Jul
2021

Jan
2022

Jul
2022

Jan
2023

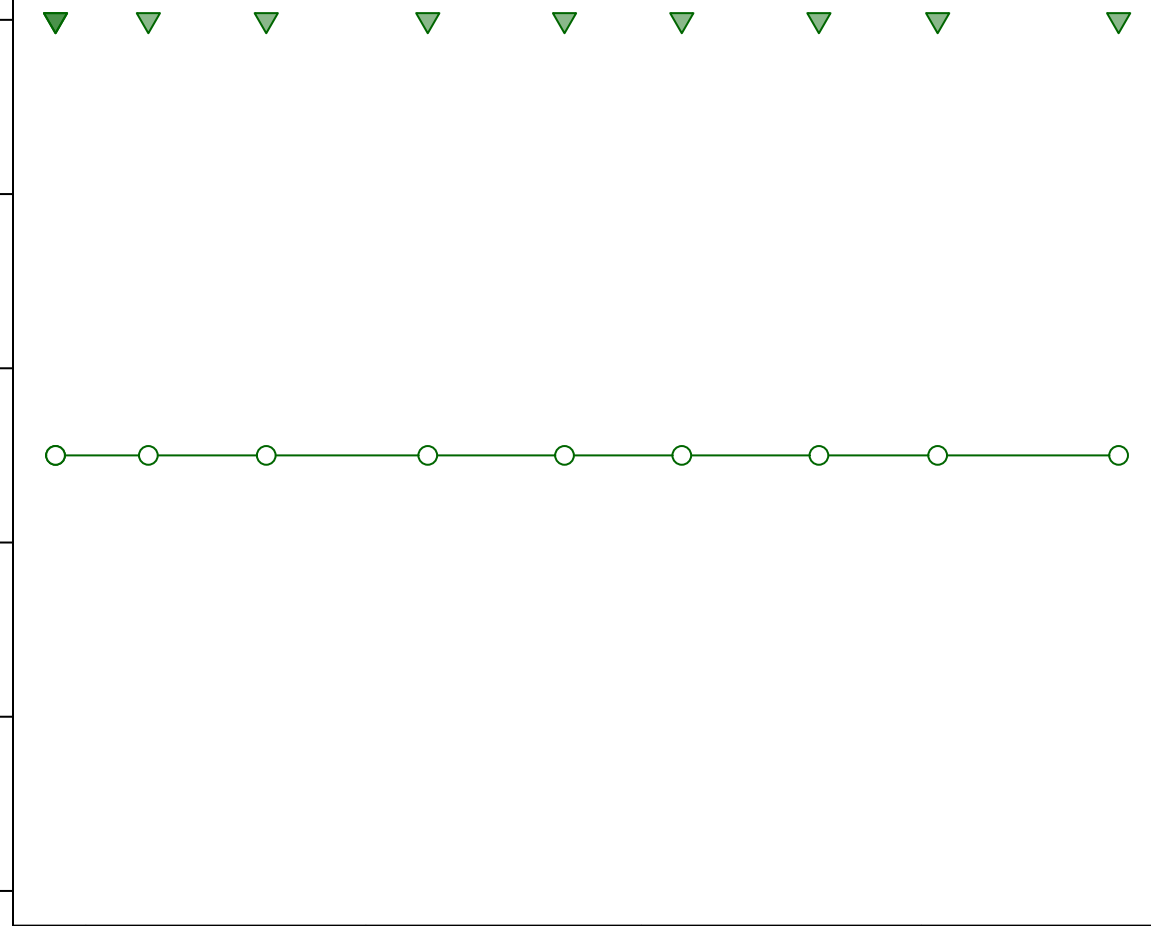
Stats

N Data: 10
N Detect: 0
% Detect: 0

MK criteria not met

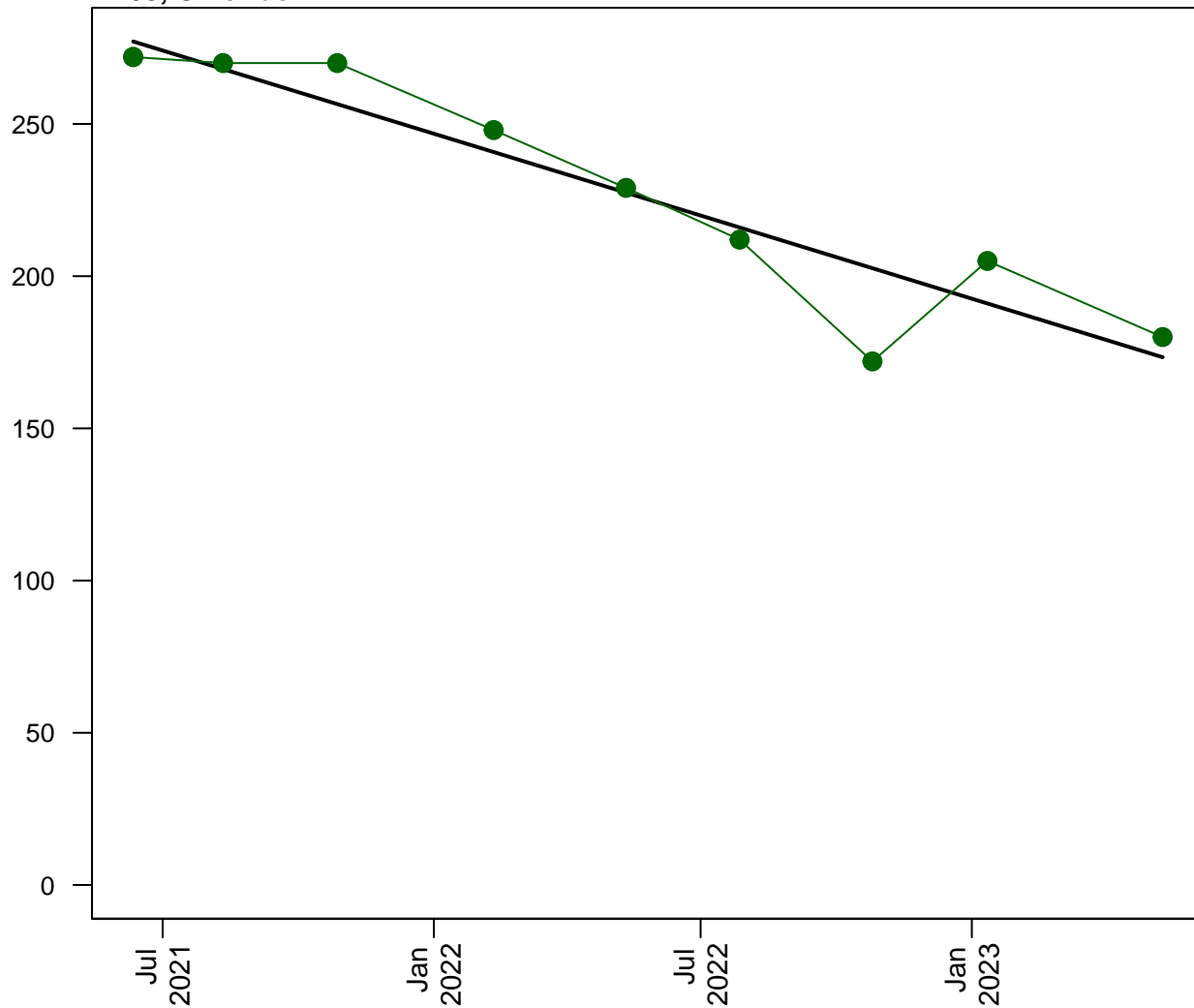
Shapes

● Detect
○ NonDetect
▼ Detect Limit



Scatterplots and Trend Analysis D103, Chloride

Concentration (mg/L)



Stats

N Data: 10
N Detect: 10
% Detect: 100

95% Confidence
MK Trend: Significant
MK p-val: <0.001
Direction: Decreasing

Lines

Linear Fit

Shapes

● Detect
○ NonDetect
▼ Detect Limit

Scatterplots and Trend Analysis

D103, Chromium

Concentration (µg/L)

12
10
8
6
4
2
0

Jul
2021

Jan
2022

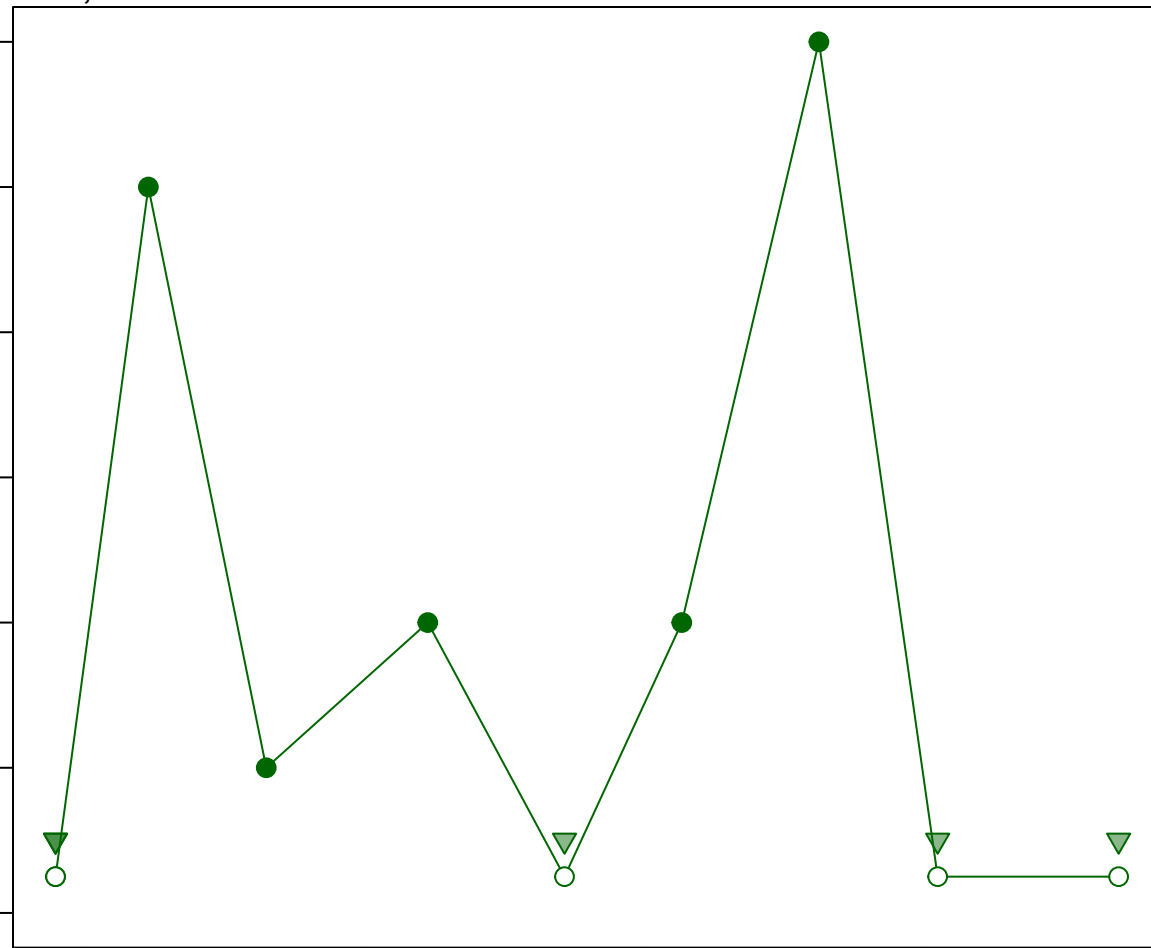
Jul
2022

Jan
2023

Stats
N Data: 10
N Detect: 5
% Detect: 50

95% Confidence
MK Trend: NS
MK p-val: 0.846

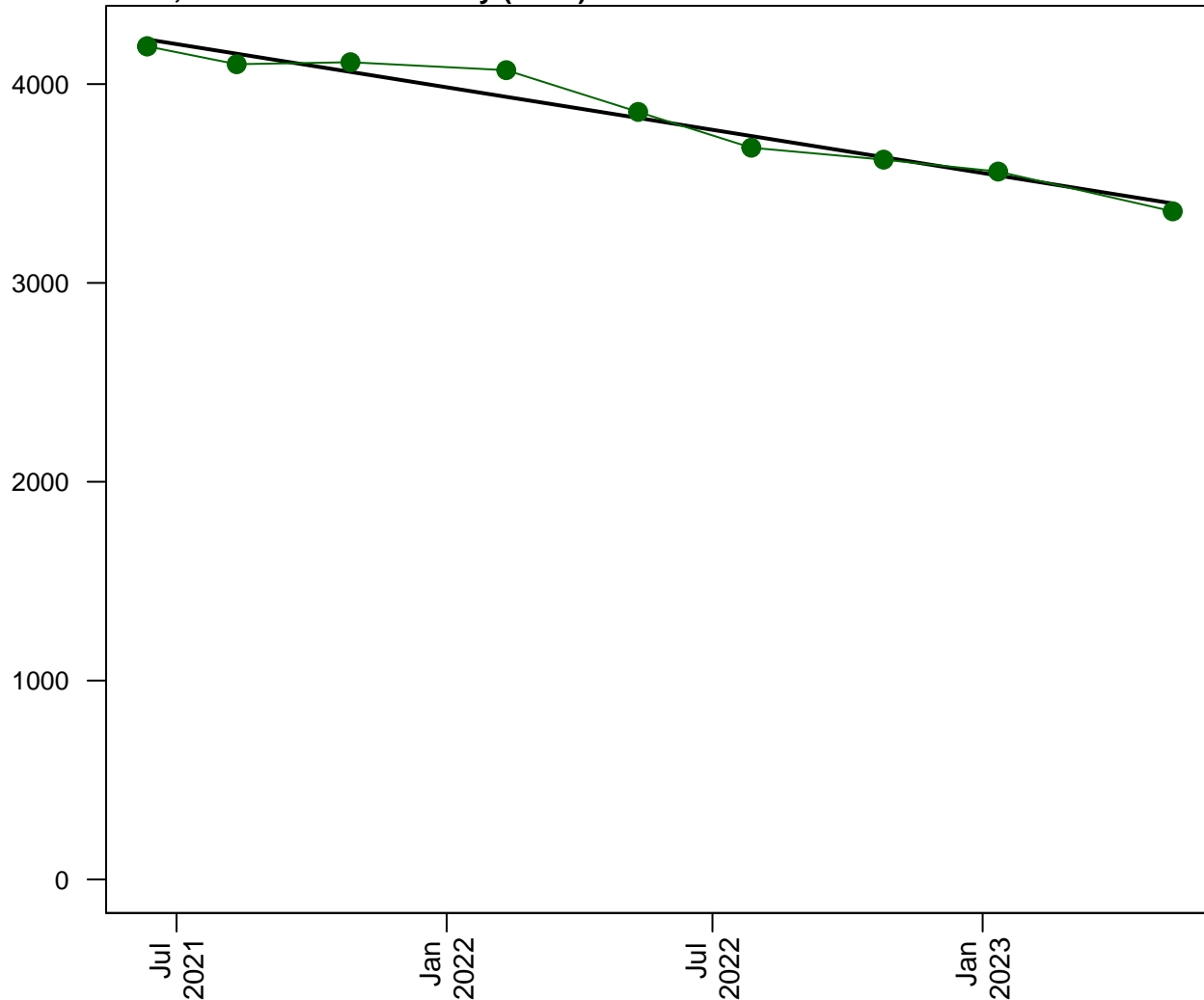
Shapes
● Detect
○ NonDetect
▼ Detect Limit



Scatterplots and Trend Analysis

D103, Electrical Conductivity (Field)

Concentration (uS/cm)



Stats

N Data: 10

N Detect: 10

% Detect: 100

95% Confidence

MK Trend: Significant

MK p-val: <0.001

Direction: Decreasing

Lines

Linear Fit

Shapes

Detect

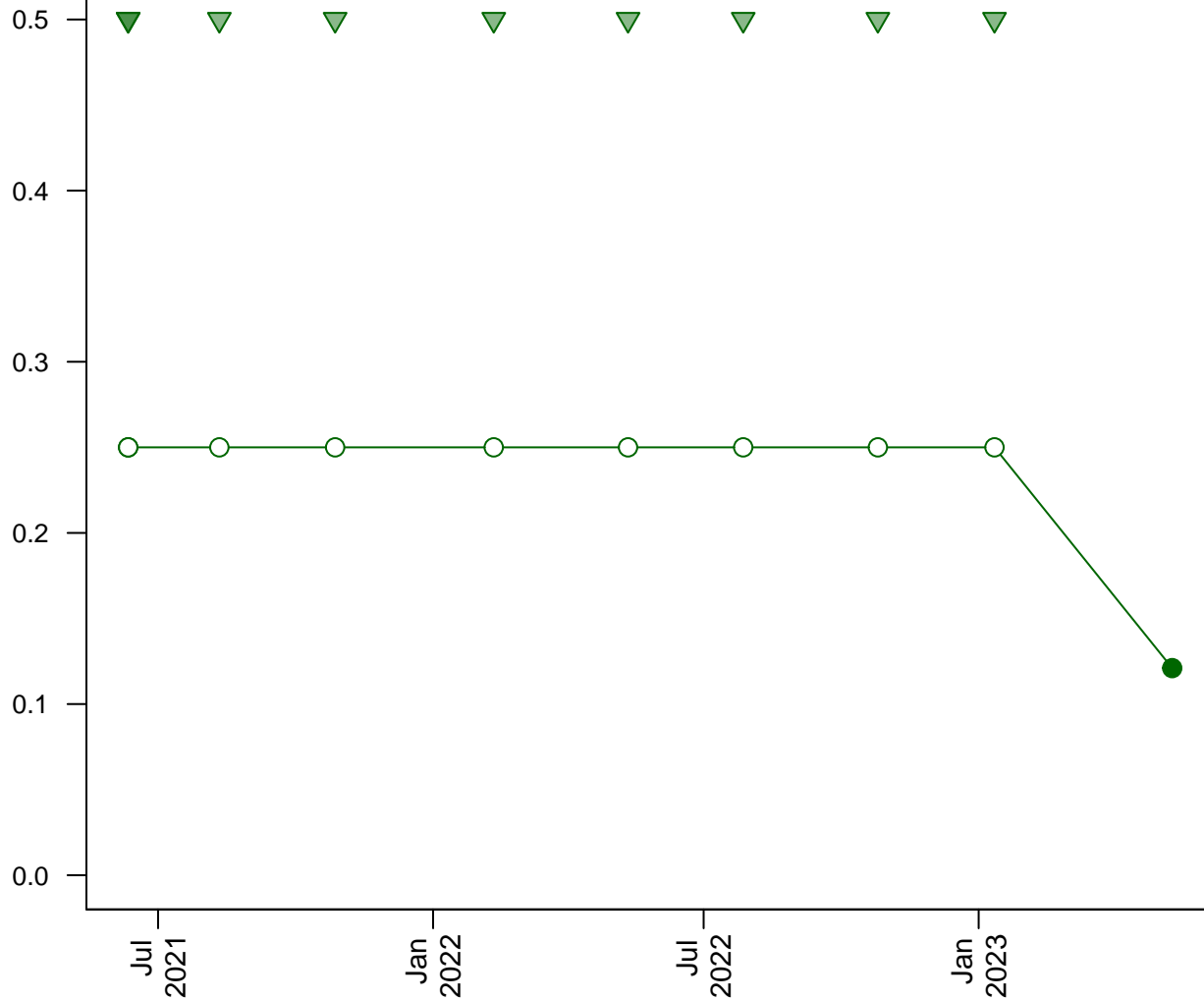
NonDetect

Detect Limit

Scatterplots and Trend Analysis

D103, Fluoride

Concentration (mg/L)



Stats

N Data: 10

N Detect: 1

% Detect: 10

MK criteria not met

Shapes



Detect



NonDetect



Detect Limit

Scatterplots and Trend Analysis

D103, Iron

Concentration (µg/L)

20000
15000
10000
5000
0

Jul
2021

Jan
2022

Jul
2022

Jan
2023

Stats

N Data: 19
N Detect: 19
% Detect: 100

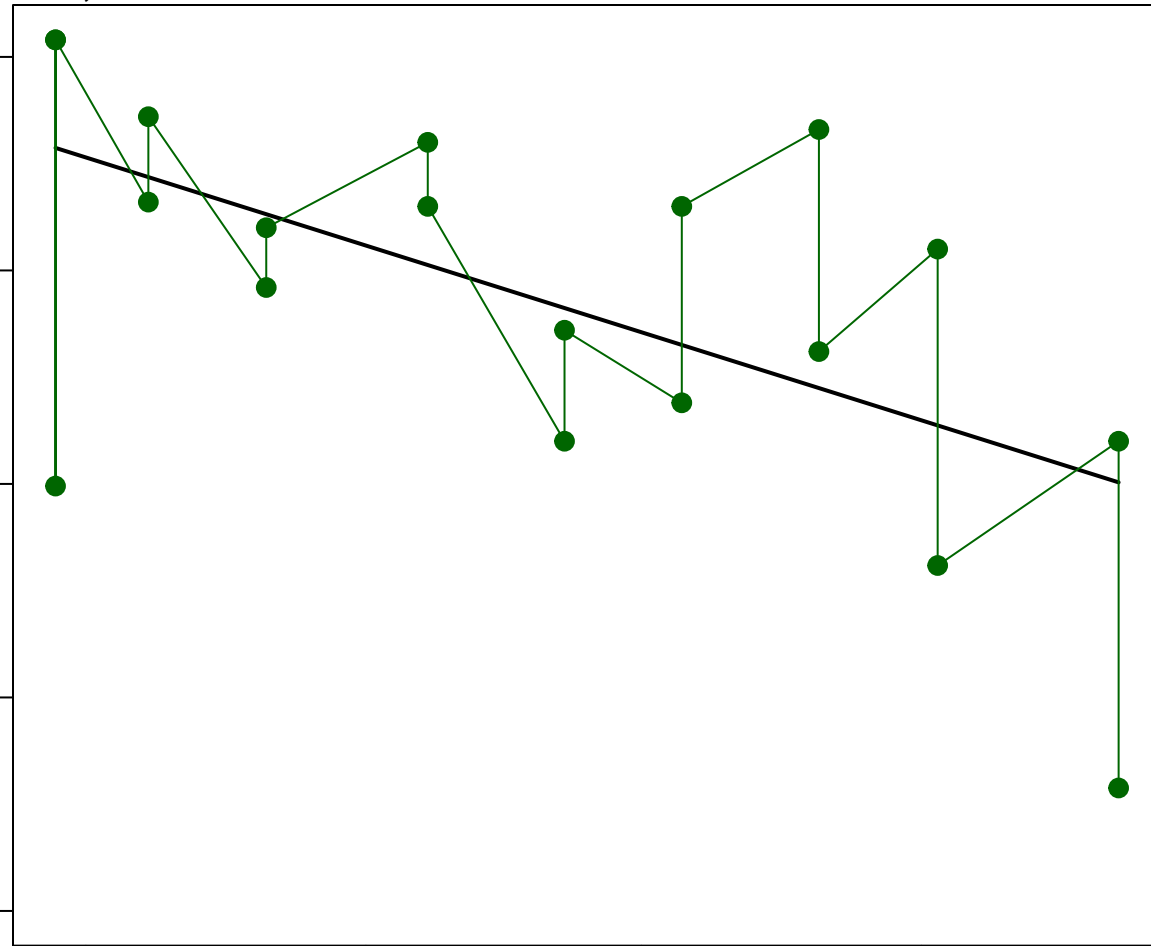
95% Confidence
MK Trend: Significant
MK p-val: 0.0073
Direction: Decreasing

Lines

Linear Fit

Shapes

● Detect
○ NonDetect
▼ Detect Limit



Scatterplots and Trend Analysis

D103, Lead

Concentration (µg/L)

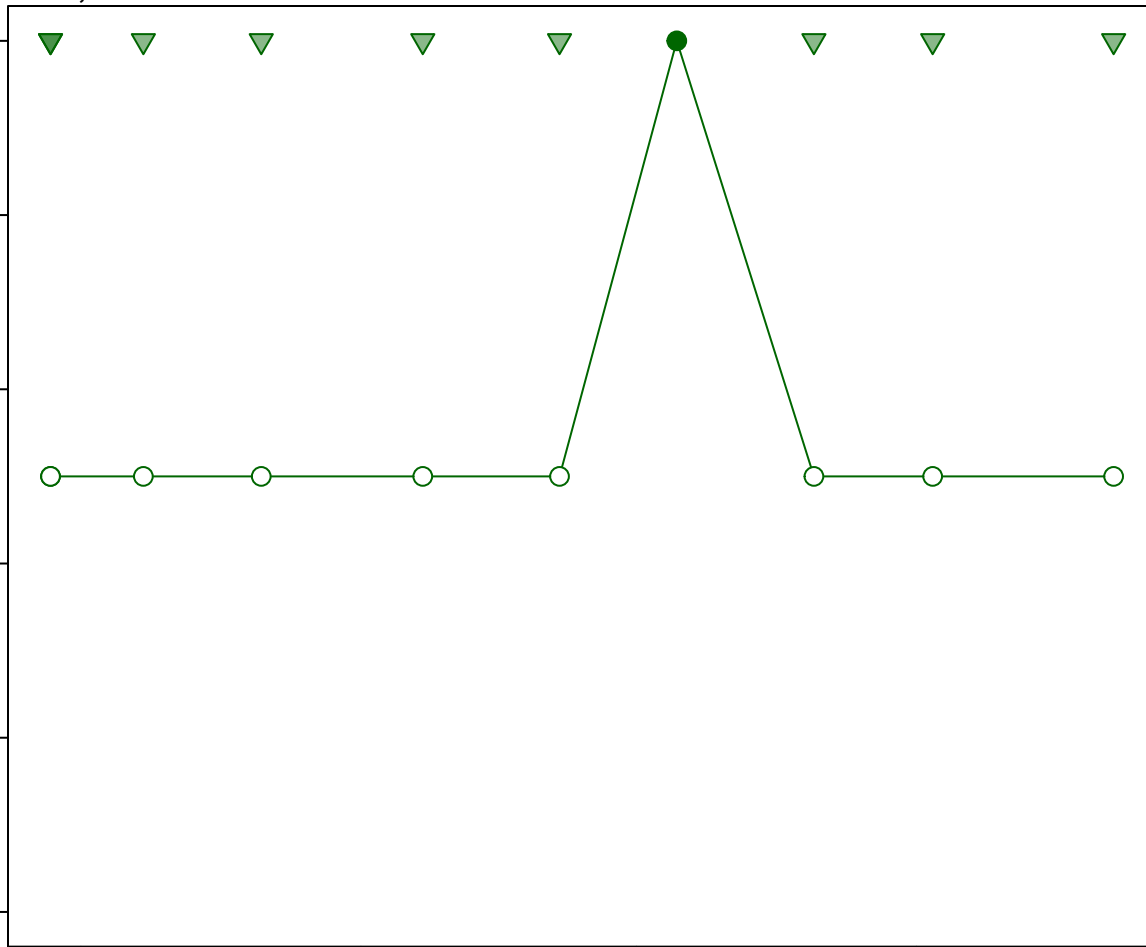
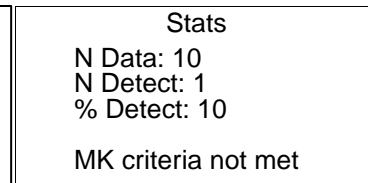
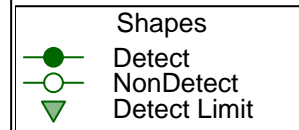
1.0
0.8
0.6
0.4
0.2
0.0

Jul
2021

Jan
2022

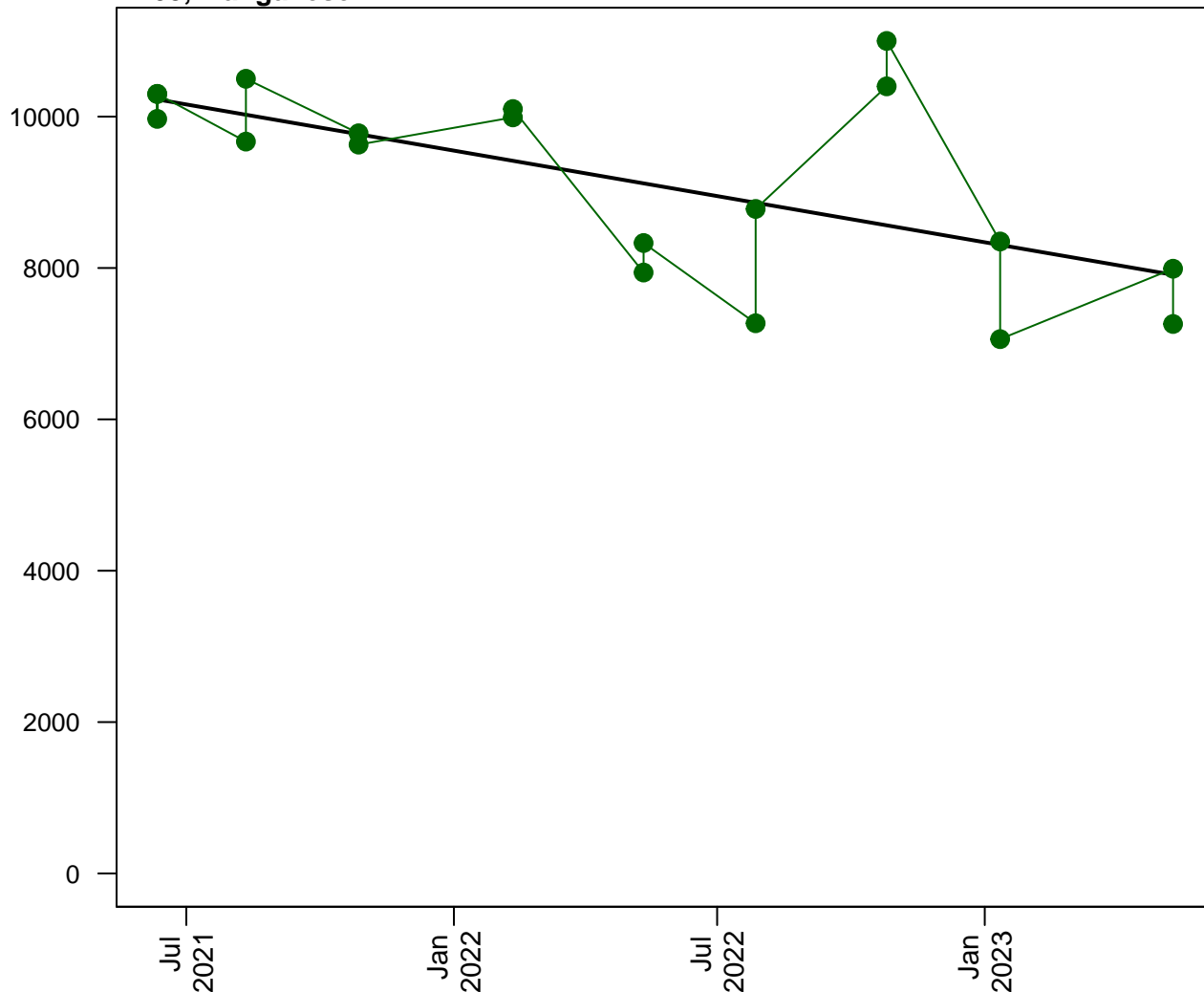
Jul
2022

Jan
2023



Scatterplots and Trend Analysis D103, Manganese

Concentration (µg/L)



Stats

N Data: 19
N Detect: 19
% Detect: 100

95% Confidence
MK Trend: Significant
MK p-val: 0.0165
Direction: Decreasing

Lines

Linear Fit

Shapes

● Detect
○ NonDetect
▼ Detect Limit

Scatterplots and Trend Analysis

D103, Mercury

Concentration ($\mu\text{g/L}$)

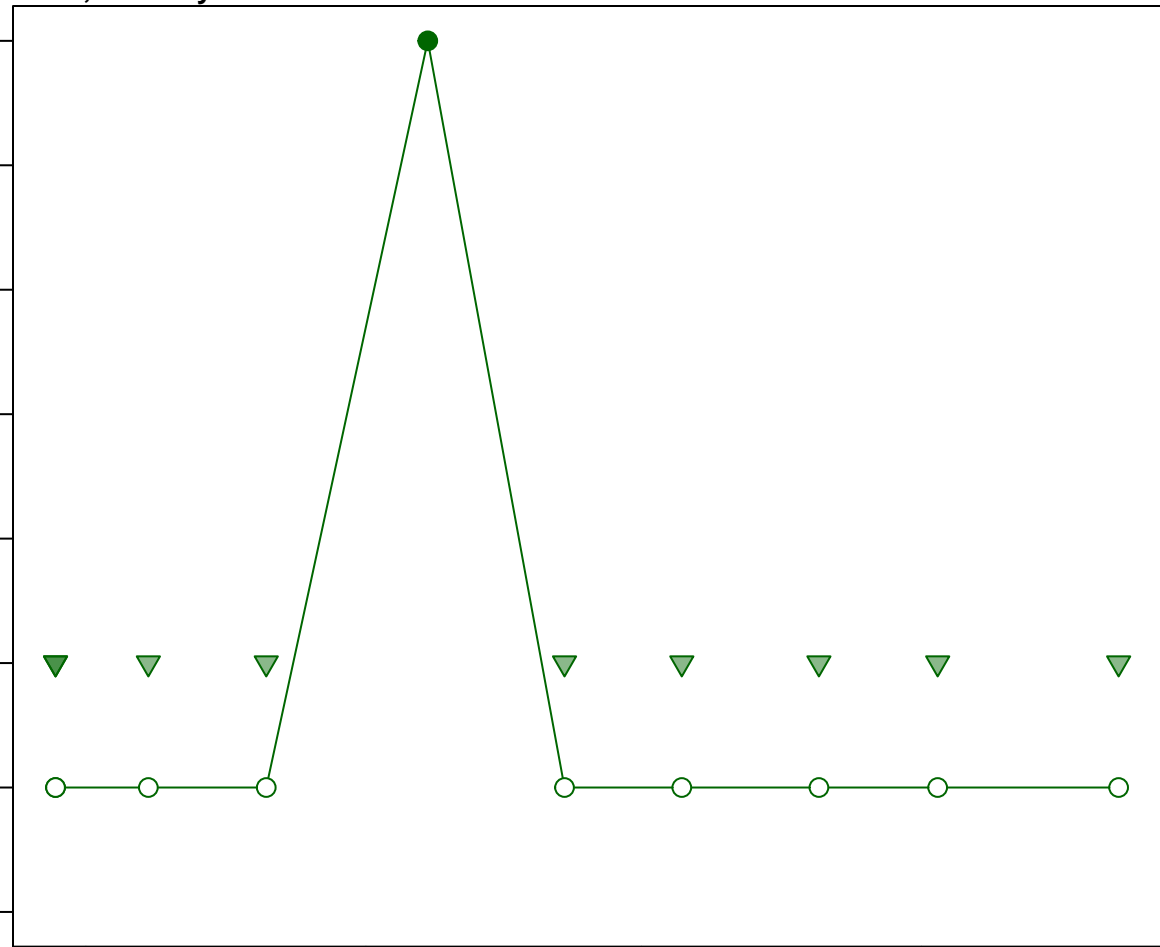
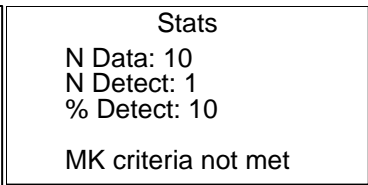
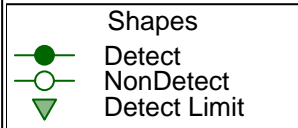
0.14
0.12
0.10
0.08
0.06
0.04
0.02
0.00

Jul
2021

Jan
2022

Jul
2022

Jan
2023



Scatterplots and Trend Analysis

D103, Molybdenum

Concentration (µg/L)

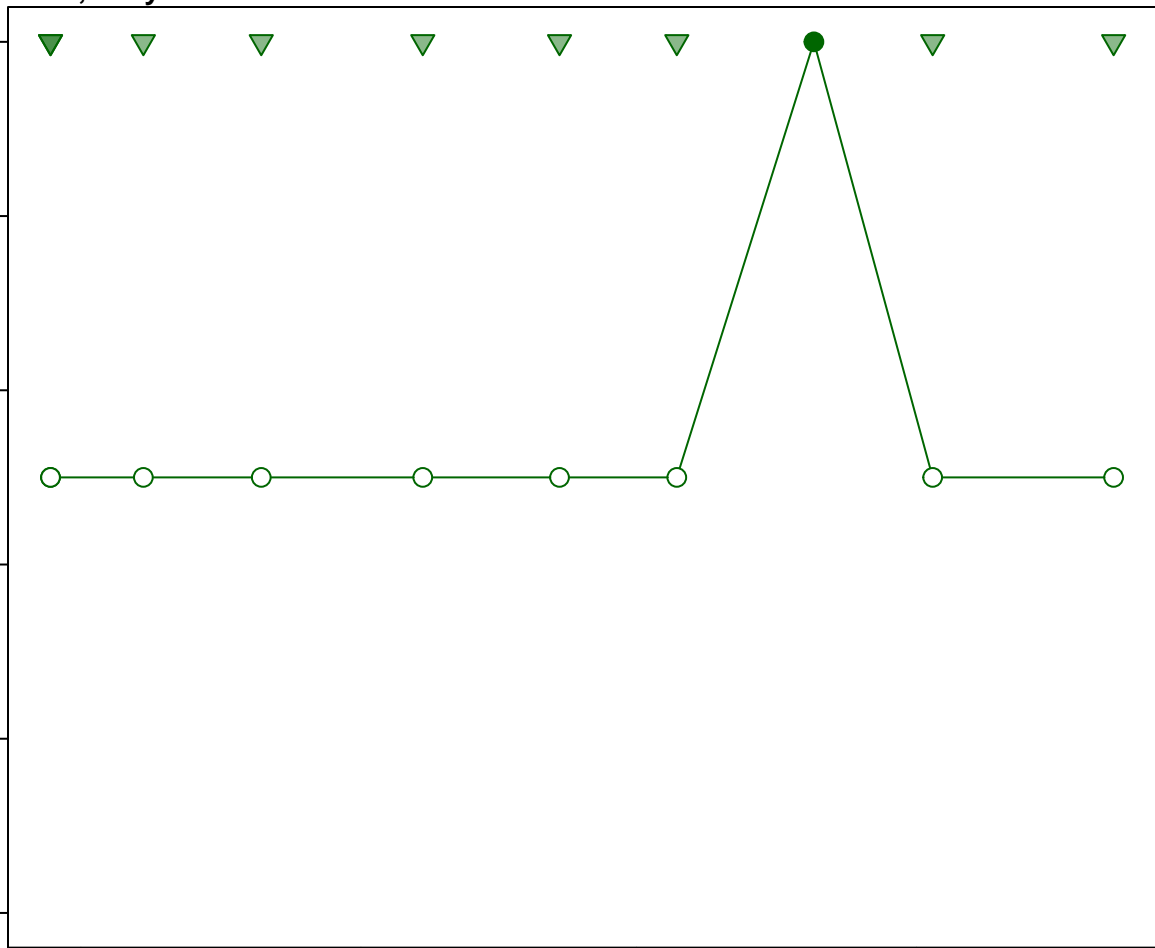
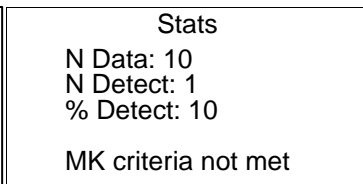
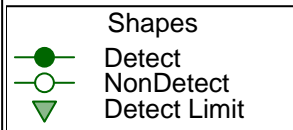
1.0
0.8
0.6
0.4
0.2
0.0

Jul
2021

Jan
2022

Jul
2022

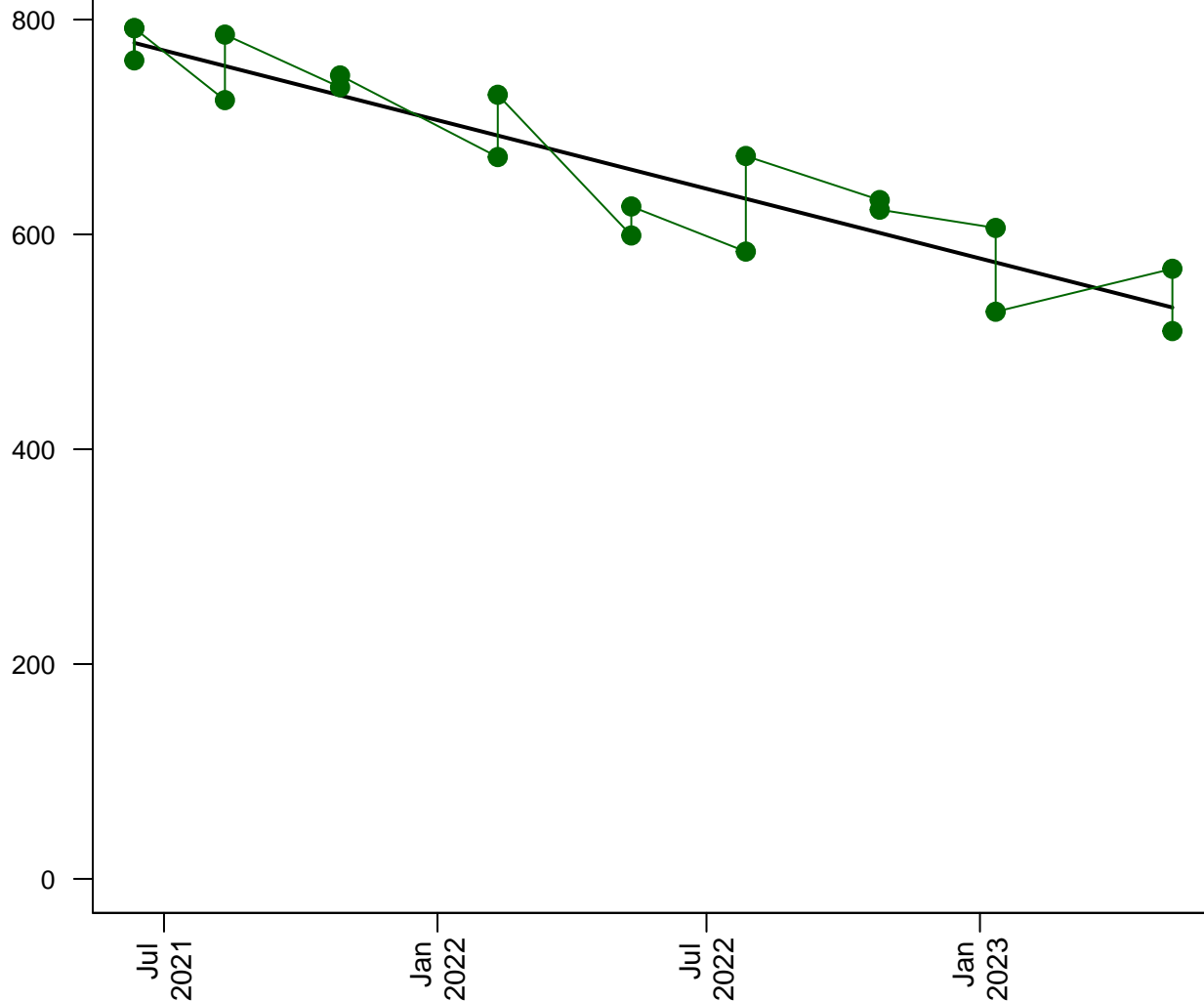
Jan
2023



Scatterplots and Trend Analysis

D103, Nickel

Concentration (µg/L)



Stats

N Data: 19
N Detect: 19
% Detect: 100

95% Confidence
MK Trend: Significant
MK p-val: <0.001
Direction: Decreasing

Lines

— Linear Fit

Shapes

● Detect
○ NonDetect
▼ Detect Limit

Scatterplots and Trend Analysis

D103, Selenium

Concentration (µg/L)

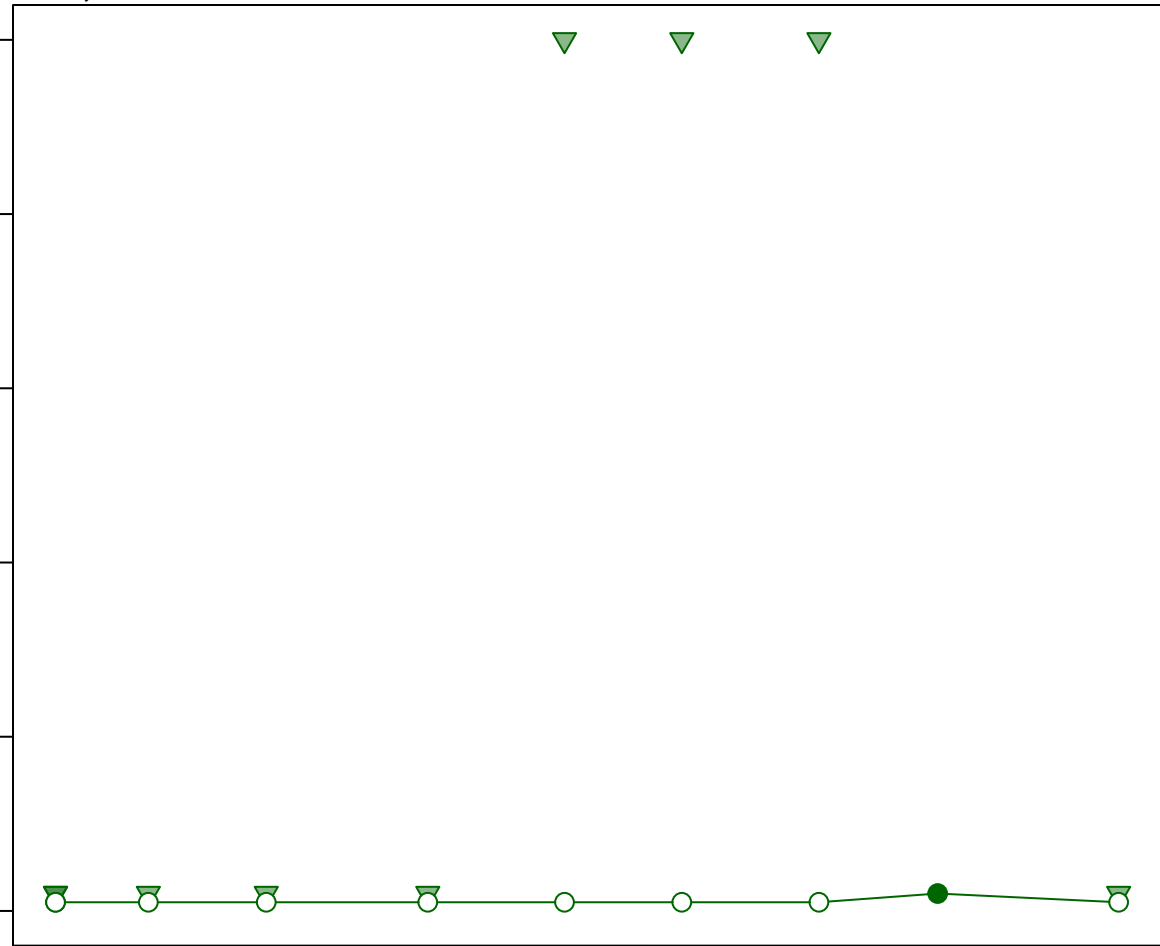
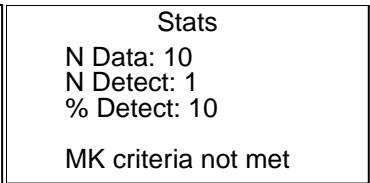
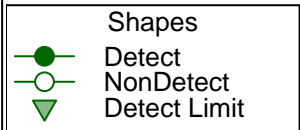
10
8
6
4
2
0

Jul
2021

Jan
2022

Jul
2022

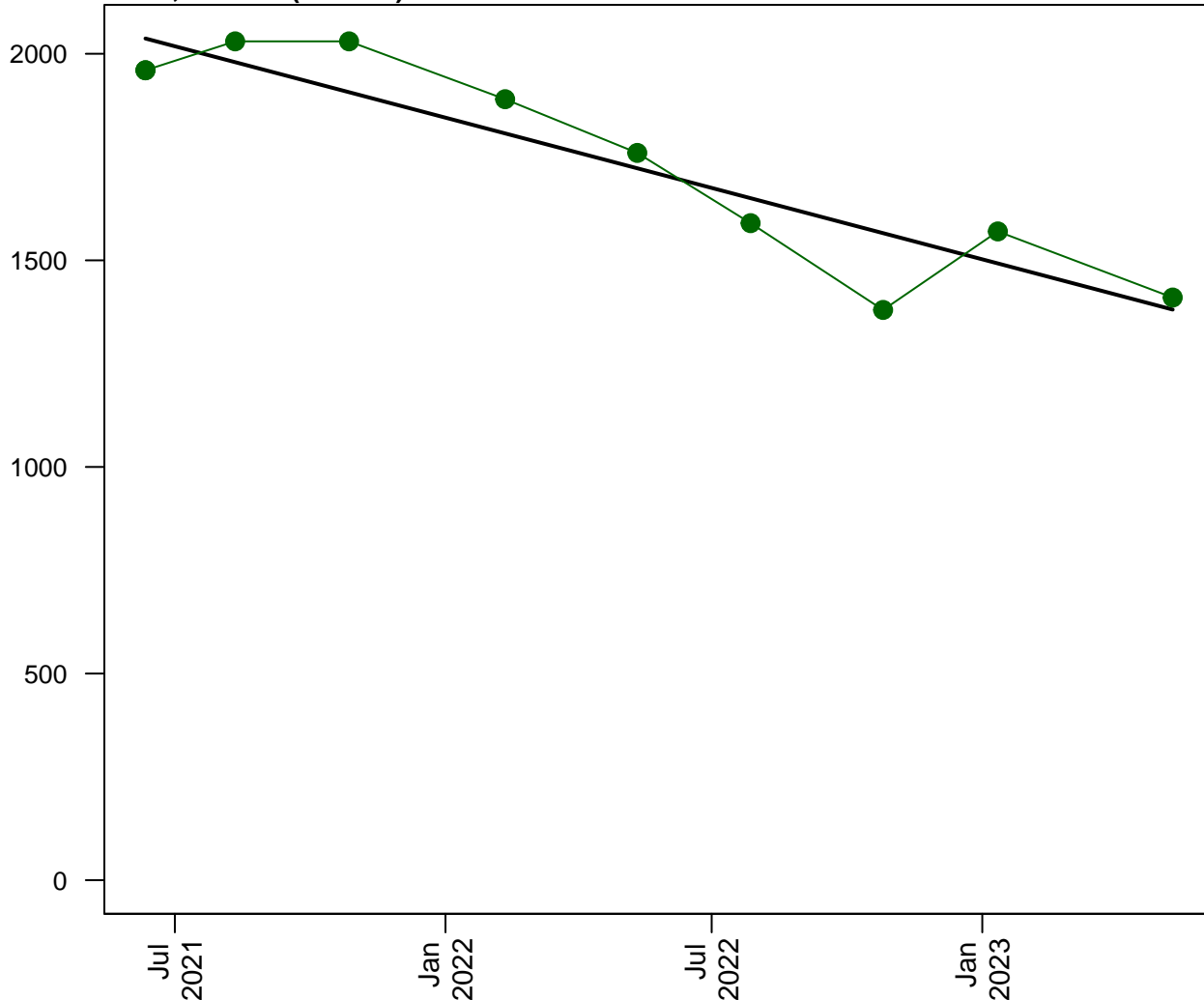
Jan
2023



Scatterplots and Trend Analysis

D103, Sulfate (as SO4)

Concentration (mg/L)



Stats

N Data: 10
N Detect: 10
% Detect: 100

95% Confidence
MK Trend: Significant
MK p-val: 0.00501
Direction: Decreasing

Lines

— Linear Fit

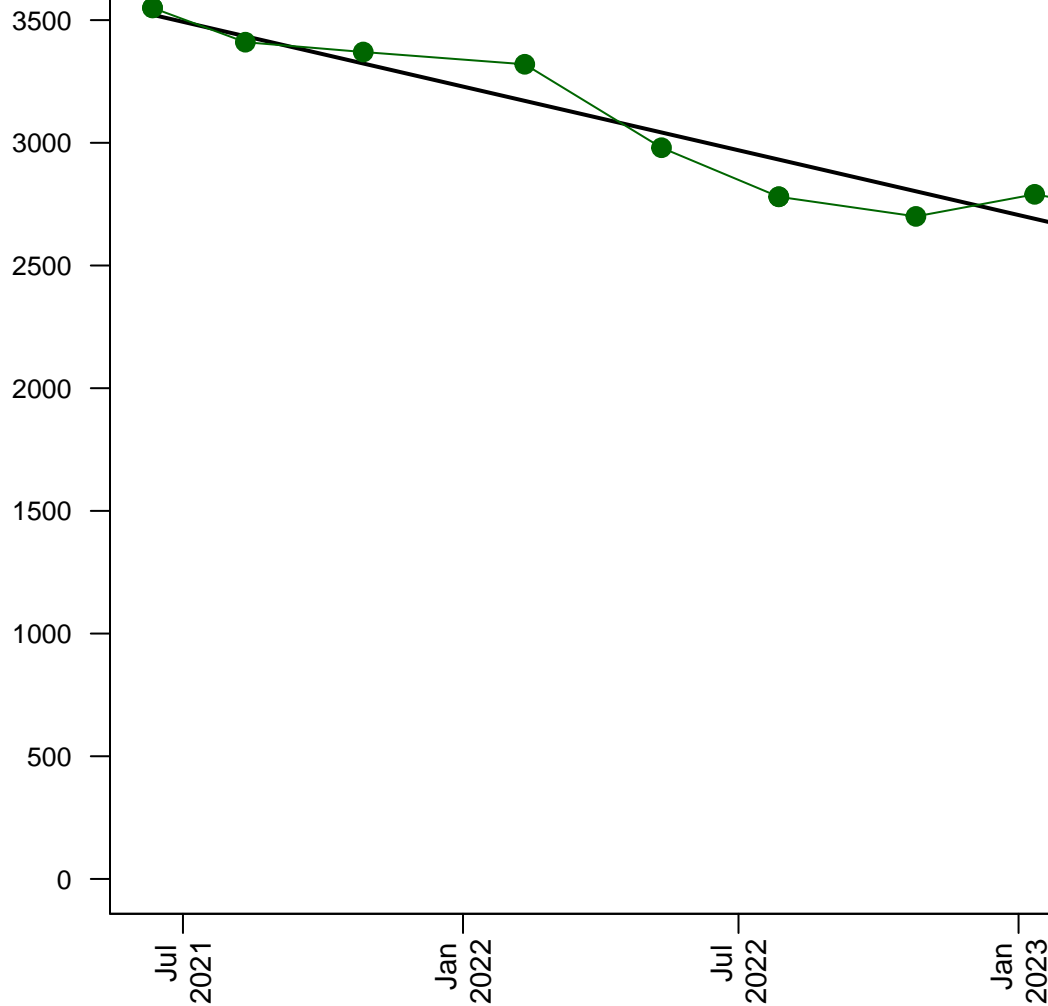
Shapes

● Detect
○ NonDetect
▼ Detect Limit

Scatterplots and Trend Analysis

D103, Total Dissolved Solids (TDS)

Concentration (mg/L)



Stats

N Data: 11

N Detect: 11

% Detect: 100

95% Confidence

MK Trend: Significant

MK p-val: <0.001

Direction: Decreasing

Lines

Linear Fit

Shapes

Detect

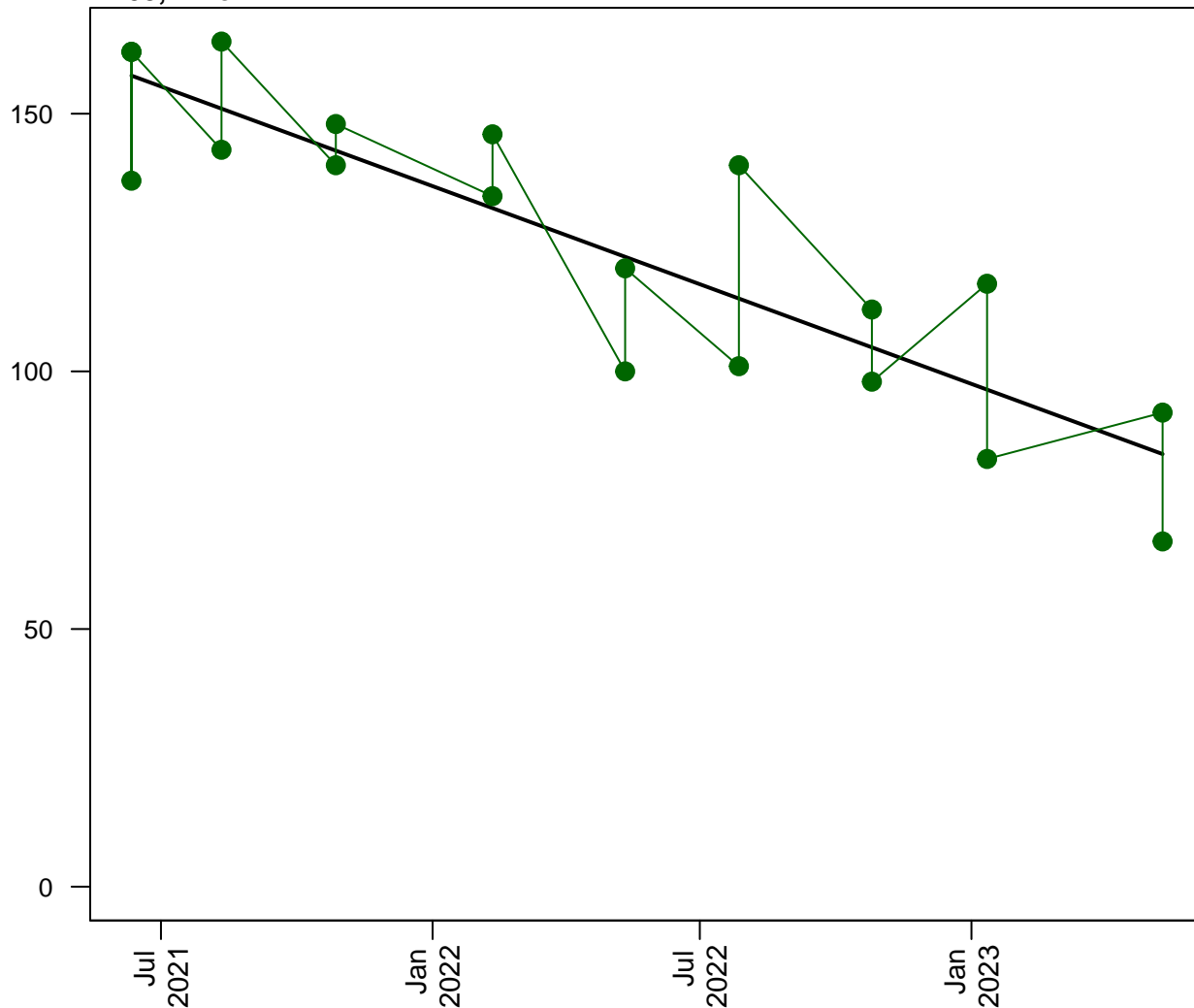
NonDetect

Detect Limit

Scatterplots and Trend Analysis

D103, Zinc

Concentration (µg/L)



Stats

N Data: 19
N Detect: 19
% Detect: 100

95% Confidence
MK Trend: Significant
MK p-val: <0.001
Direction: Decreasing

Lines

Linear Fit

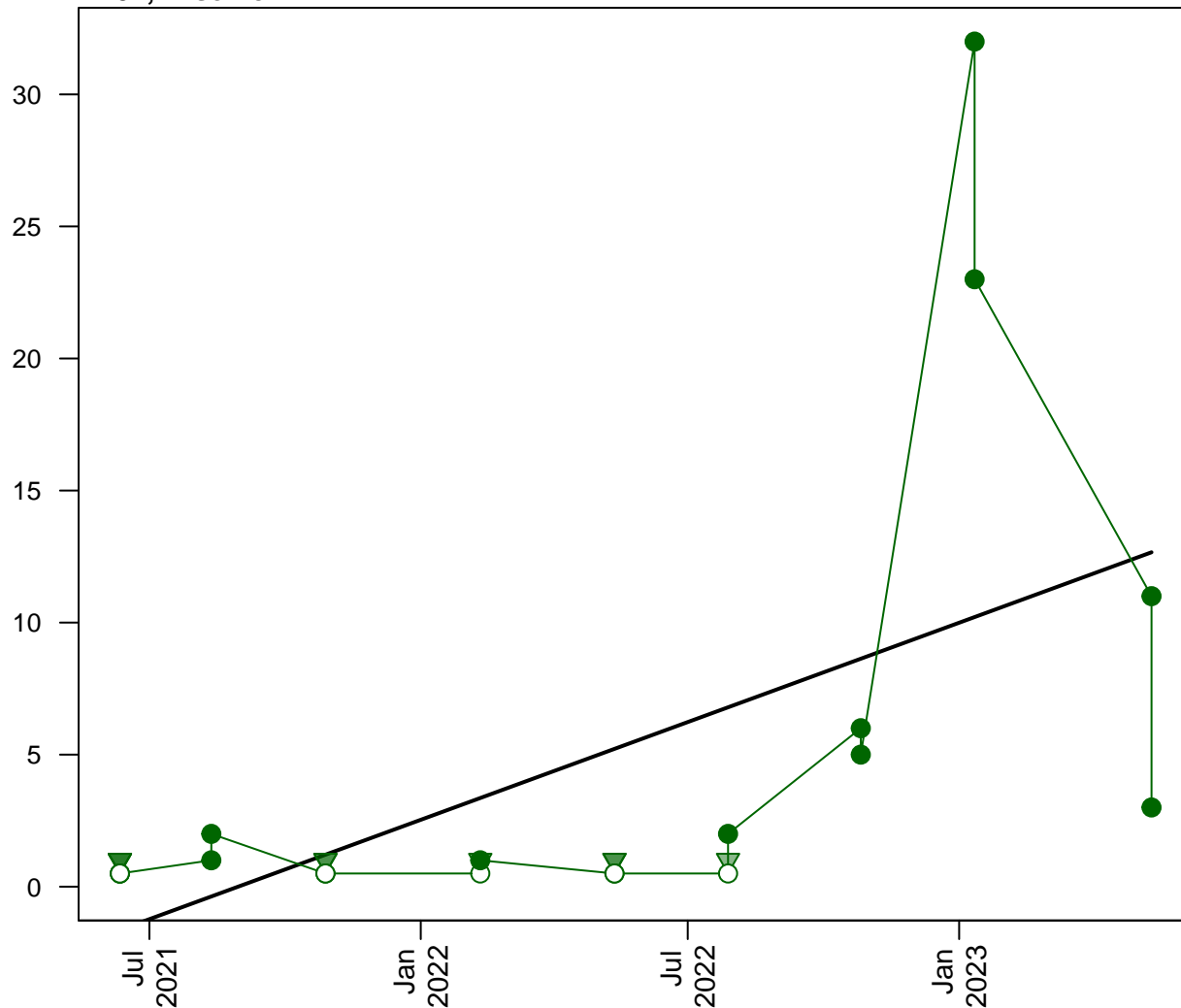
Shapes

● Detect
○ NonDetect
▼ Detect Limit

Scatterplots and Trend Analysis

D104, Arsenic

Concentration (µg/L)



Stats

N Data: 19
N Detect: 10
% Detect: 53

95% Confidence
MK Trend: Significant
MK p-val: 0.00189
Direction: Increasing

Lines

Linear Fit

Shapes

● Detect
○ NonDetect
▼ Detect Limit

Scatterplots and Trend Analysis

D104, Boron

Concentration (µg/L)

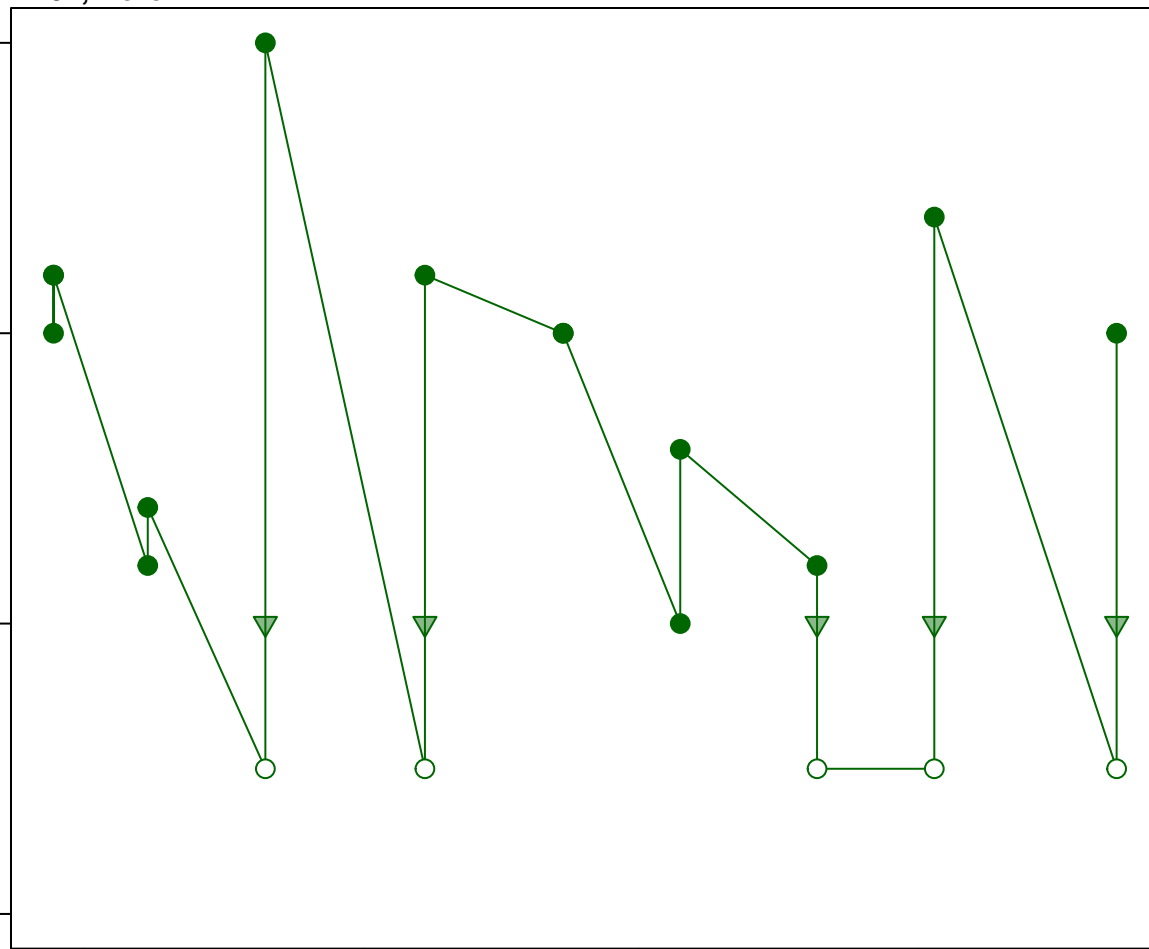
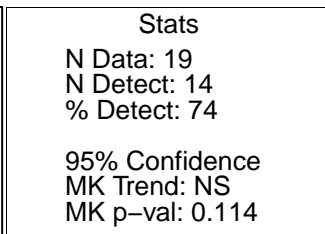
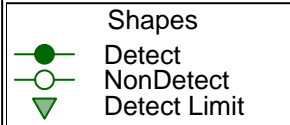
150
100
50
0

Jul
2021

Jan
2022

Jul
2022

Jan
2023



Scatterplots and Trend Analysis

D104, Cadmium

Concentration (µg/L)

0.10
0.08
0.06
0.04
0.02
0.00

Jul
2021

Jan
2022

Jul
2022

Jan
2023

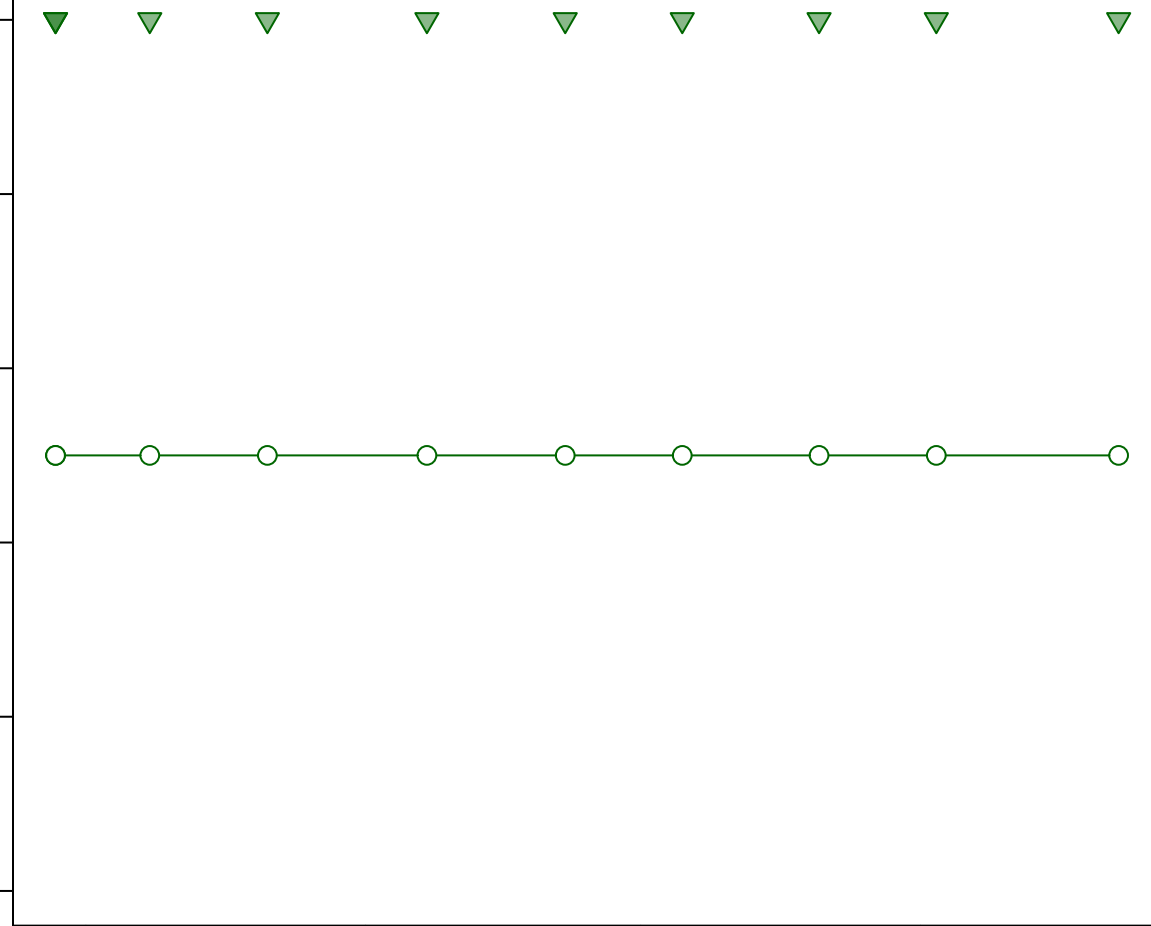
Stats

N Data: 10
N Detect: 0
% Detect: 0

MK criteria not met

Shapes

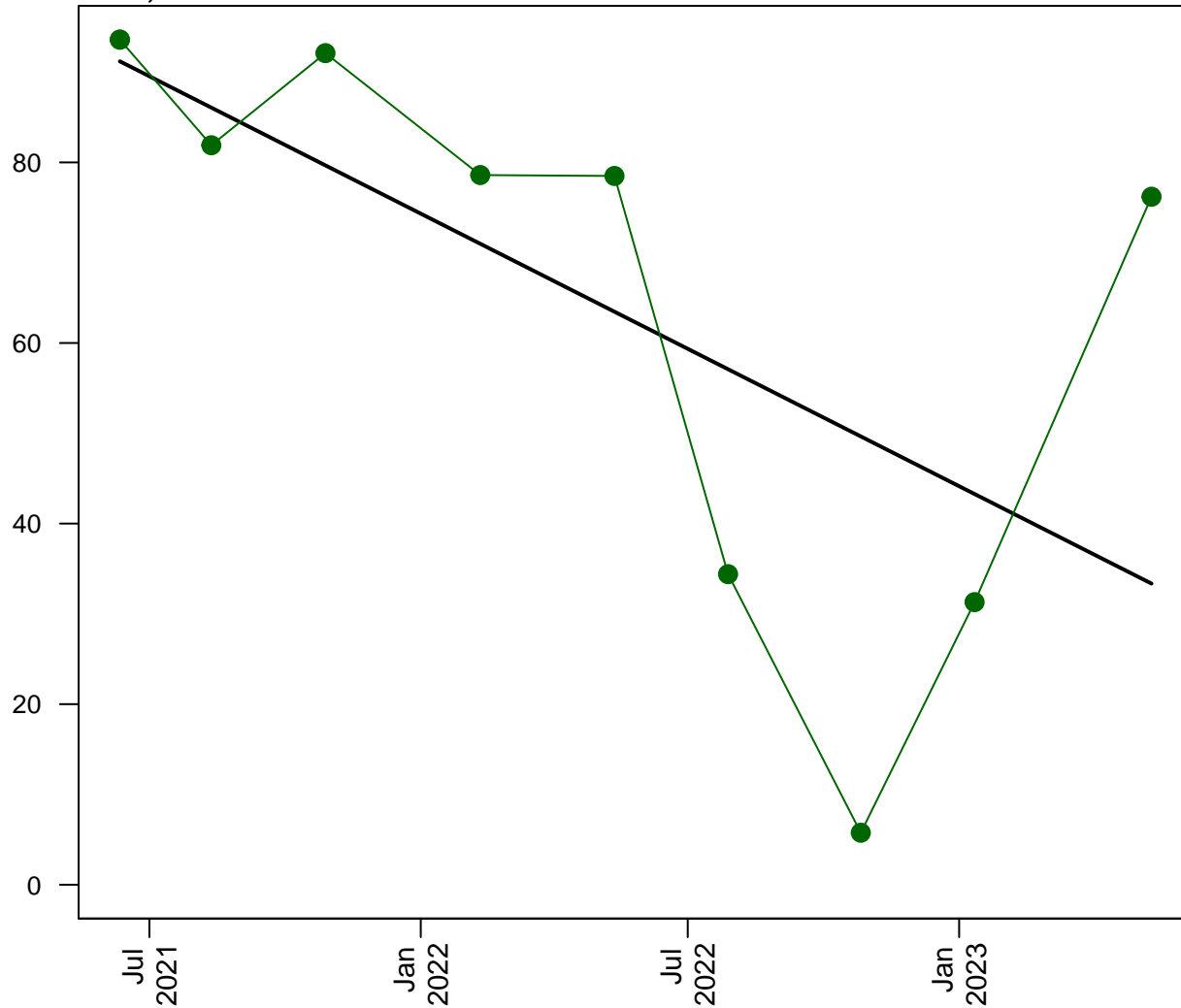
● Detect
○ NonDetect
▼ Detect Limit



Scatterplots and Trend Analysis

D104, Chloride

Concentration (mg/L)



Stats

N Data: 10
N Detect: 10
% Detect: 100

95% Confidence
MK Trend: Significant
MK p-val: 0.00217
Direction: Decreasing

Lines

— Linear Fit

Shapes

● Detect
○ NonDetect
▼ Detect Limit

Scatterplots and Trend Analysis

D104, Chromium

Concentration (µg/L)

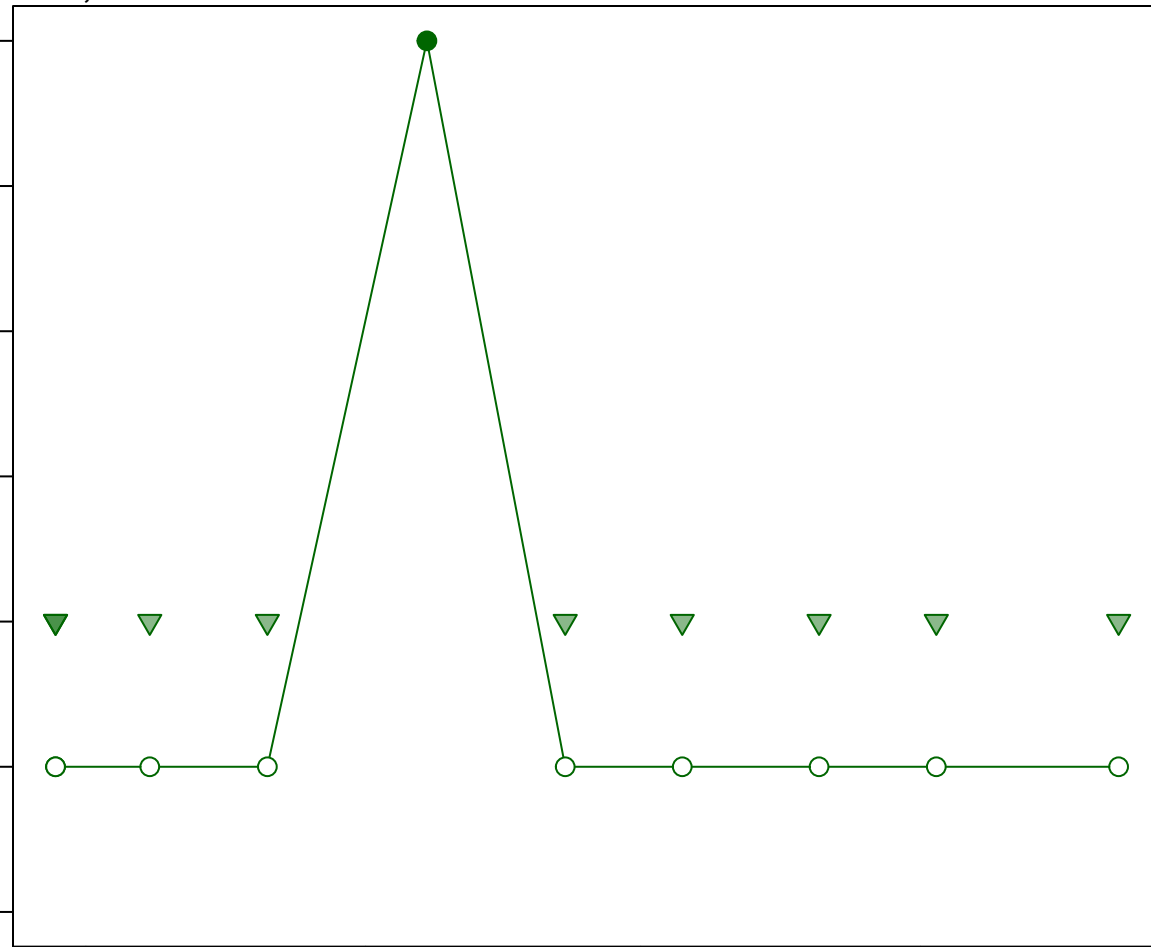
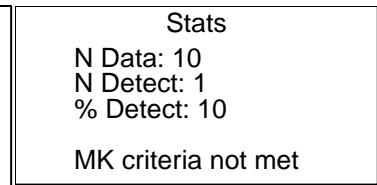
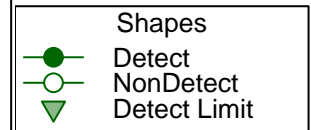
3.0
2.5
2.0
1.5
1.0
0.5
0.0

Jul
2021

Jan
2022

Jul
2022

Jan
2023



Scatterplots and Trend Analysis

D104, Electrical Conductivity (Field)

Concentration (uS/cm)

1400
1200
1000
800
600
400
200
0

Jul
2021

Jan
2022

Jul
2022

Jan
2023

Stats

N Data: 10
N Detect: 10
% Detect: 100

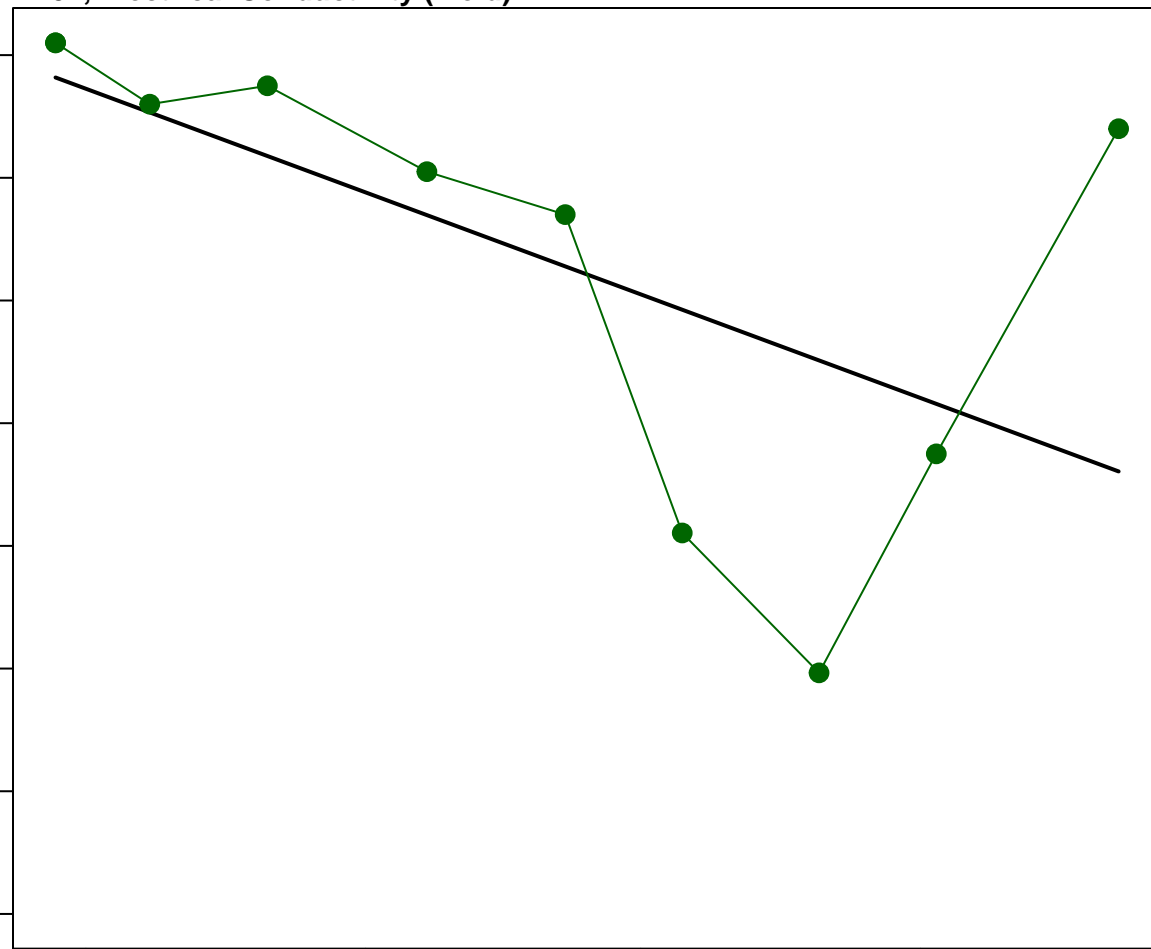
95% Confidence
MK Trend: Significant
MK p-val: 0.0116
Direction: Decreasing

Lines

Linear Fit

Shapes

● Detect
○ NonDetect
▼ Detect Limit



Scatterplots and Trend Analysis

D104, Fluoride

Concentration (mg/L)

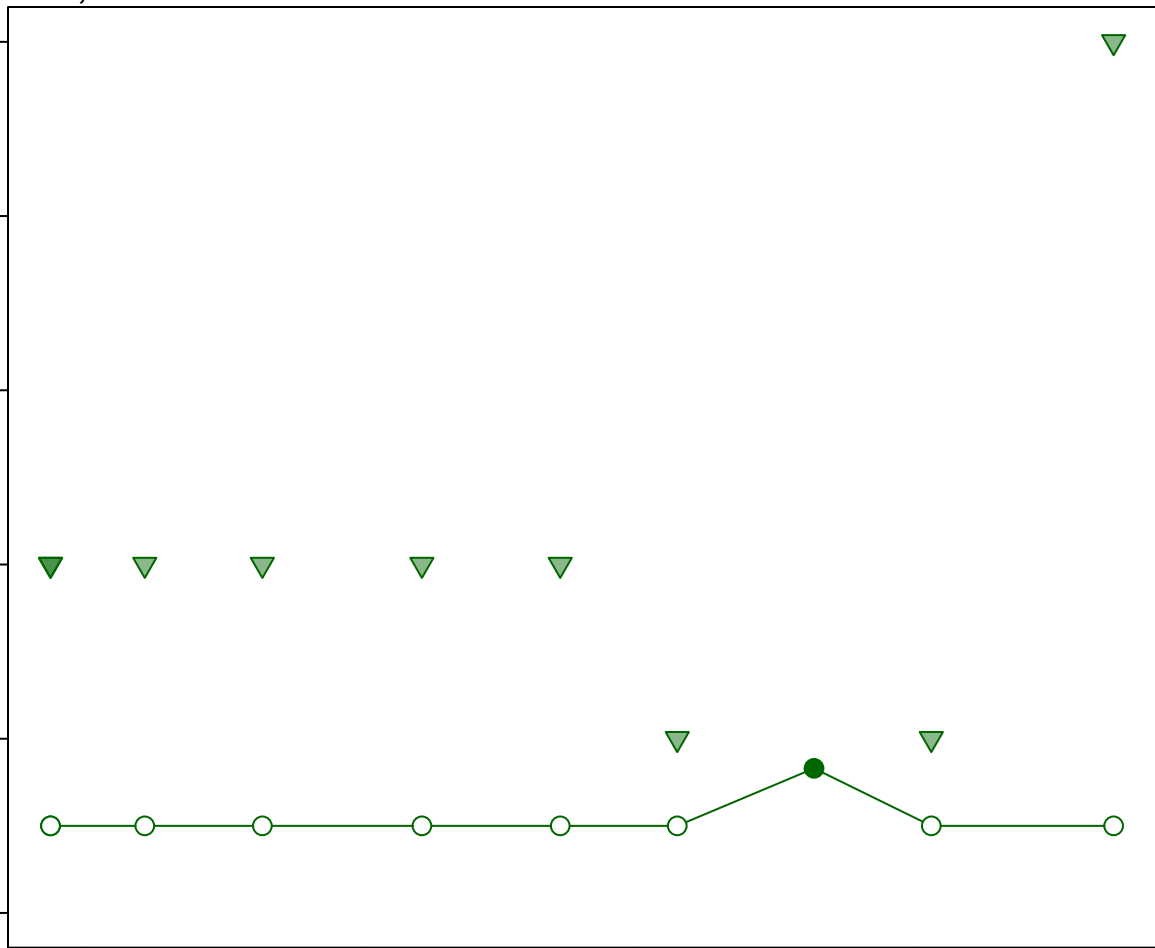
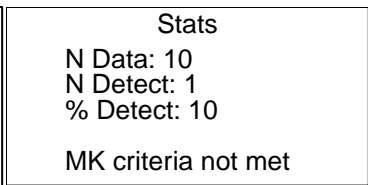
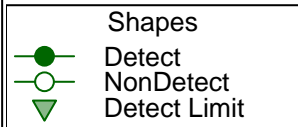
0.5
0.4
0.3
0.2
0.1
0.0

Jul
2021

Jan
2022

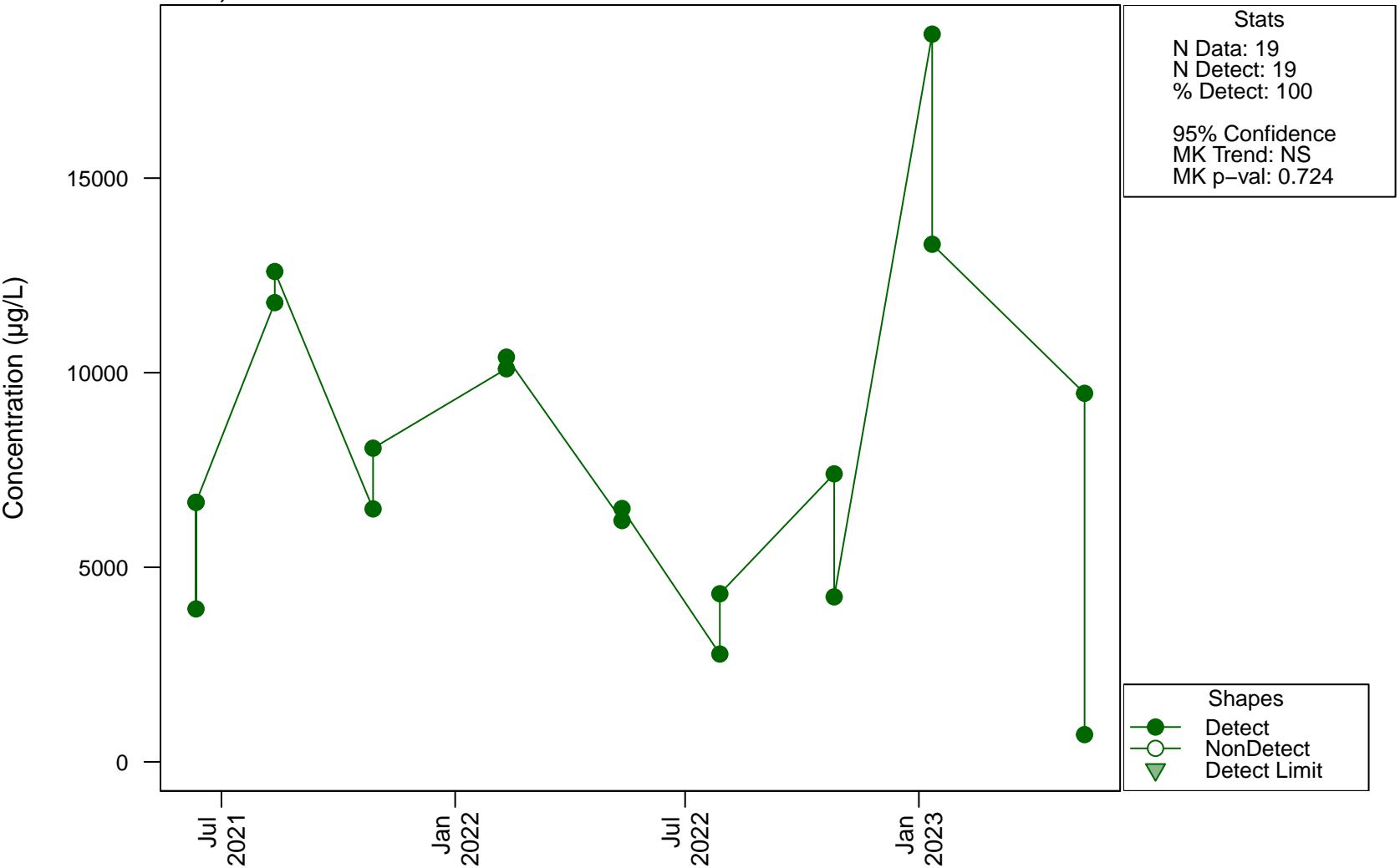
Jul
2022

Jan
2023



Scatterplots and Trend Analysis

D104, Iron



Scatterplots and Trend Analysis

D104, Lead

Concentration (µg/L)

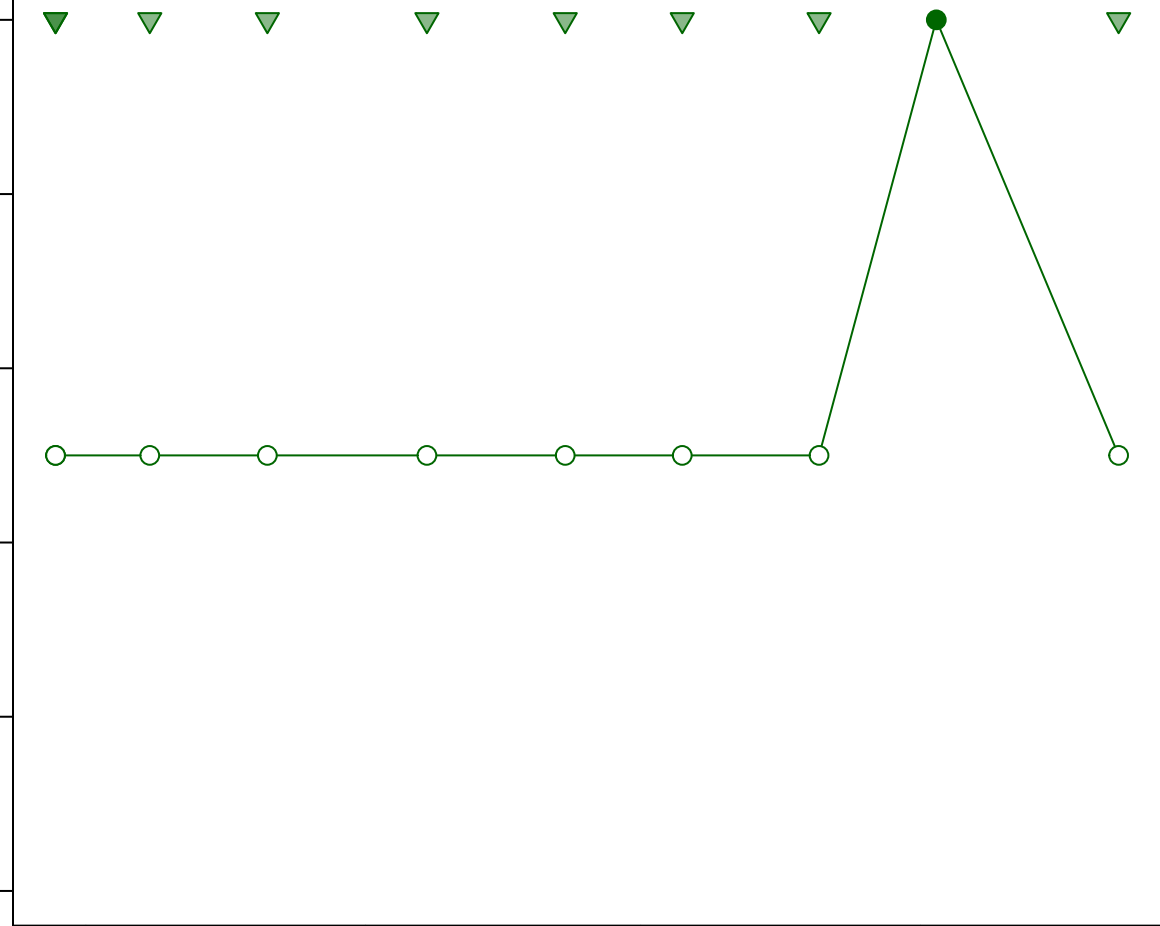
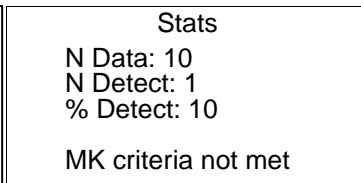
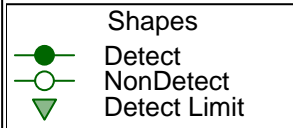
1.0
0.8
0.6
0.4
0.2
0.0

Jul
2021

Jan
2022

Jul
2022

Jan
2023



Scatterplots and Trend Analysis

D104, Manganese

Concentration (µg/L)

5000
4000
3000
2000
1000
0

Jul
2021

Jan
2022

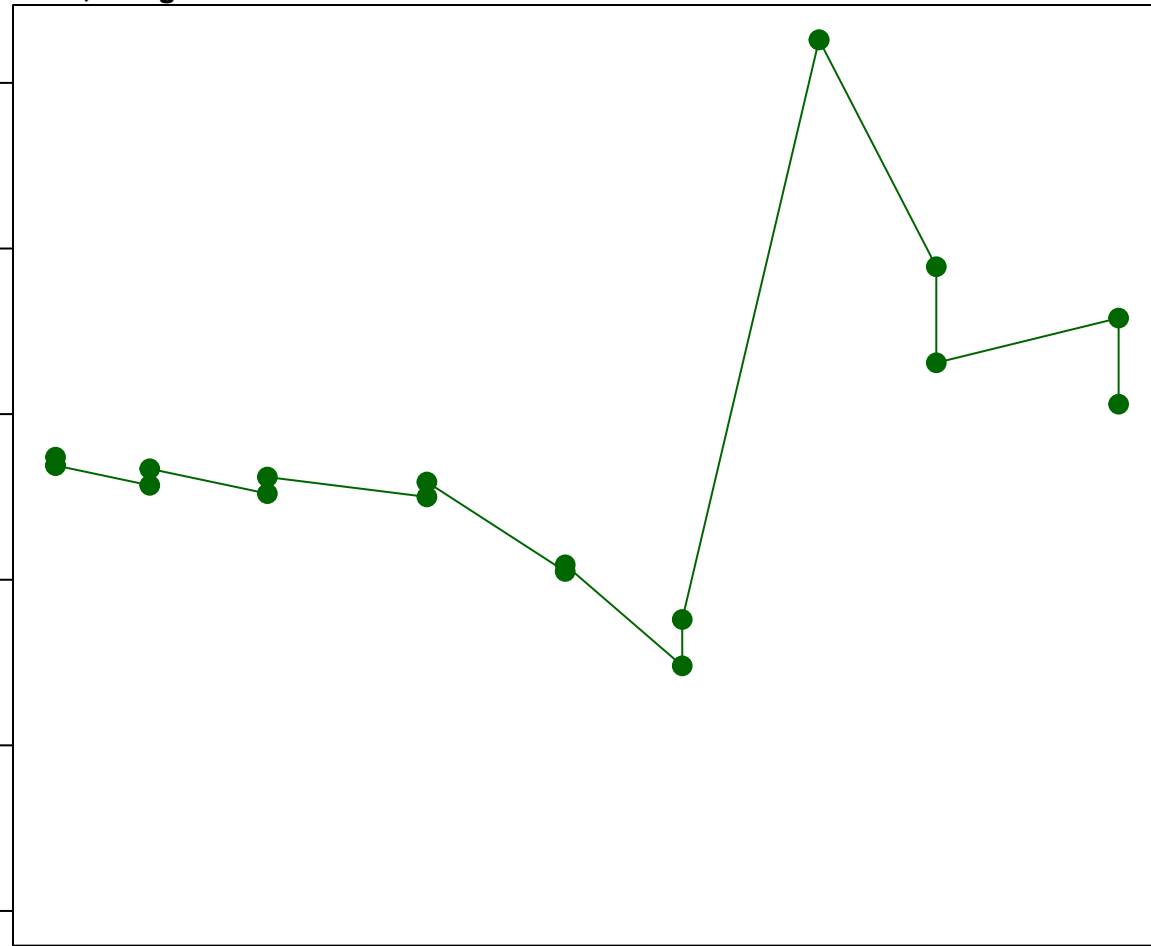
Jul
2022

Jan
2023

Stats
N Data: 19
N Detect: 19
% Detect: 100

95% Confidence
MK Trend: NS
MK p-val: 0.888

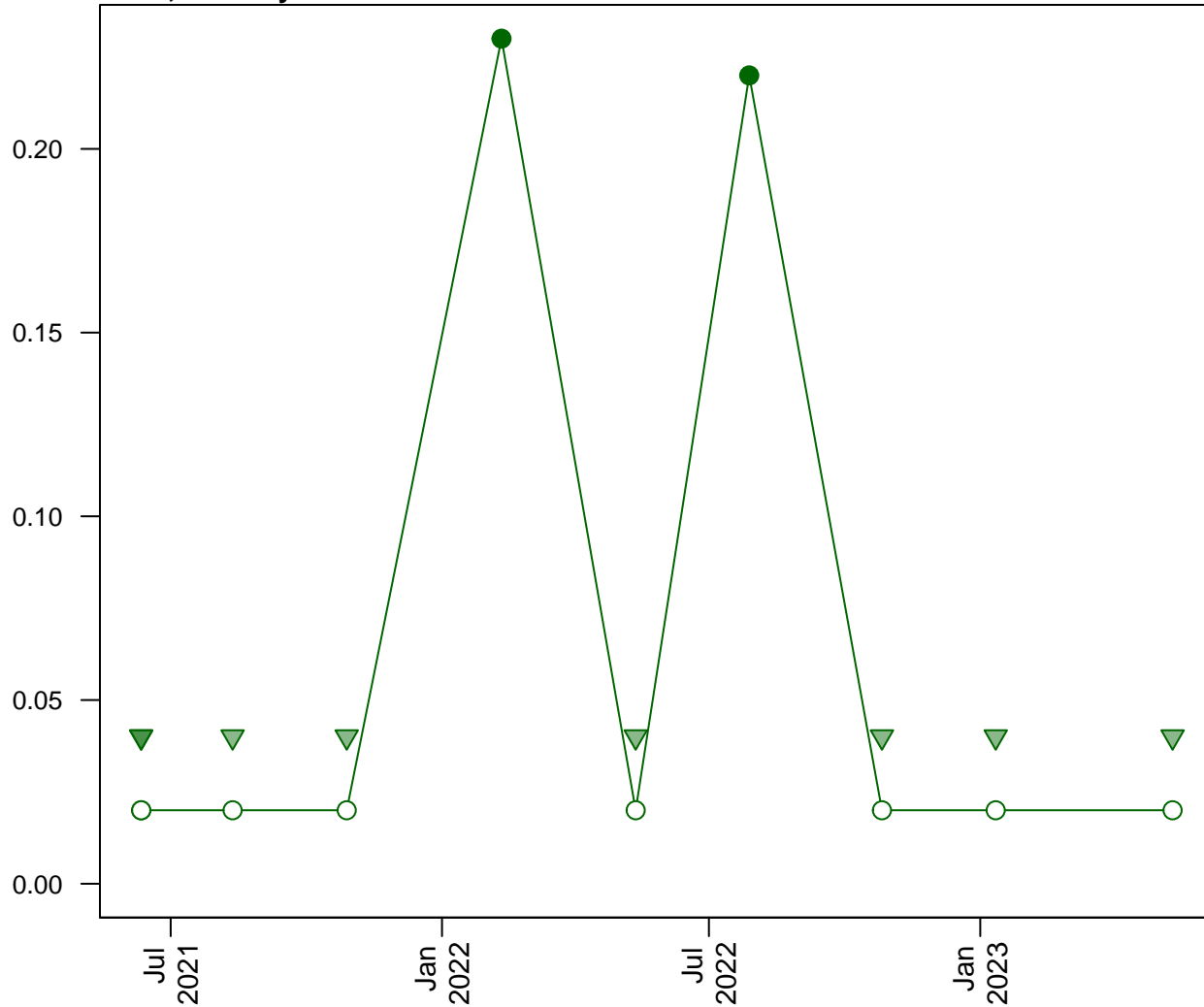
Shapes
● Detect
○ NonDetect
▼ Detect Limit



Scatterplots and Trend Analysis

D104, Mercury

Concentration ($\mu\text{g/L}$)



Stats

N Data: 10
N Detect: 2
% Detect: 20

MK criteria not met

Shapes

● Detect
○ NonDetect
▼ Detect Limit

Scatterplots and Trend Analysis

D104, Molybdenum

Concentration (µg/L)

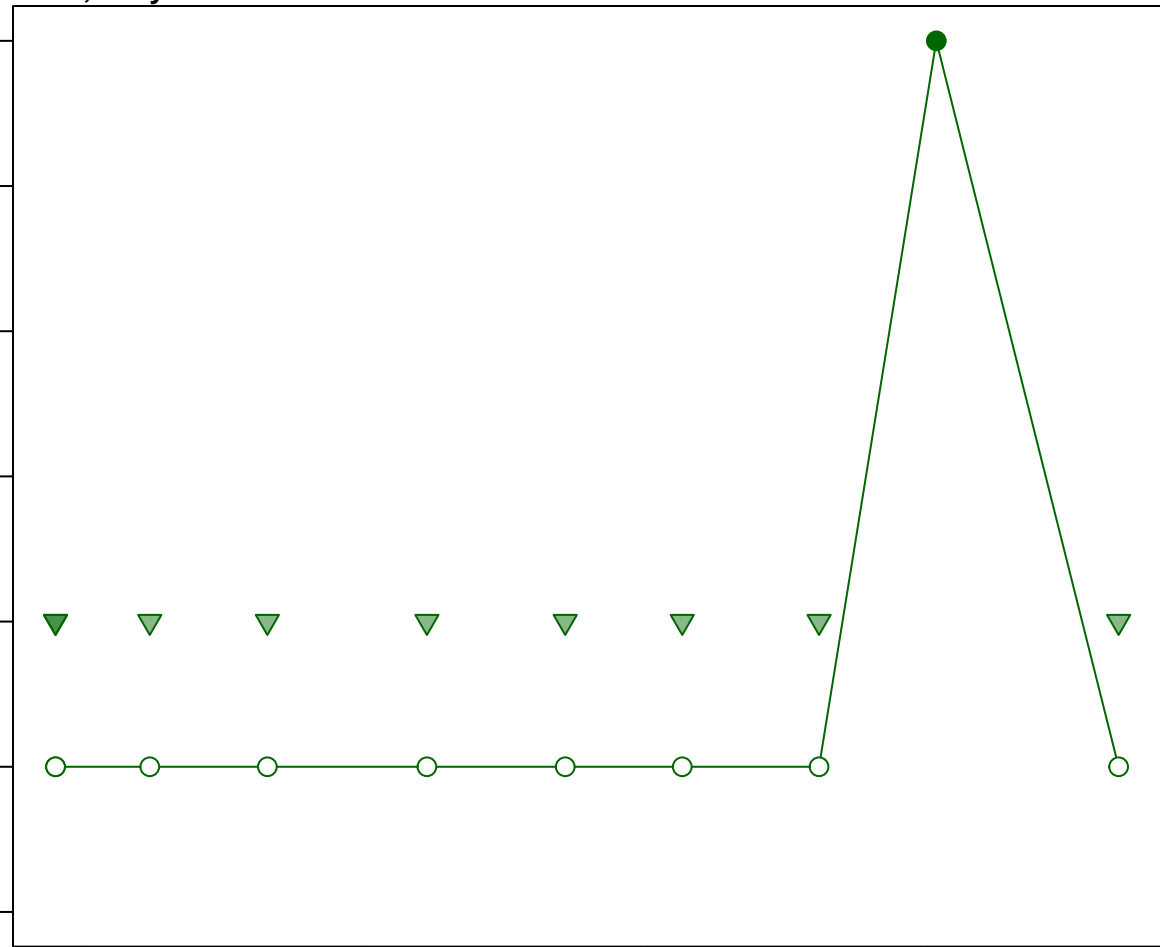
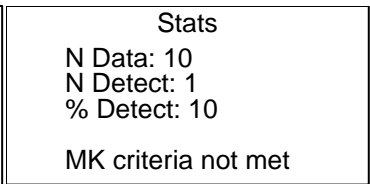
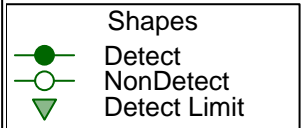
3.0
2.5
2.0
1.5
1.0
0.5
0.0

Jul
2021

Jan
2022

Jul
2022

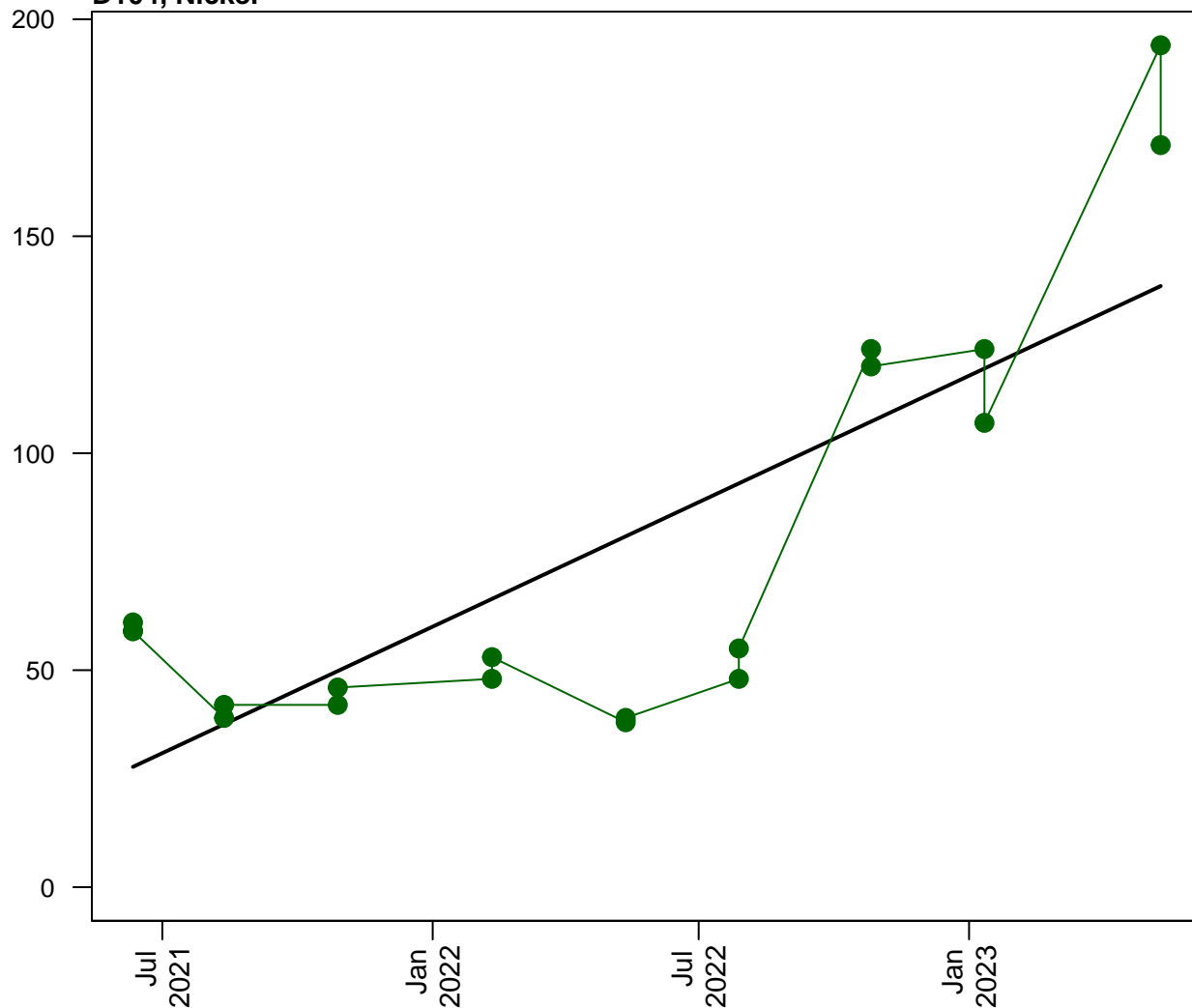
Jan
2023



Scatterplots and Trend Analysis

D104, Nickel

Concentration (µg/L)



Stats

N Data: 19
N Detect: 19
% Detect: 100

95% Confidence
MK Trend: Significant
MK p-val: 0.0163
Direction: Increasing

Lines

— Linear Fit

Shapes

● Detect
○ NonDetect
▼ Detect Limit

Scatterplots and Trend Analysis

D104, Selenium

Concentration (µg/L)

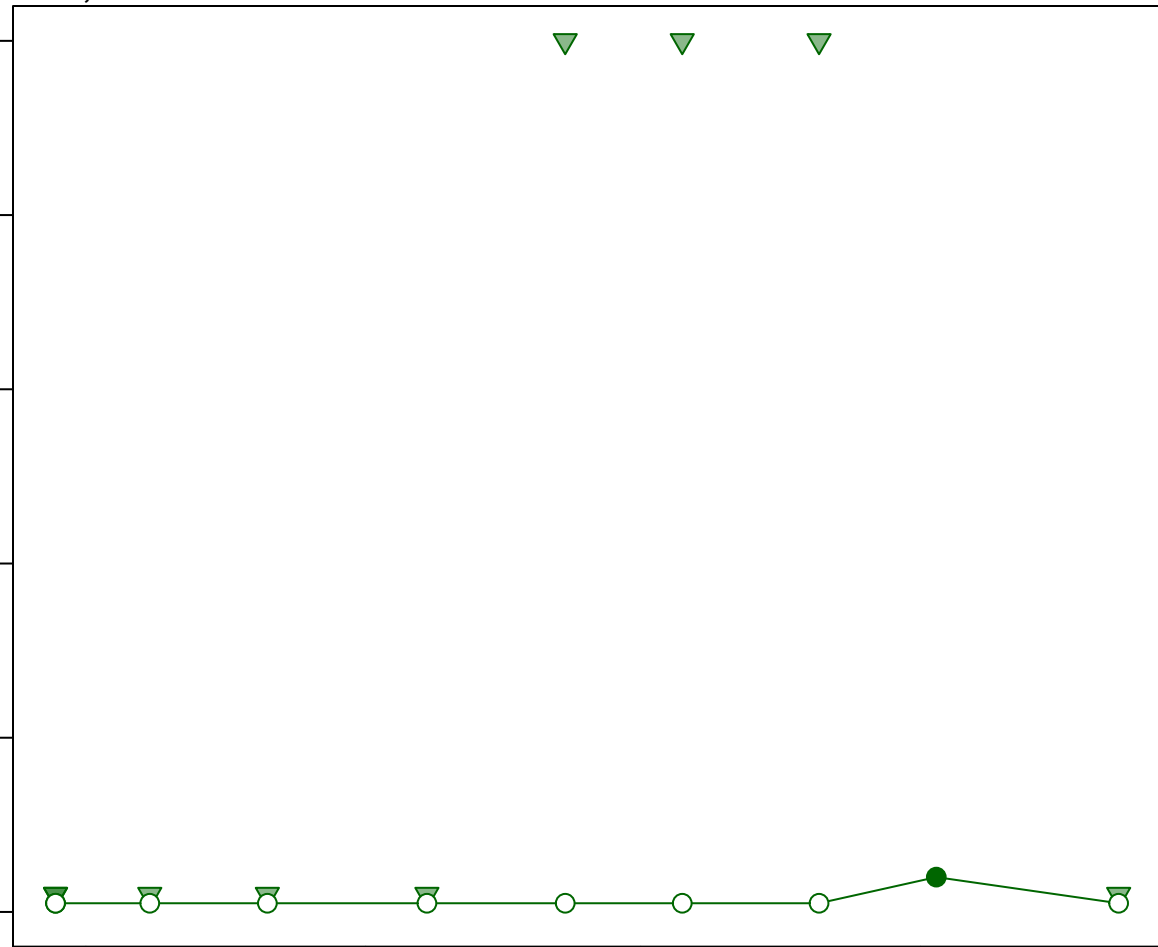
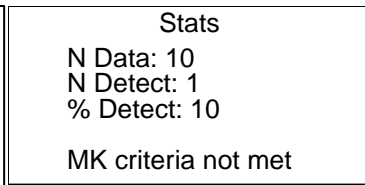
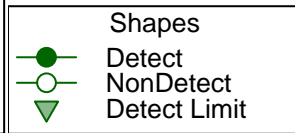
10
8
6
4
2
0

Jul
2021

Jan
2022

Jul
2022

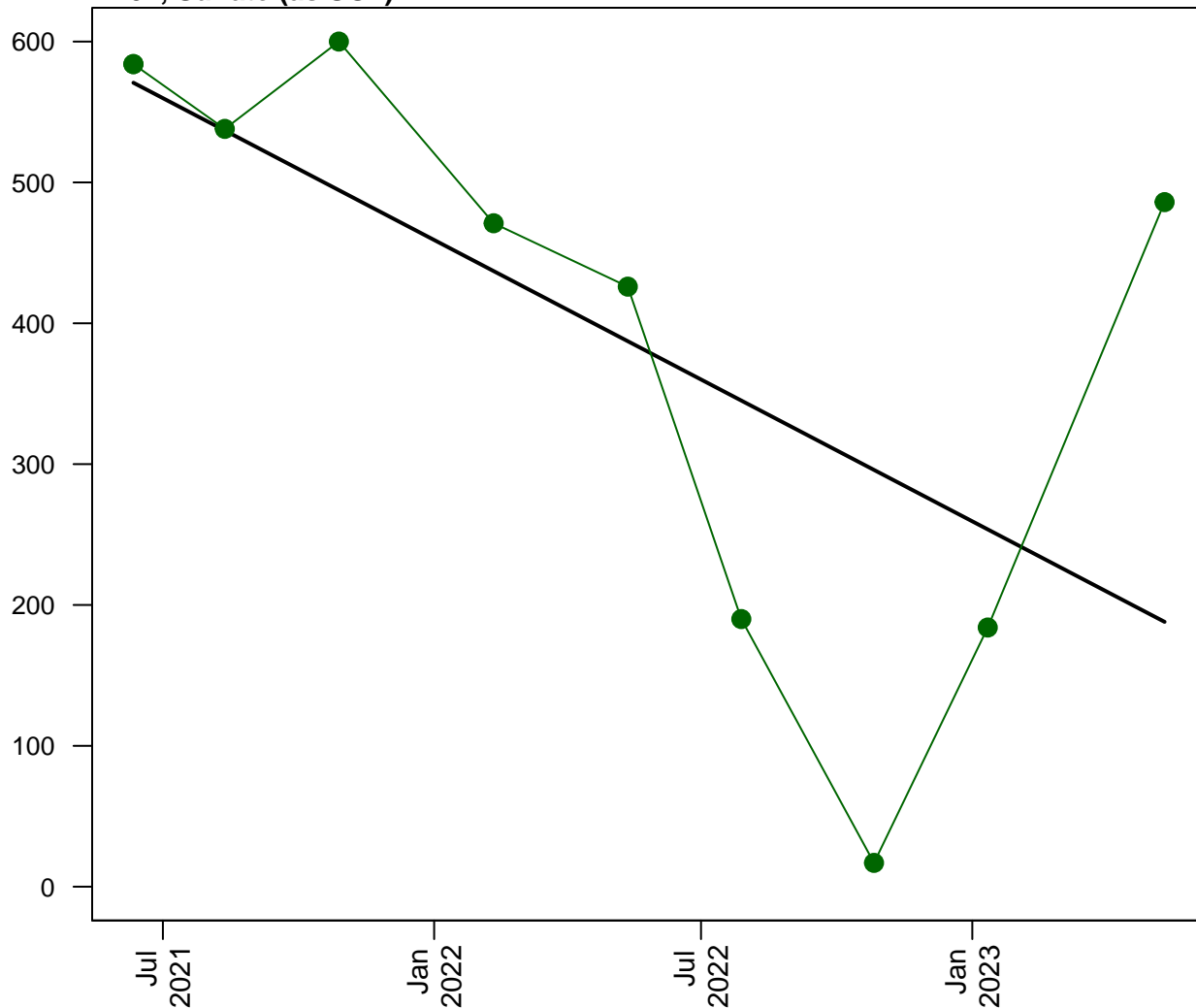
Jan
2023



Scatterplots and Trend Analysis

D104, Sulfate (as SO4)

Concentration (mg/L)



Stats

N Data: 10
N Detect: 10
% Detect: 100

95% Confidence
MK Trend: Significant
MK p-val: 0.0191
Direction: Decreasing

Lines

— Linear Fit

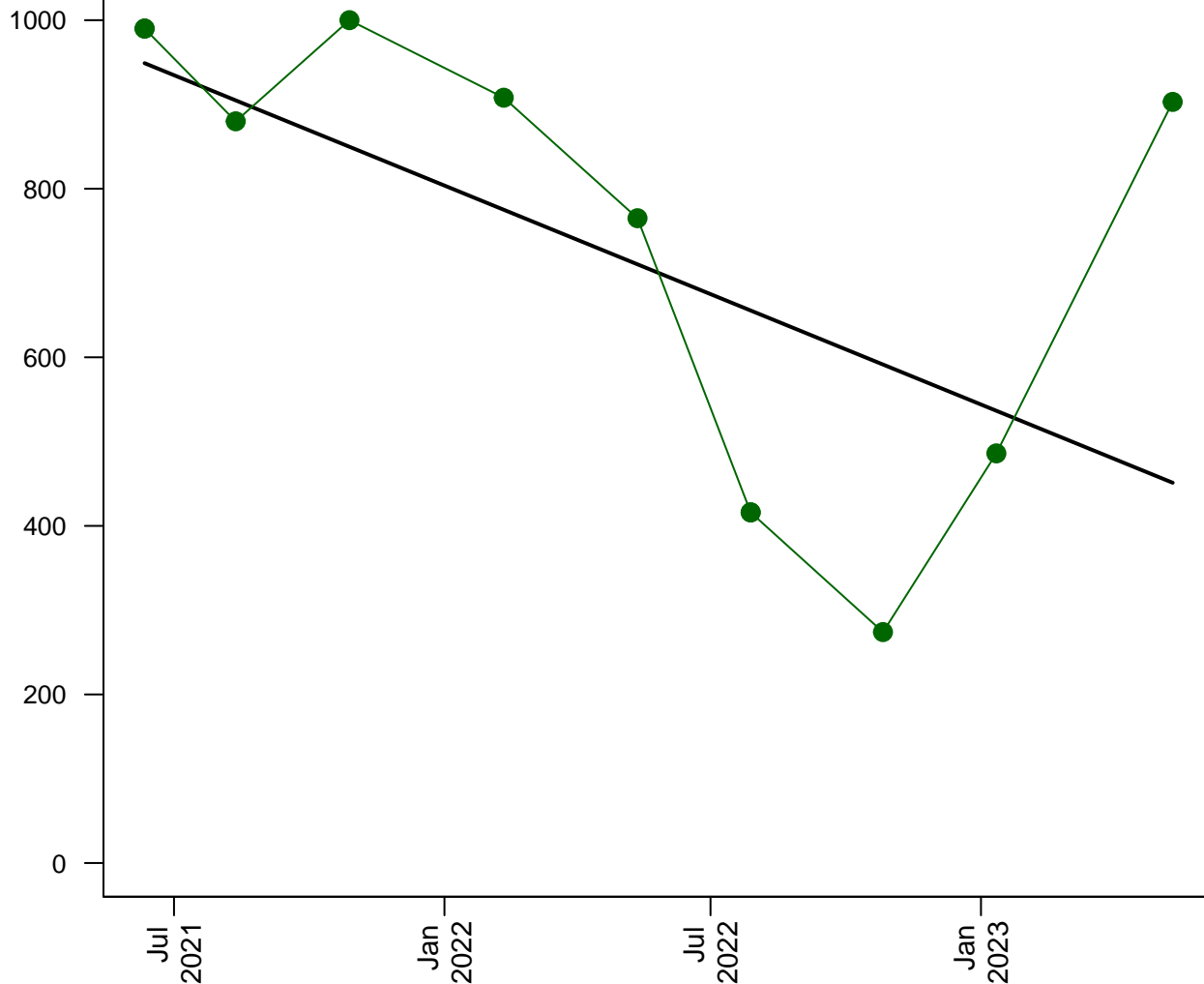
Shapes

● Detect
○ NonDetect
▼ Detect Limit

Scatterplots and Trend Analysis

D104, Total Dissolved Solids (TDS)

Concentration (mg/L)



Stats

N Data: 11
N Detect: 11
% Detect: 100

95% Confidence
MK Trend: Significant
MK p-val: 0.0334
Direction: Decreasing

Lines

— Linear Fit

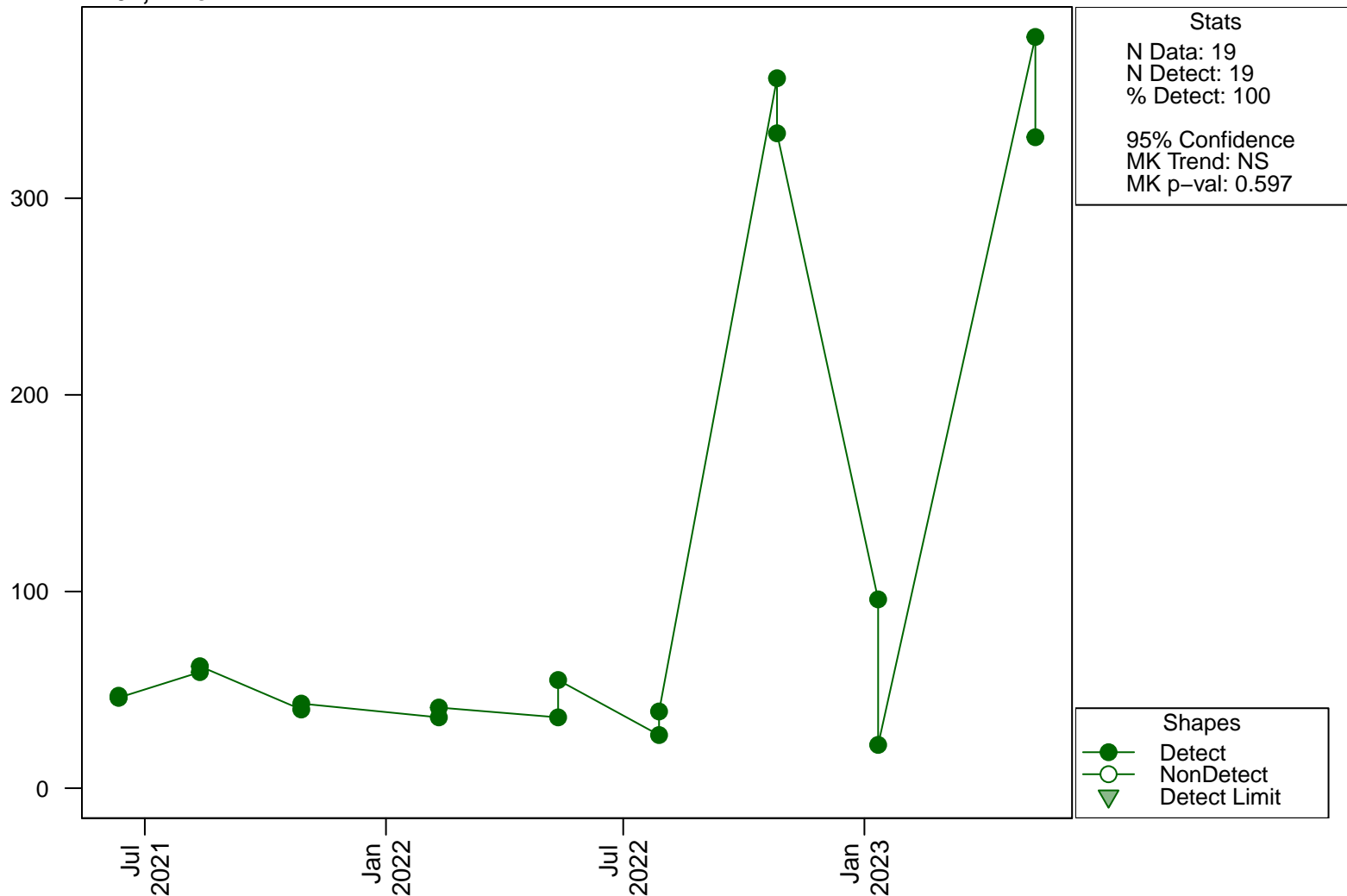
Shapes

● Detect
○ NonDetect
▼ Detect Limit

Scatterplots and Trend Analysis

D104, Zinc

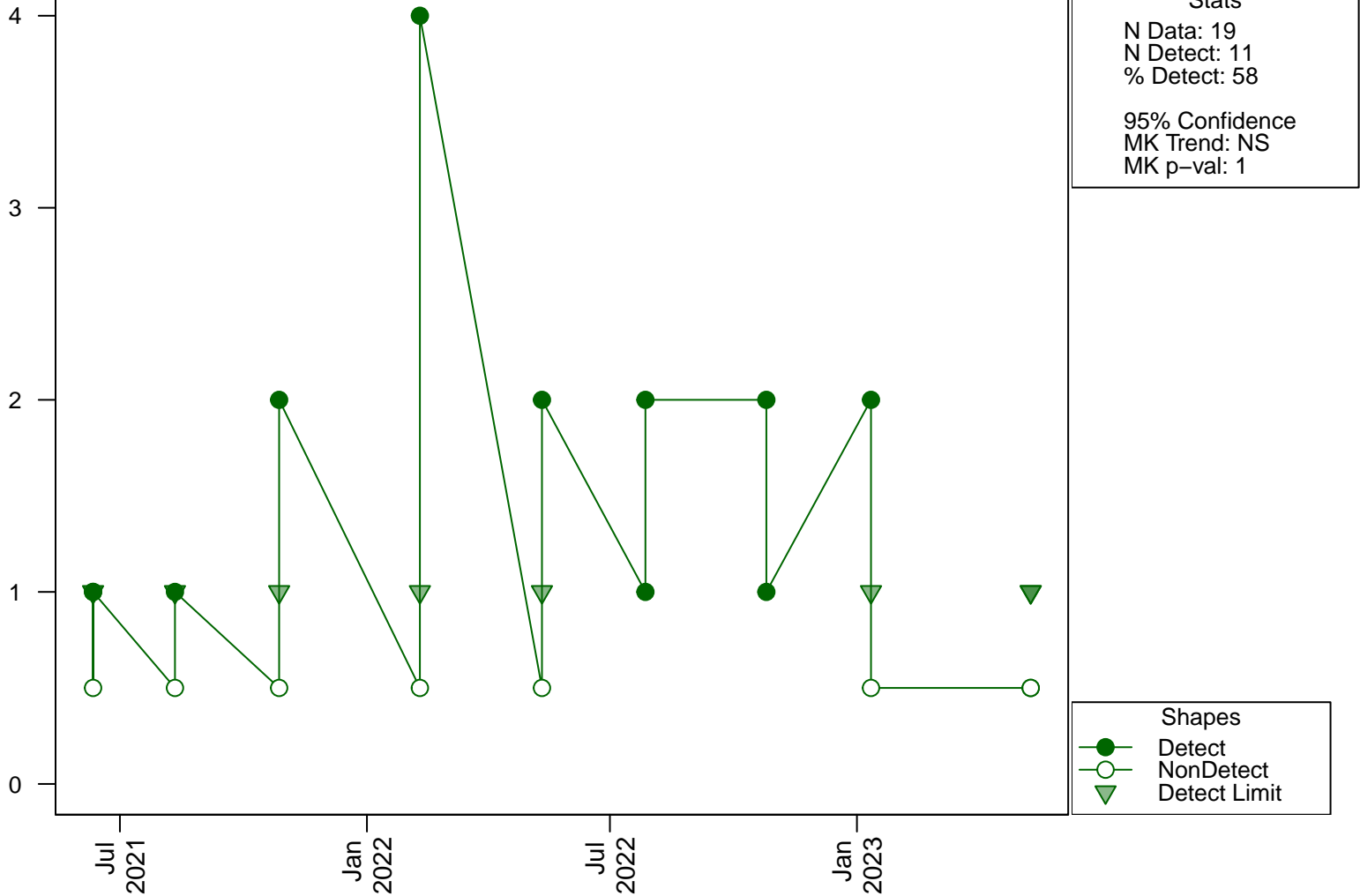
Concentration (µg/L)



Scatterplots and Trend Analysis

D105, Arsenic

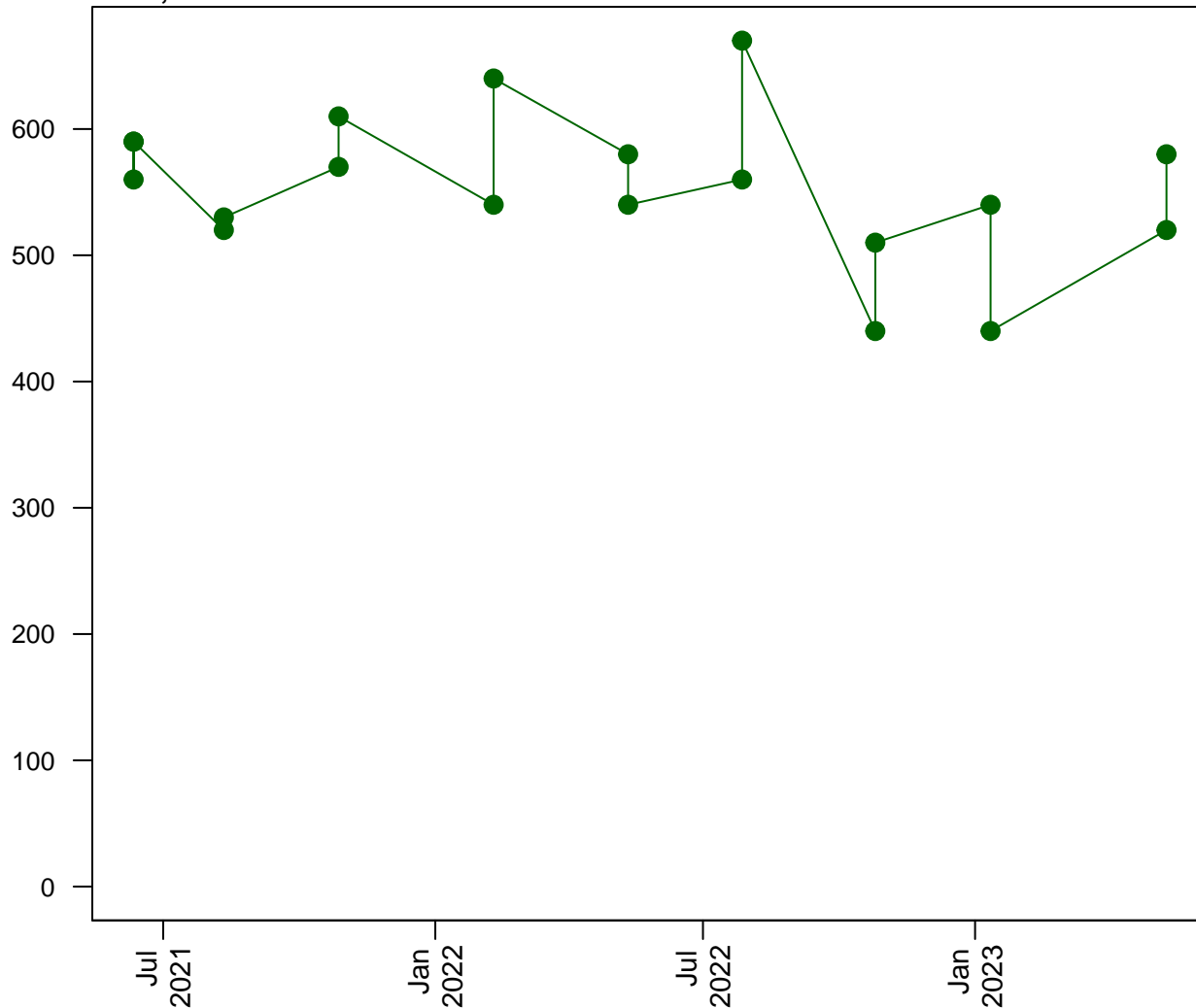
Concentration (µg/L)



Scatterplots and Trend Analysis

D105, Boron

Concentration (µg/L)



Stats

N Data: 19

N Detect: 19

% Detect: 100

95% Confidence

MK Trend: NS

MK p-val: 0.167

Shapes

● Detect

○ NonDetect

▼ Detect Limit

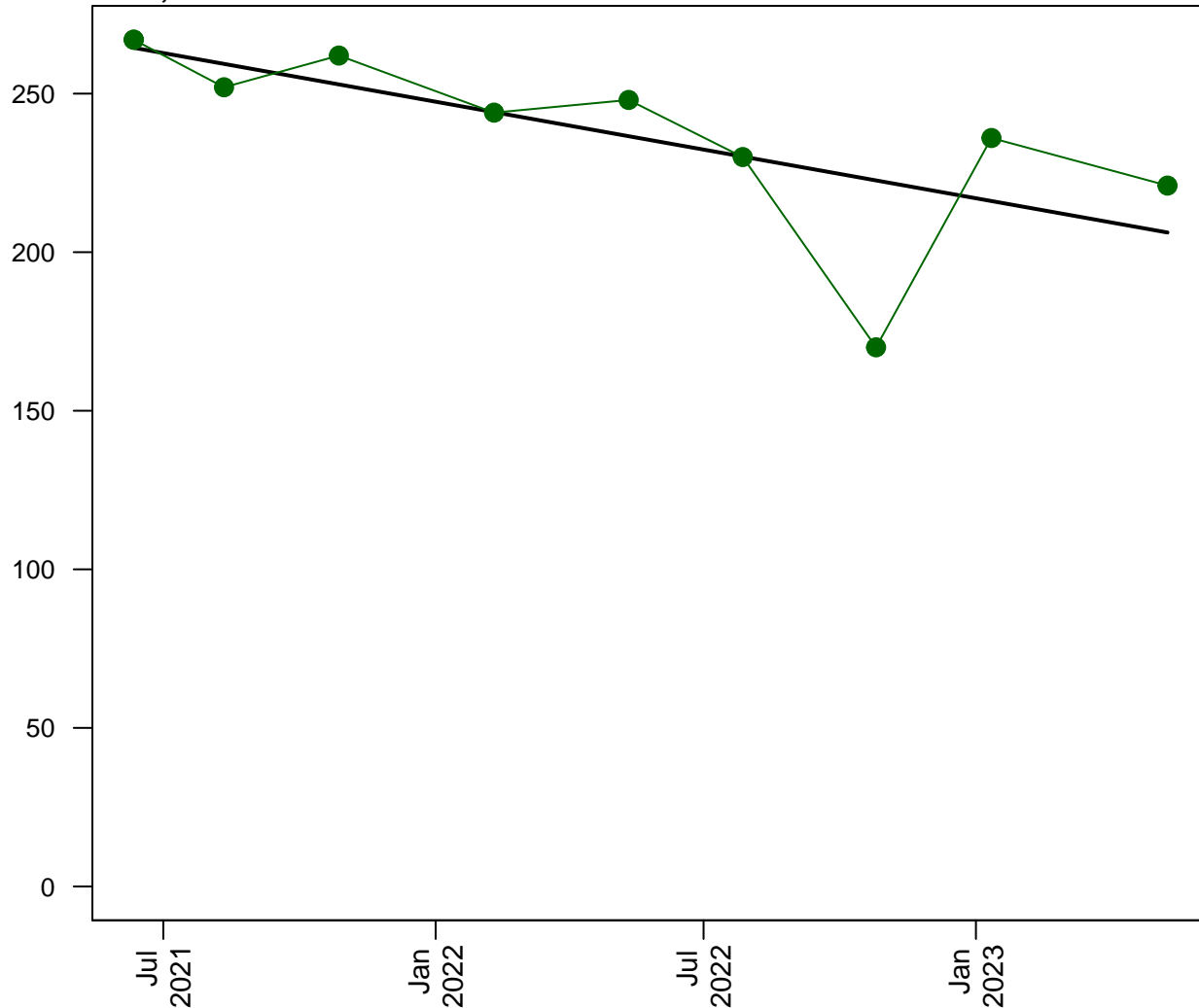
D105, Cadmium



Scatterplots and Trend Analysis

D105, Chloride

Concentration (mg/L)



Stats

N Data: 10
N Detect: 10
% Detect: 100

95% Confidence
MK Trend: Significant
MK p-val: 0.00217
Direction: Decreasing

Lines

Linear Fit

Shapes

● Detect
○ NonDetect
▼ Detect Limit

Scatterplots and Trend Analysis

D105, Chromium

Concentration (µg/L)

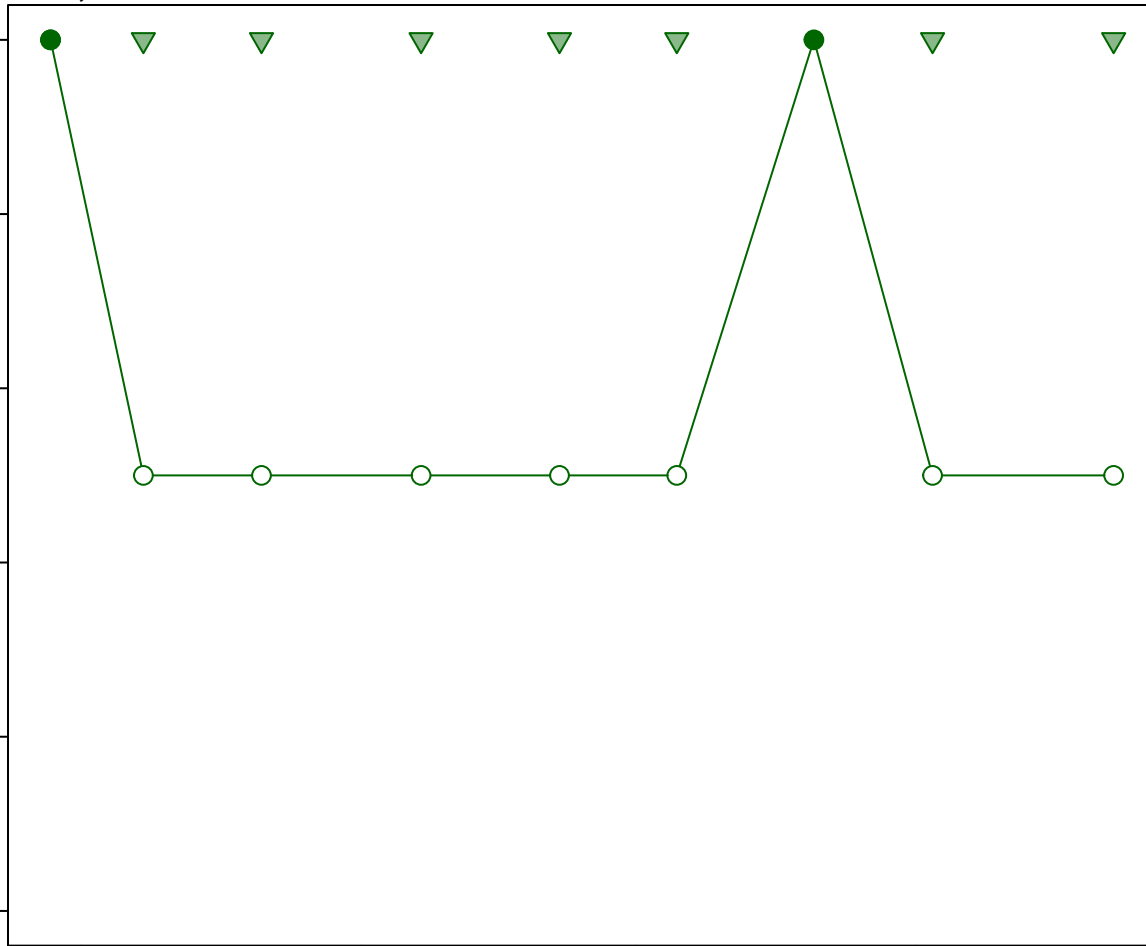
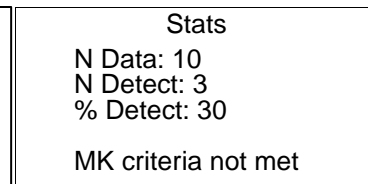
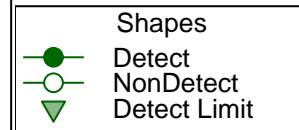
1.0
0.8
0.6
0.4
0.2
0.0

Jul
2021

Jan
2022

Jul
2022

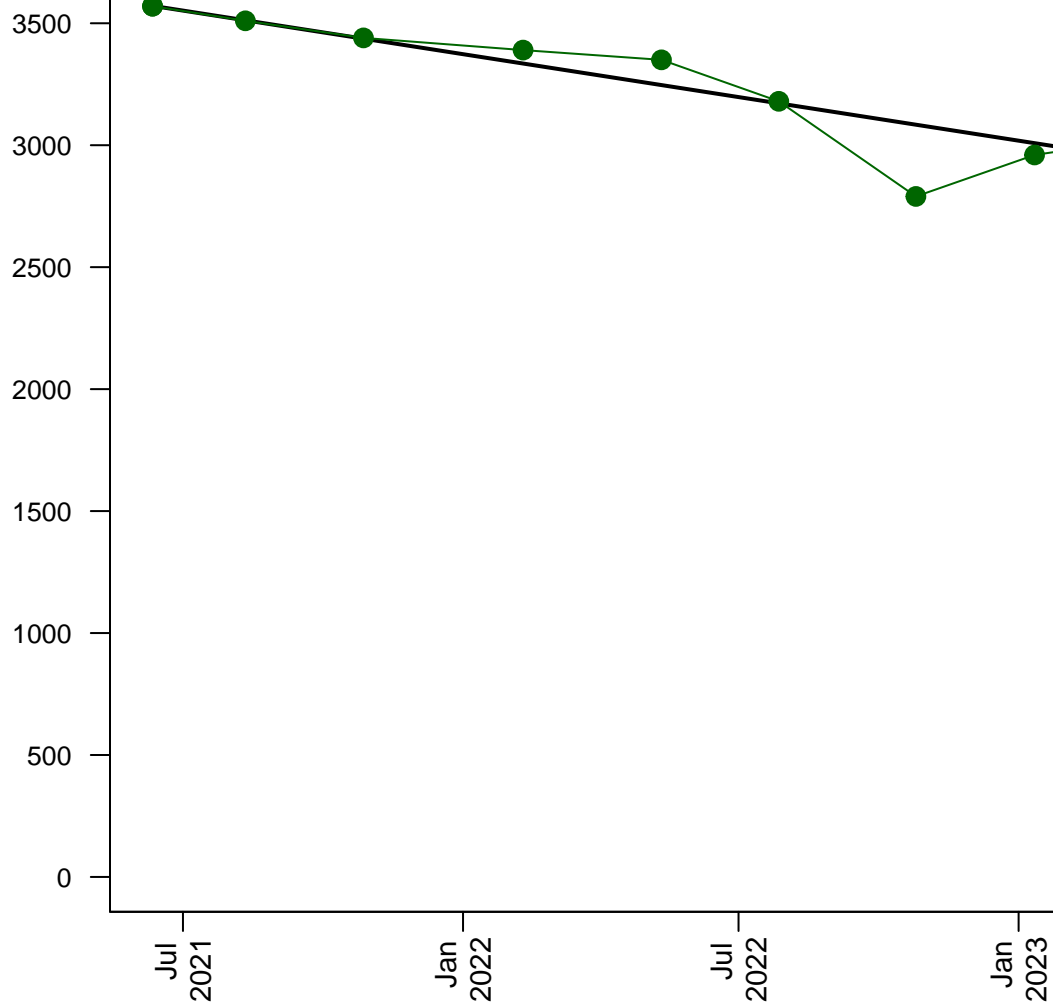
Jan
2023



Scatterplots and Trend Analysis

D105, Electrical Conductivity (Field)

Concentration (uS/cm)



Stats

N Data: 10
N Detect: 10
% Detect: 100

95% Confidence
MK Trend: Significant
MK p-val: <0.001
Direction: Decreasing

Lines

Linear Fit

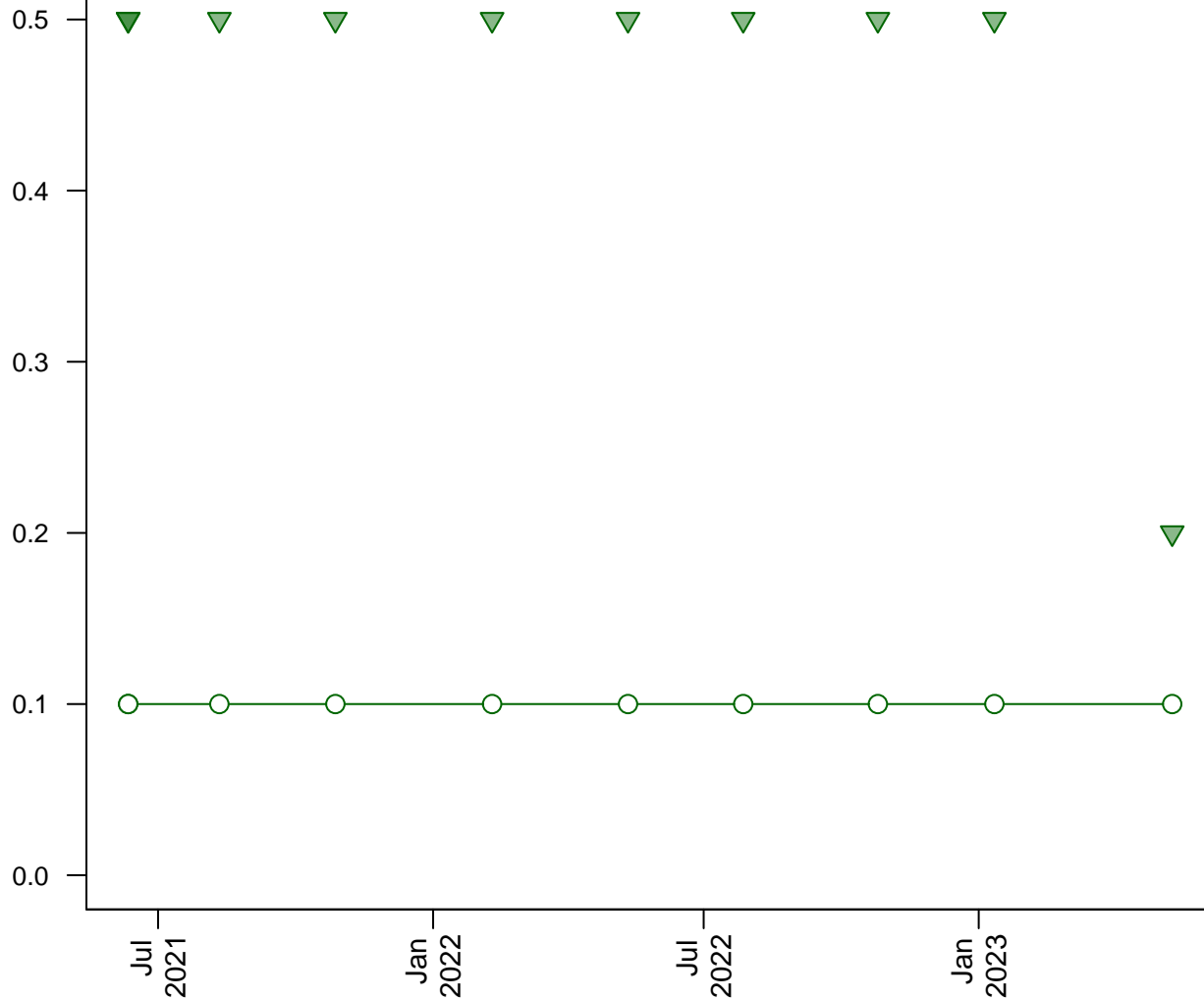
Shapes

● Detect
○ NonDetect
▼ Detect Limit

Scatterplots and Trend Analysis

D105, Fluoride

Concentration (mg/L)



Stats

N Data: 10

N Detect: 0

% Detect: 0

MK criteria not met

Shapes



Detect



NonDetect

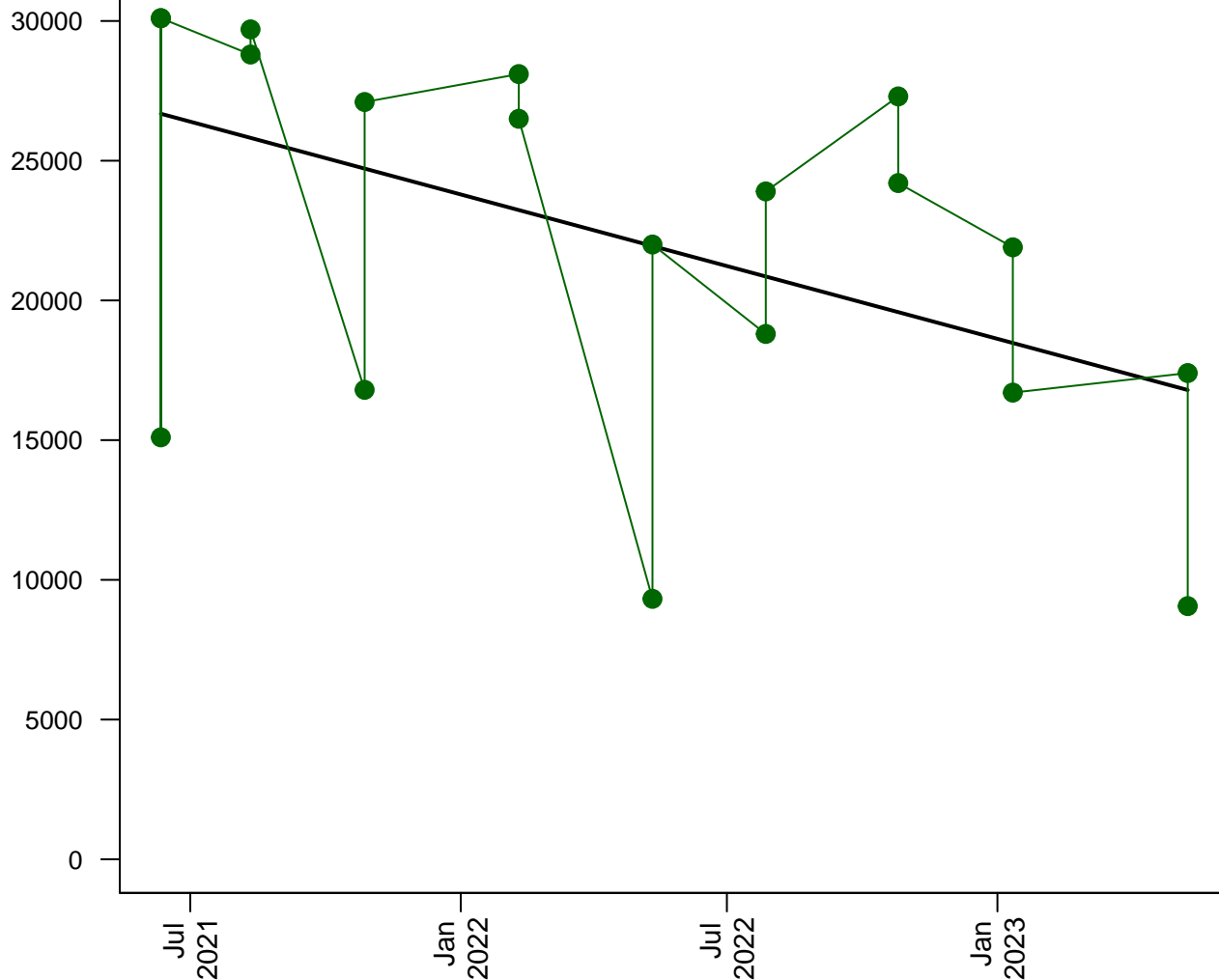


Detect Limit

Scatterplots and Trend Analysis

D105, Iron

Concentration (µg/L)



Stats

N Data: 19
N Detect: 19
% Detect: 100

95% Confidence
MK Trend: Significant
MK p-val: 0.00737
Direction: Decreasing

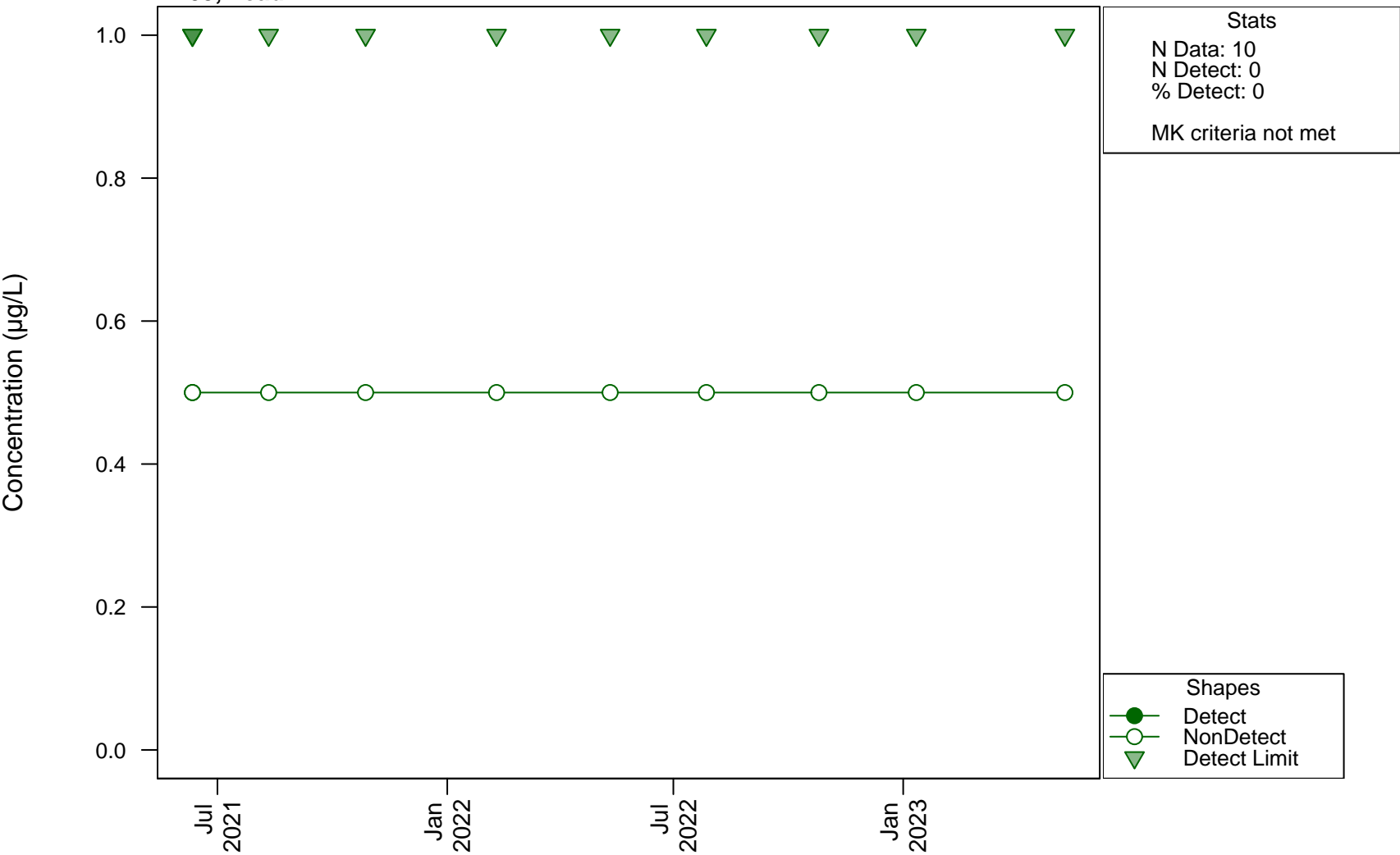
Lines

— Linear Fit

Shapes

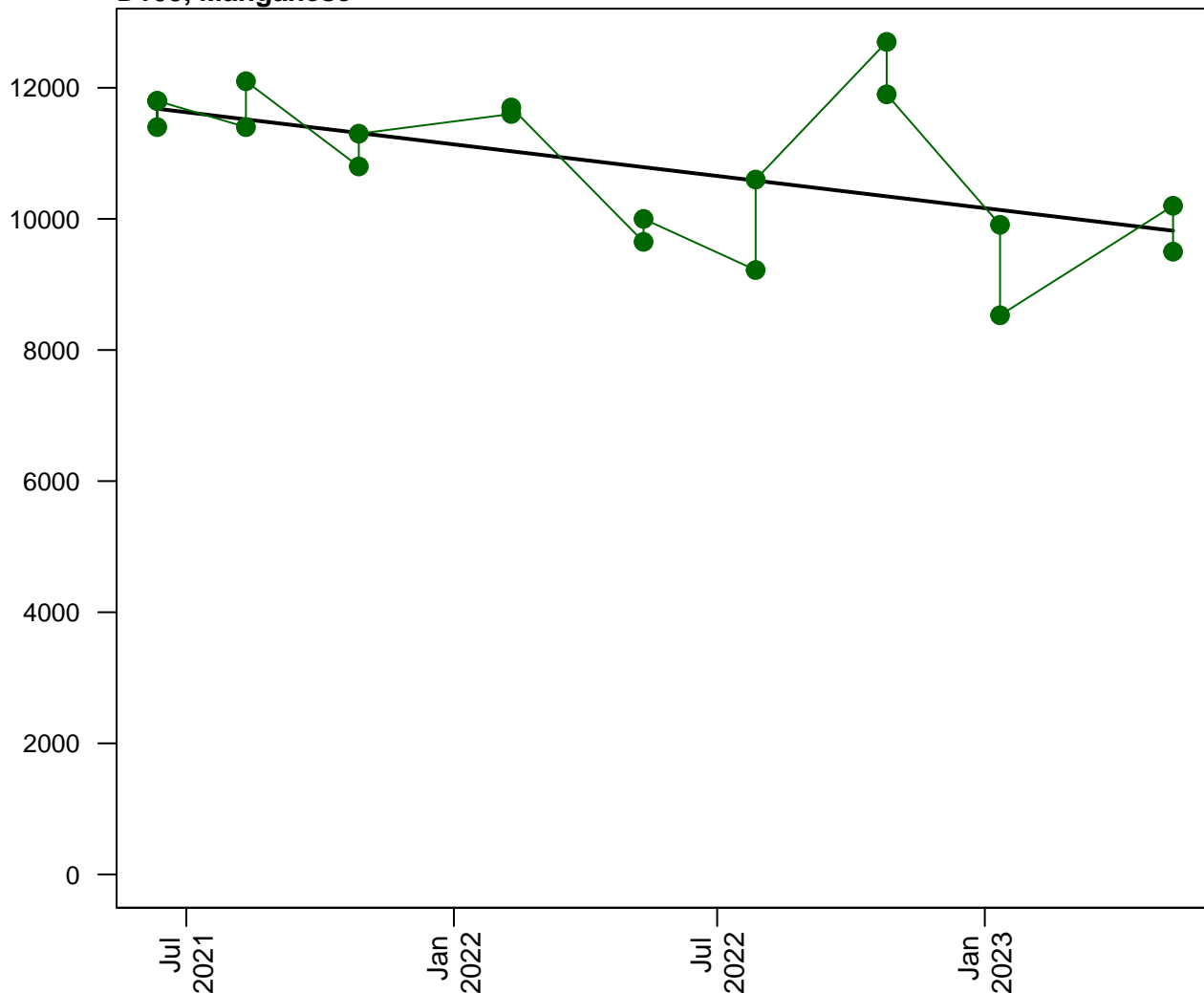
● Detect
○ NonDetect
▼ Detect Limit

D105, Lead



Scatterplots and Trend Analysis D105, Manganese

Concentration (µg/L)



Stats

N Data: 19
N Detect: 19
% Detect: 100

95% Confidence
MK Trend: Significant
MK p-val: 0.0218
Direction: Decreasing

Lines

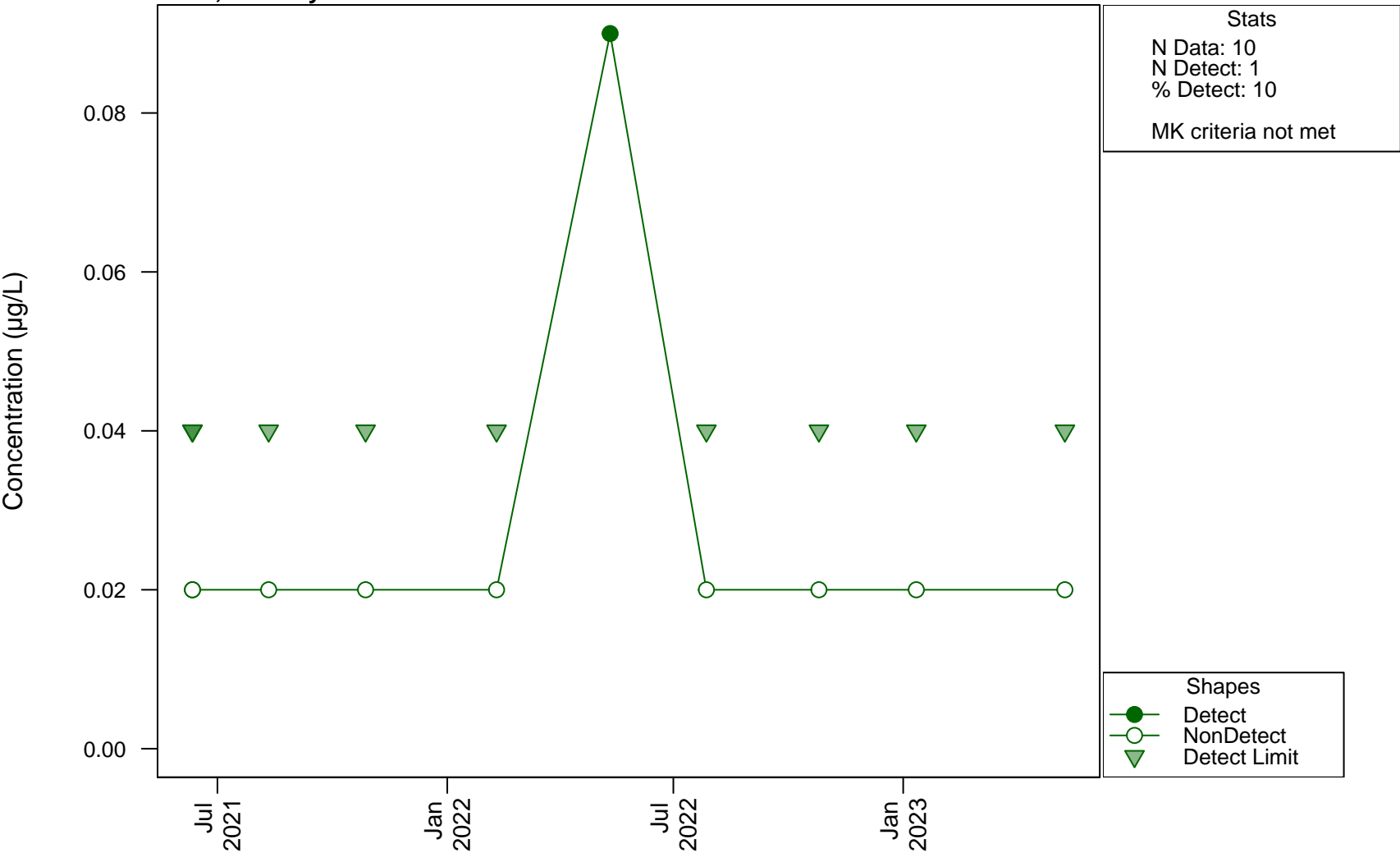
— Linear Fit

Shapes

● Detect
○ NonDetect
▼ Detect Limit

Scatterplots and Trend Analysis

D105, Mercury



Scatterplots and Trend Analysis

D105, Molybdenum

Concentration (µg/L)

1.0
0.8
0.6
0.4
0.2
0.0

Jul
2021

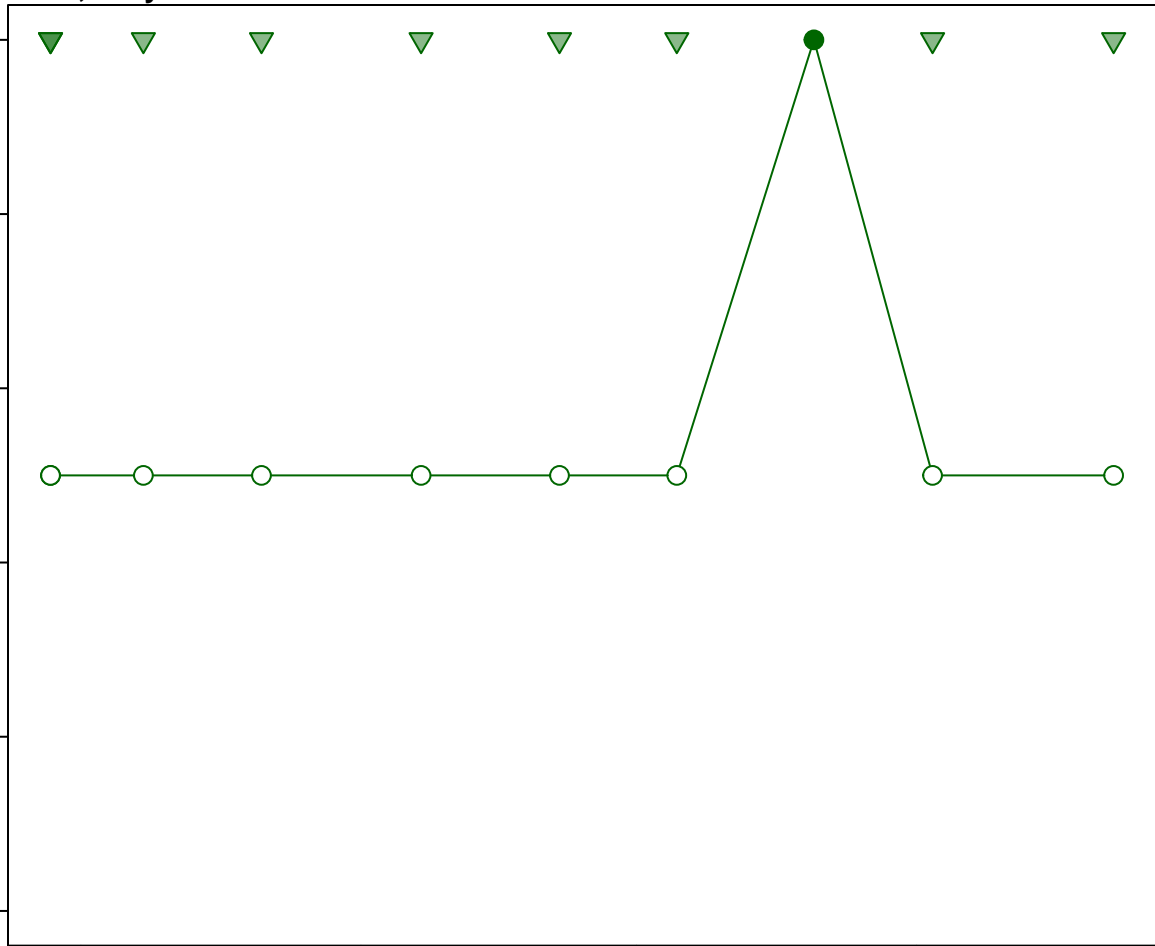
Jan
2022

Jul
2022

Jan
2023

Stats
N Data: 10
N Detect: 1
% Detect: 10
MK criteria not met

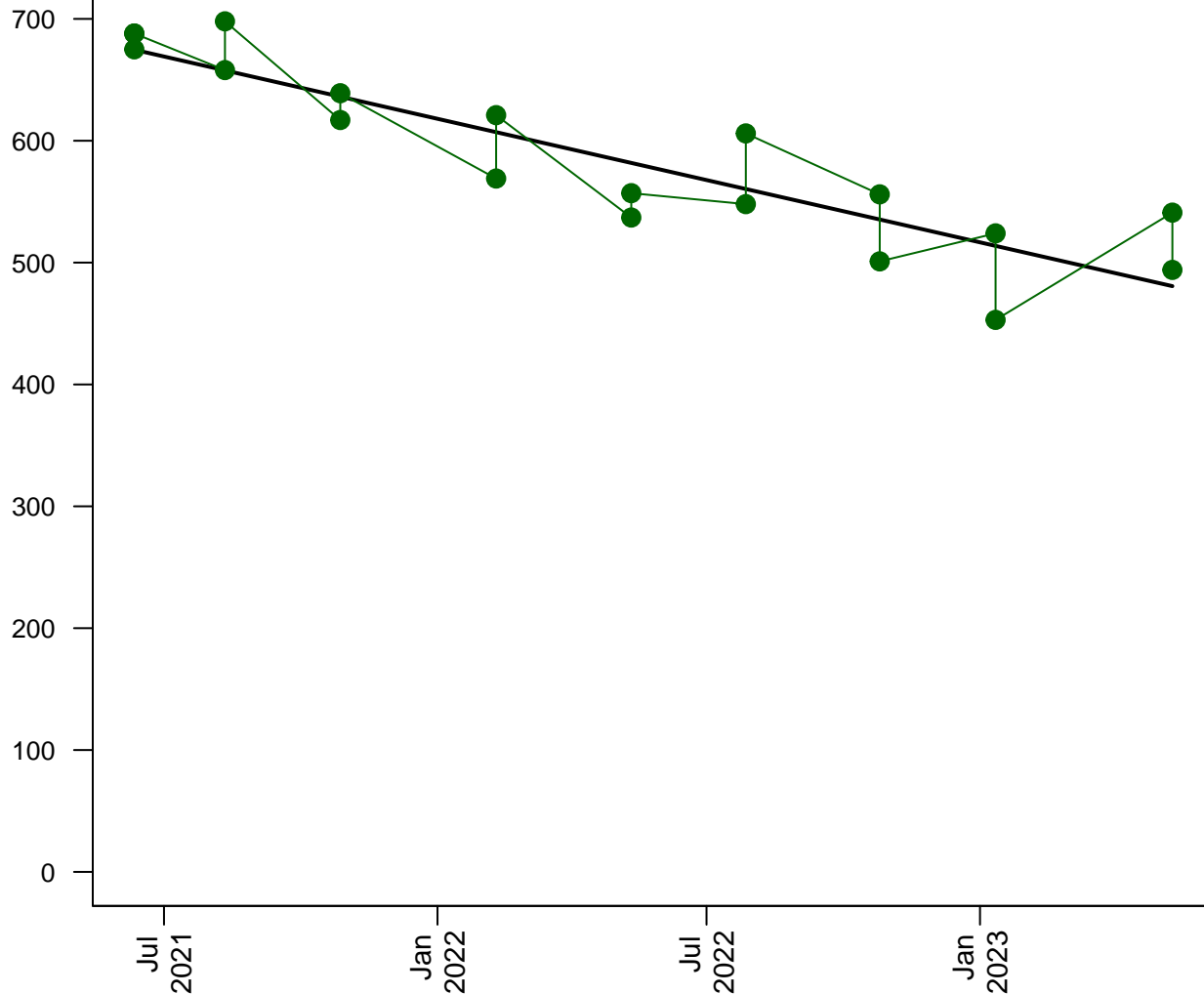
Shapes
● Detect
○ NonDetect
▼ Detect Limit



Scatterplots and Trend Analysis

D105, Nickel

Concentration (µg/L)



Stats

N Data: 19
N Detect: 19
% Detect: 100

95% Confidence
MK Trend: Significant
MK p-val: <0.001
Direction: Decreasing

Lines

— Linear Fit

Shapes

● Detect
○ NonDetect
▼ Detect Limit

Scatterplots and Trend Analysis

D105, Selenium

Concentration (µg/L)

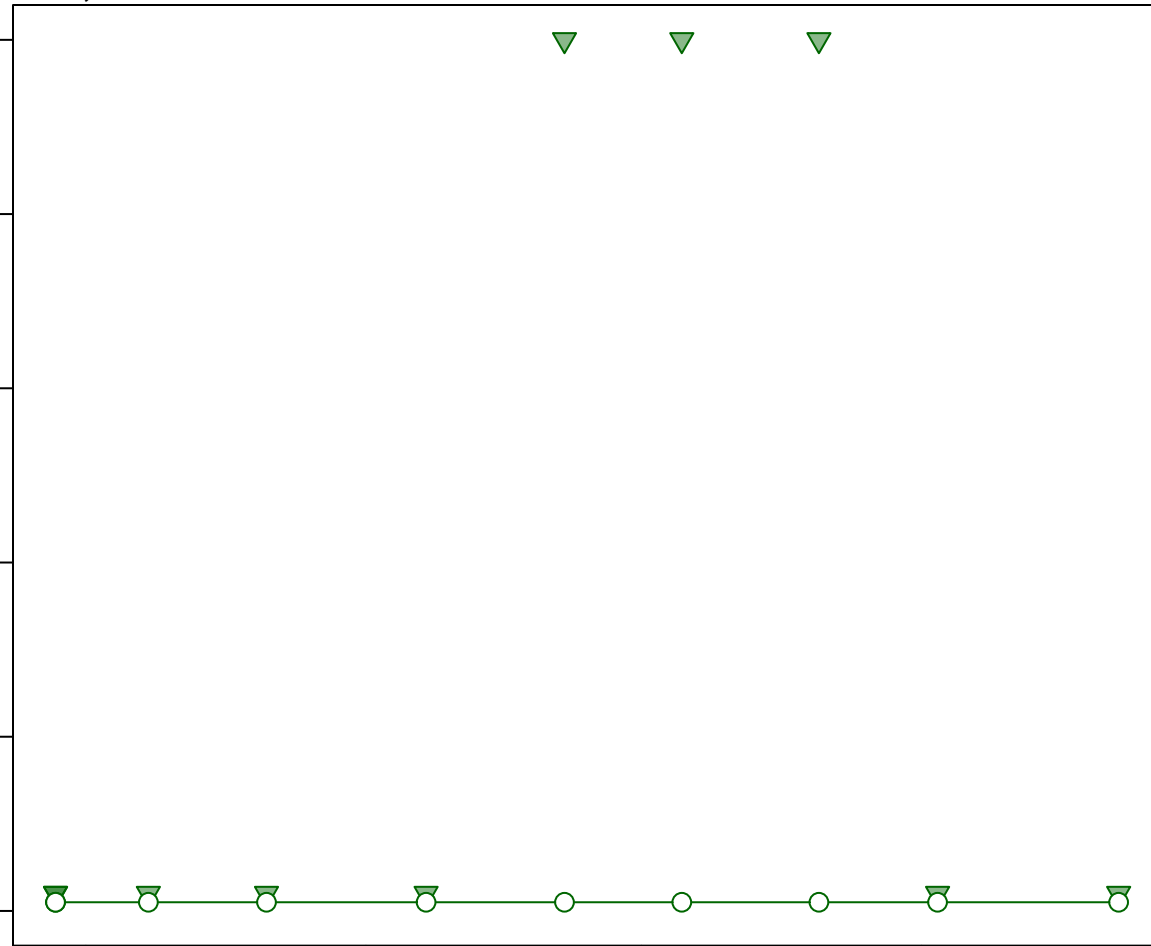
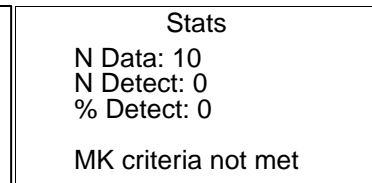
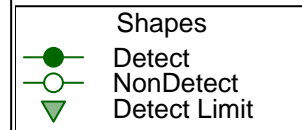
10
8
6
4
2
0

Jul
2021

Jan
2022

Jul
2022

Jan
2023



Scatterplots and Trend Analysis

D105, Sulfate (as SO4)

Concentration (mg/L)

1500
1000
500
0

Jul
2021

Jan
2022

Jul
2022

Jan
2023

Stats

N Data: 10
N Detect: 10
% Detect: 100

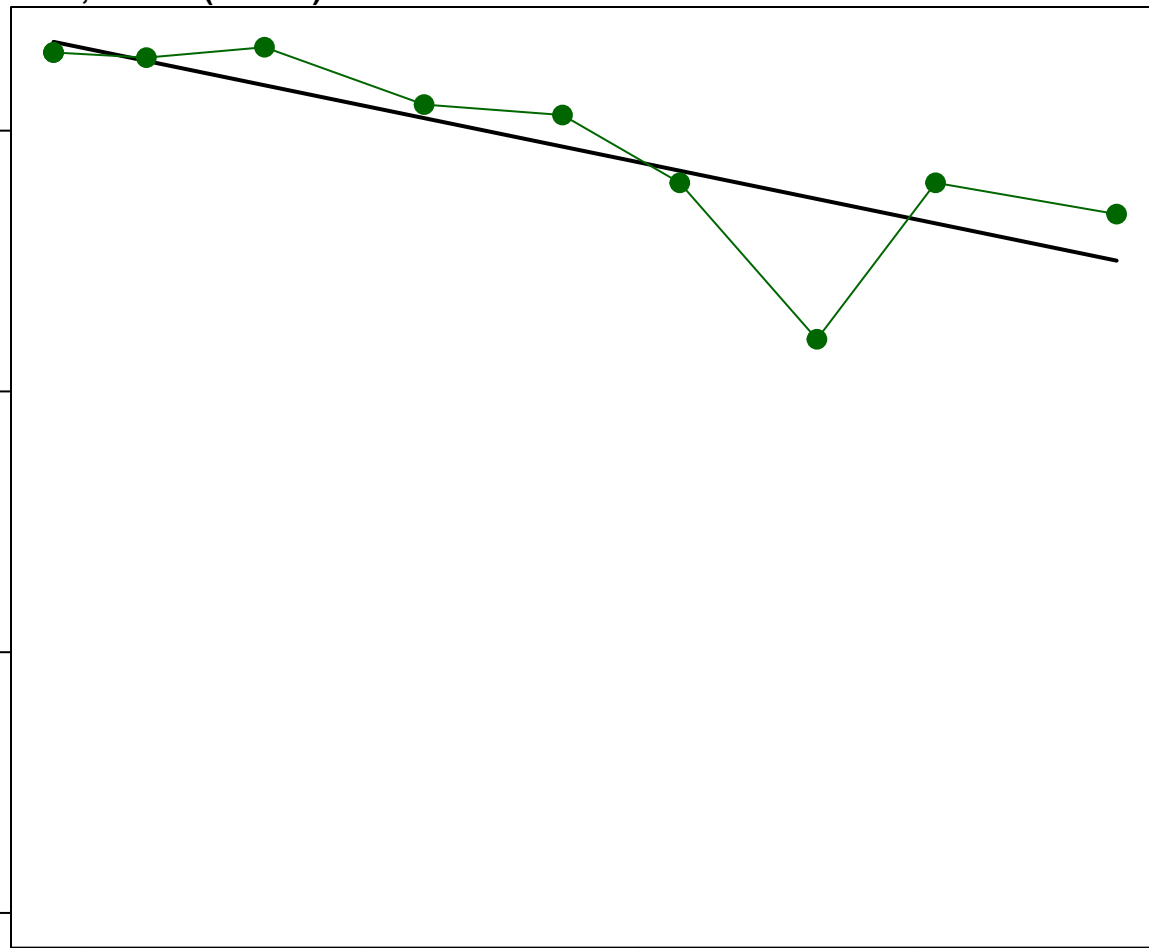
95% Confidence
MK Trend: Significant
MK p-val: 0.00282
Direction: Decreasing

Lines

Linear Fit

Shapes

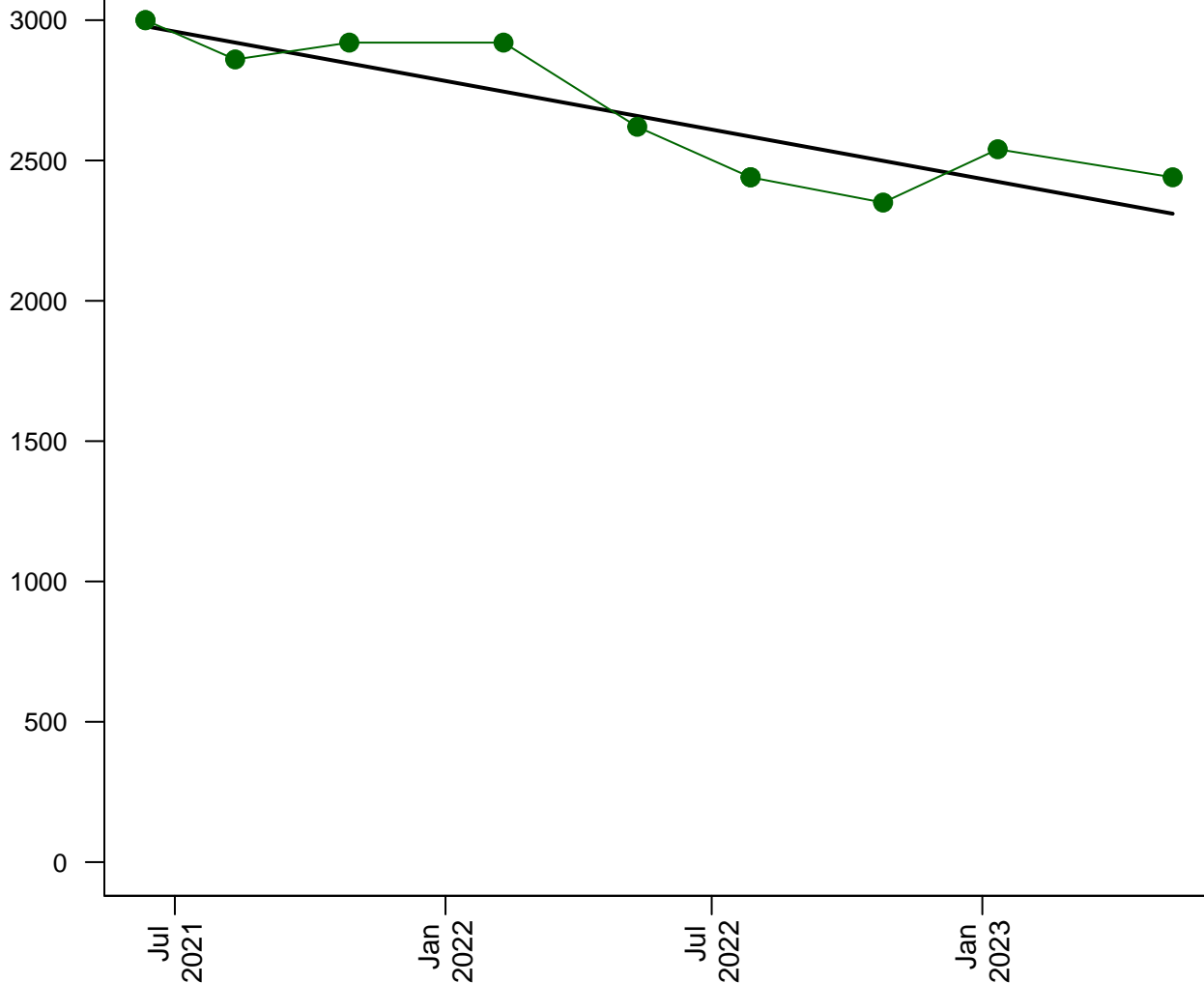
● Detect
○ NonDetect
▼ Detect Limit



Scatterplots and Trend Analysis

D105, Total Dissolved Solids (TDS)

Concentration (mg/L)



Stats

N Data: 11

N Detect: 11

% Detect: 100

95% Confidence

MK Trend: Significant

MK p-val: 0.00246

Direction: Decreasing

Lines

Linear Fit

Shapes

● Detect

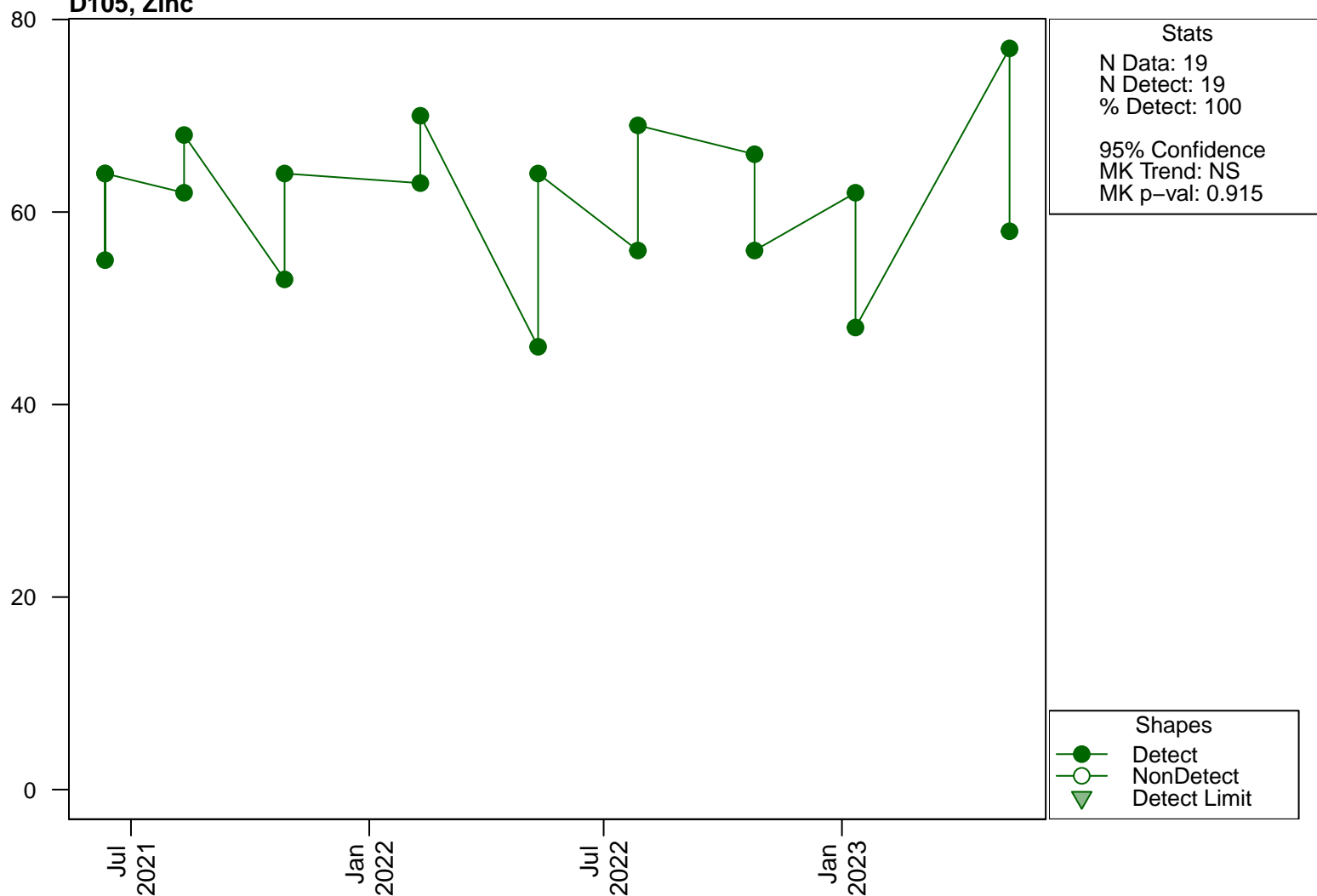
○ NonDetect

▼ Detect Limit

Scatterplots and Trend Analysis

D105, Zinc

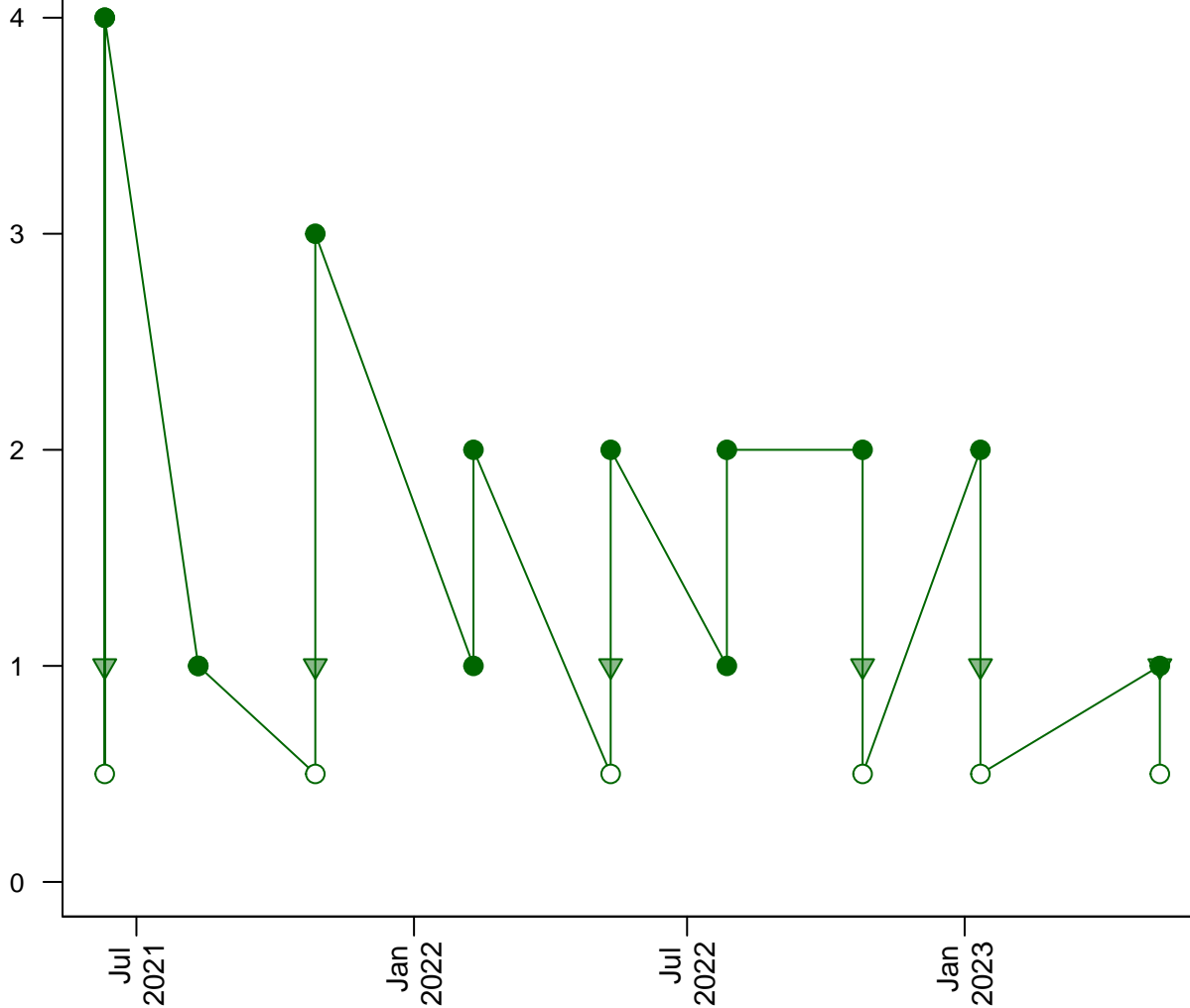
Concentration (µg/L)



Scatterplots and Trend Analysis

D106, Arsenic

Concentration (µg/L)



Stats

N Data: 19
N Detect: 13
% Detect: 68

95% Confidence
MK Trend: NS
MK p-val: 0.187

Shapes

● Detect
○ NonDetect
▼ Detect Limit

Scatterplots and Trend Analysis

D106, Boron

Concentration (µg/L)

2500
2000
1500
1000
500
0

Jul
2021

Jan
2022

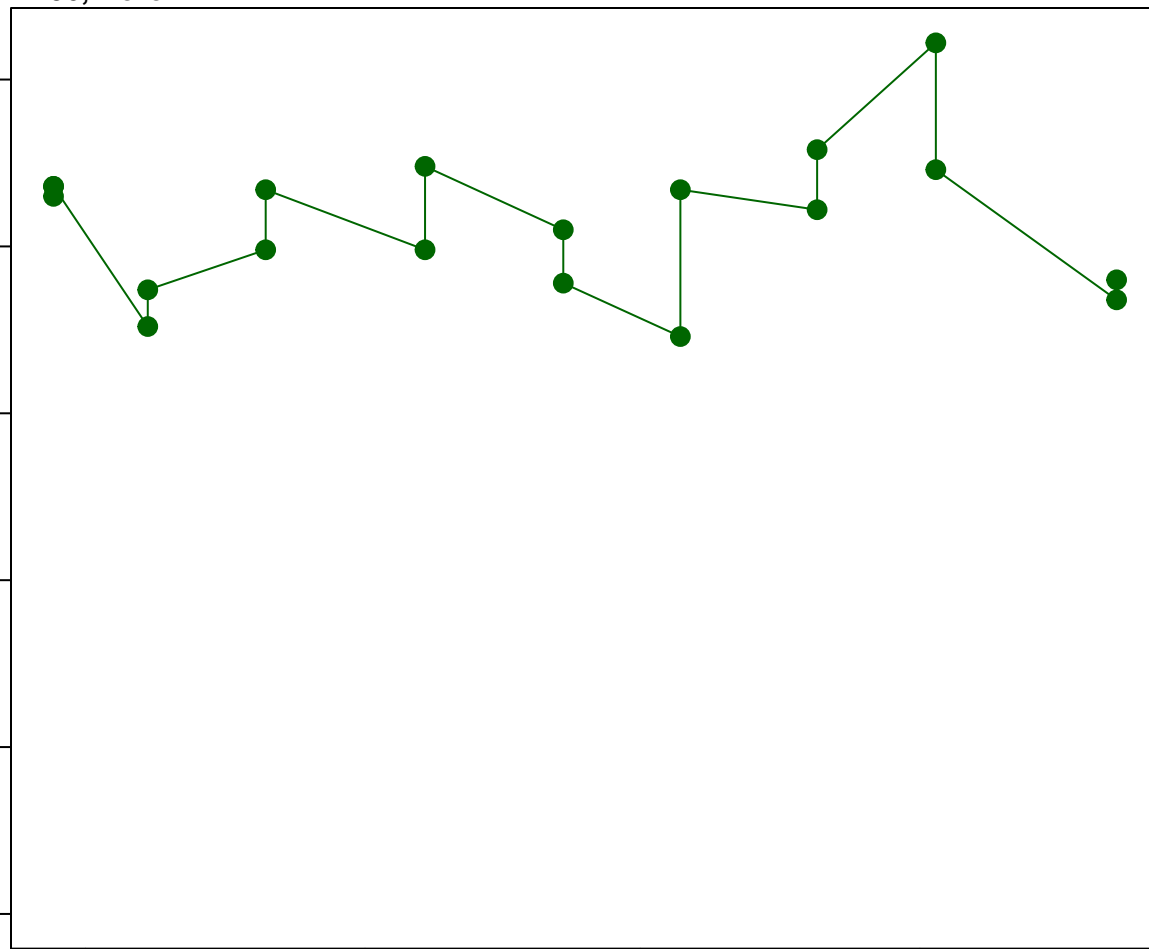
Jul
2022

Jan
2023

Shapes
● Detect
○ NonDetect
▼ Detect Limit

Stats
N Data: 19
N Detect: 19
% Detect: 100

95% Confidence
MK Trend: NS
MK p-val: 0.888



Scatterplots and Trend Analysis

D106, Cadmium

Concentration (µg/L)

0.10
0.08
0.06
0.04
0.02
0.00

Jul
2021

Jan
2022

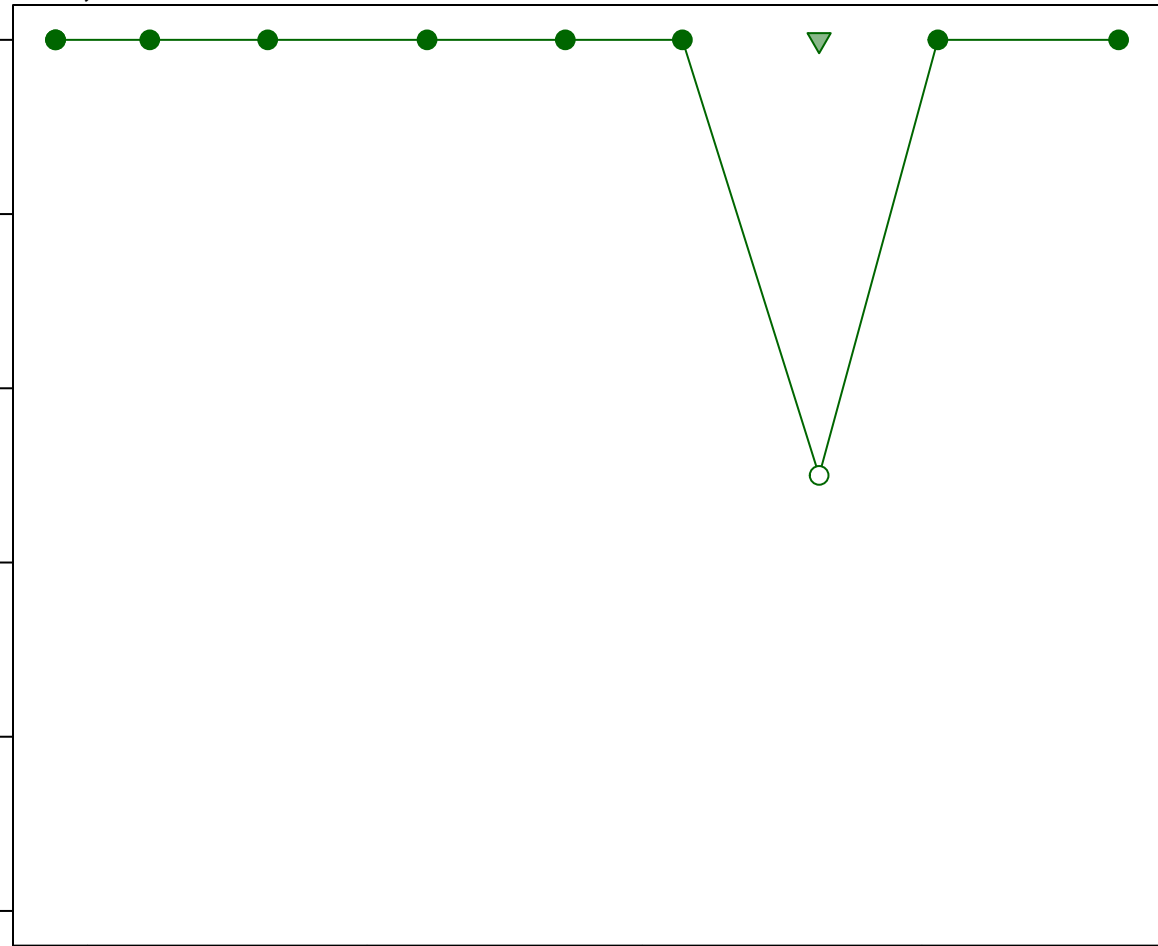
Jul
2022

Jan
2023

Stats
N Data: 10
N Detect: 9
% Detect: 90

95% Confidence
MK Trend: NS
MK p-val: 0.383

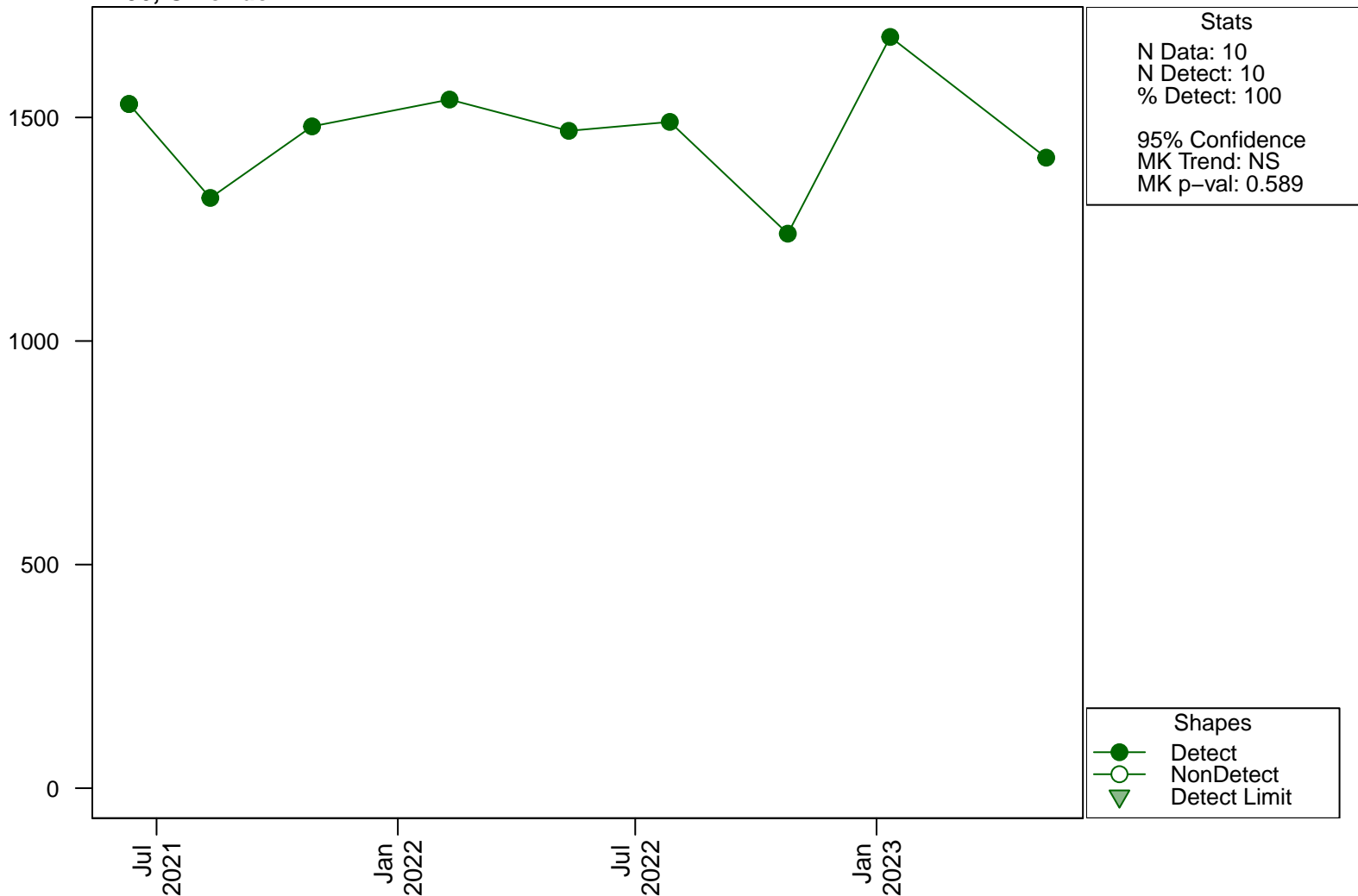
Shapes
● Detect
○ NonDetect
▼ Detect Limit



Scatterplots and Trend Analysis

D106, Chloride

Concentration (mg/L)



Scatterplots and Trend Analysis

D106, Chromium

Concentration (µg/L)

10
8
6
4
2
0

Jul
2021

Jan
2022

Jul
2022

Jan
2023

Stats

N Data: 10

N Detect: 4

% Detect: 40

MK criteria not met

Shapes

● Detect

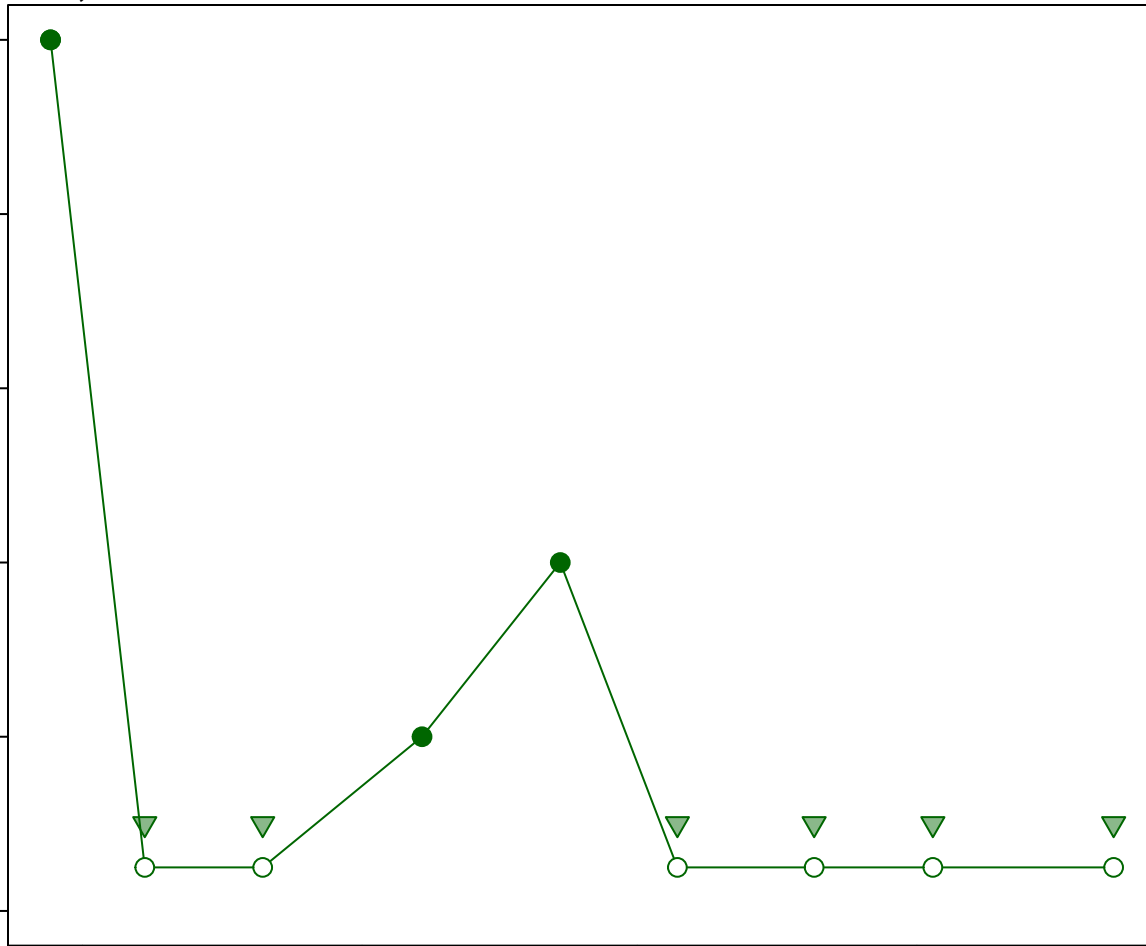
○ NonDetect

▼ Detect Limit

Detect

NonDetect

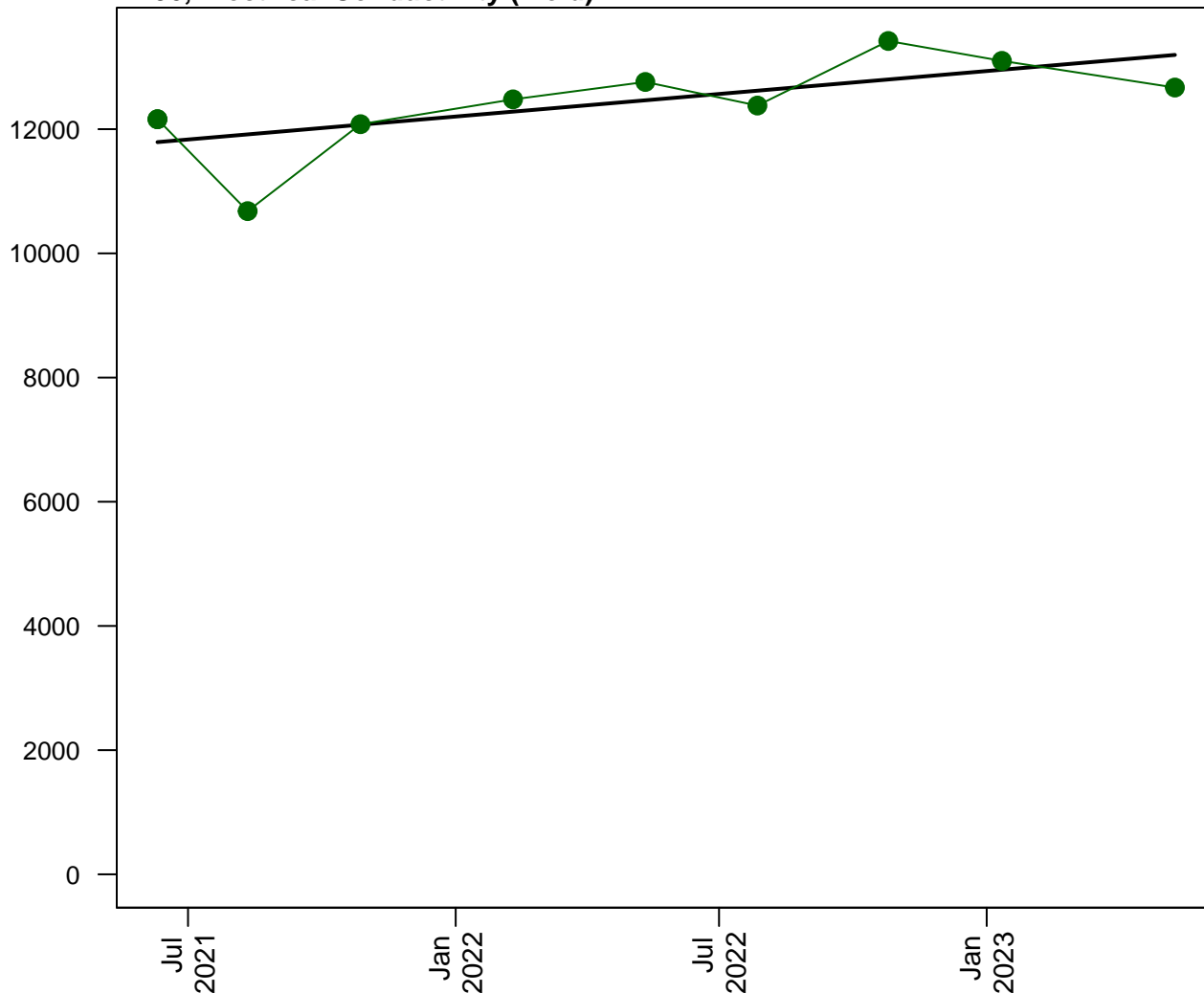
Detect Limit



Scatterplots and Trend Analysis

D106, Electrical Conductivity (Field)

Concentration (uS/cm)



Stats

N Data: 10

N Detect: 10

% Detect: 100

95% Confidence

MK Trend: Significant

MK p-val: 0.0305

Direction: Increasing

Lines

Linear Fit

Shapes

● Detect

○ NonDetect

▼ Detect Limit

Scatterplots and Trend Analysis

D106, Fluoride

Concentration (mg/L)

2.0
1.5
1.0
0.5
0.0

Jul
2021

Jan
2022

Jul
2022

Jan
2023

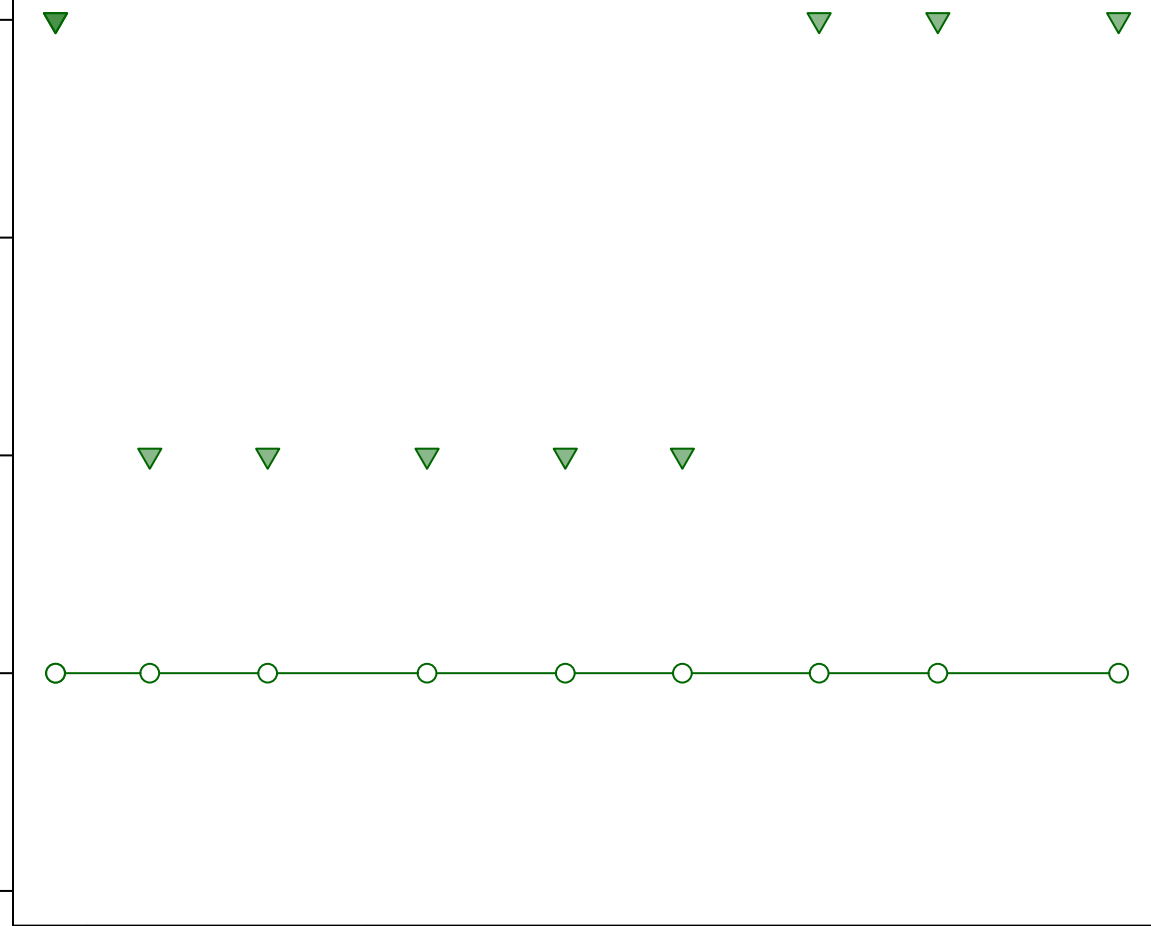
Stats

N Data: 10
N Detect: 0
% Detect: 0

MK criteria not met

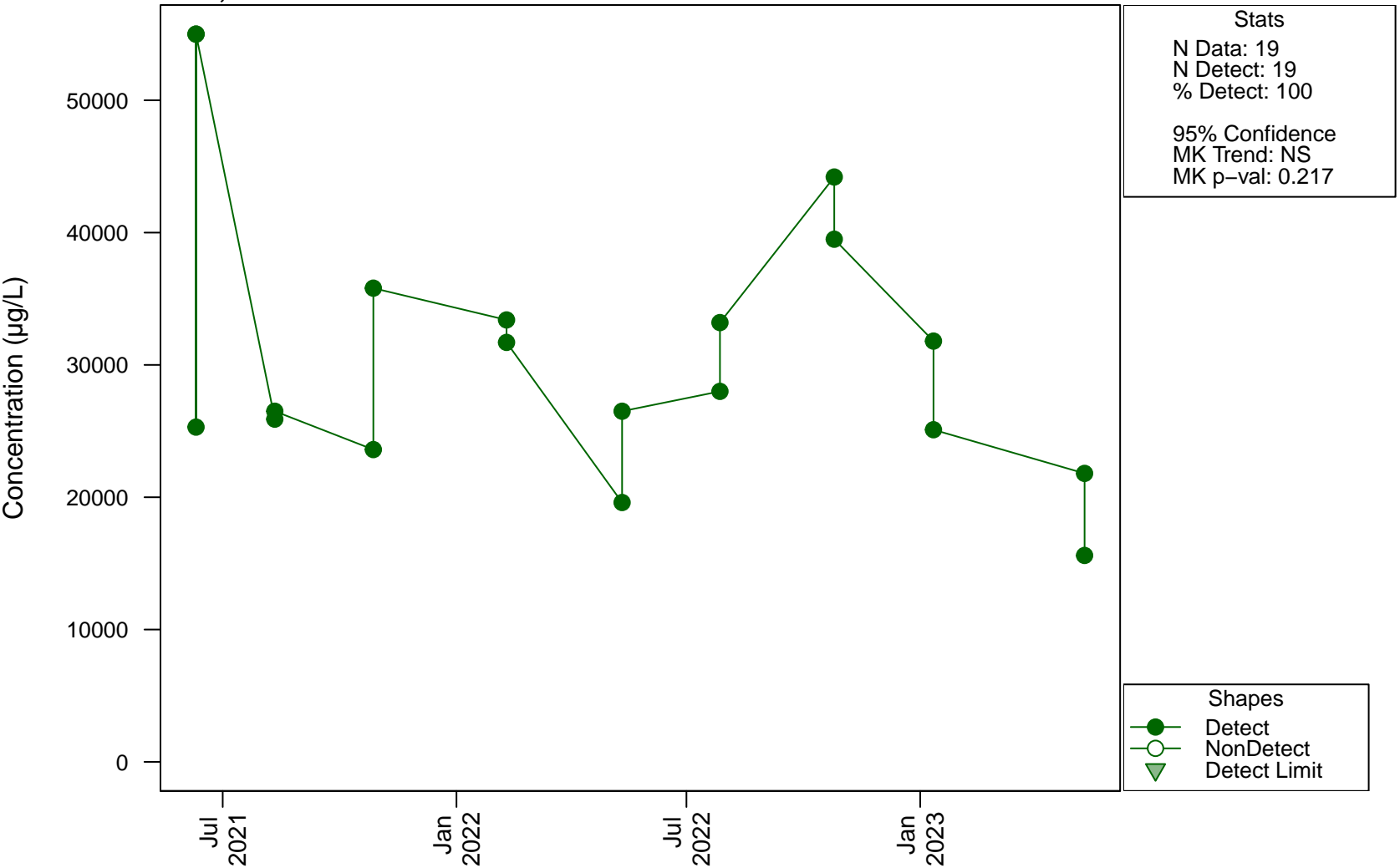
Shapes

● Detect
○ NonDetect
▼ Detect Limit



Scatterplots and Trend Analysis

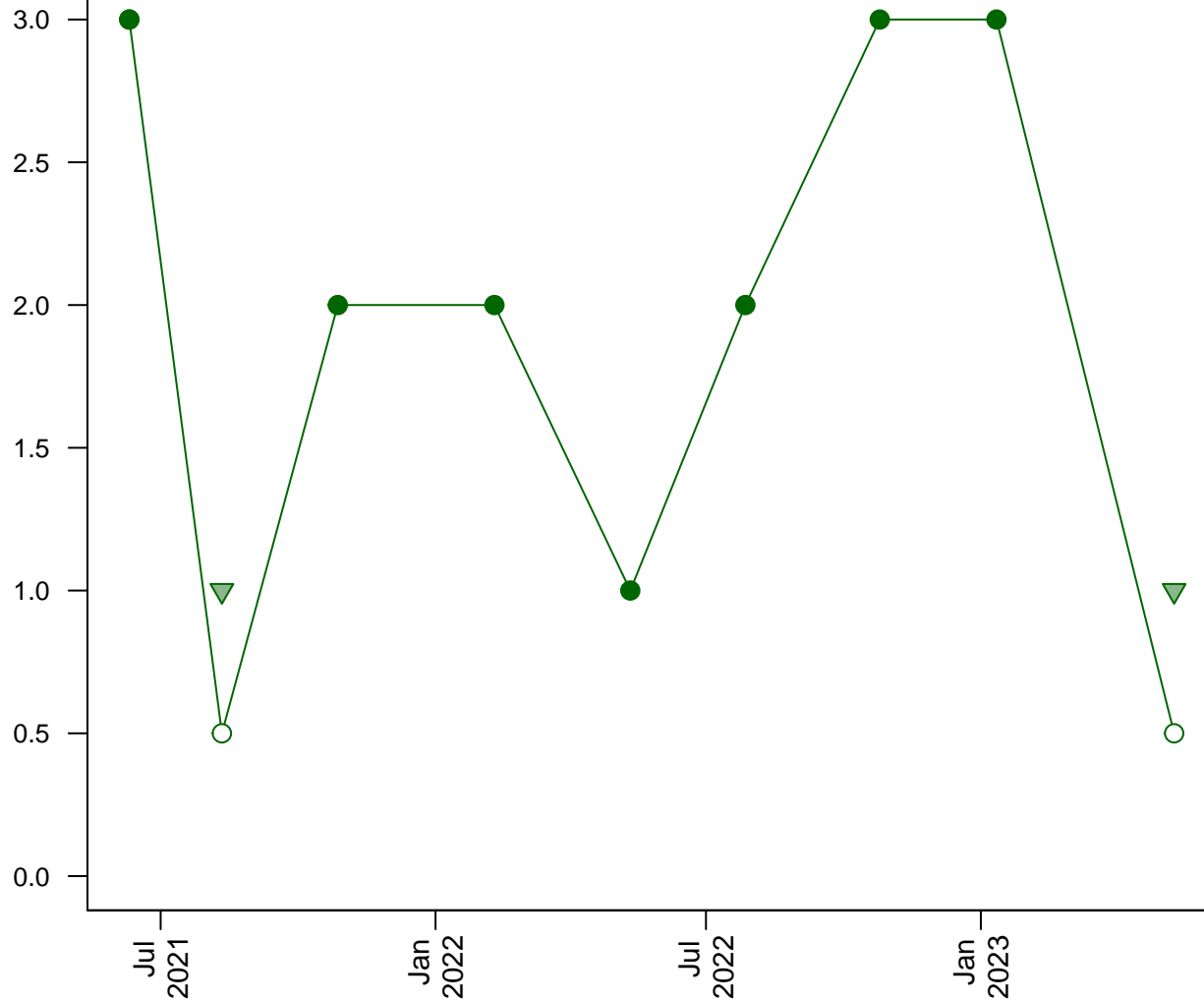
D106, Iron



Scatterplots and Trend Analysis

D106, Lead

Concentration (µg/L)



Stats

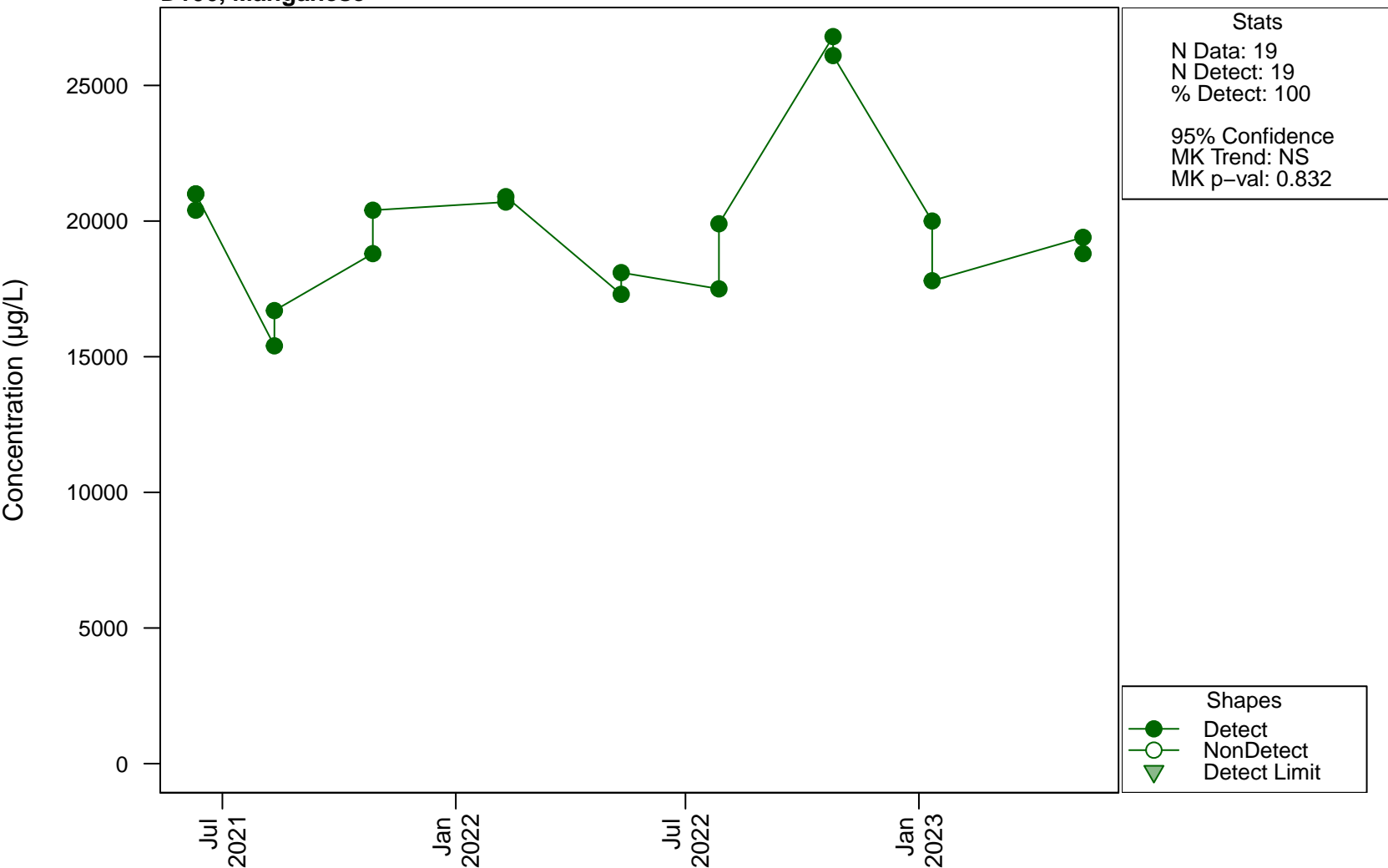
N Data: 10
N Detect: 8
% Detect: 80

95% Confidence
MK Trend: NS
MK p-val: 0.635

Shapes

● Detect
○ NonDetect
▼ Detect Limit

Scatterplots and Trend Analysis D106, Manganese



Scatterplots and Trend Analysis

D106, Mercury

Concentration (µg/L)

0.12
0.10
0.08
0.06
0.04
0.02
0.00

Jul
2021

Jan
2022

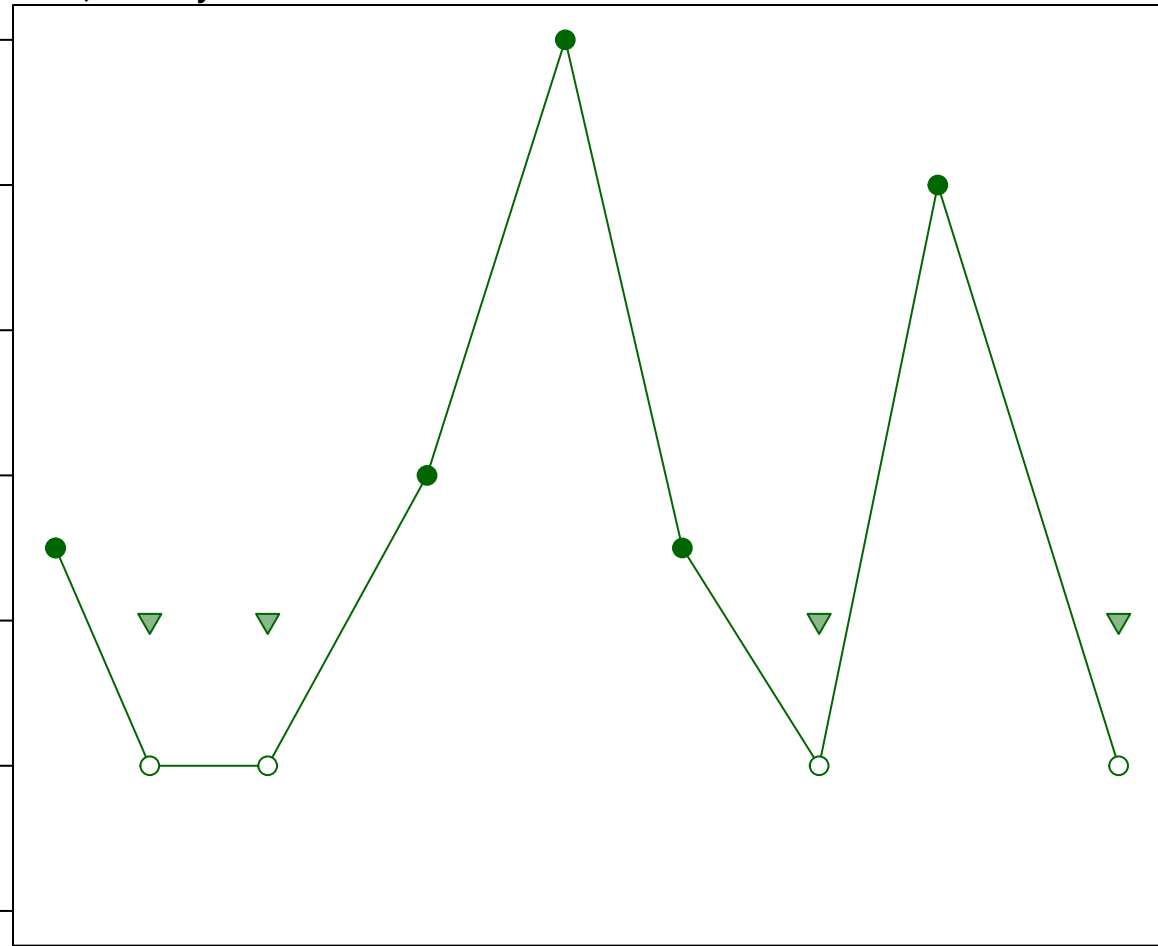
Jul
2022

Jan
2023

Stats
N Data: 10
N Detect: 6
% Detect: 60

95% Confidence
MK Trend: NS
MK p-val: 1

Shapes
● Detect
○ NonDetect
▼ Detect Limit



Scatterplots and Trend Analysis

D106, Molybdenum

Concentration (µg/L)

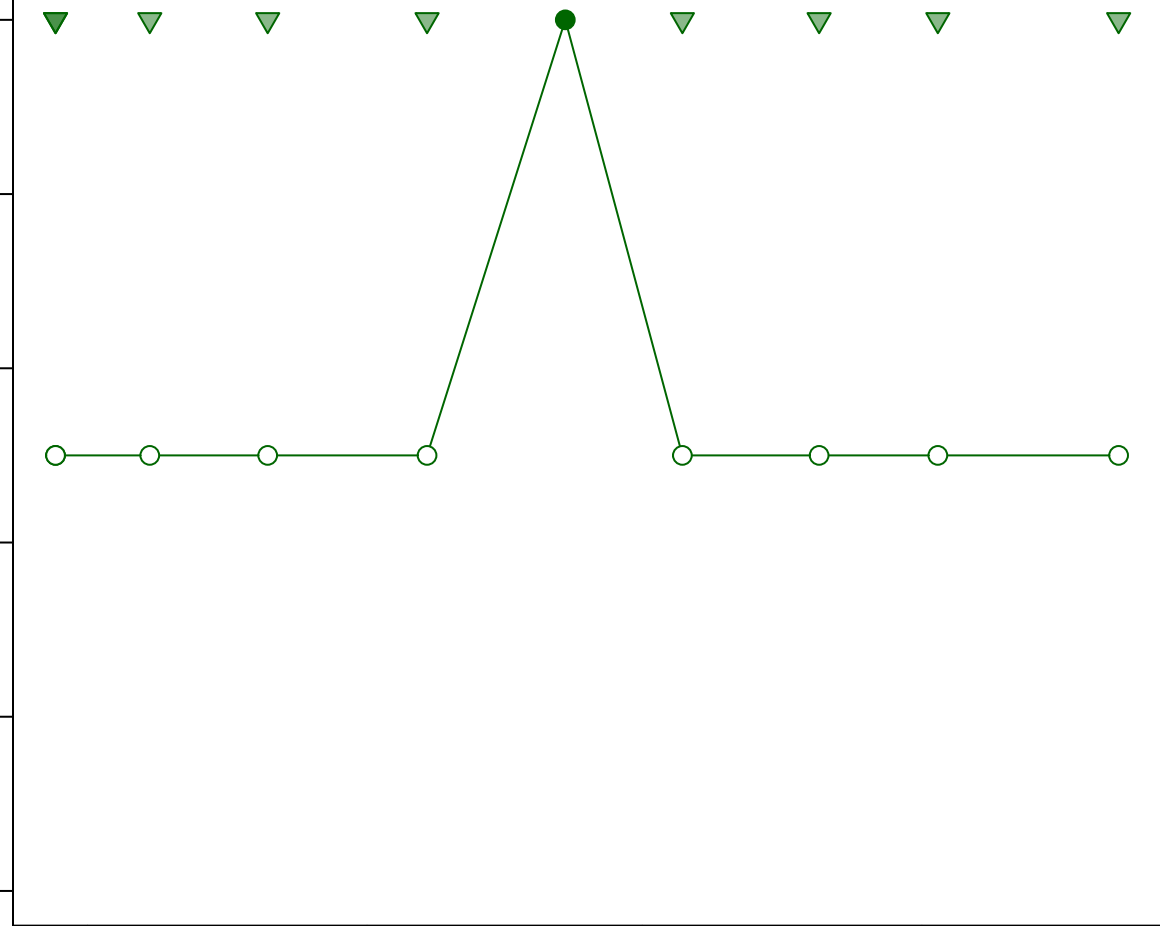
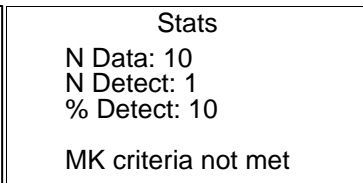
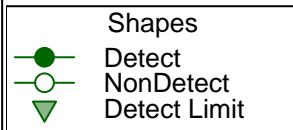
1.0
0.8
0.6
0.4
0.2
0.0

Jul
2021

Jan
2022

Jul
2022

Jan
2023



Scatterplots and Trend Analysis

D106, Nickel

Concentration (µg/L)

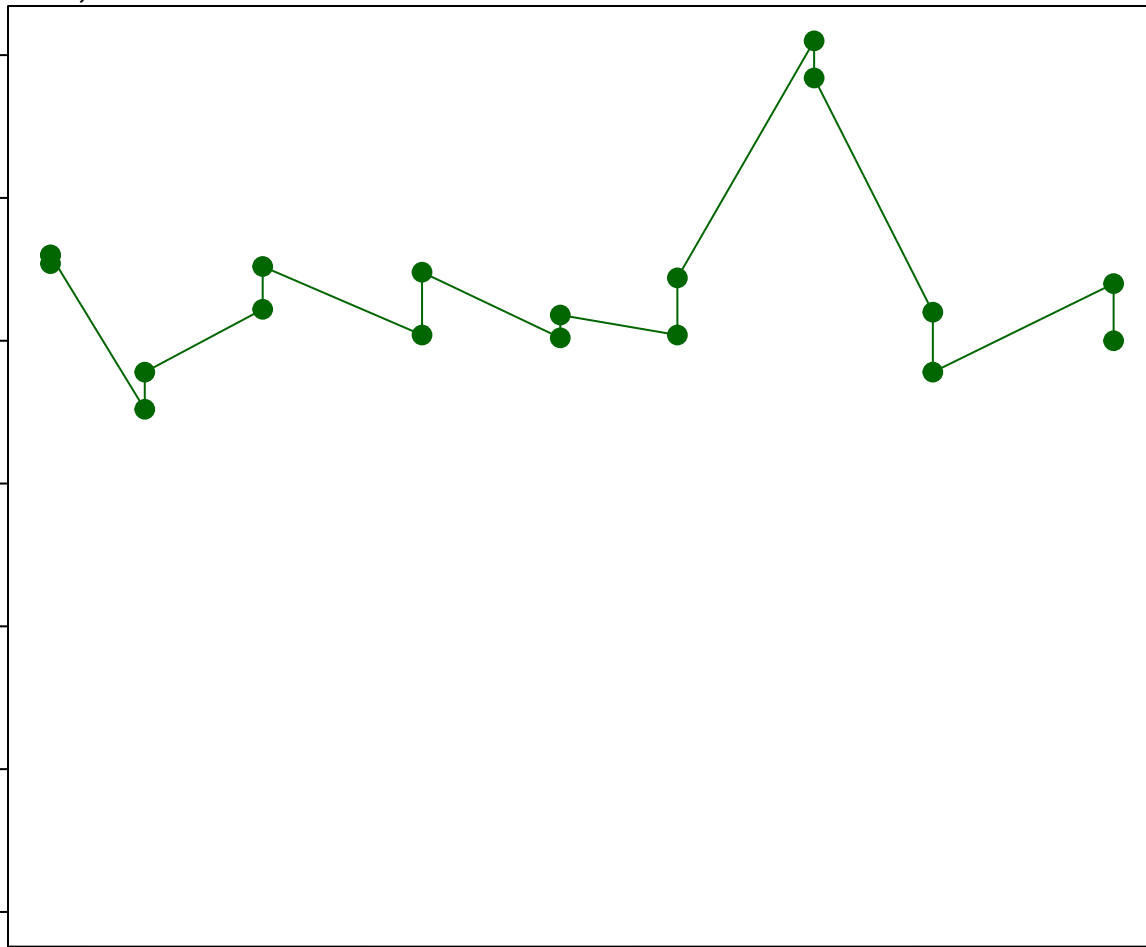
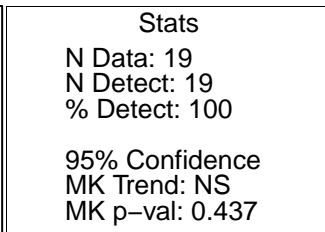
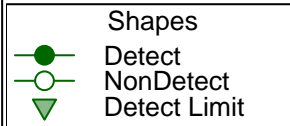
3000
2500
2000
1500
1000
500
0

Jul
2021

Jan
2022

Jul
2022

Jan
2023



Scatterplots and Trend Analysis

D106, Selenium

Concentration (µg/L)

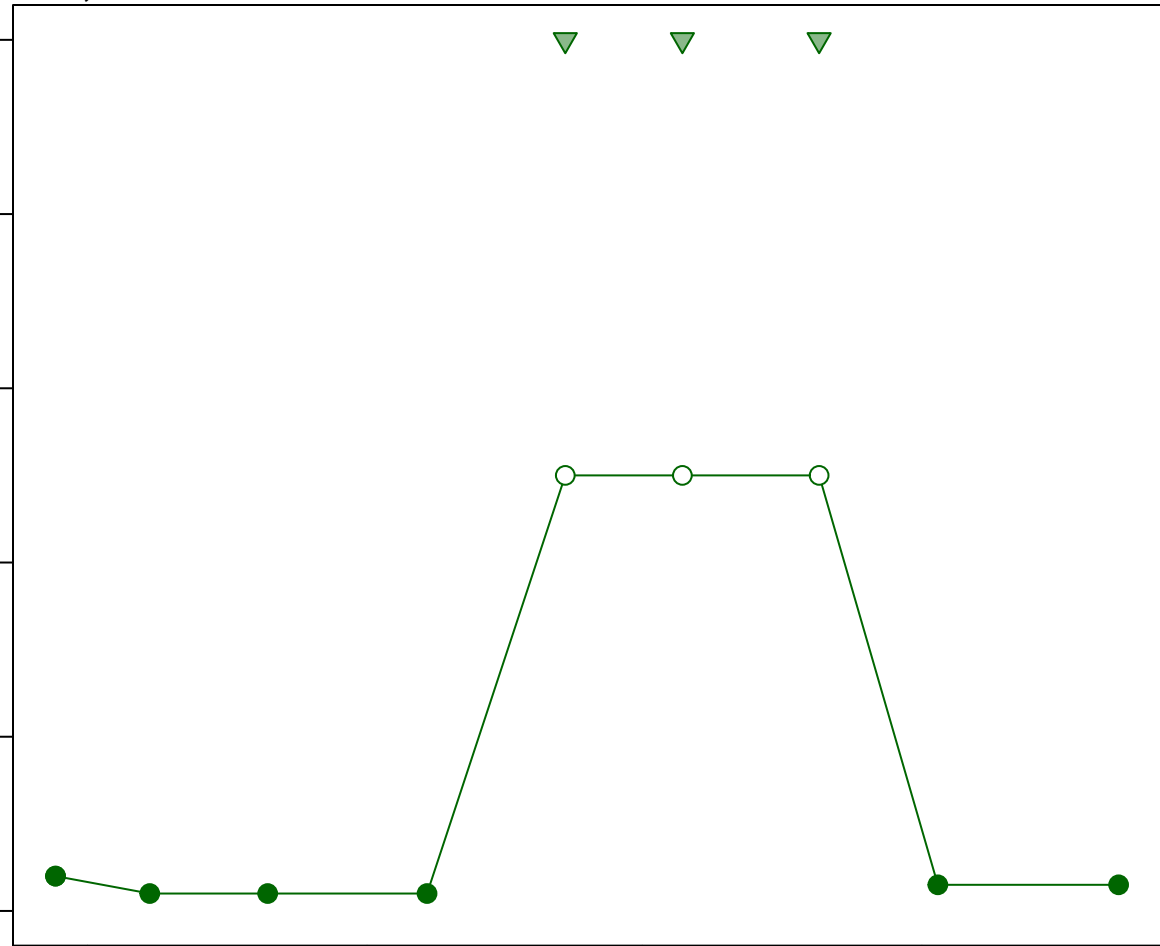
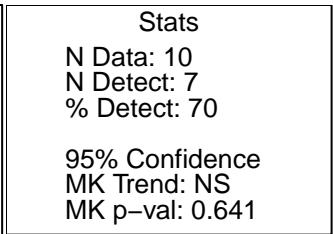
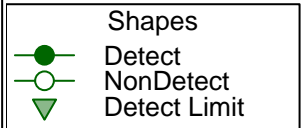
10
8
6
4
2
0

Jul
2021

Jan
2022

Jul
2022

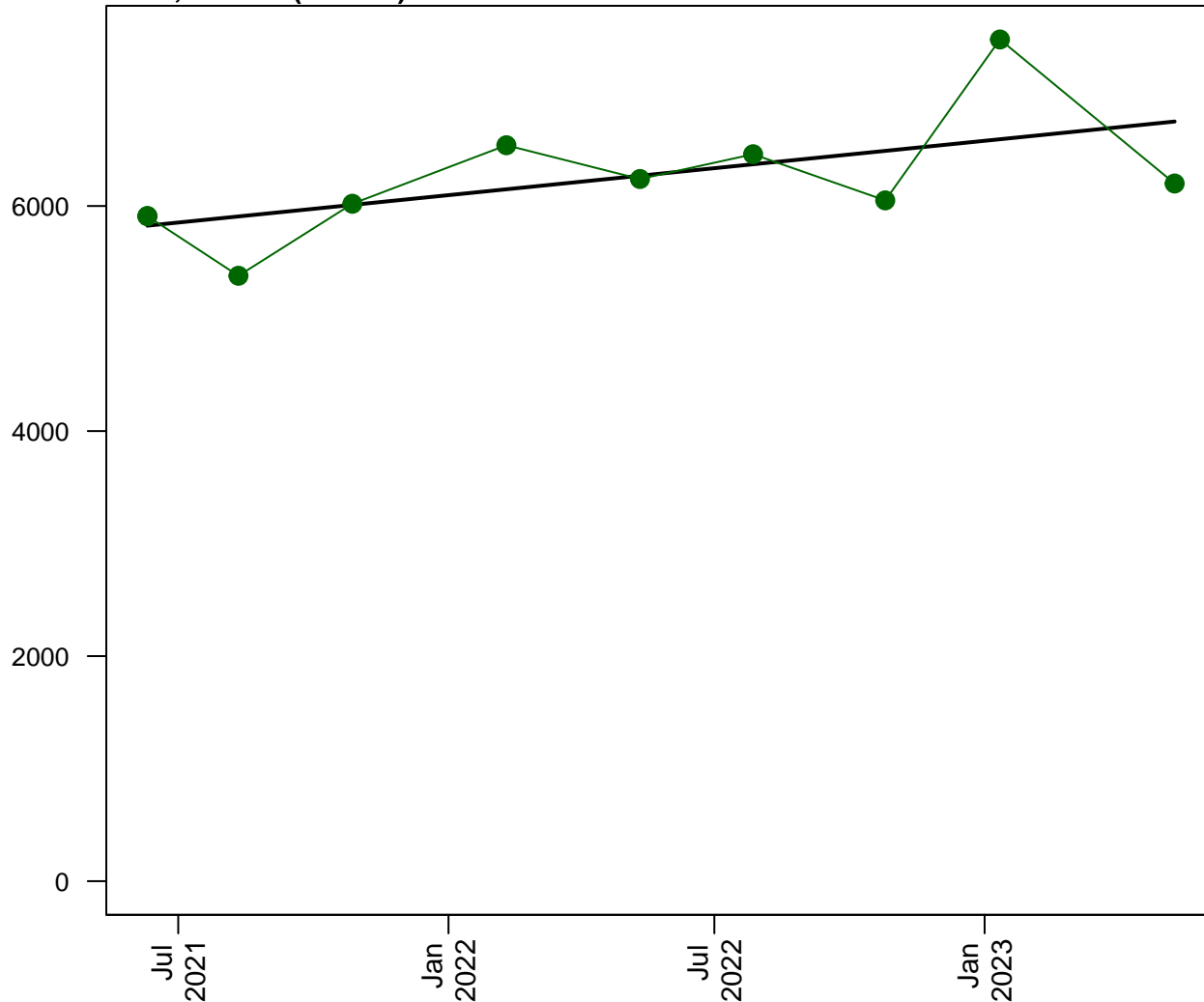
Jan
2023



Scatterplots and Trend Analysis

D106, Sulfate (as SO4)

Concentration (mg/L)



Stats

N Data: 10
N Detect: 10
% Detect: 100

95% Confidence
MK Trend: Significant
MK p-val: 0.0473
Direction: Increasing

Lines

Linear Fit

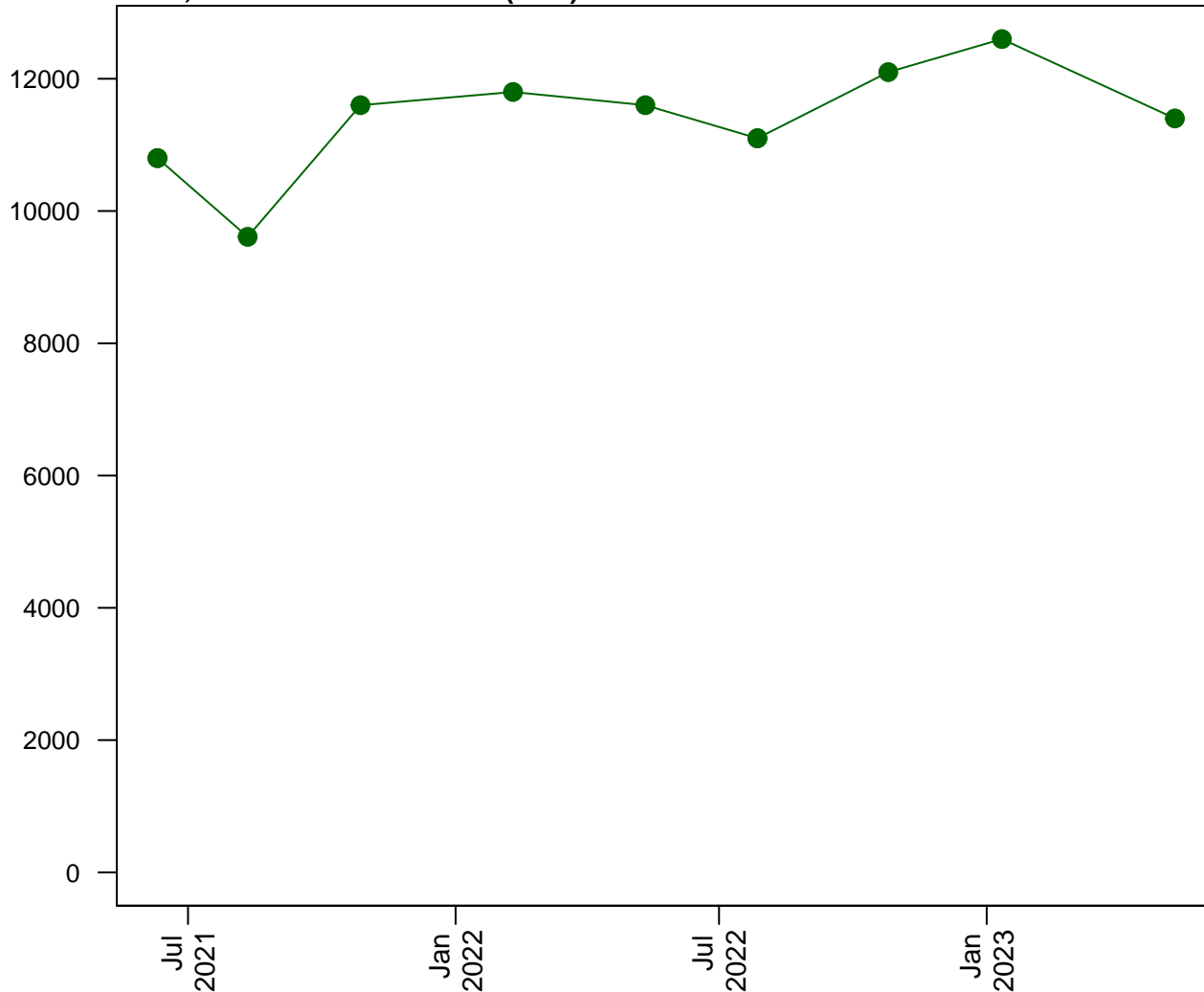
Shapes

Detect
NonDetect
Detect Limit

Scatterplots and Trend Analysis

D106, Total Dissolved Solids (TDS)

Concentration (mg/L)



Stats

N Data: 11
N Detect: 11
% Detect: 100

95% Confidence
MK Trend: NS
MK p-val: 0.0579

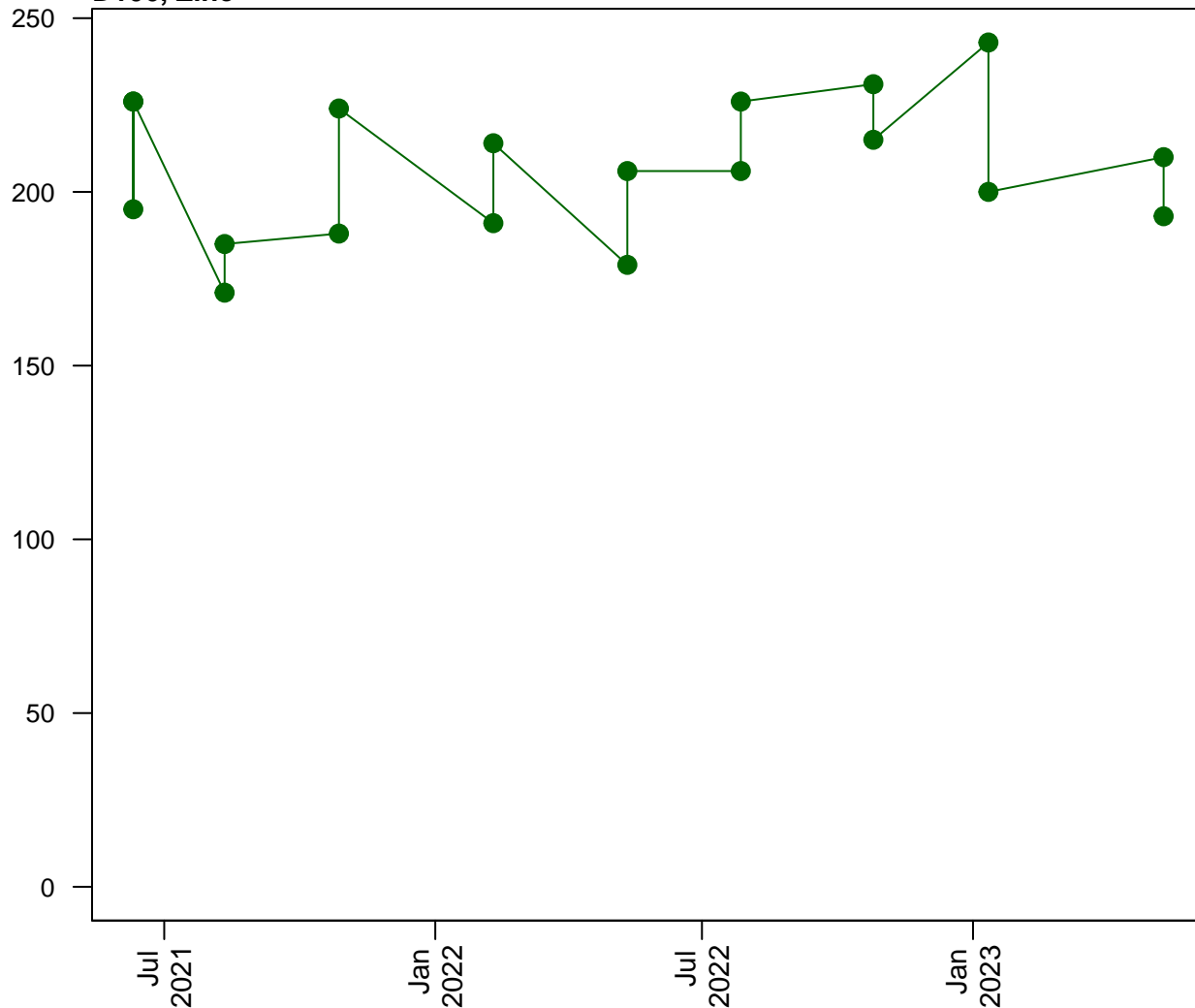
Shapes

● Detect
○ NonDetect
▼ Detect Limit

Scatterplots and Trend Analysis

D106, Zinc

Concentration (µg/L)



Stats

N Data: 19
N Detect: 19
% Detect: 100

95% Confidence
MK Trend: NS
MK p-val: 0.416

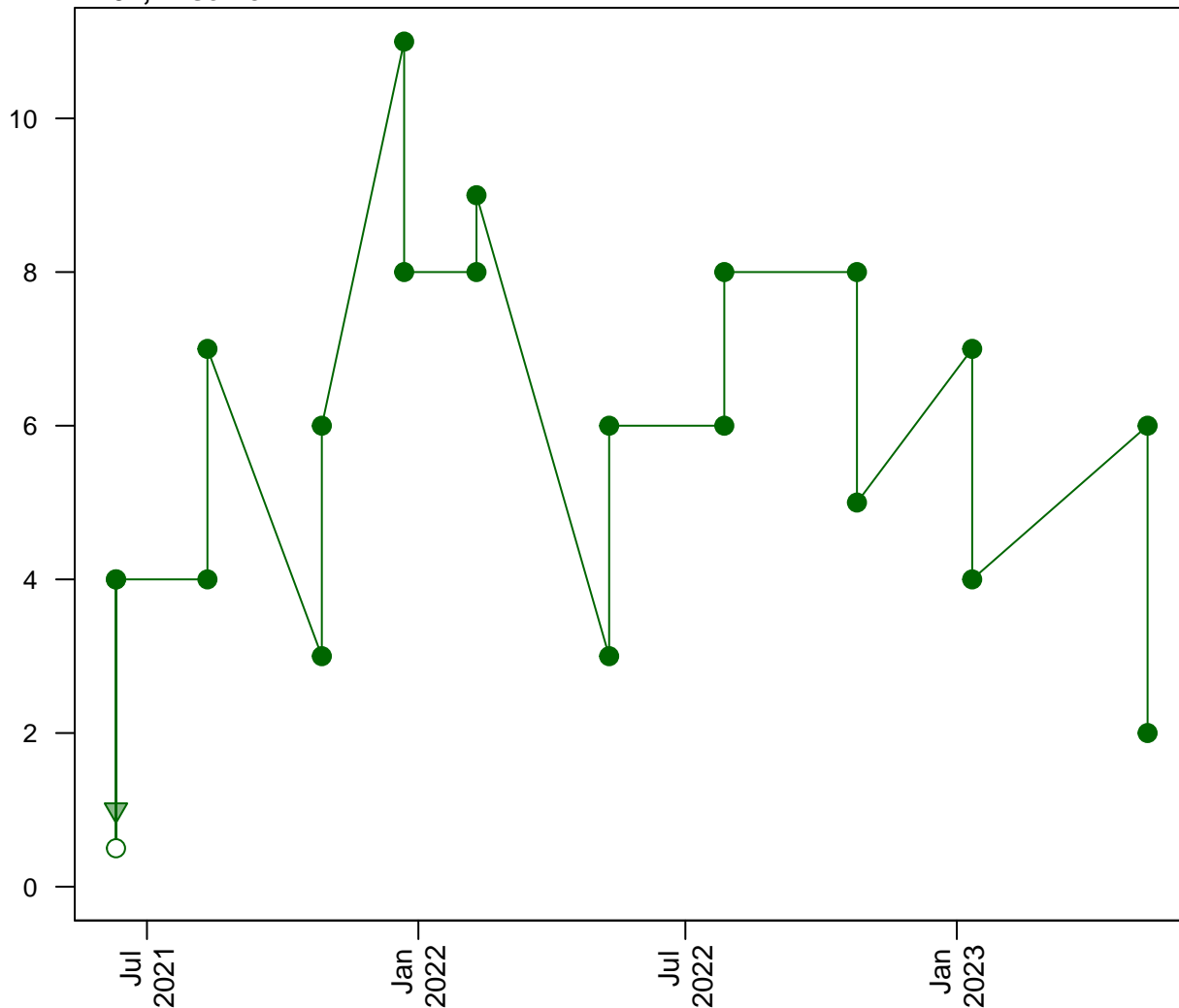
Shapes

● Detect
○ NonDetect
▼ Detect Limit

Scatterplots and Trend Analysis

D107, Arsenic

Concentration (µg/L)



Stats

N Data: 21
N Detect: 20
% Detect: 95

95% Confidence
MK Trend: NS
MK p-val: 0.645

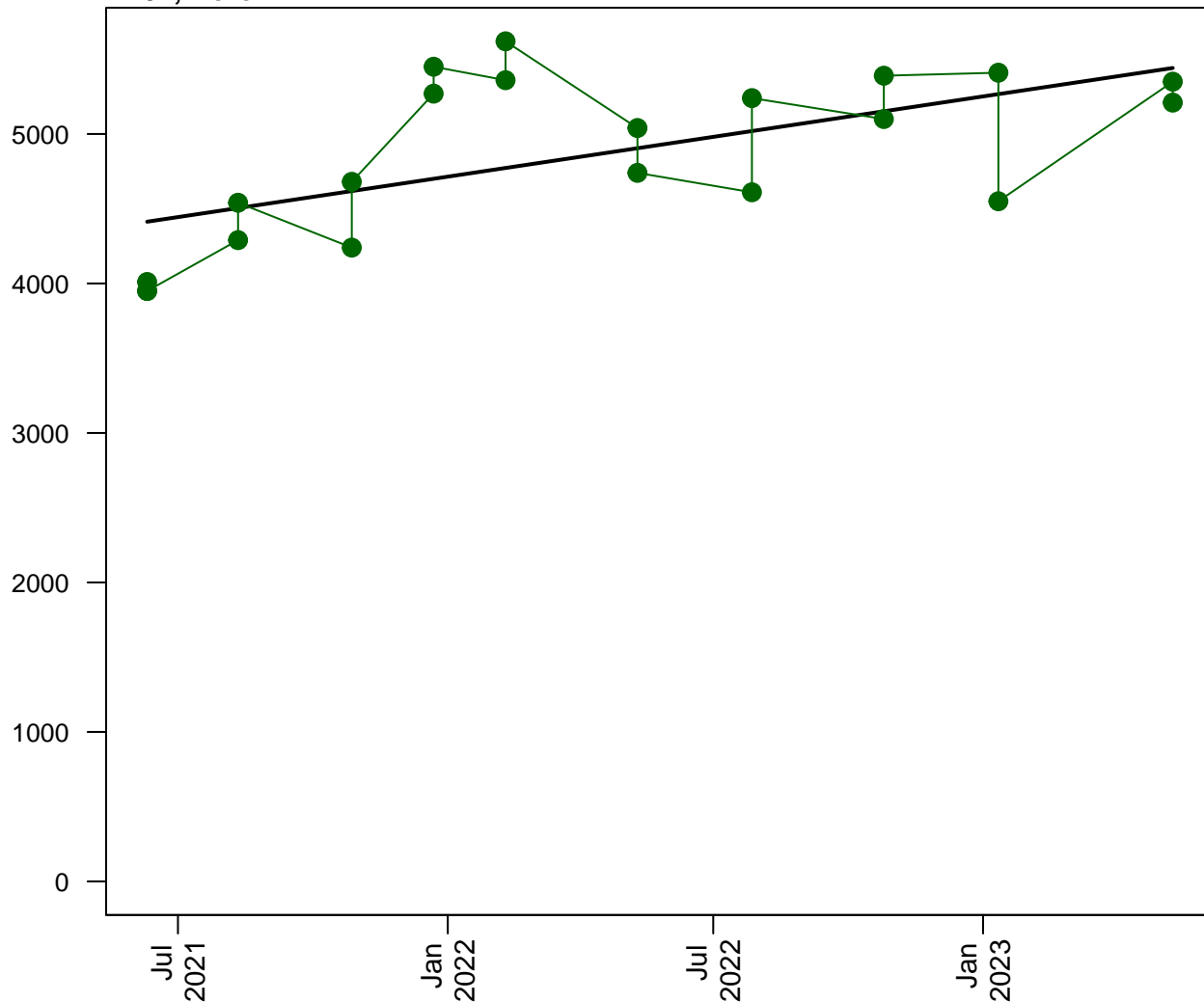
Shapes

● Detect
○ NonDetect
▼ Detect Limit

Scatterplots and Trend Analysis

D107, Boron

Concentration (µg/L)



Stats

N Data: 21
N Detect: 21
% Detect: 100

95% Confidence
MK Trend: Significant
MK p-val: 0.00624
Direction: Increasing

Lines

— Linear Fit

Shapes

● Detect
○ NonDetect
▼ Detect Limit

Scatterplots and Trend Analysis

D107, Cadmium

Concentration (µg/L)

1.5
1.0
0.5
0.0

Jul
2021

Jan
2022

Jul
2022

Jan
2023

Stats

N Data: 11

N Detect: 11

% Detect: 100

95% Confidence

MK Trend: NS

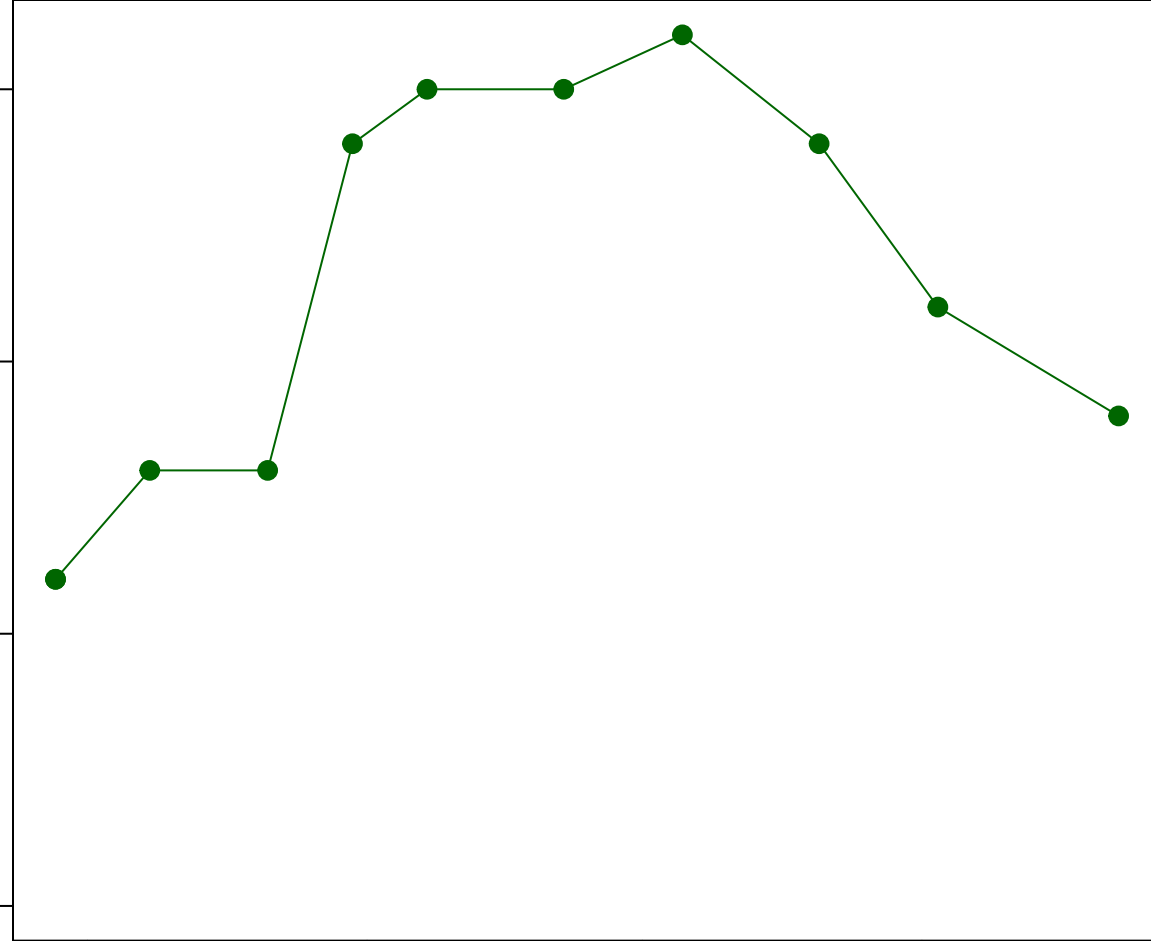
MK p-val: 0.0691

Shapes

● Detect

○ NonDetect

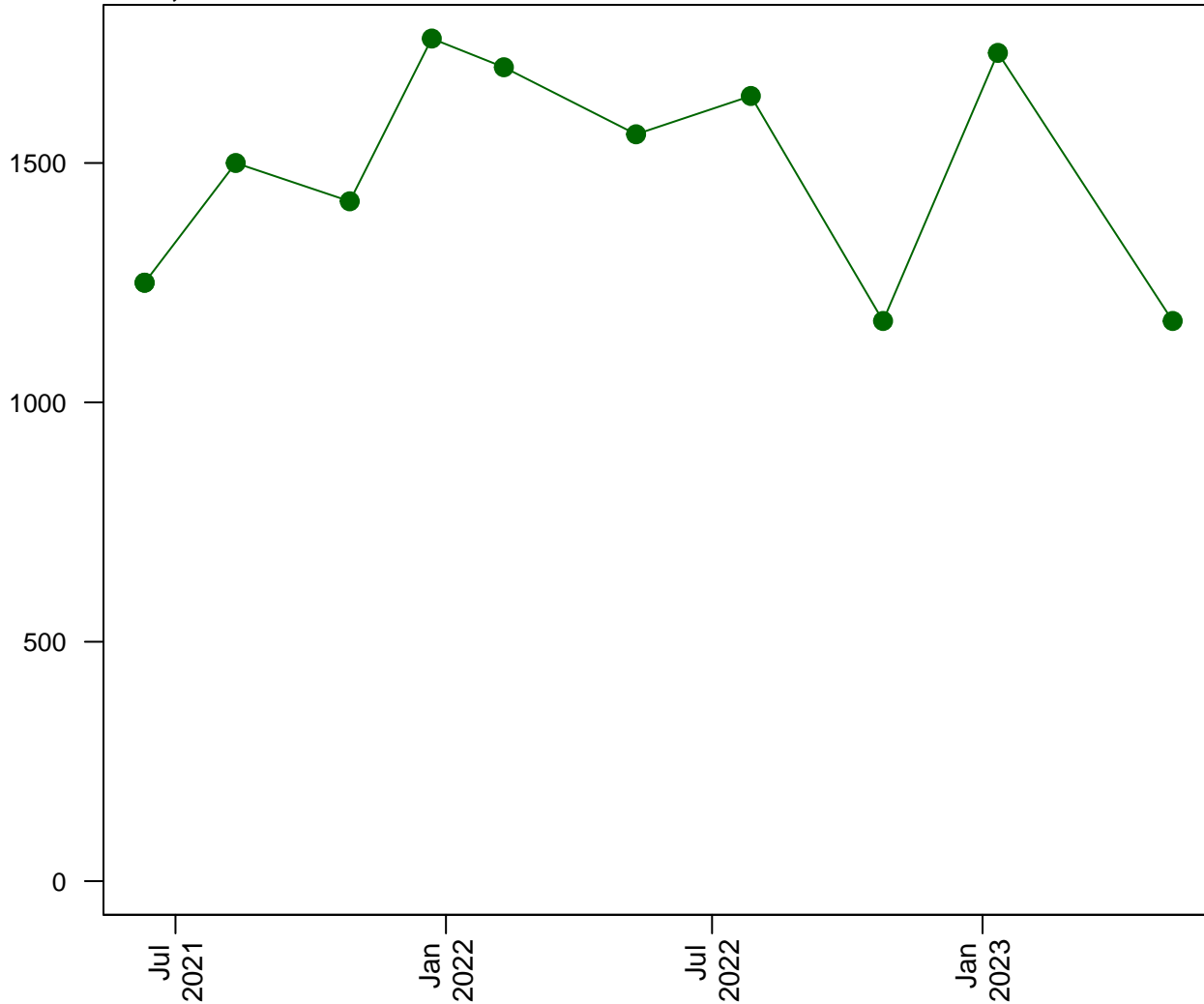
▼ Detect Limit



Scatterplots and Trend Analysis

D107, Chloride

Concentration (mg/L)



Stats

N Data: 11
N Detect: 11
% Detect: 100

95% Confidence
MK Trend: NS
MK p-val: 0.694

Shapes

● Detect
○ NonDetect
▼ Detect Limit

Scatterplots and Trend Analysis

D107, Chromium

Concentration (µg/L)

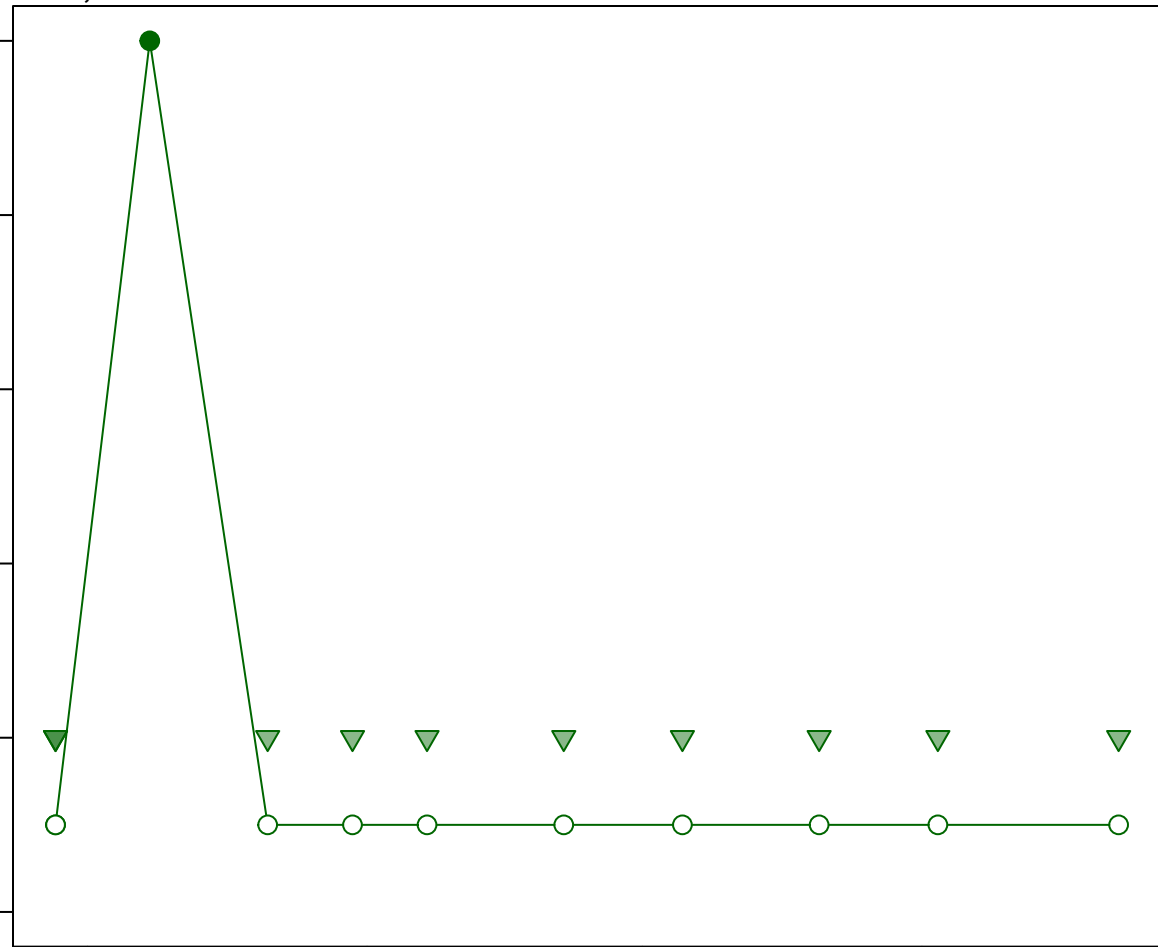
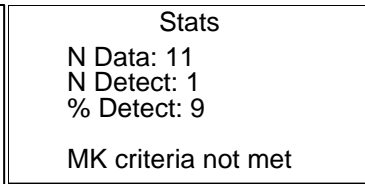
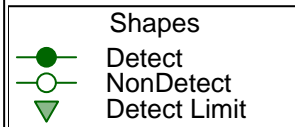
5
4
3
2
1
0

Jul
2021

Jan
2022

Jul
2022

Jan
2023



Scatterplots and Trend Analysis

D107, Electrical Conductivity (Field)

Concentration (uS/cm)

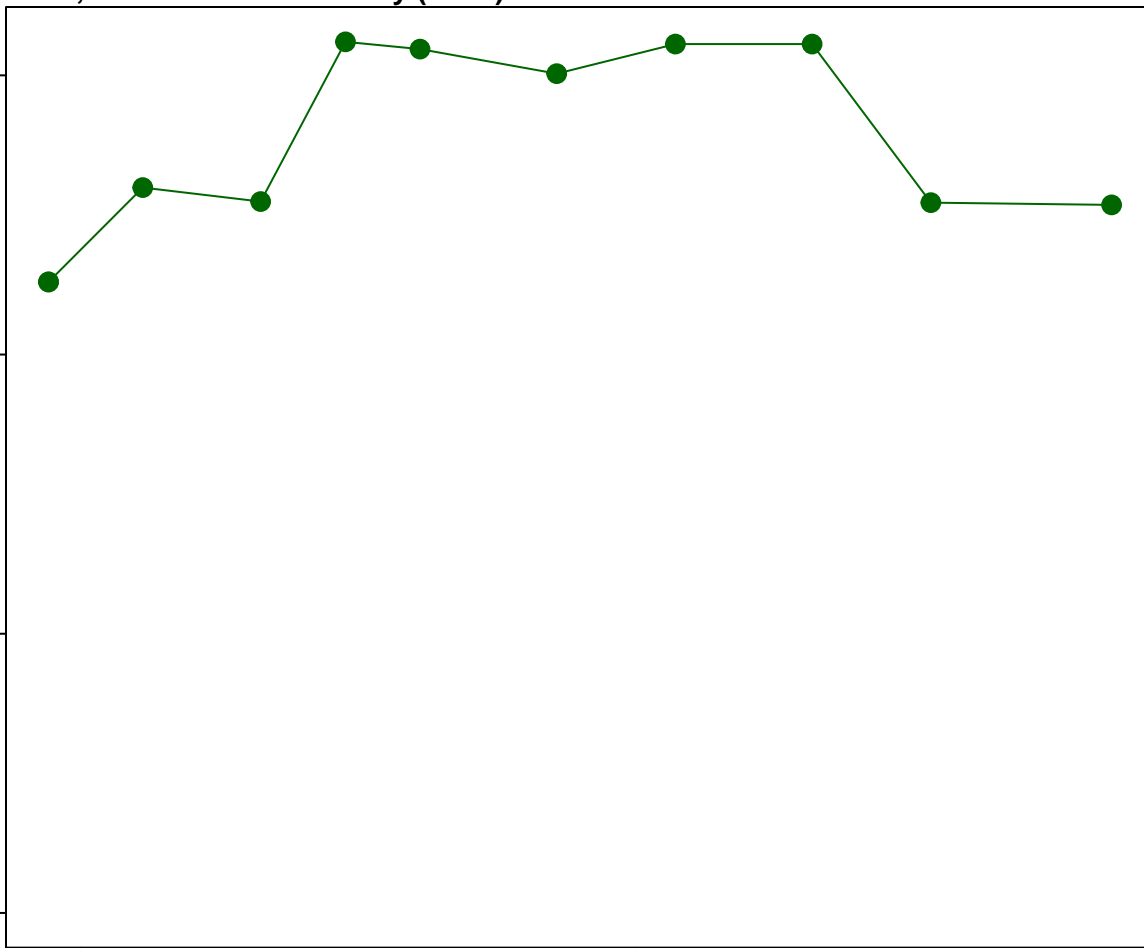
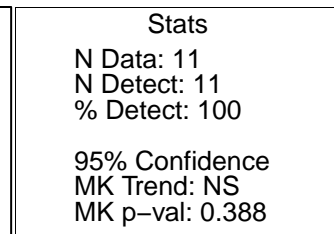
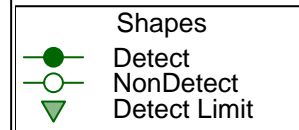
15000
10000
5000
0

Jul
2021

Jan
2022

Jul
2022

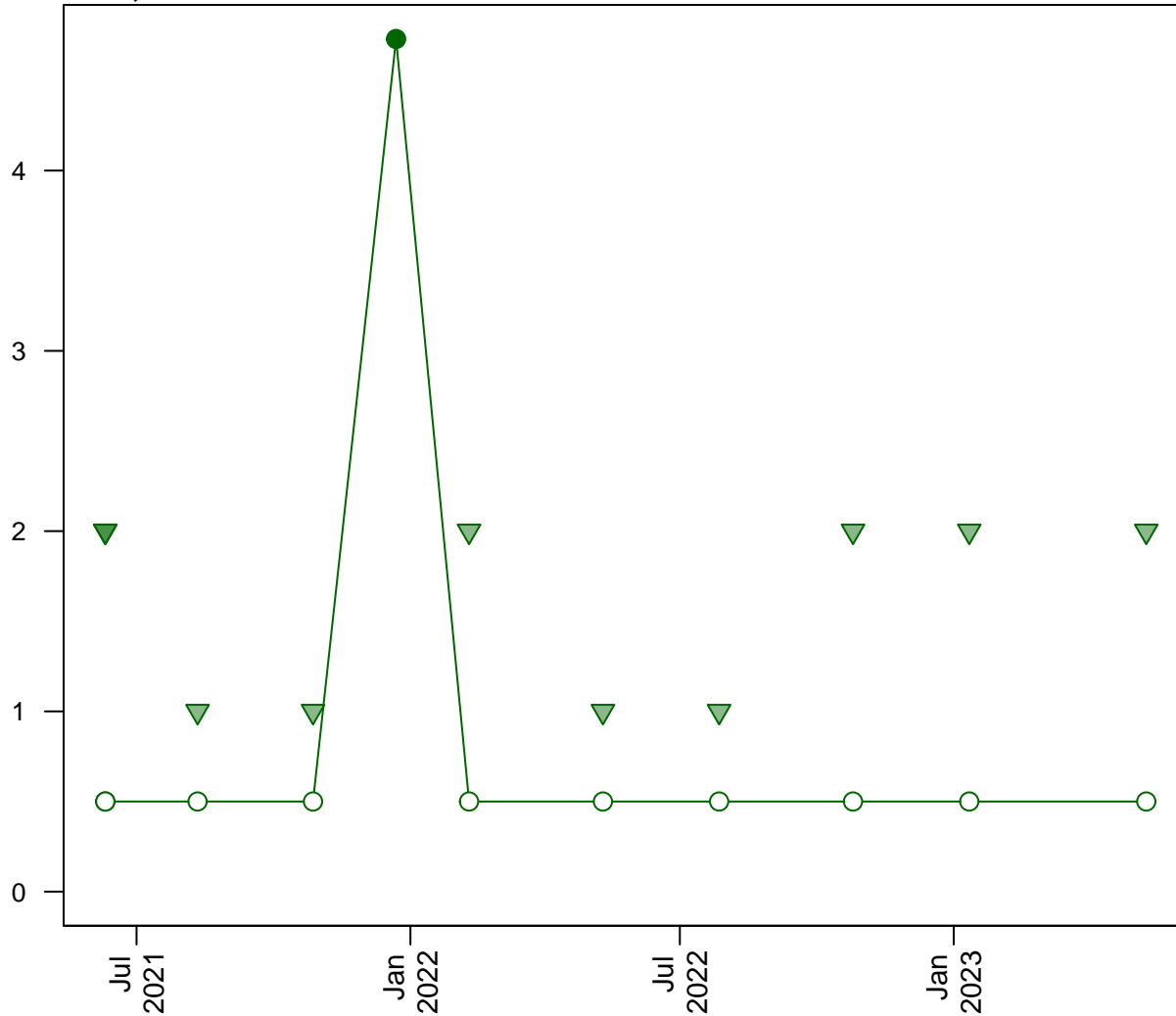
Jan
2023



Scatterplots and Trend Analysis

D107, Fluoride

Concentration (mg/L)



Stats

N Data: 11

N Detect: 1

% Detect: 9

MK criteria not met

Shapes

● Detect

○ NonDetect

▼ Detect Limit

Scatterplots and Trend Analysis

D107, Iron

Concentration (µg/L)

35000
30000
25000
20000
15000
10000
5000
0

Jul
2021

Jan
2022

Jul
2022

Jan
2023

Stats

N Data: 21
N Detect: 21
% Detect: 100

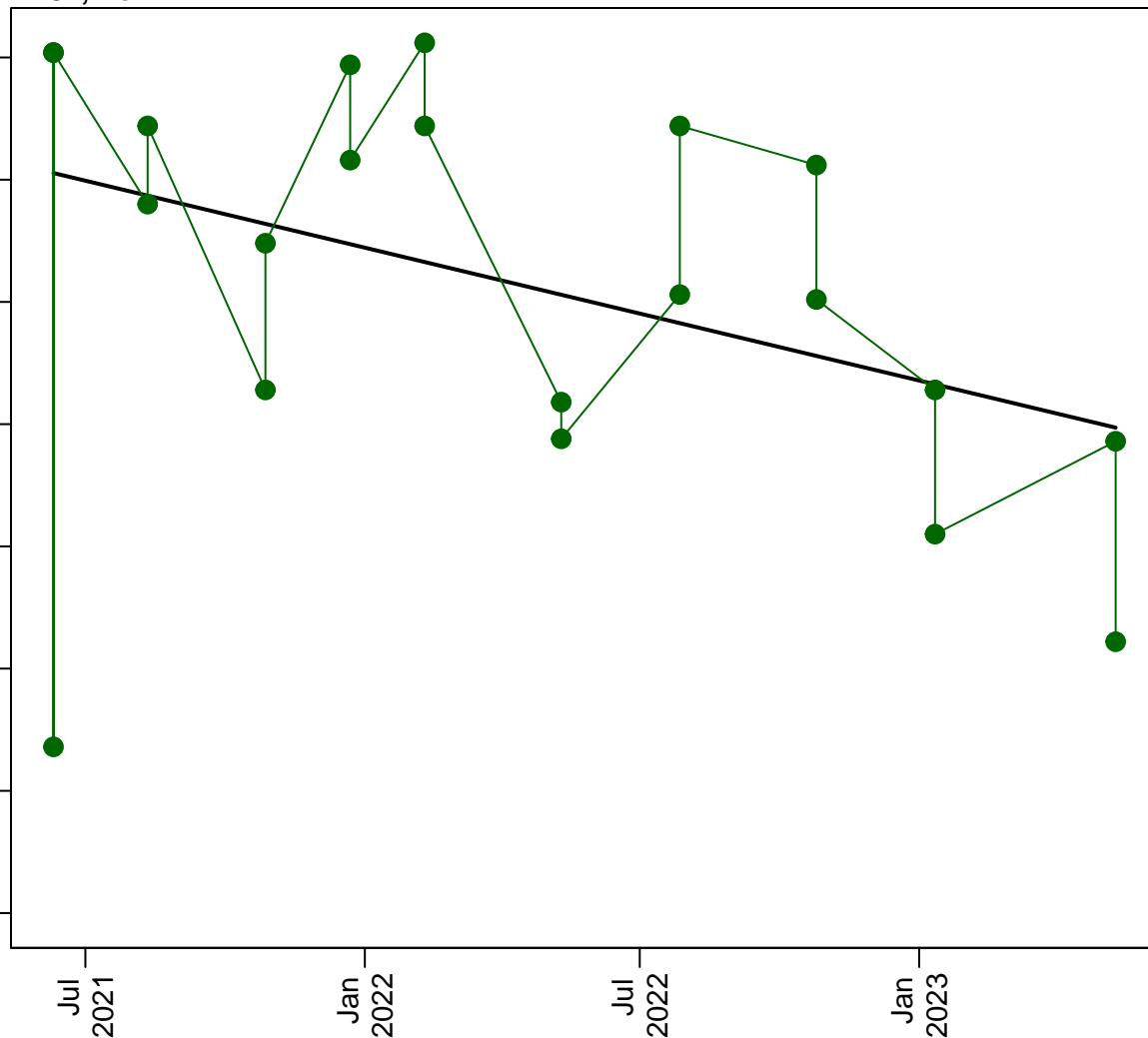
95% Confidence
MK Trend: Significant
MK p-val: 0.0175
Direction: Decreasing

Lines

Linear Fit

Shapes

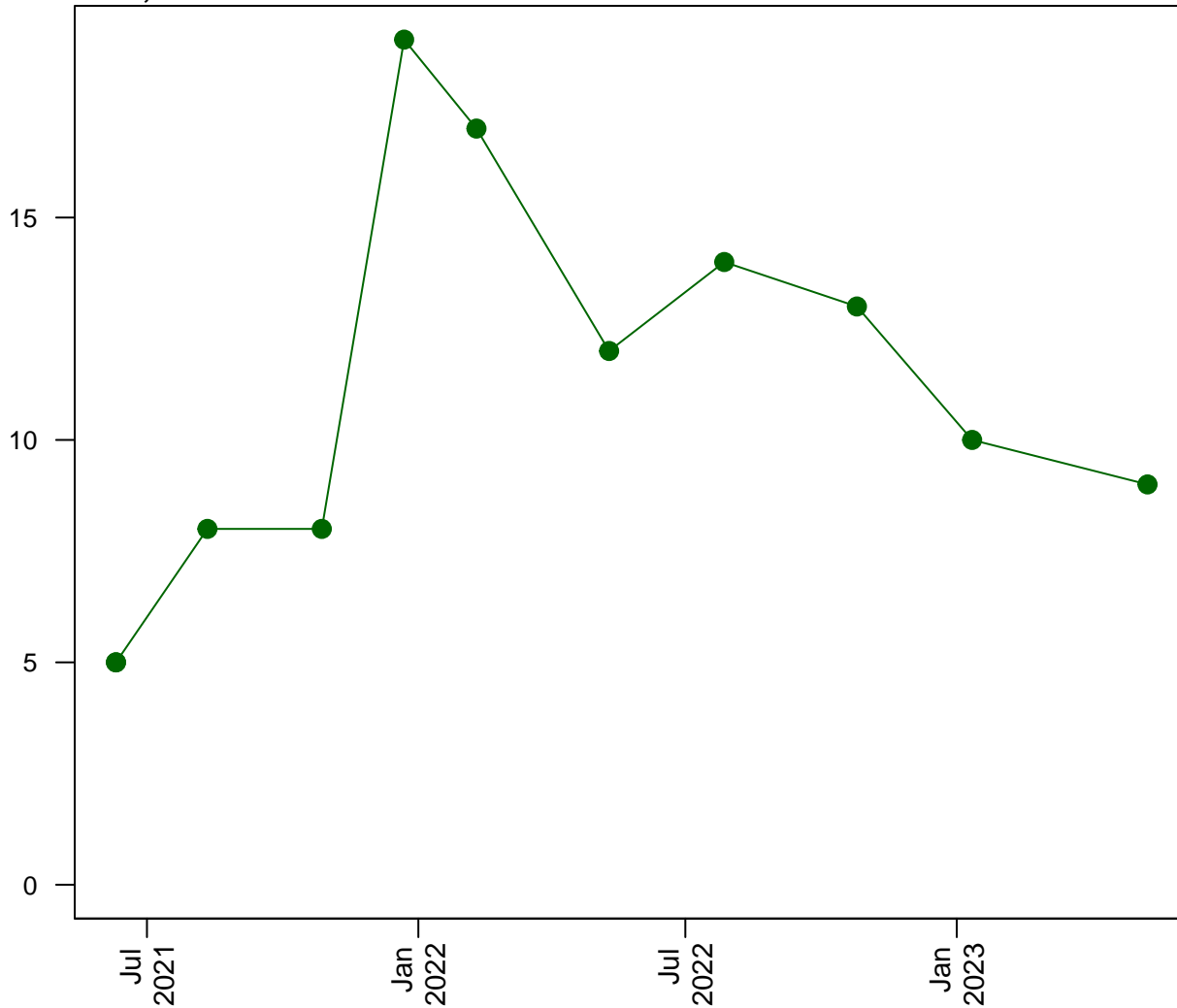
● Detect
○ NonDetect
▼ Detect Limit



Scatterplots and Trend Analysis

D107, Lead

Concentration (µg/L)



Stats

N Data: 11
N Detect: 11
% Detect: 100

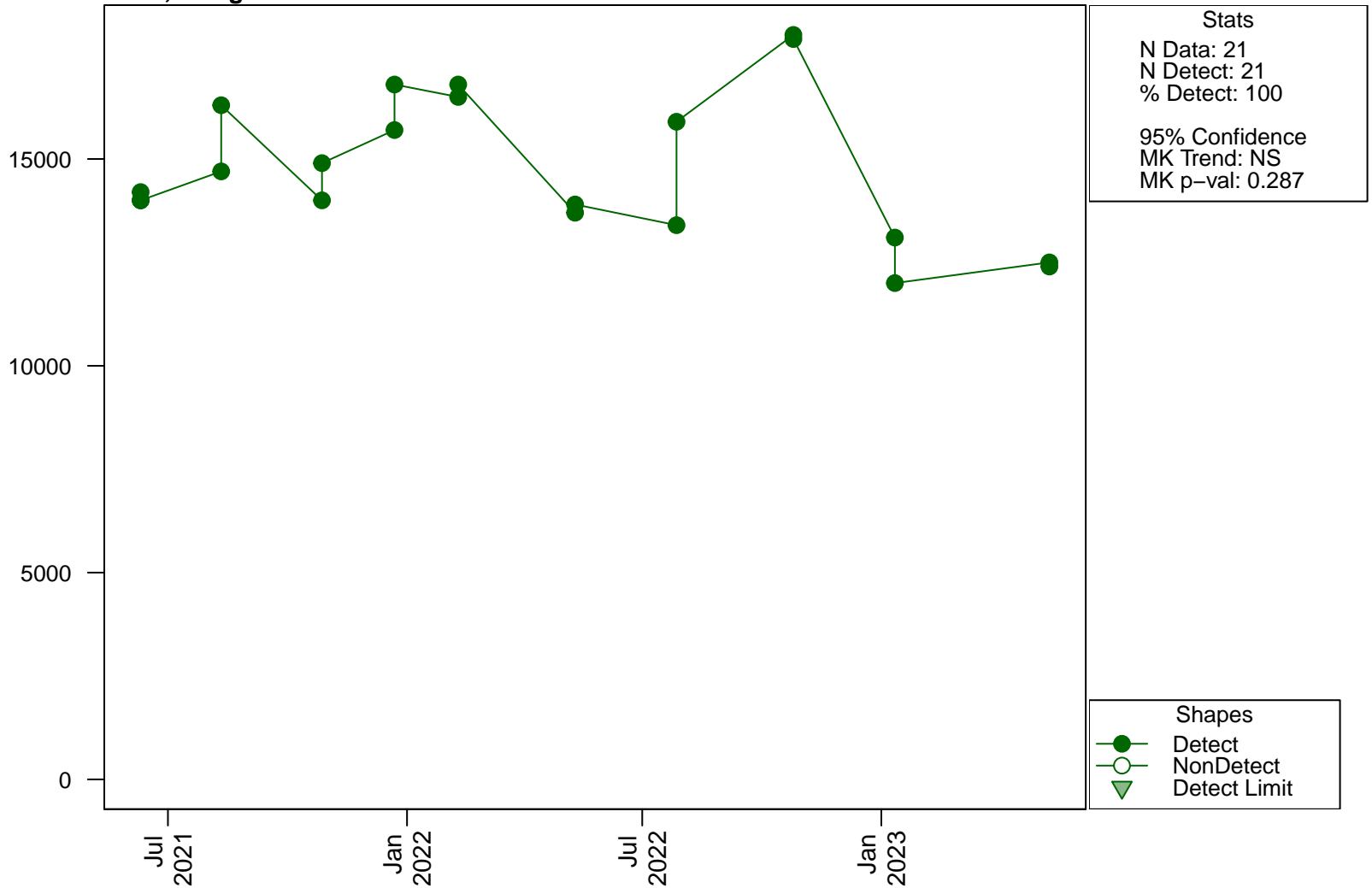
95% Confidence
MK Trend: NS
MK p-val: 0.239

Shapes

● Detect
○ NonDetect
▼ Detect Limit

Scatterplots and Trend Analysis D107, Manganese

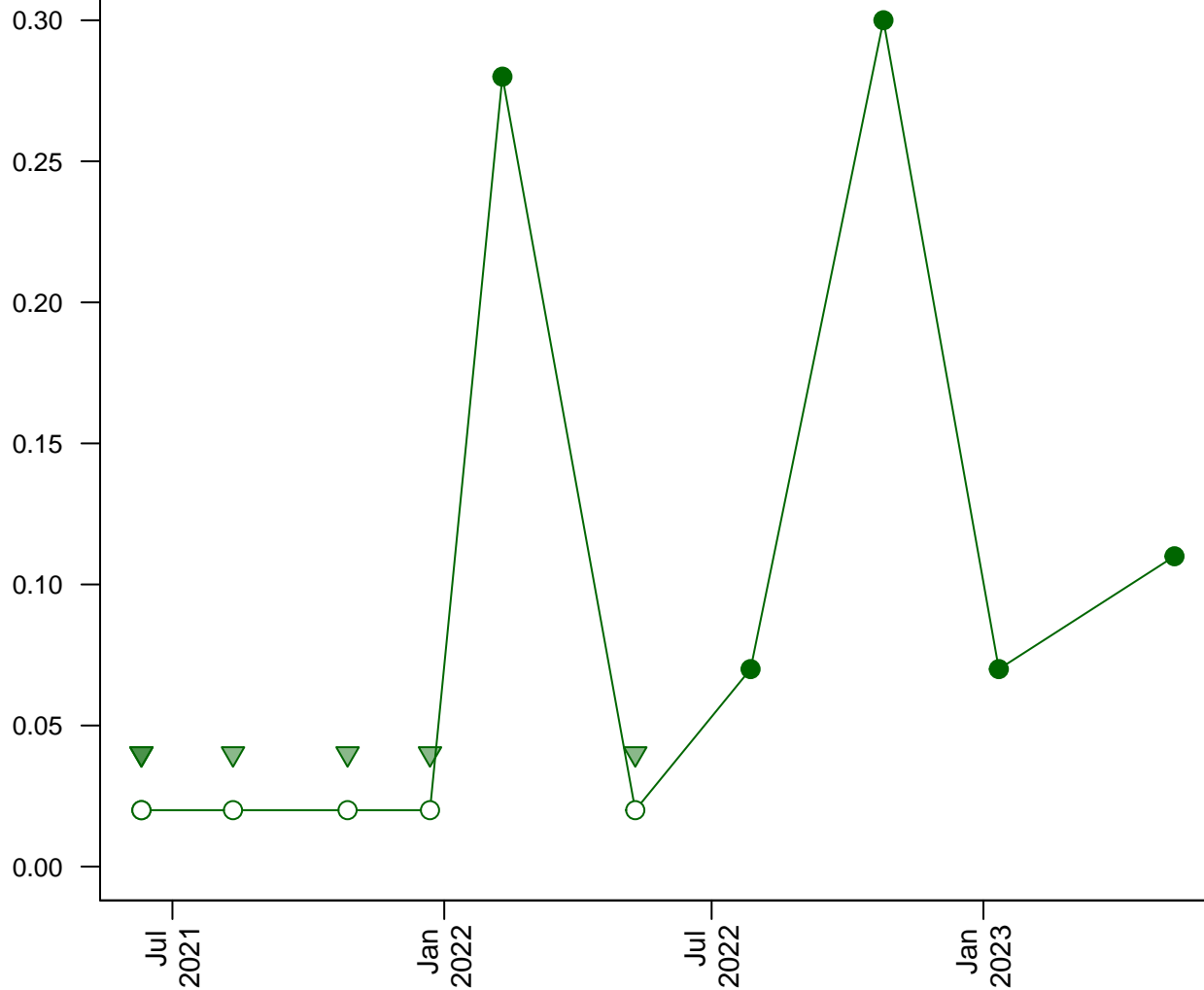
Concentration (µg/L)



Scatterplots and Trend Analysis

D107, Mercury

Concentration (µg/L)



Stats

N Data: 11

N Detect: 5

% Detect: 45

MK criteria not met

Shapes

● Detect

○ NonDetect

▼ Detect Limit

Scatterplots and Trend Analysis

D107, Molybdenum

Concentration (µg/L)

1.0
0.8
0.6
0.4
0.2
0.0

Jul
2021

Jan
2022

Jul
2022

Jan
2023

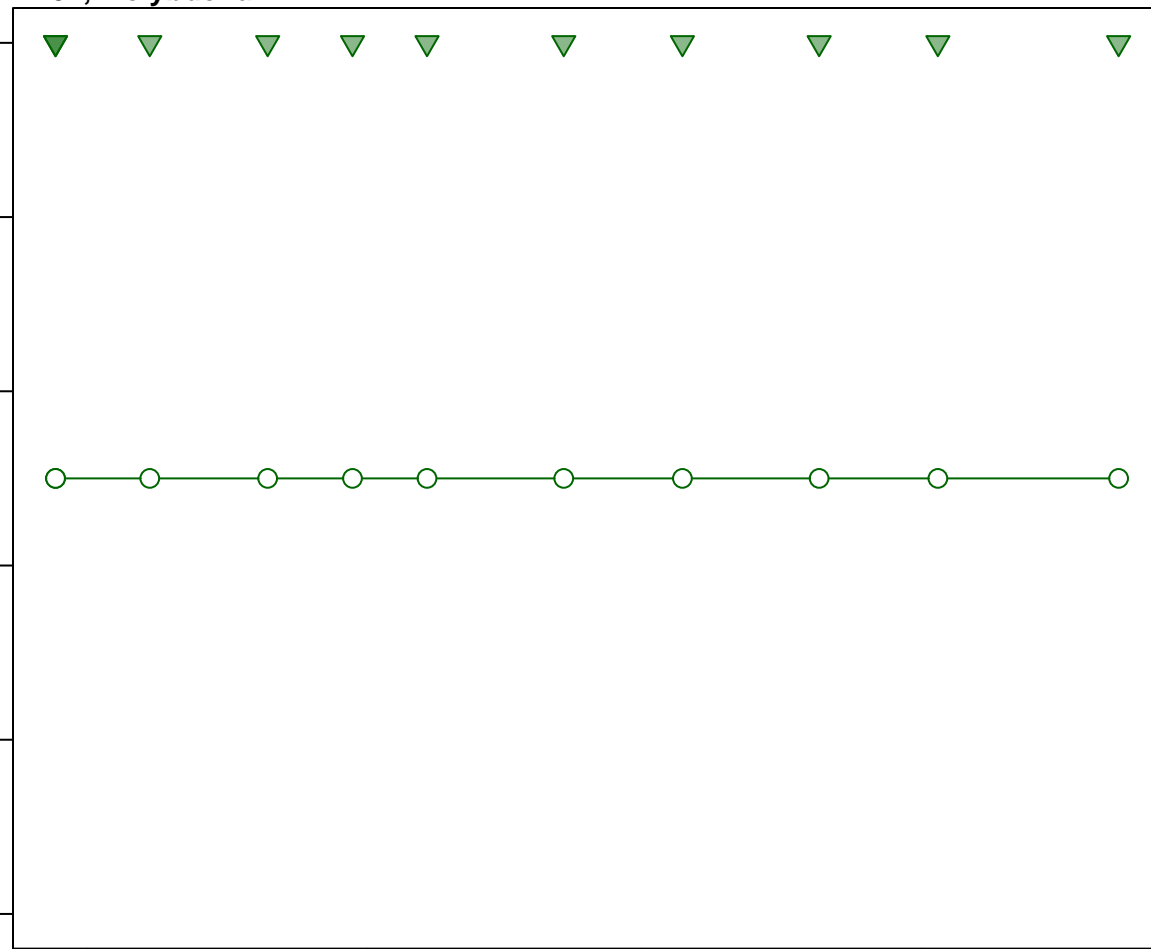
Stats

N Data: 11
N Detect: 0
% Detect: 0

MK criteria not met

Shapes

● Detect
○ NonDetect
▼ Detect Limit



Scatterplots and Trend Analysis

D107, Nickel

Concentration (µg/L)

3000
2500
2000
1500
1000
500
0

Jul
2021

Jan
2022

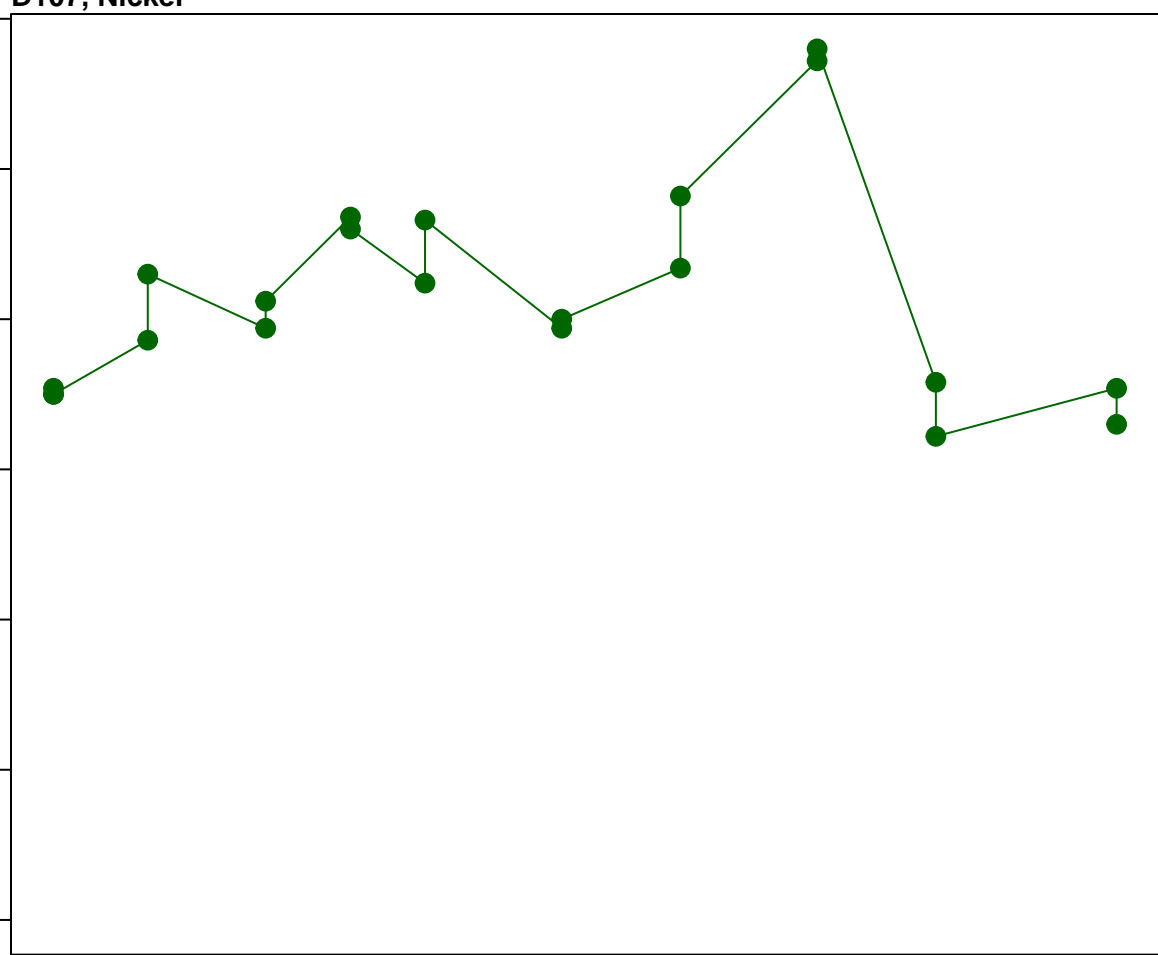
Jul
2022

Jan
2023

Stats
N Data: 21
N Detect: 21
% Detect: 100

95% Confidence
MK Trend: NS
MK p-val: 0.429

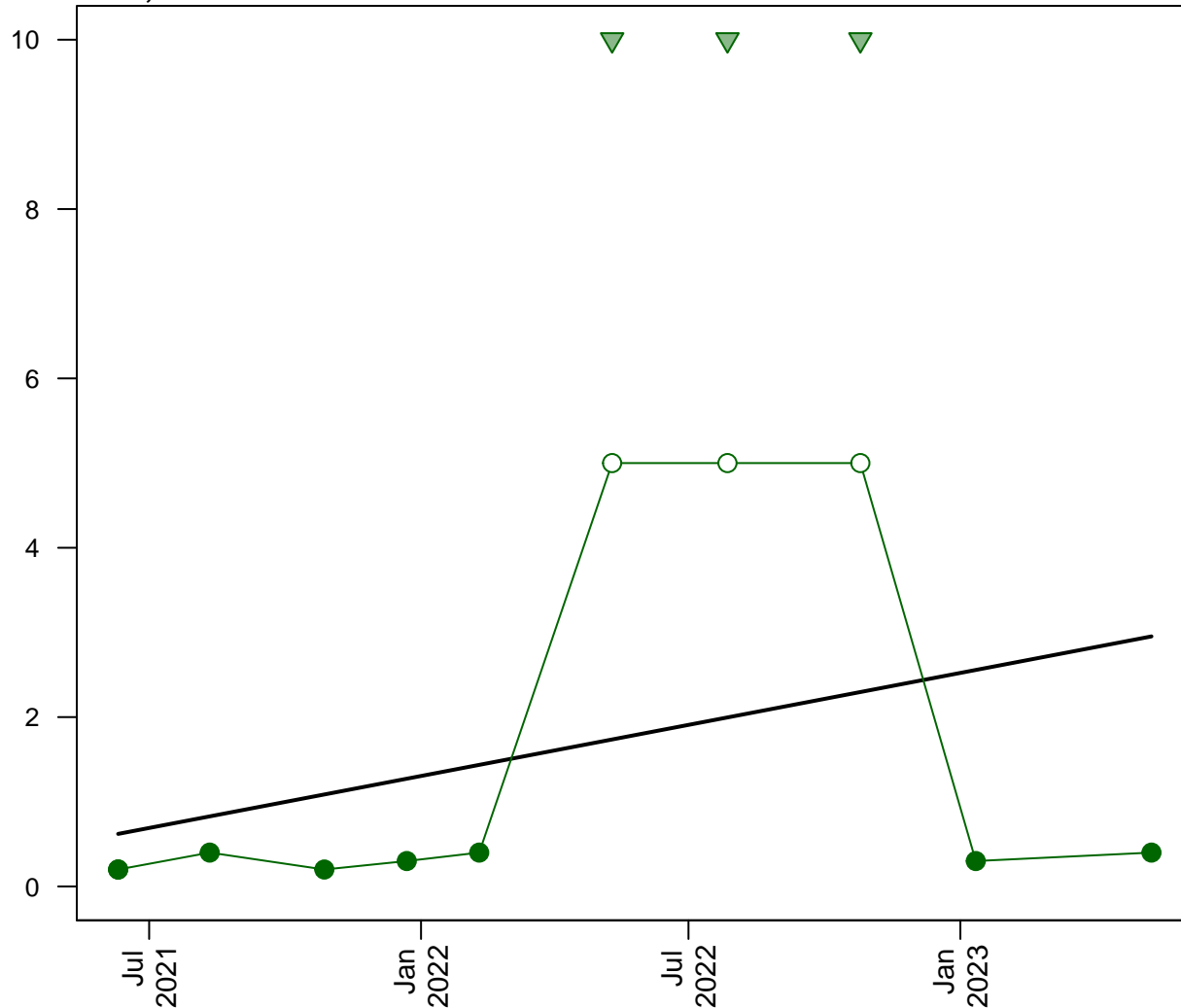
Shapes
● Detect
○ NonDetect
▼ Detect Limit



Scatterplots and Trend Analysis

D107, Selenium

Concentration (µg/L)



Stats

N Data: 11

N Detect: 8

% Detect: 73

95% Confidence

MK Trend: Significant

MK p-val: 0.0427

Direction: Increasing

Lines

Linear Fit

Shapes

Detect

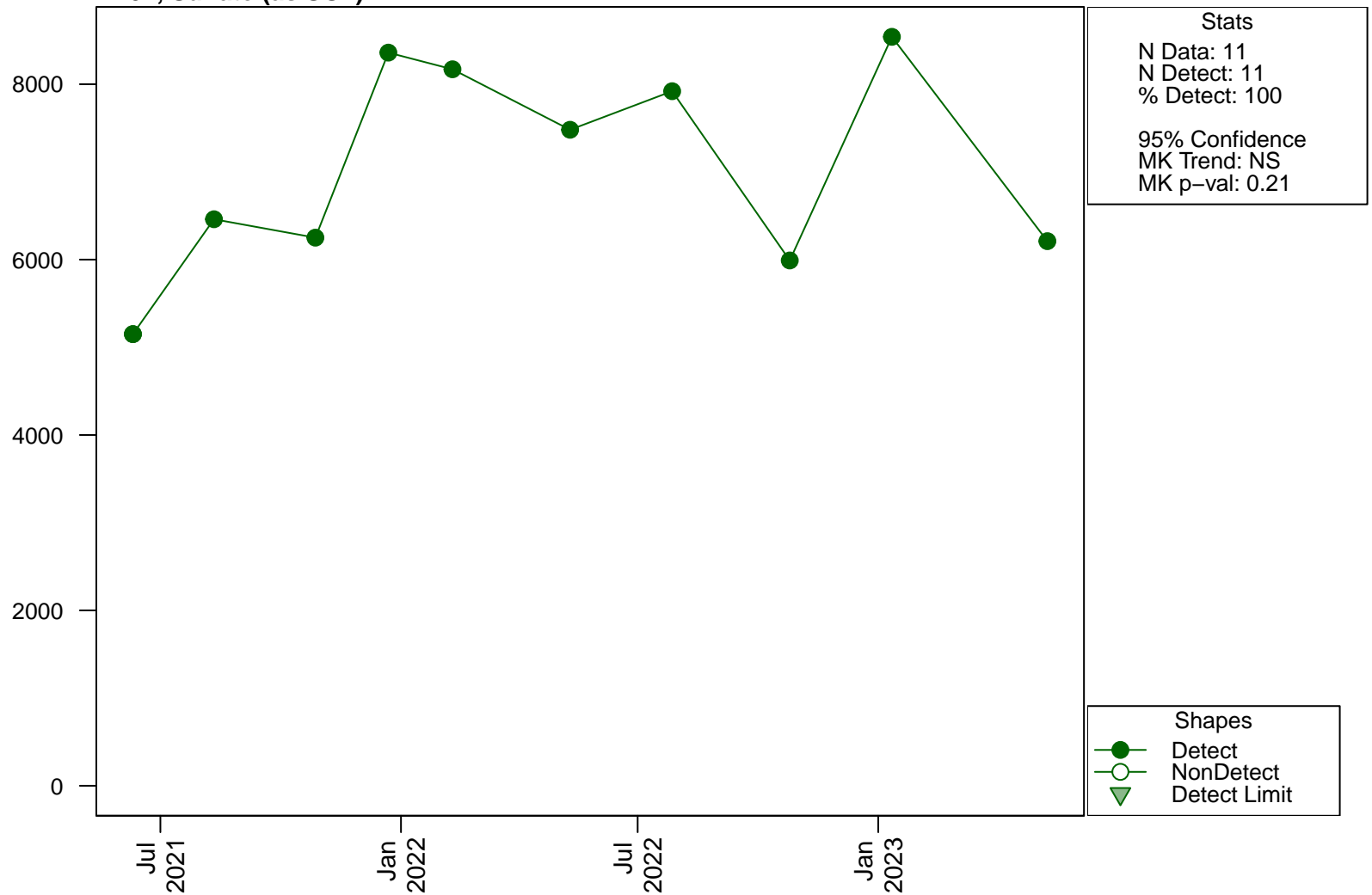
NonDetect

Detect Limit

Scatterplots and Trend Analysis

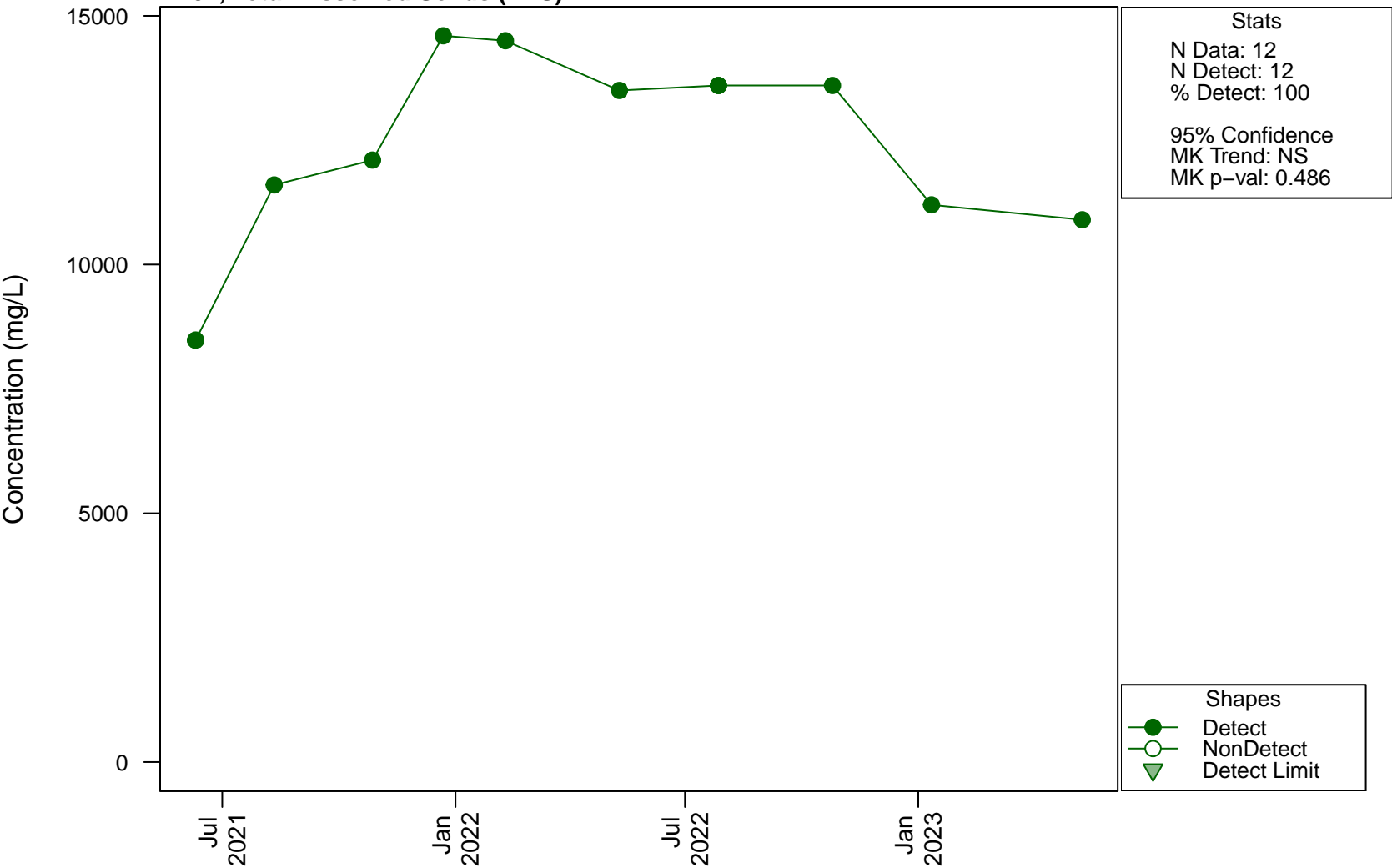
D107, Sulfate (as SO4)

Concentration (mg/L)



Scatterplots and Trend Analysis

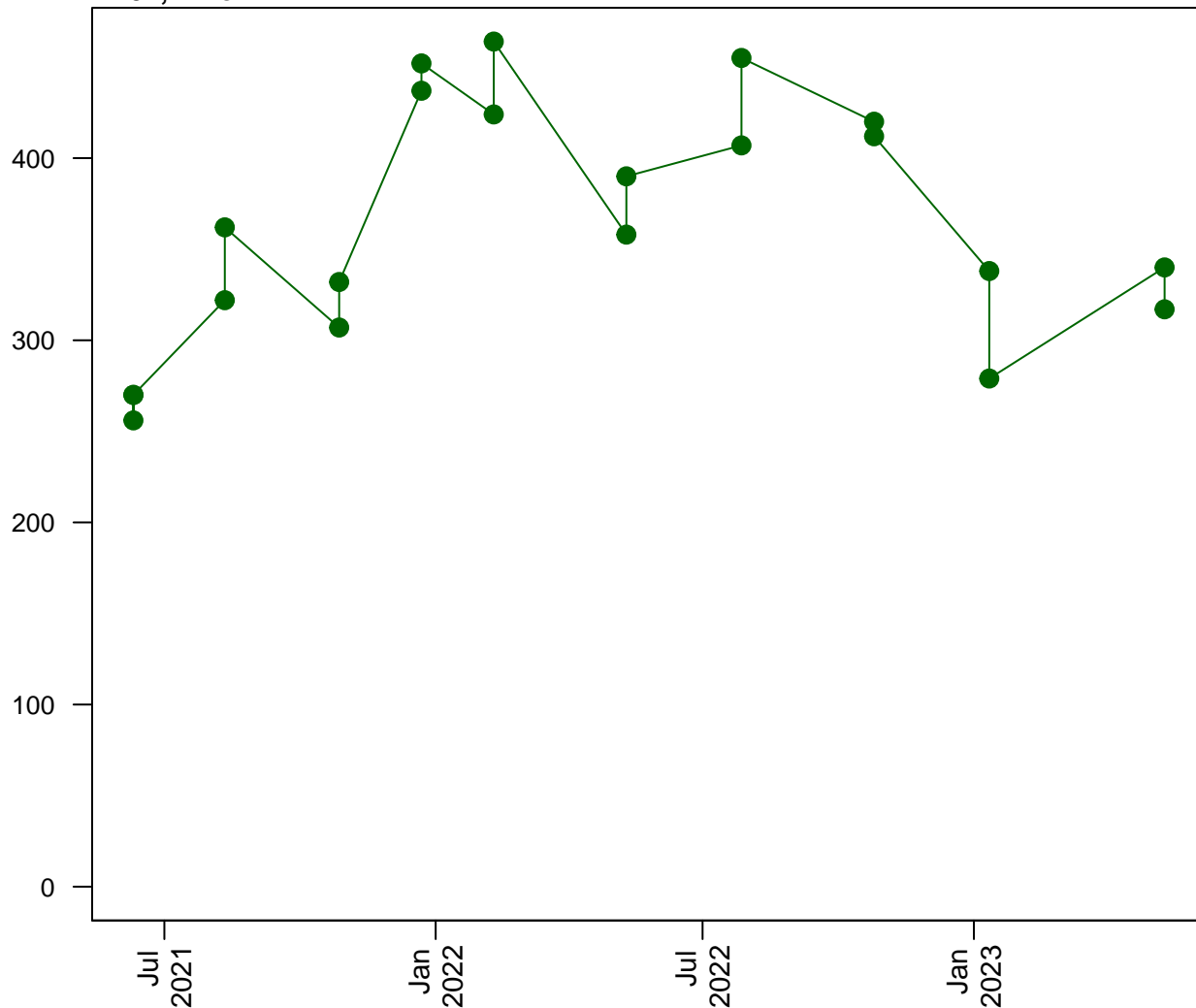
D107, Total Dissolved Solids (TDS)



Scatterplots and Trend Analysis

D107, Zinc

Concentration (µg/L)



Stats

N Data: 21
N Detect: 21
% Detect: 100

95% Confidence
MK Trend: NS
MK p-val: 0.224

Shapes

● Detect
○ NonDetect
▼ Detect Limit

Scatterplots and Trend Analysis

D11, Arsenic

Concentration (µg/L)

12
10
8
6
4
2
0

Jul
2021

Jan
2022

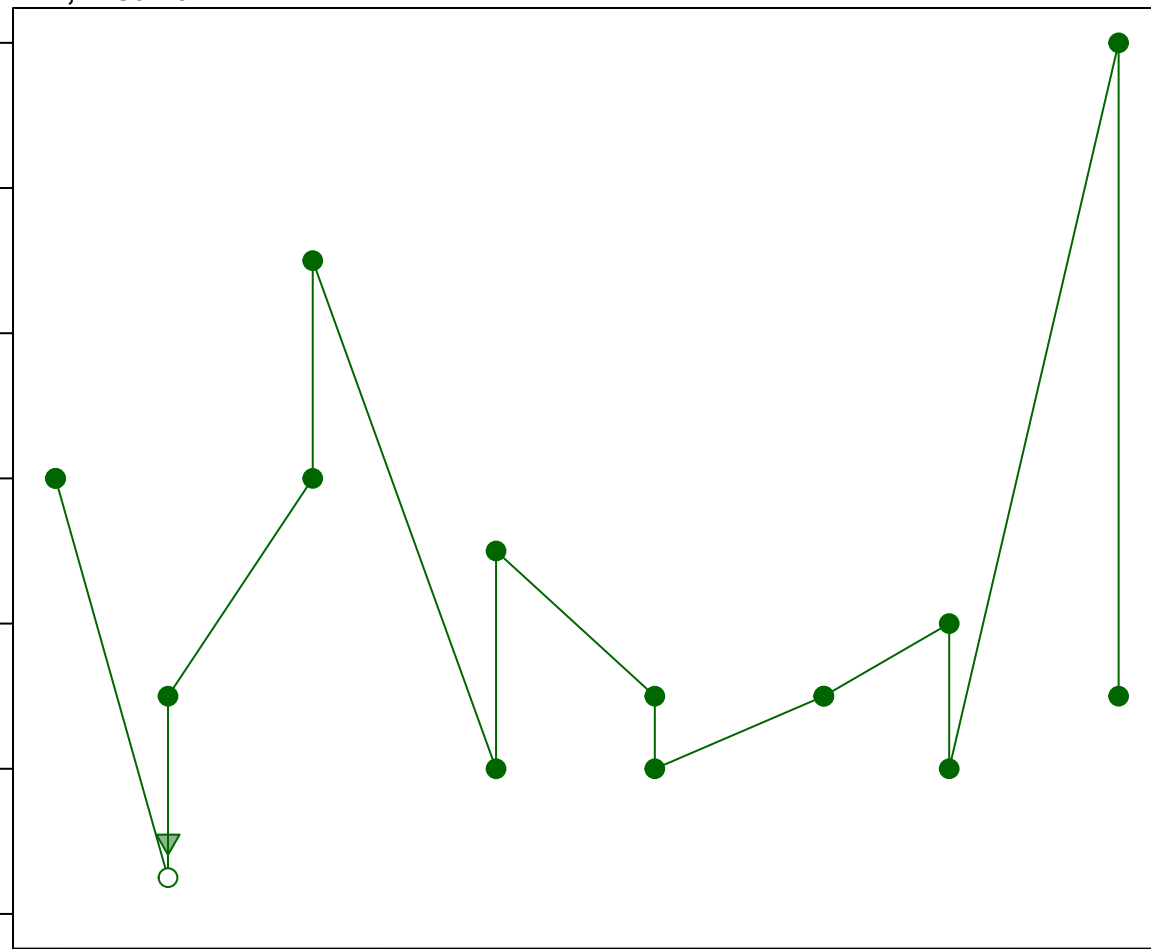
Jul
2022

Jan
2023

Stats
N Data: 16
N Detect: 15
% Detect: 94

95% Confidence
MK Trend: NS
MK p-val: 0.642

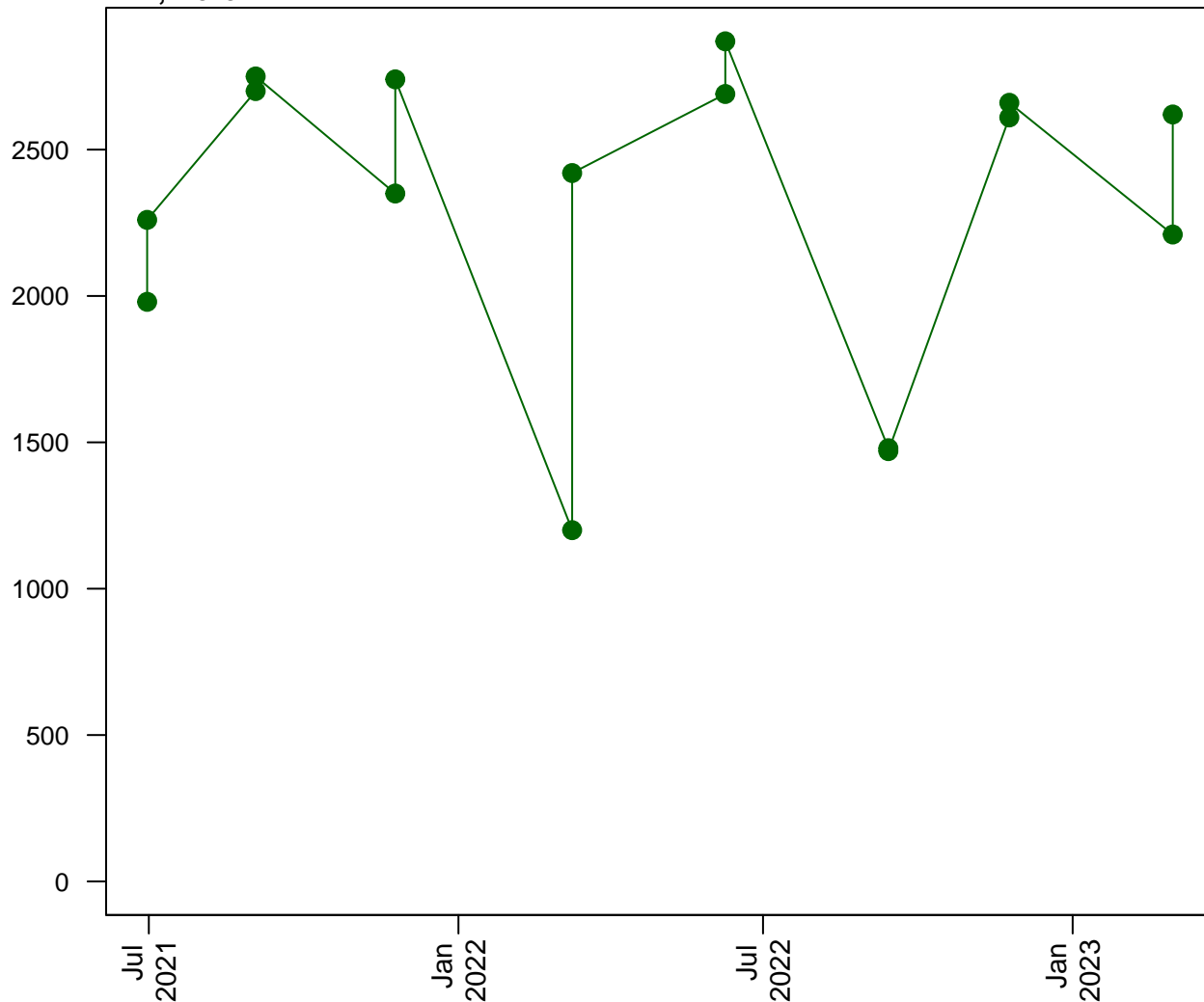
Shapes
● Detect
○ NonDetect
▼ Detect Limit



Scatterplots and Trend Analysis

D11, Boron

Concentration (µg/L)



Stats

N Data: 16
N Detect: 16
% Detect: 100

95% Confidence
MK Trend: NS
MK p-val: 0.785

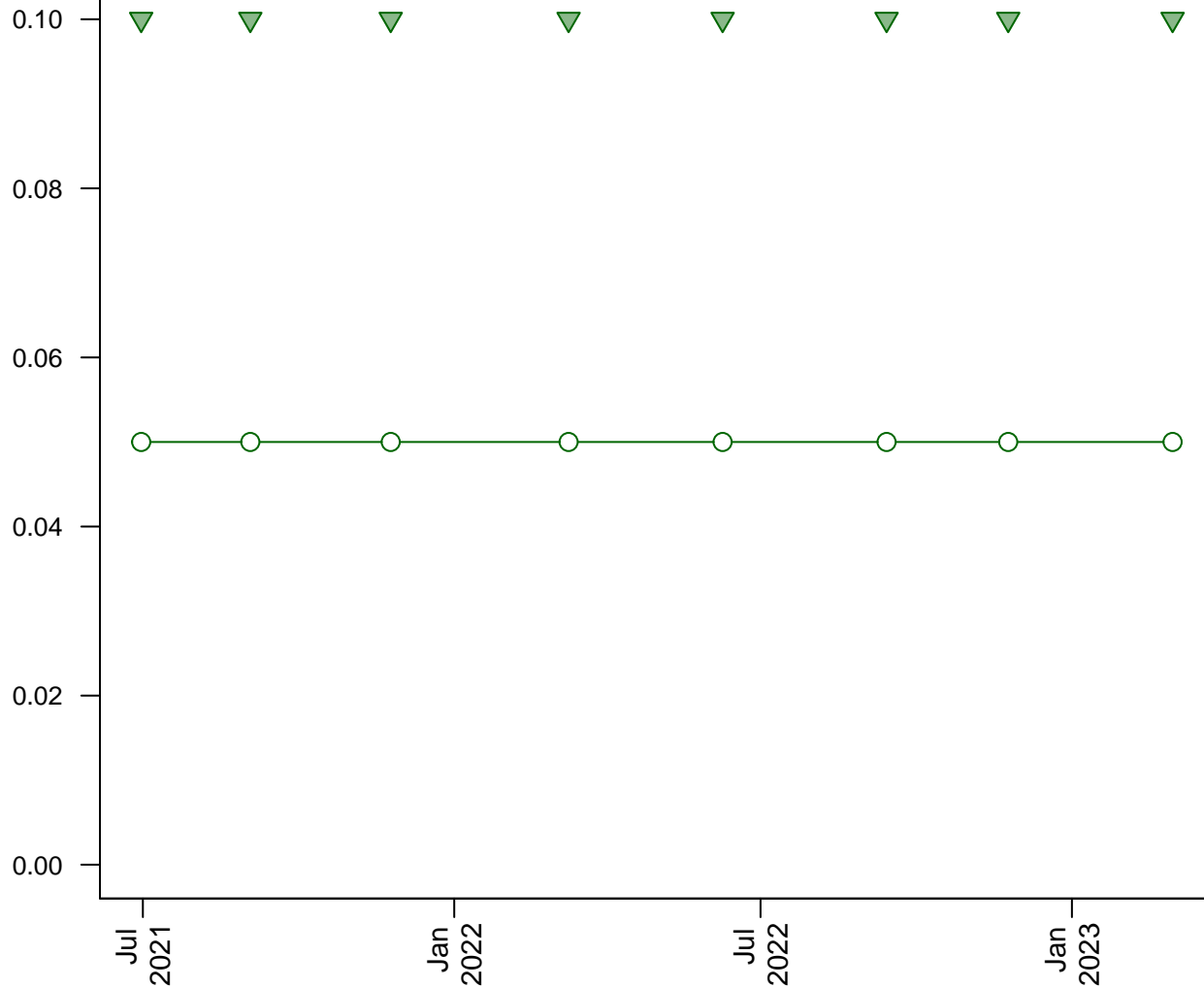
Shapes

● Detect
○ NonDetect
▼ Detect Limit

Scatterplots and Trend Analysis

D11, Cadmium

Concentration (µg/L)



Stats

N Data: 8

N Detect: 0

% Detect: 0

MK criteria not met

Shapes

●

Detect

○

NonDetect

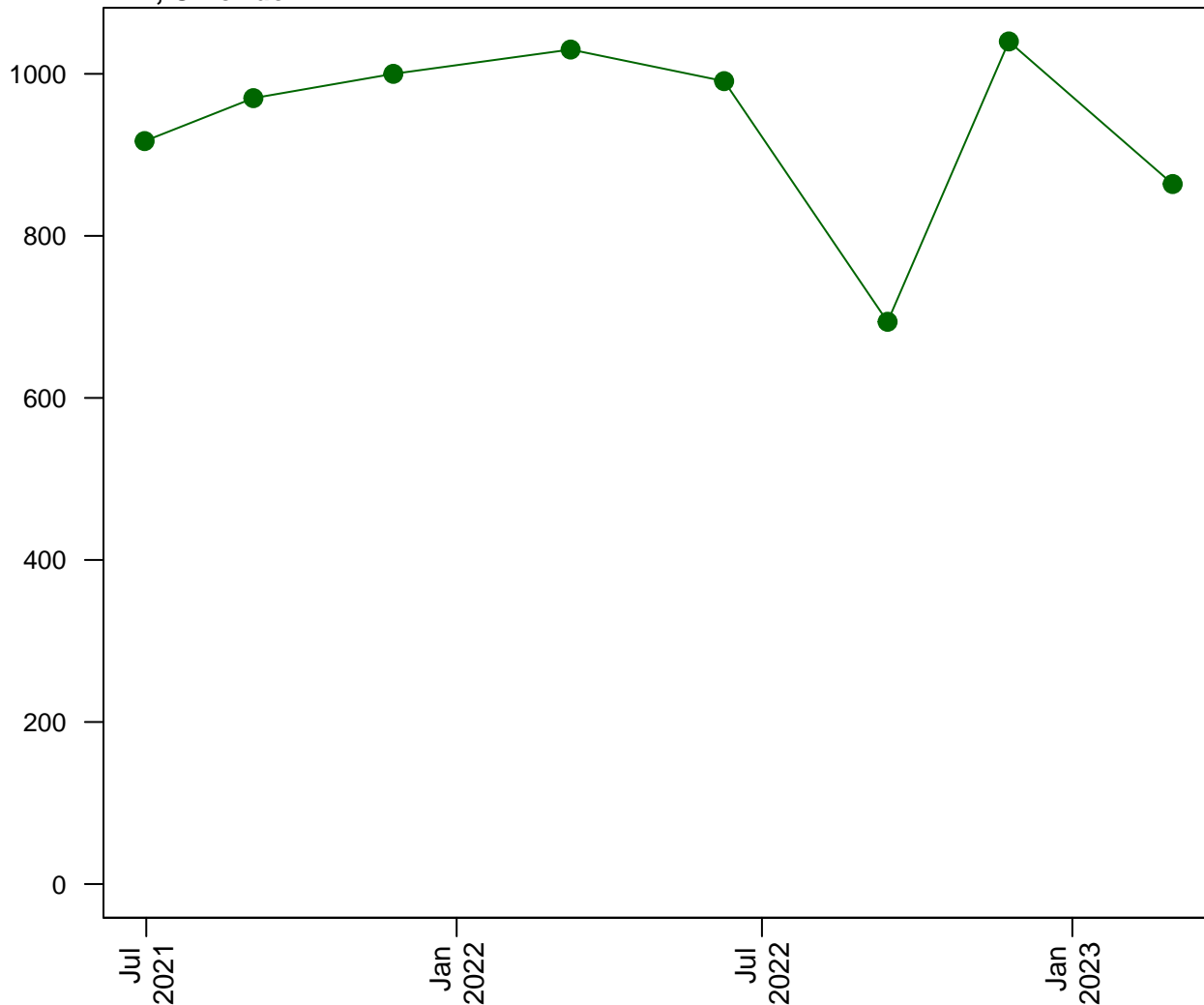
▼

Detect Limit

Scatterplots and Trend Analysis

D11, Chloride

Concentration (mg/L)



Stats

N Data: 8

N Detect: 8

% Detect: 100

95% Confidence

MK Trend: NS

MK p-val: 0.905

Shapes



Detect



NonDetect

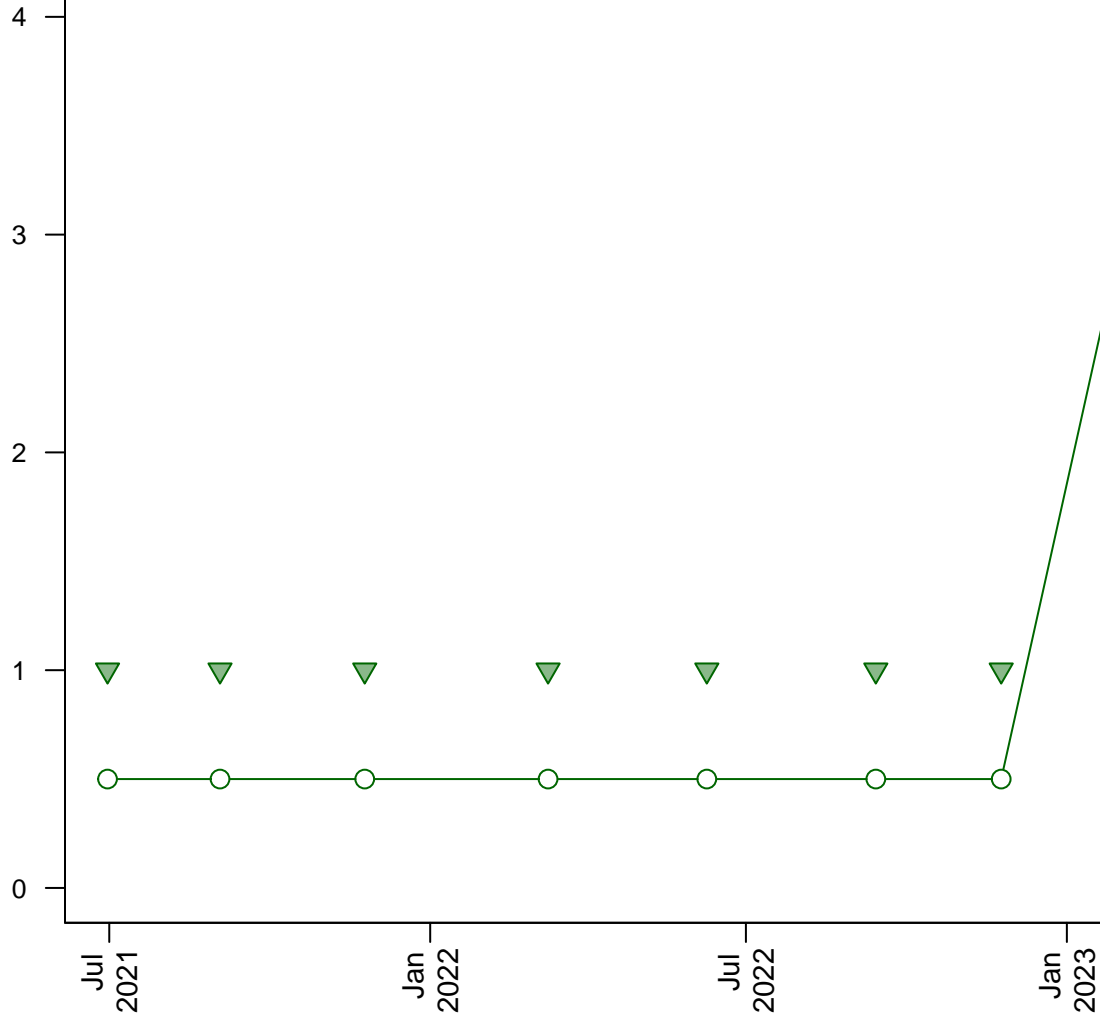


Detect Limit

Scatterplots and Trend Analysis

D11, Chromium

Concentration (µg/L)



Stats

N Data: 8

N Detect: 1

% Detect: 12

MK criteria not met

Shapes

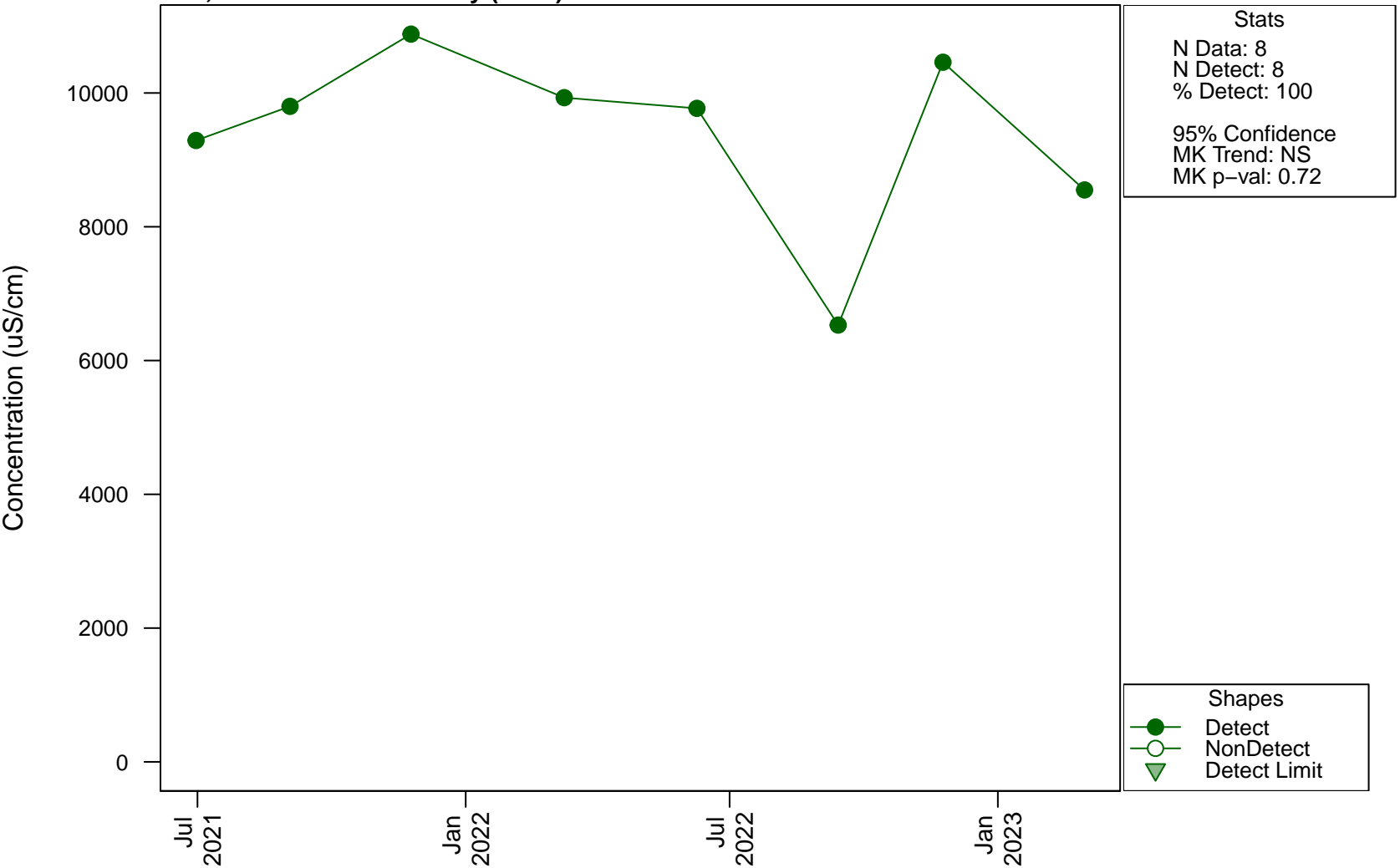
● Detect

○ NonDetect

▼ Detect Limit

Scatterplots and Trend Analysis

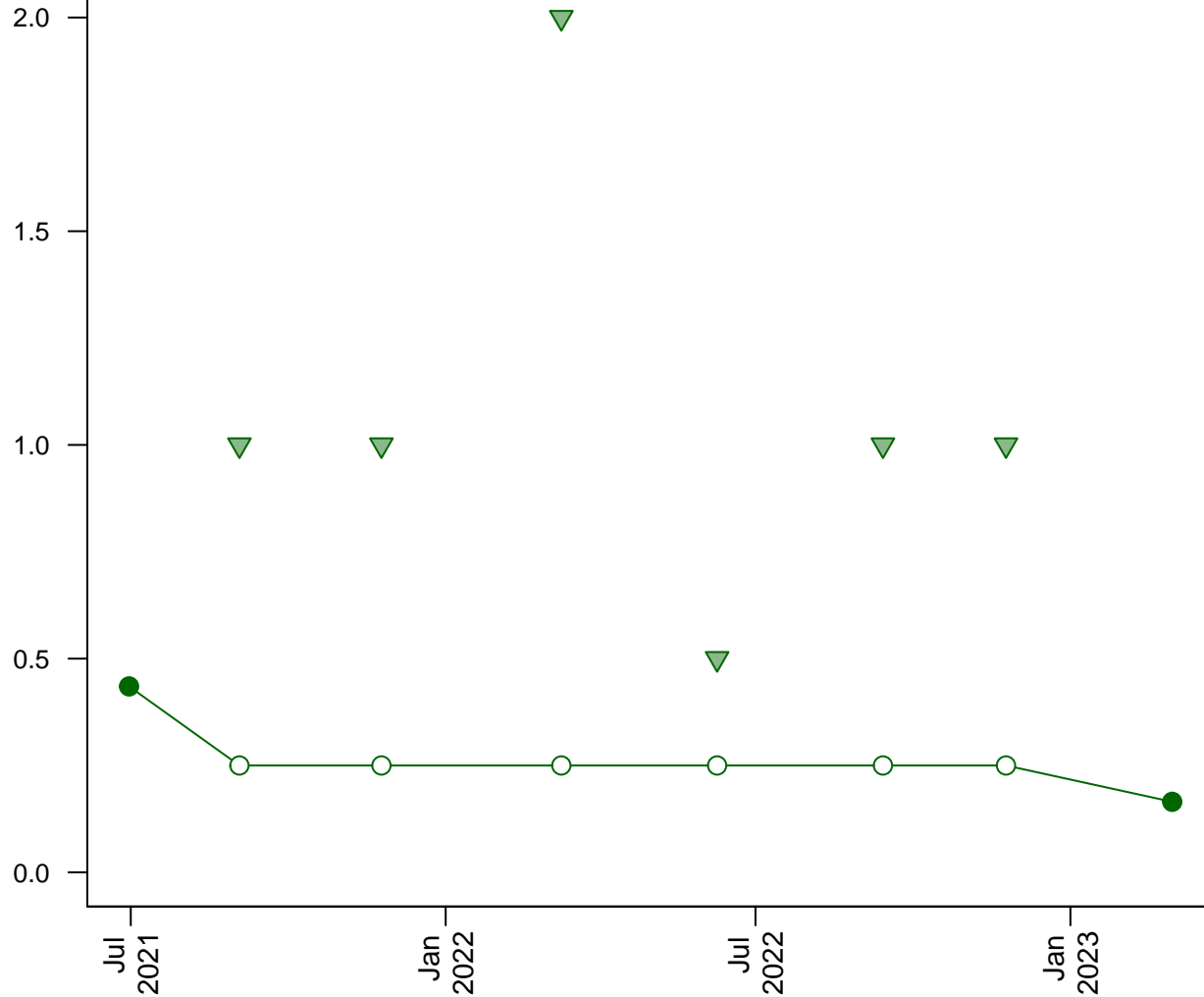
D11, Electrical Conductivity (Field)



Scatterplots and Trend Analysis

D11, Fluoride

Concentration (mg/L)



Stats

N Data: 8

N Detect: 2

% Detect: 25

MK criteria not met

Shapes

●

Detect

○

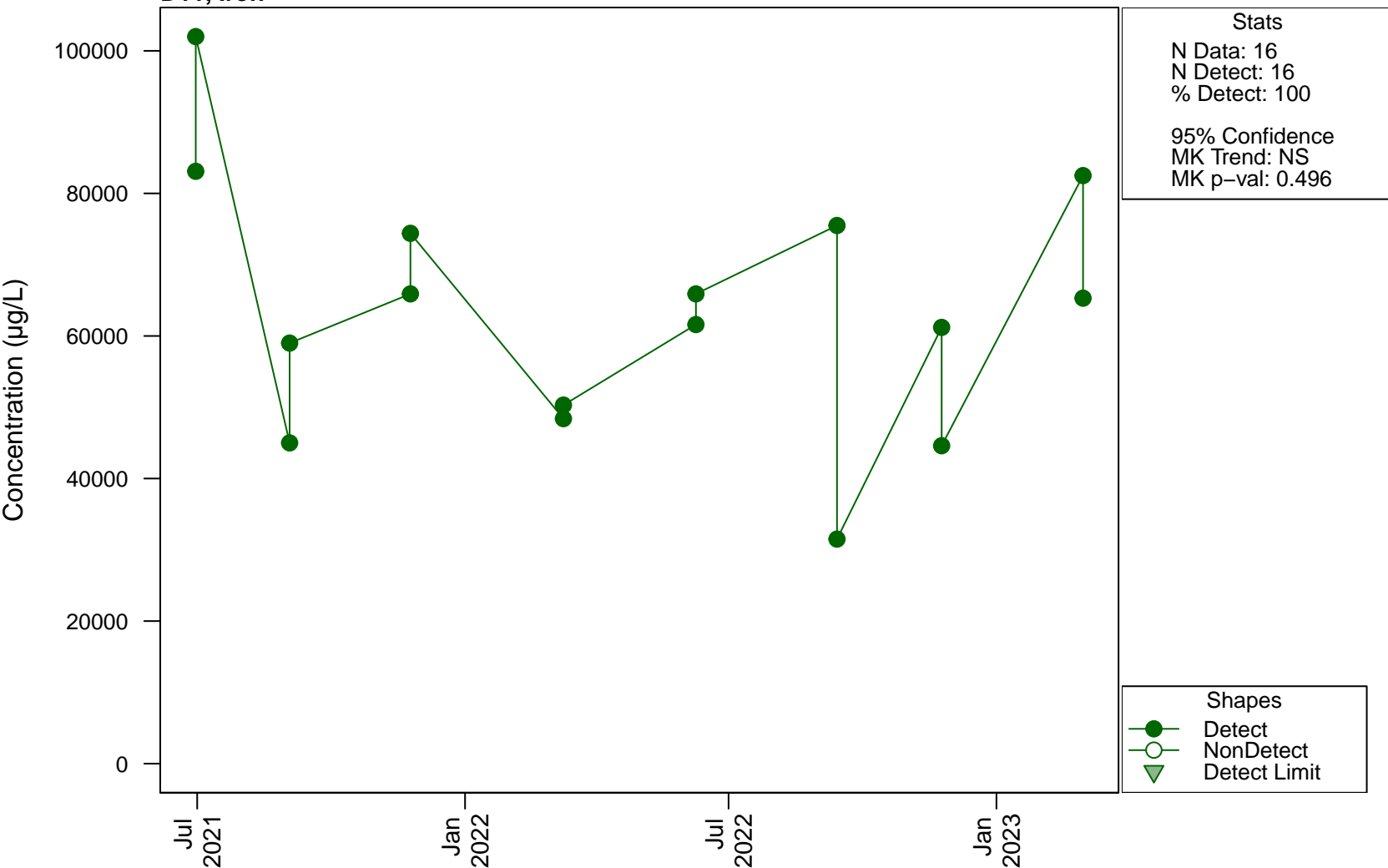
NonDetect

▼

Detect Limit

Scatterplots and Trend Analysis

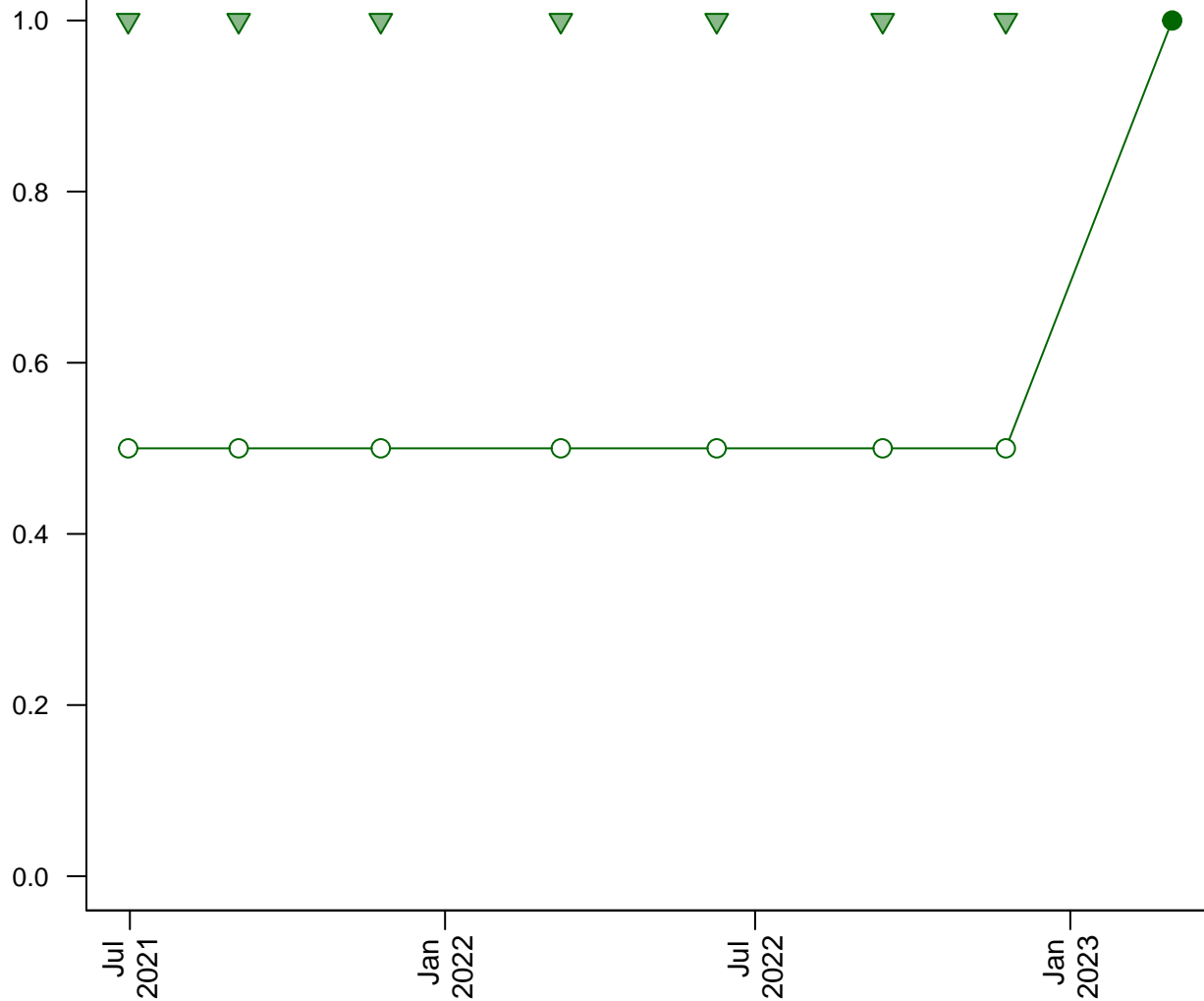
D11, Iron



Scatterplots and Trend Analysis

D11, Lead

Concentration (µg/L)



Stats

N Data: 8

N Detect: 1

% Detect: 12

MK criteria not met

Shapes

● Detect

○ NonDetect

▼ Detect Limit

Scatterplots and Trend Analysis

D11, Manganese

Concentration (µg/L)

15000
10000
5000
0

Jul
2021

Jan
2022

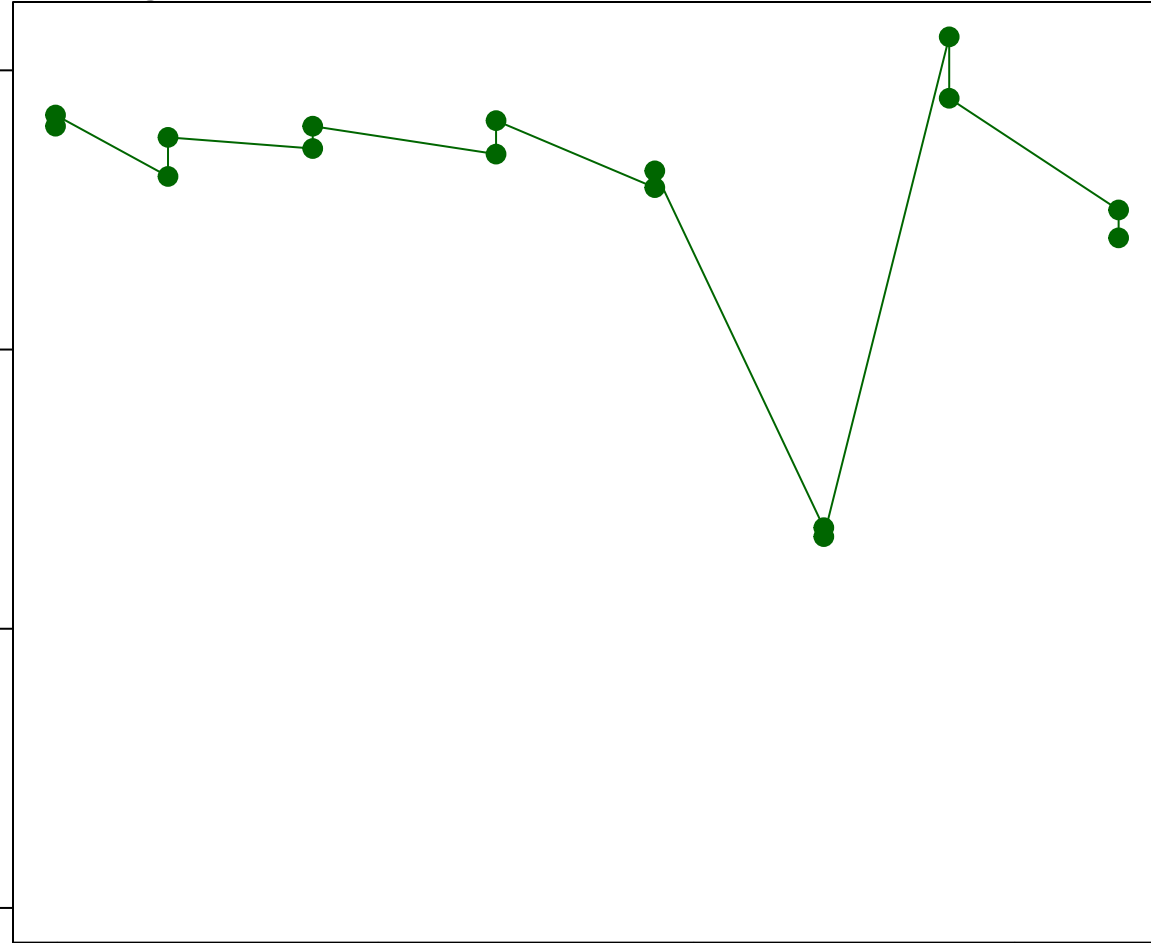
Jul
2022

Jan
2023

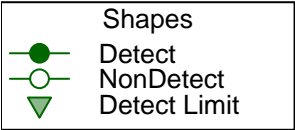
Stats
N Data: 16
N Detect: 16
% Detect: 100

95% Confidence
MK Trend: NS
MK p-val: 0.112

Shapes
● Detect
○ NonDetect
▼ Detect Limit



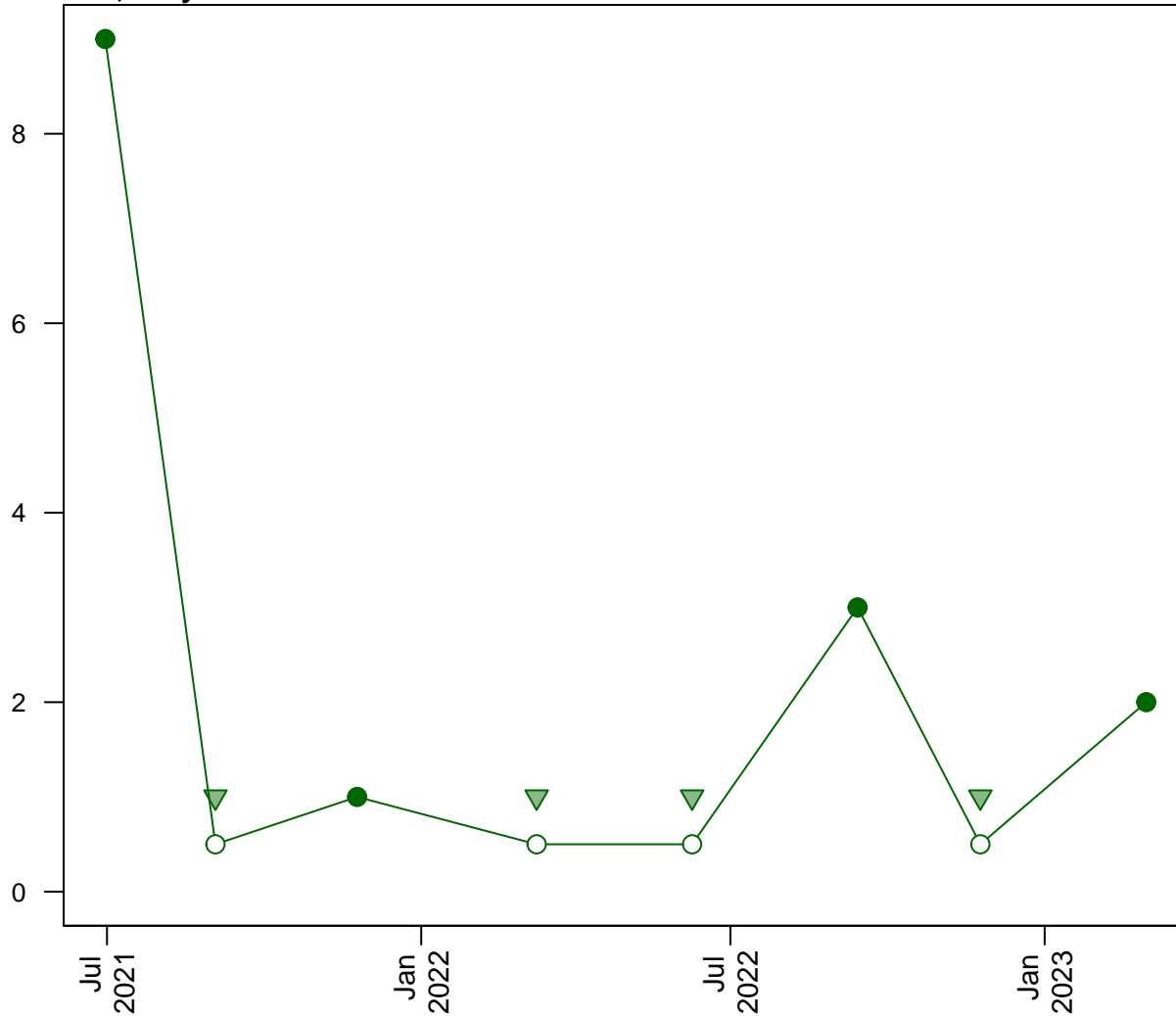
D11, Mercury



Scatterplots and Trend Analysis

D11, Molybdenum

Concentration (µg/L)



Stats

N Data: 8

N Detect: 4

% Detect: 50

95% Confidence

MK Trend: NS

MK p-val: 0.79

Shapes



Detect



NonDetect

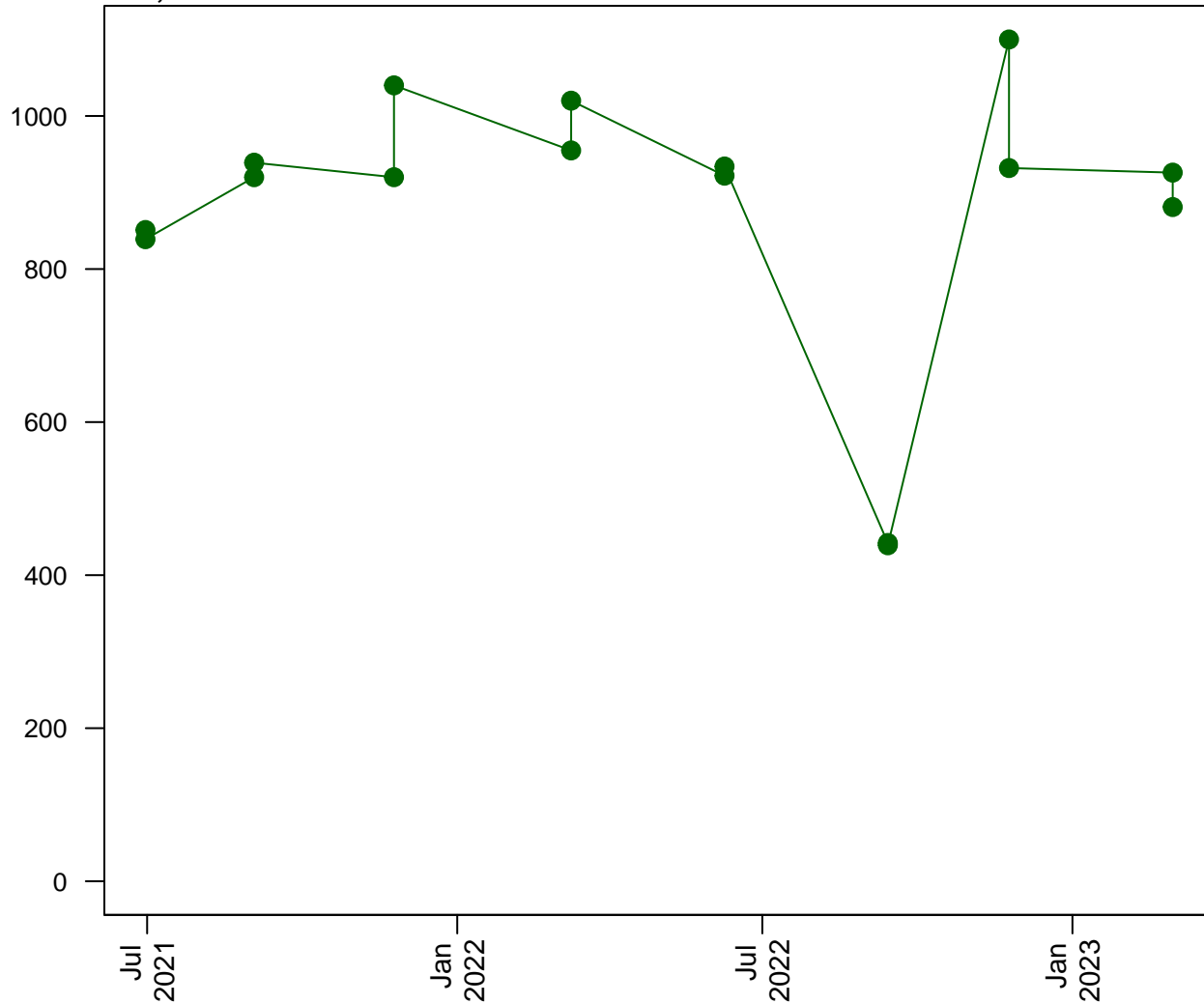


Detect Limit

Scatterplots and Trend Analysis

D11, Nickel

Concentration (µg/L)



Stats

N Data: 16
N Detect: 16
% Detect: 100

95% Confidence
MK Trend: NS
MK p-val: 0.82

Shapes

- Detect
- NonDetect
- ▼ Detect Limit

Scatterplots and Trend Analysis

D11, Selenium

Concentration (µg/L)

10
8
6
4
2
0

Jul
2021

Jan
2022

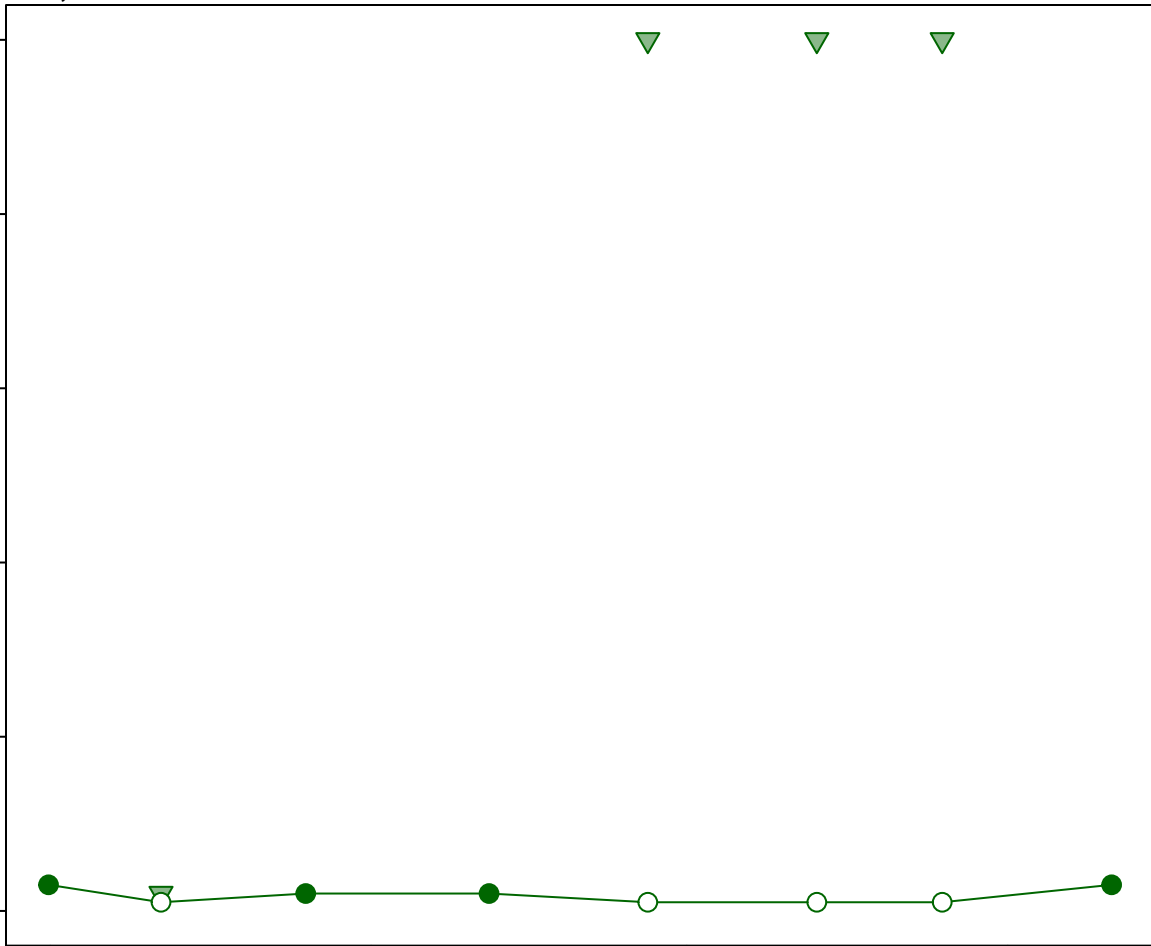
Jul
2022

Jan
2023

Stats
N Data: 8
N Detect: 4
% Detect: 50

95% Confidence
MK Trend: NS
MK p-val: 0.589

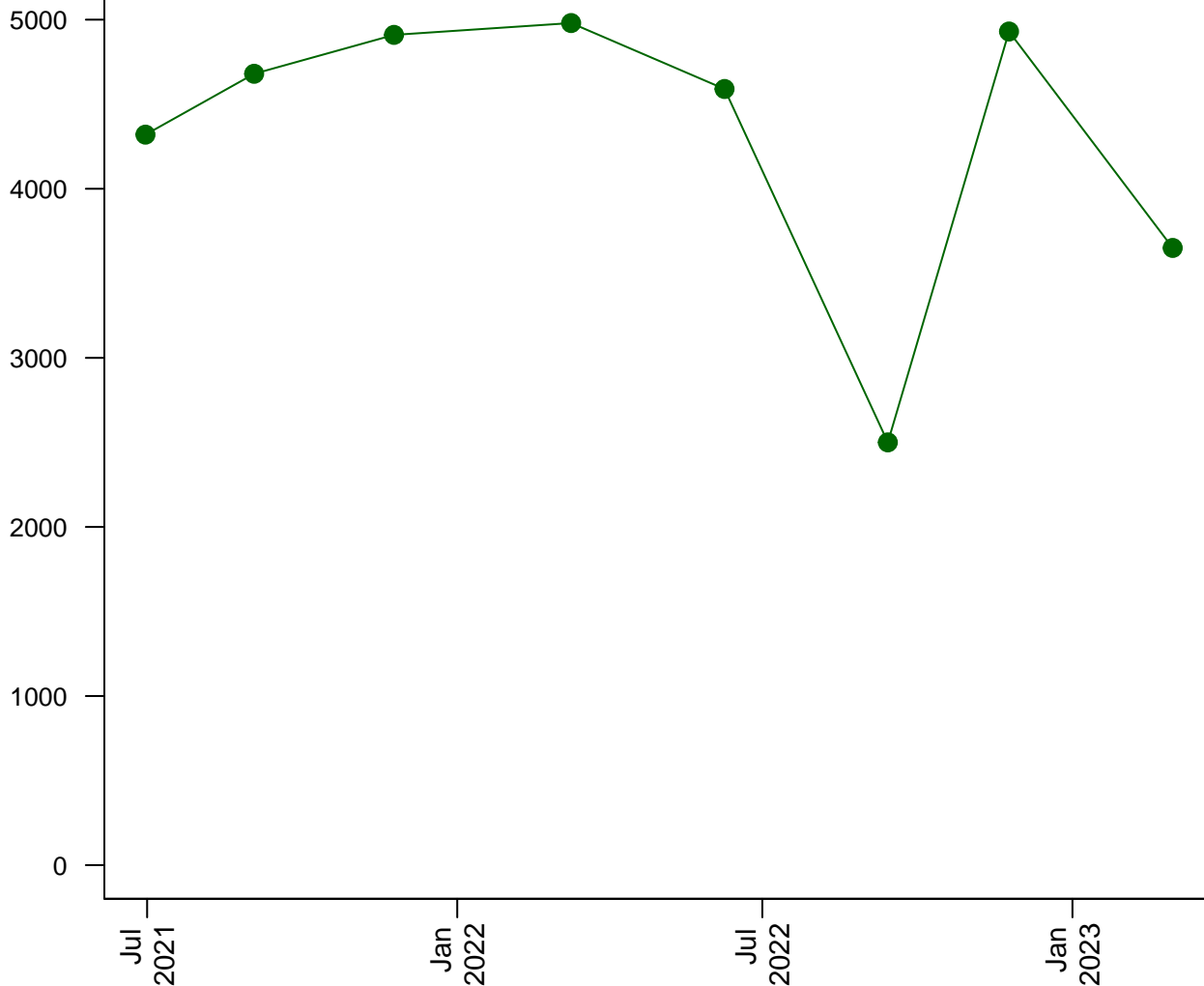
Shapes
● Detect
○ NonDetect
▼ Detect Limit



Scatterplots and Trend Analysis

D11, Sulfate (as SO4)

Concentration (mg/L)



Stats

N Data: 8

N Detect: 8

% Detect: 100

95% Confidence

MK Trend: NS

MK p-val: 0.905

Shapes



Detect



NonDetect

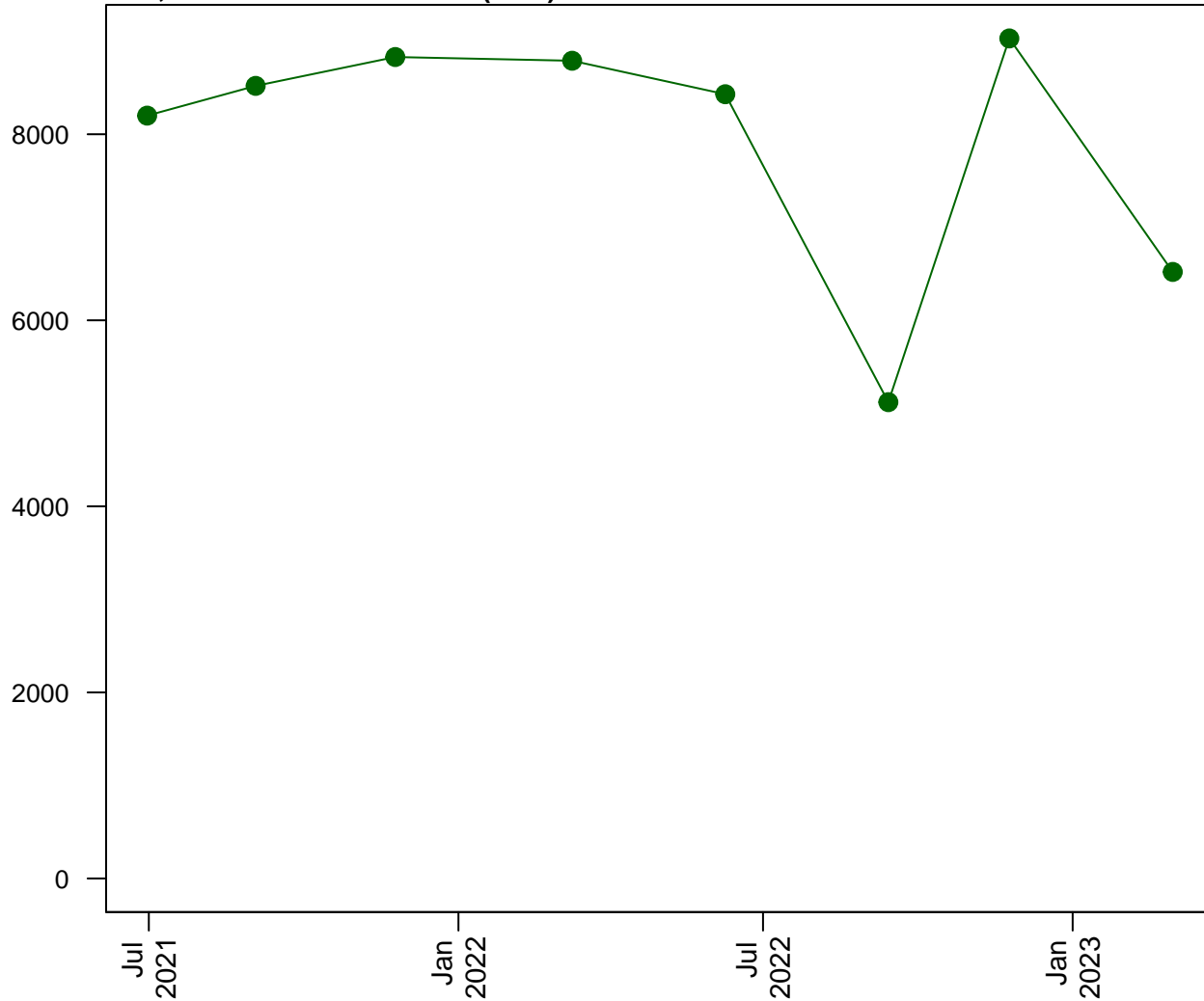


Detect Limit

Scatterplots and Trend Analysis

D11, Total Dissolved Solids (TDS)

Concentration (mg/L)



Stats

N Data: 8

N Detect: 8

% Detect: 100

95% Confidence

MK Trend: NS

MK p-val: 0.905

Shapes



Detect



NonDetect

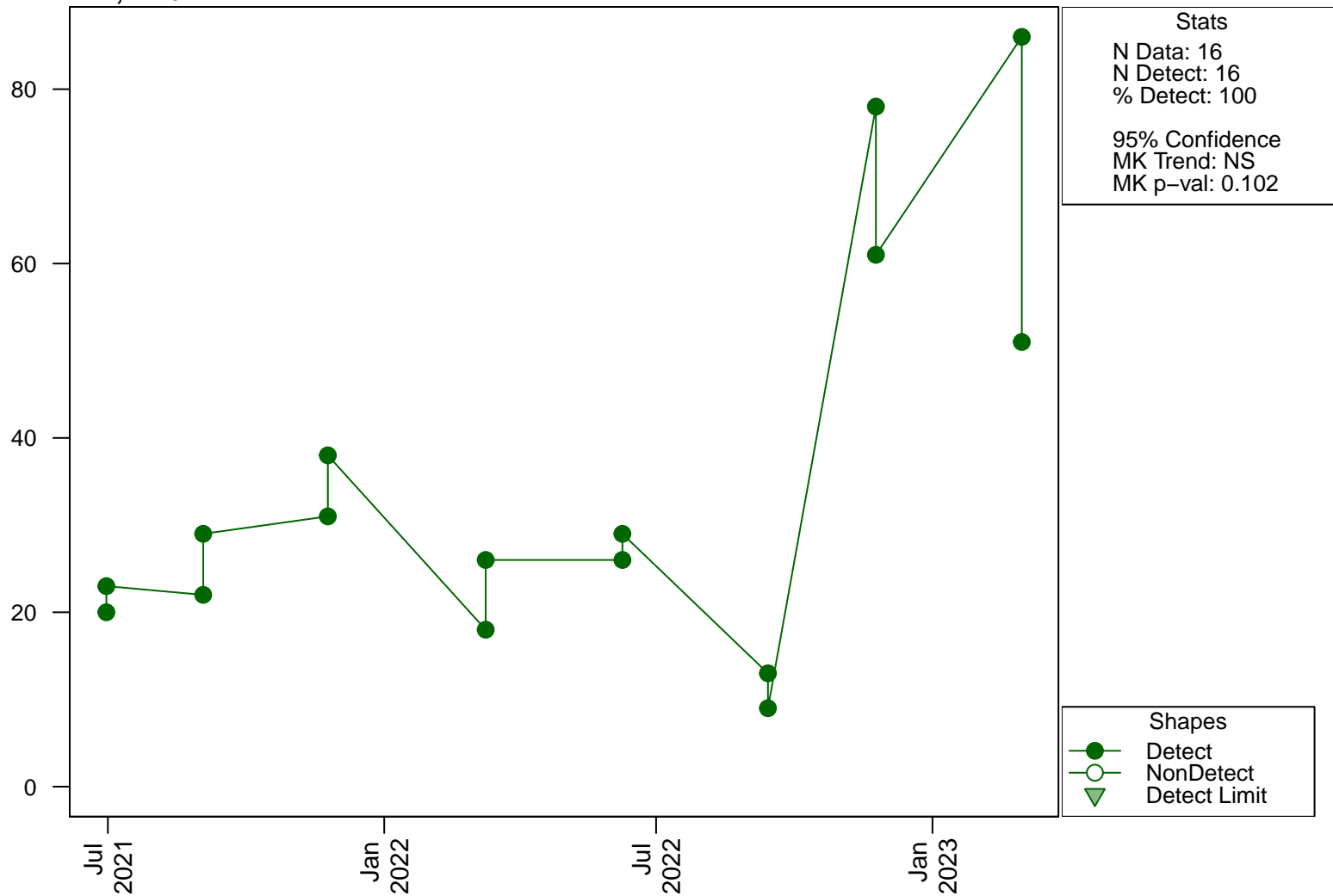


Detect Limit

Scatterplots and Trend Analysis

D11, Zinc

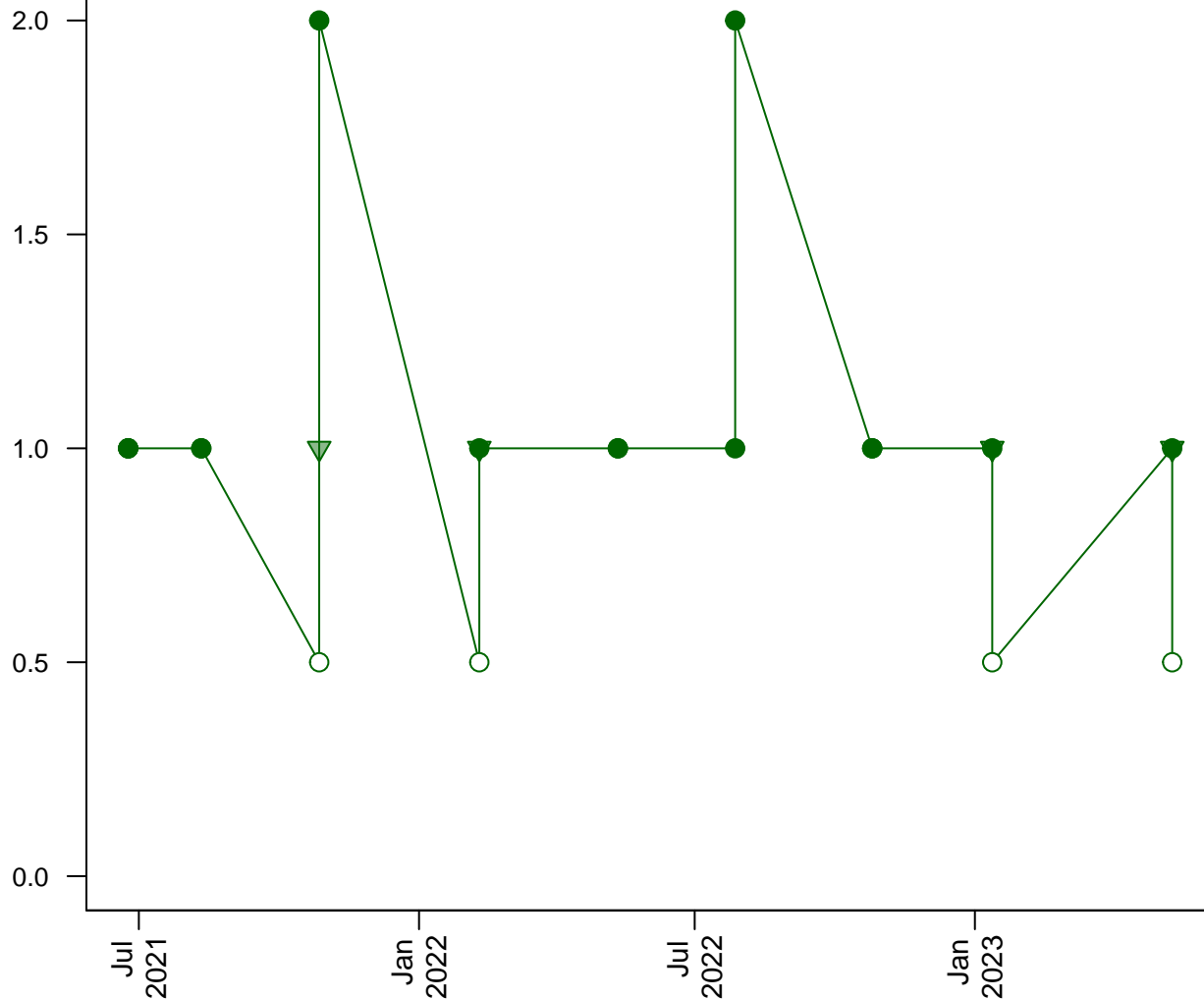
Concentration (µg/L)



Scatterplots and Trend Analysis

D113, Arsenic

Concentration (µg/L)



Stats

N Data: 19
N Detect: 15
% Detect: 79

95% Confidence
MK Trend: NS
MK p-val: 0.41

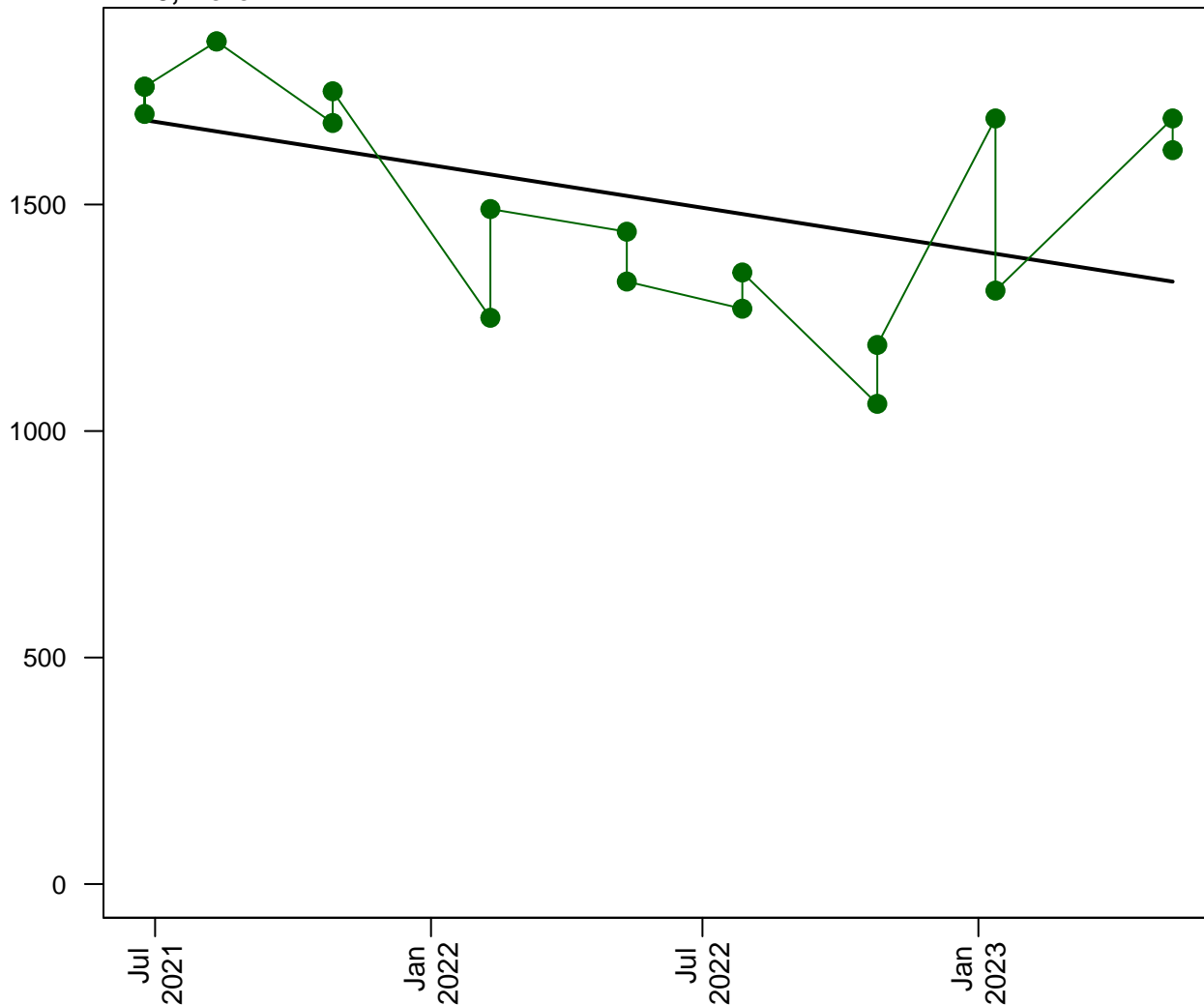
Shapes

● Detect
○ NonDetect
▼ Detect Limit

Scatterplots and Trend Analysis

D113, Boron

Concentration (µg/L)



Stats

N Data: 19
N Detect: 19
% Detect: 100

95% Confidence
MK Trend: Significant
MK p-val: 0.0122
Direction: Decreasing

Lines

— Linear Fit

Shapes

● Detect
○ NonDetect
▼ Detect Limit

Scatterplots and Trend Analysis

D113, Cadmium

Concentration (µg/L)

0.20
0.15
0.10
0.05
0.00

Jul
2021

Jan
2022

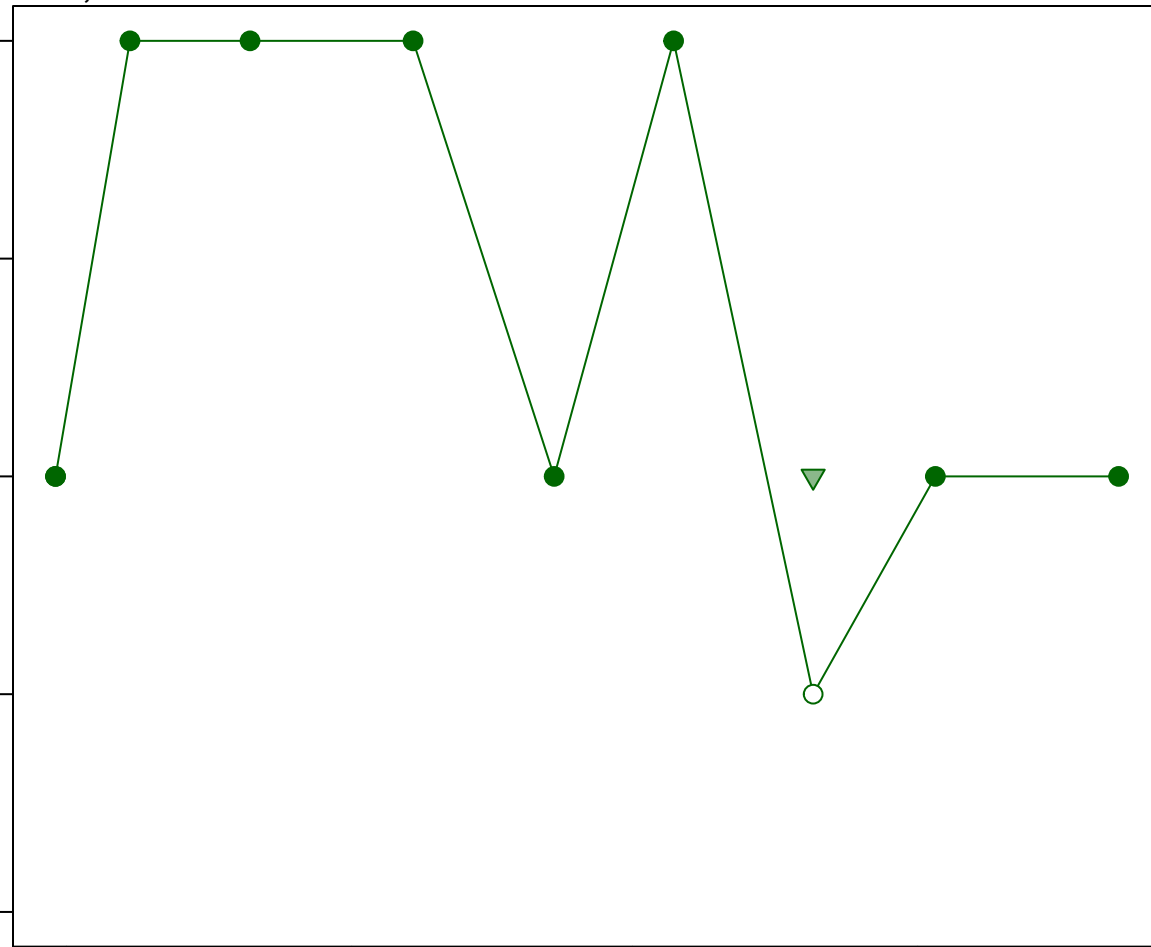
Jul
2022

Jan
2023

Stats
N Data: 10
N Detect: 9
% Detect: 90

95% Confidence
MK Trend: NS
MK p-val: 0.482

Shapes
● Detect
○ NonDetect
▼ Detect Limit



Scatterplots and Trend Analysis

D113, Chloride

Concentration (mg/L)

300
250
200
150
100
50
0

Jul
2021

Jan
2022

Jul
2022

Jan
2023

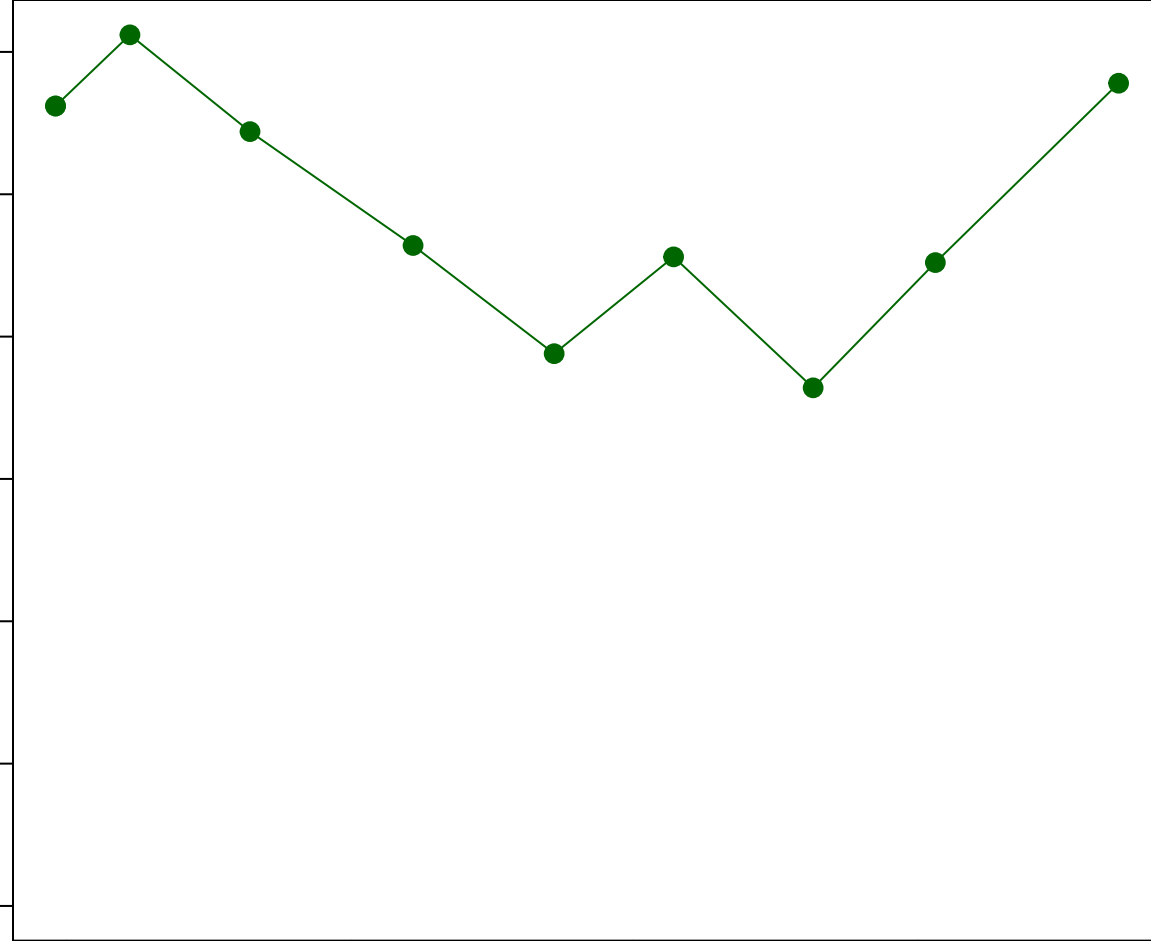
Stats

N Data: 10
N Detect: 10
% Detect: 100

95% Confidence
MK Trend: NS
MK p-val: 0.105

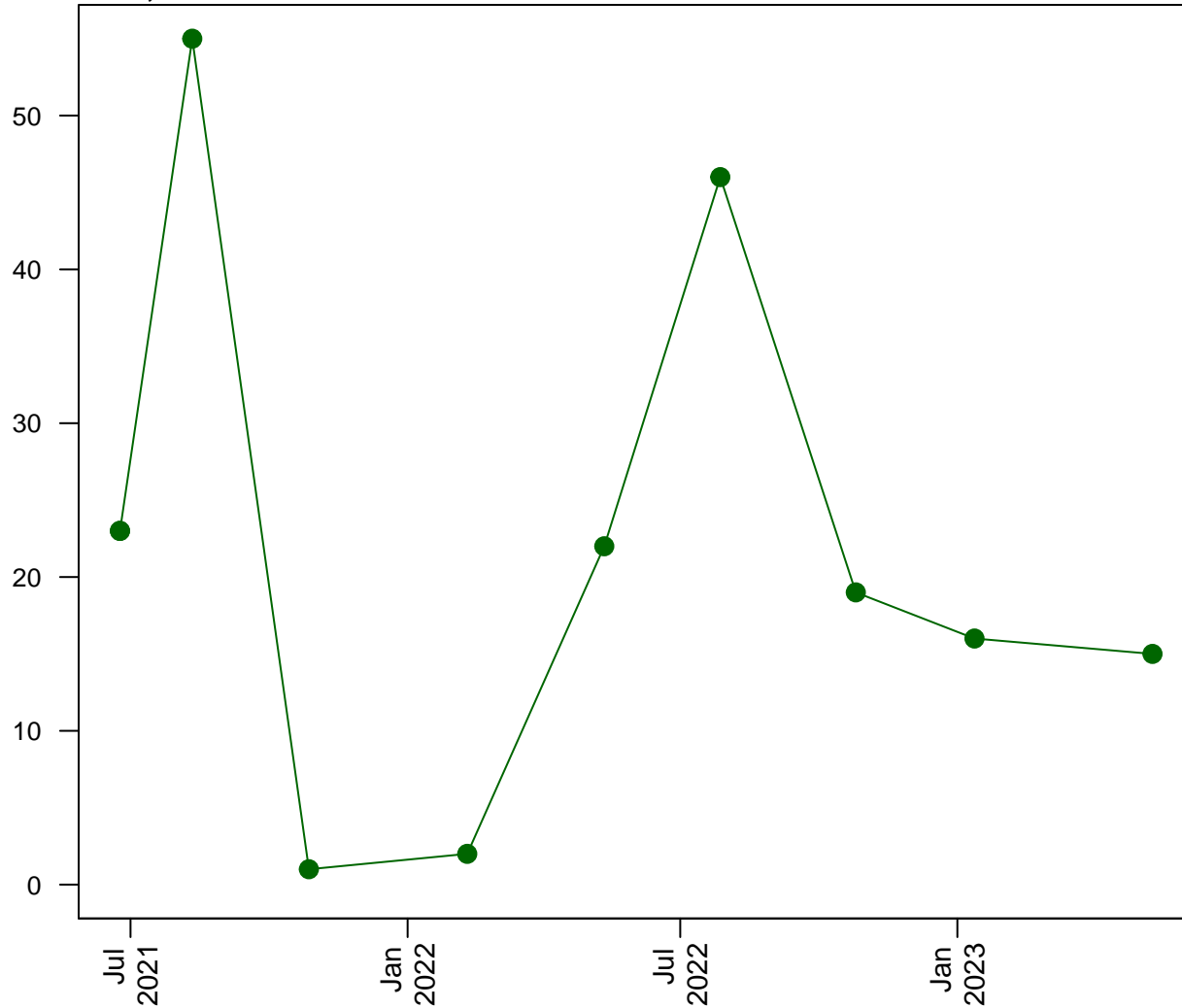
Shapes

● Detect
○ NonDetect
▼ Detect Limit



Scatterplots and Trend Analysis D113, Chromium

Concentration (µg/L)



Stats

N Data: 10
N Detect: 10
% Detect: 100

95% Confidence
MK Trend: NS
MK p-val: 0.279

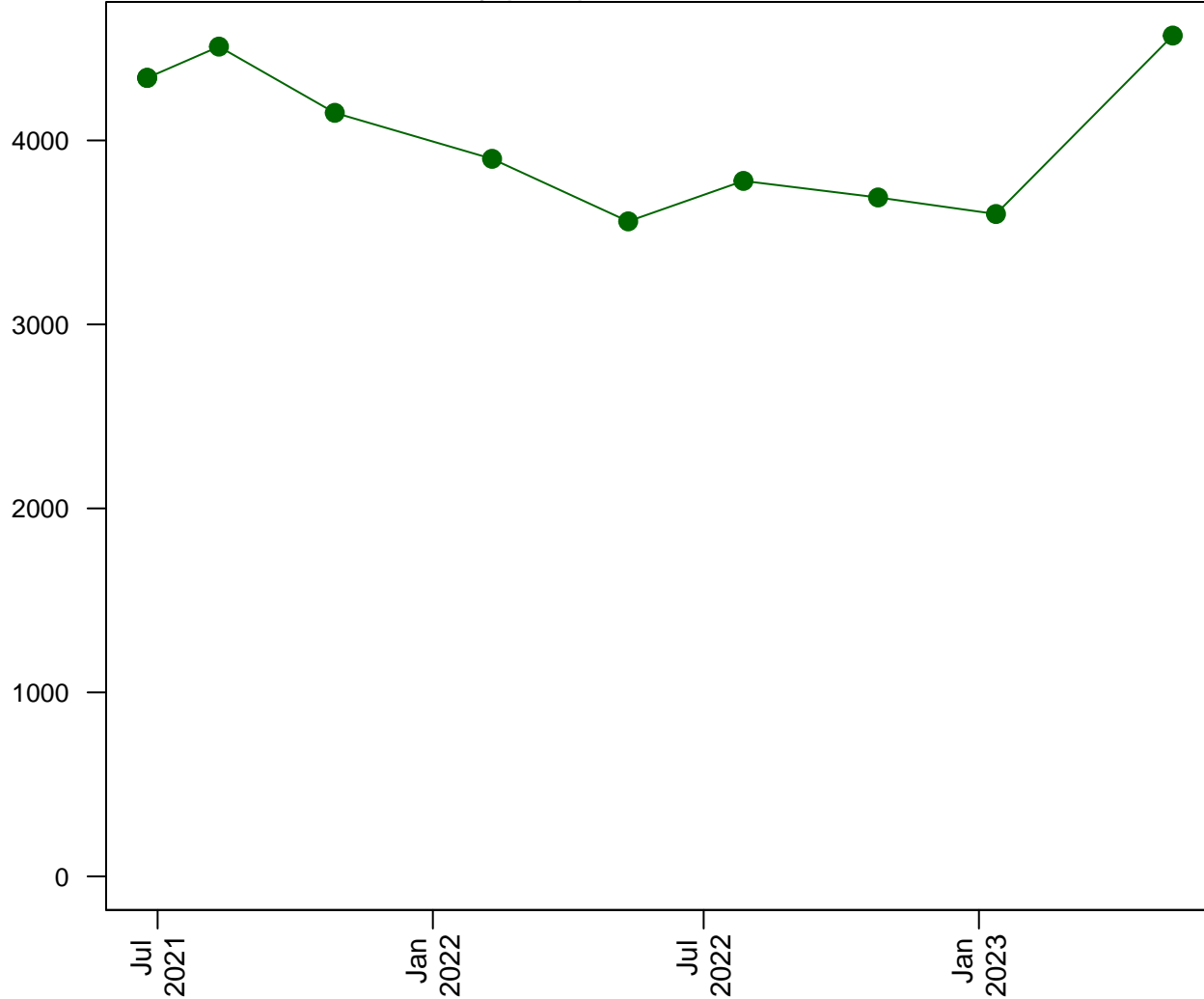
Shapes

● Detect
○ NonDetect
▼ Detect Limit

Scatterplots and Trend Analysis

D113, Electrical Conductivity (Field)

Concentration (uS/cm)



Stats

N Data: 10
N Detect: 10
% Detect: 100

95% Confidence
MK Trend: NS
MK p-val: 0.149

Shapes

● Detect
○ NonDetect
▼ Detect Limit

Scatterplots and Trend Analysis

D113, Fluoride

Concentration (mg/L)

10
8
6
4
2
0

Jul
2021

Jan
2022

Jul
2022

Jan
2023

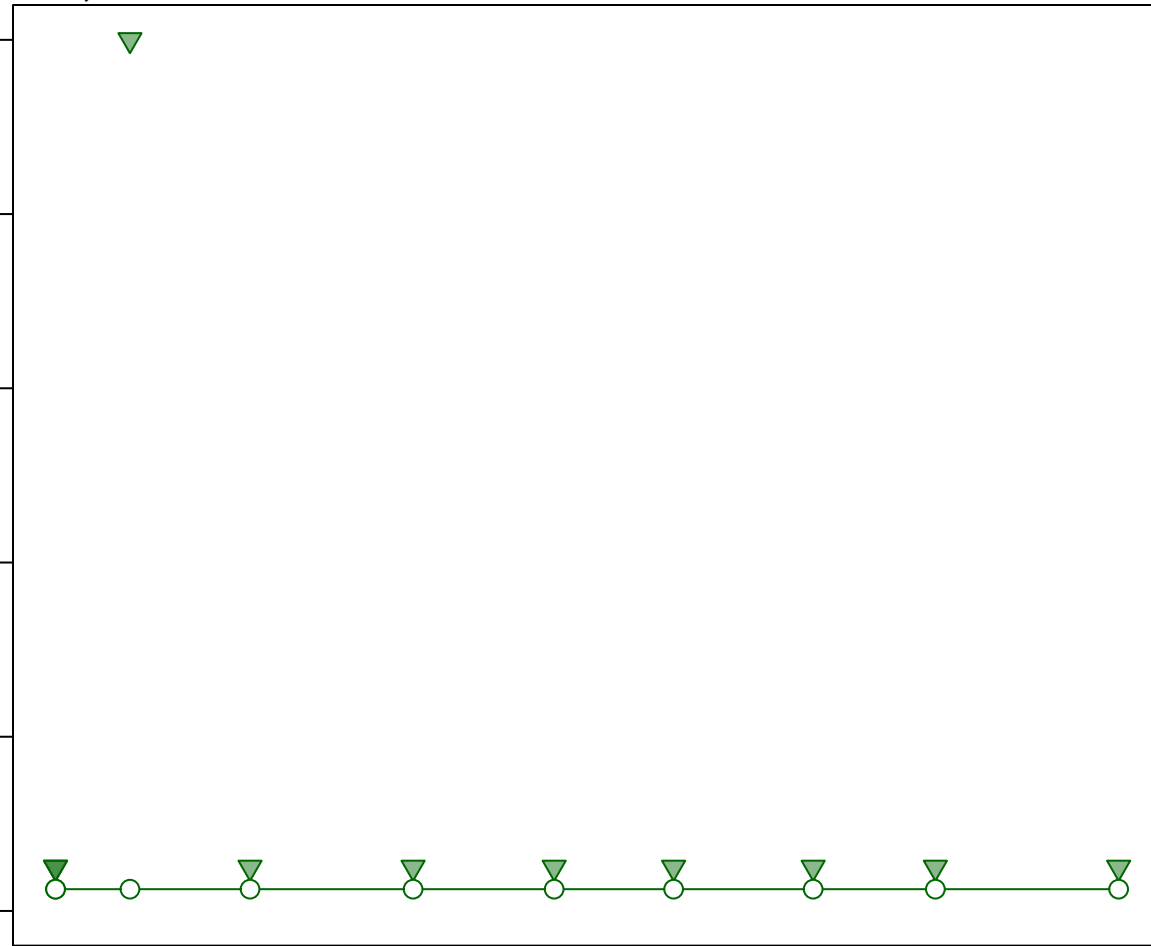
Stats

N Data: 10
N Detect: 0
% Detect: 0

MK criteria not met

Shapes

● Detect
○ NonDetect
▼ Detect Limit



Scatterplots and Trend Analysis

D113, Iron

Concentration (µg/L)

14000
12000
10000
8000
6000
4000
2000
0

Jul
2021

Jan
2022

Jul
2022

Jan
2023

Stats

N Data: 19
N Detect: 19
% Detect: 100

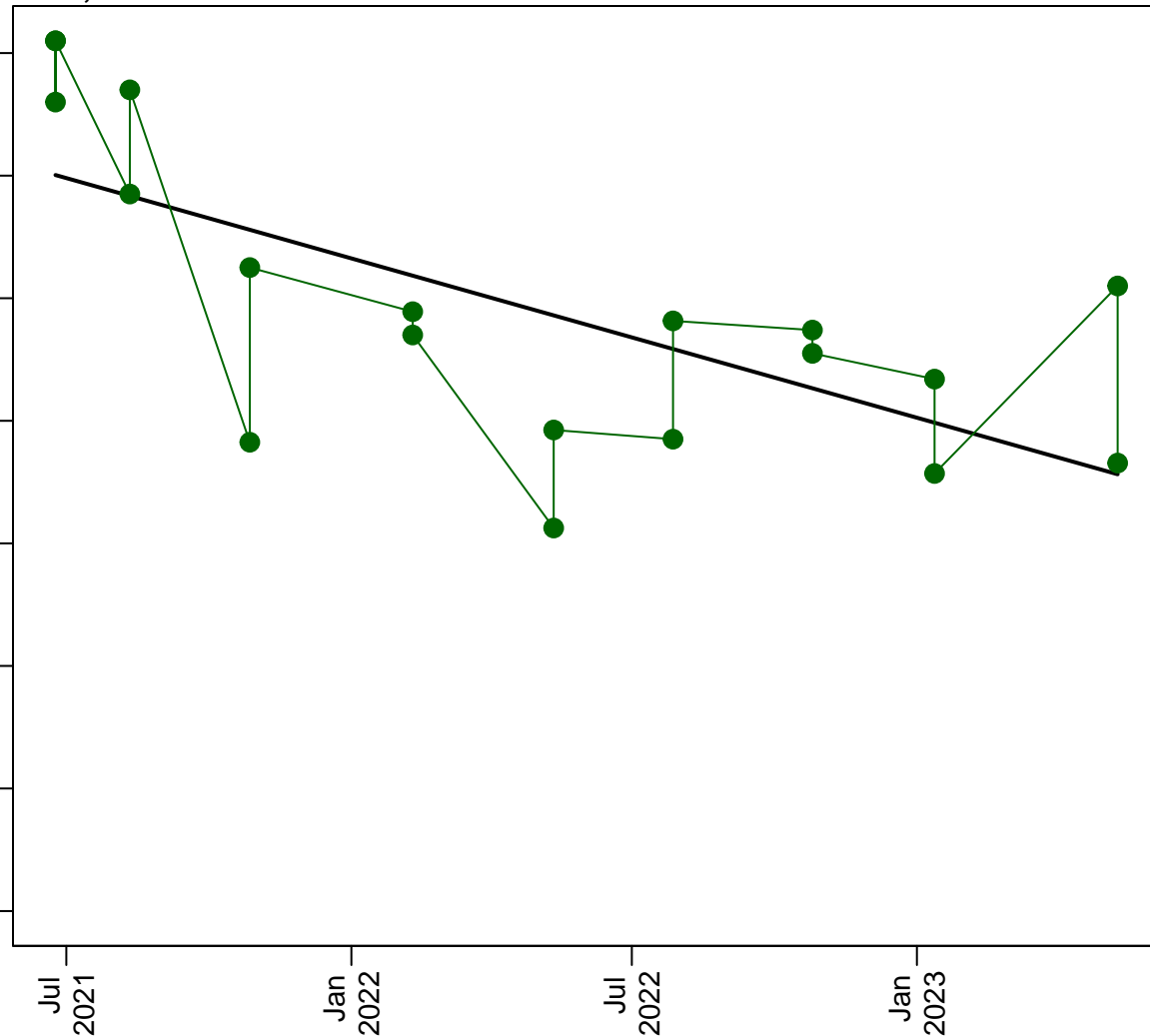
95% Confidence
MK Trend: Significant
MK p-val: 0.00243
Direction: Decreasing

Lines

Linear Fit

Shapes

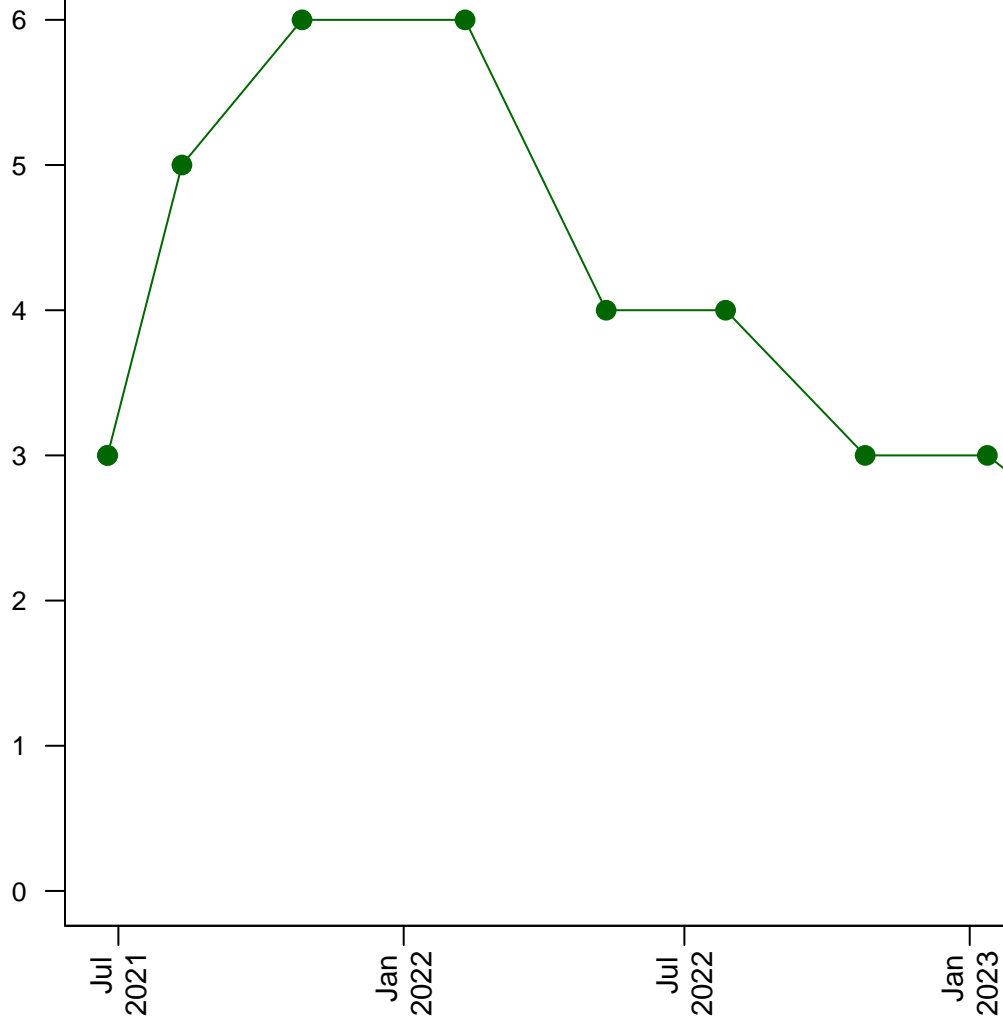
● Detect
○ NonDetect
▼ Detect Limit



Scatterplots and Trend Analysis

D113, Lead

Concentration (µg/L)



Stats

N Data: 10
N Detect: 10
% Detect: 100

95% Confidence
MK Trend: NS
MK p-val: 0.222

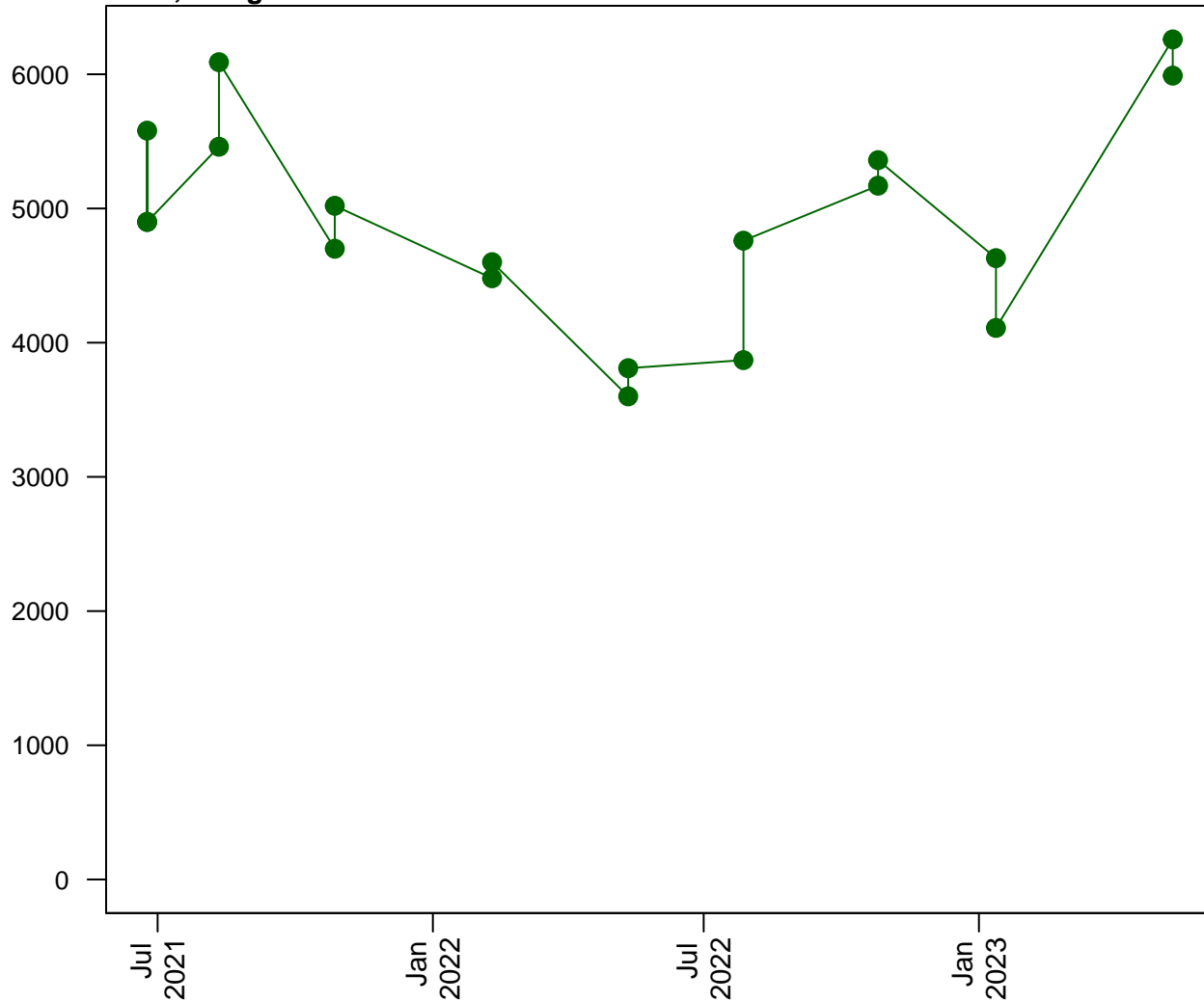
Shapes

● Detect
○ NonDetect
▼ Detect Limit

Scatterplots and Trend Analysis

D113, Manganese

Concentration (µg/L)



Stats

N Data: 19
N Detect: 19
% Detect: 100

95% Confidence
MK Trend: NS
MK p-val: 0.724

Shapes

● Detect
○ NonDetect
▼ Detect Limit

Scatterplots and Trend Analysis

D113, Mercury

Concentration (µg/L)

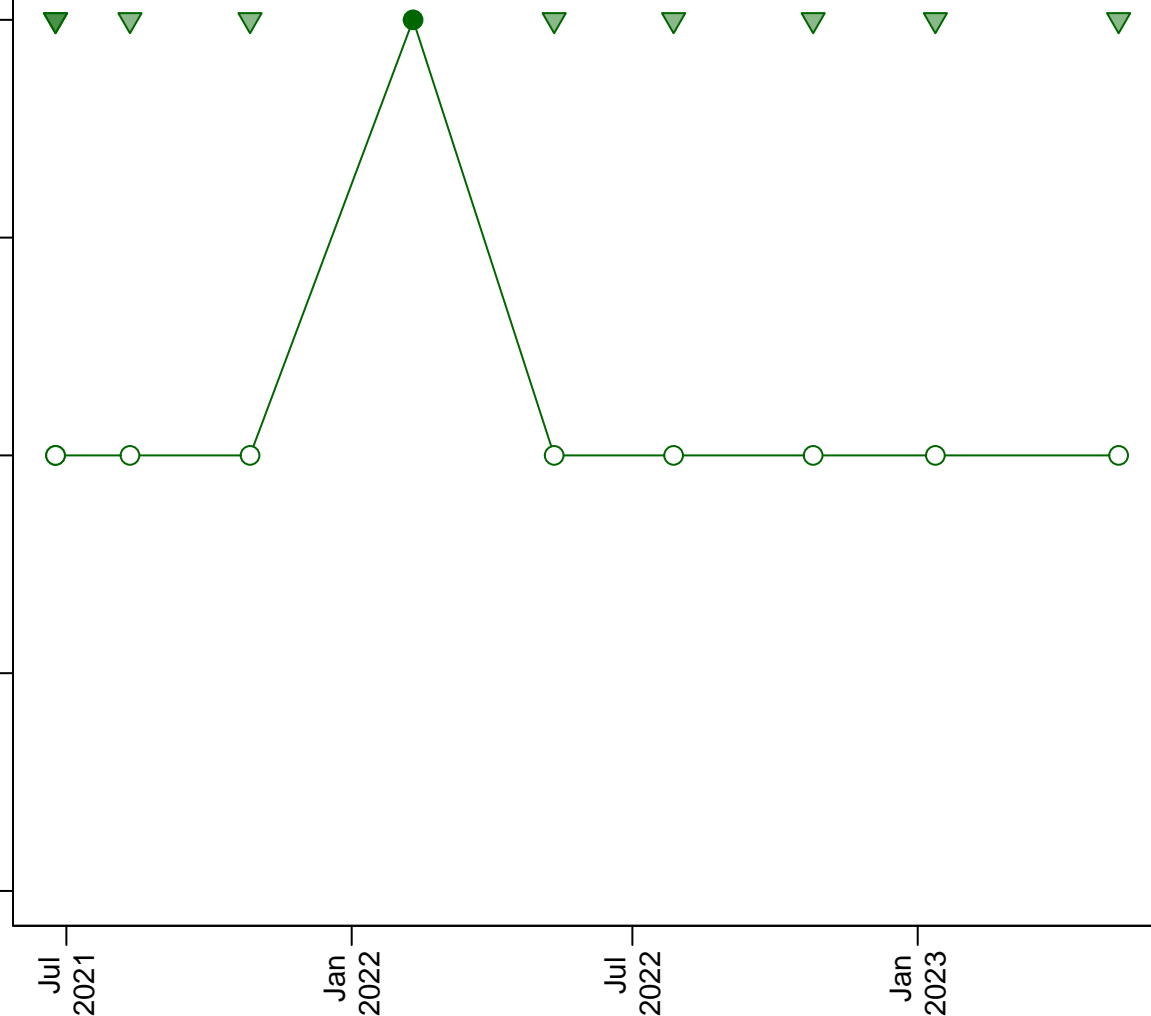
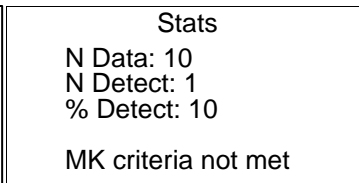
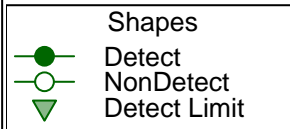
0.04
0.03
0.02
0.01
0.00

Jul
2021

Jan
2022

Jul
2022

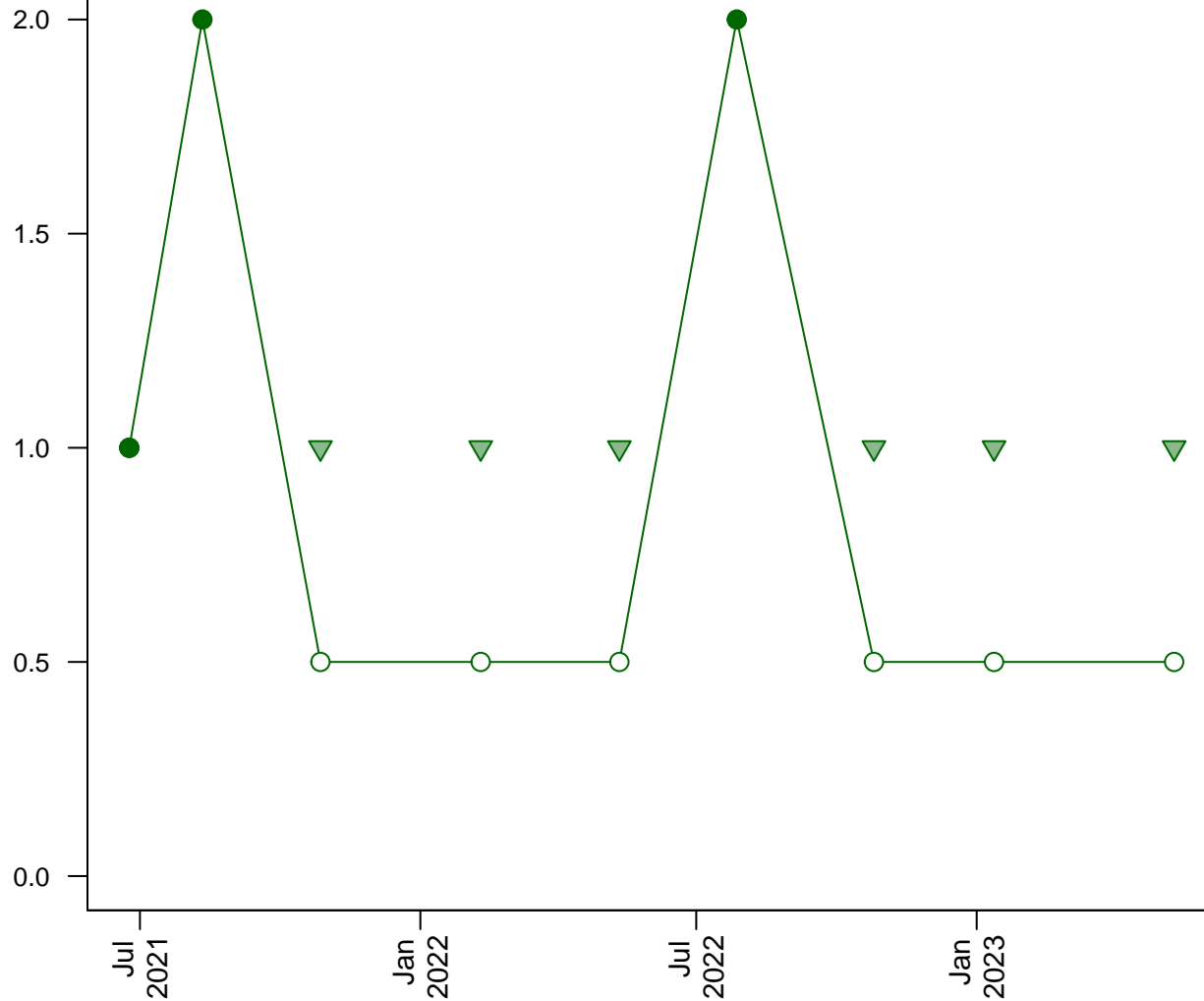
Jan
2023



Scatterplots and Trend Analysis

D113, Molybdenum

Concentration (µg/L)



Stats

N Data: 10

N Detect: 4

% Detect: 40

MK criteria not met

Shapes

● Detect

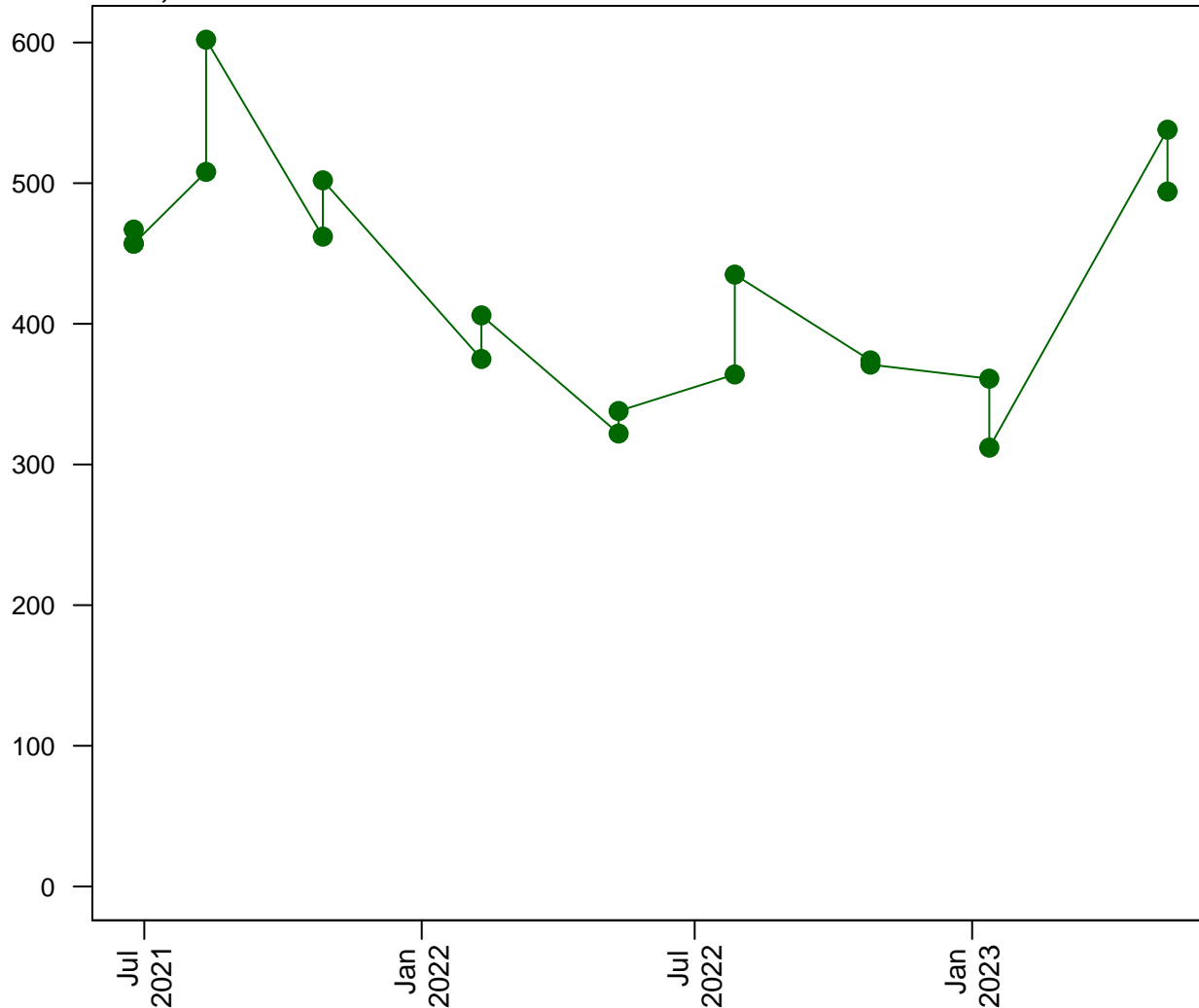
○ NonDetect

▼ Detect Limit

Scatterplots and Trend Analysis

D113, Nickel

Concentration (µg/L)



Stats

N Data: 19
N Detect: 19
% Detect: 100

95% Confidence
MK Trend: NS
MK p-val: 0.0779

Shapes

● Detect
○ NonDetect
▼ Detect Limit

Scatterplots and Trend Analysis

D113, Selenium

Concentration (µg/L)

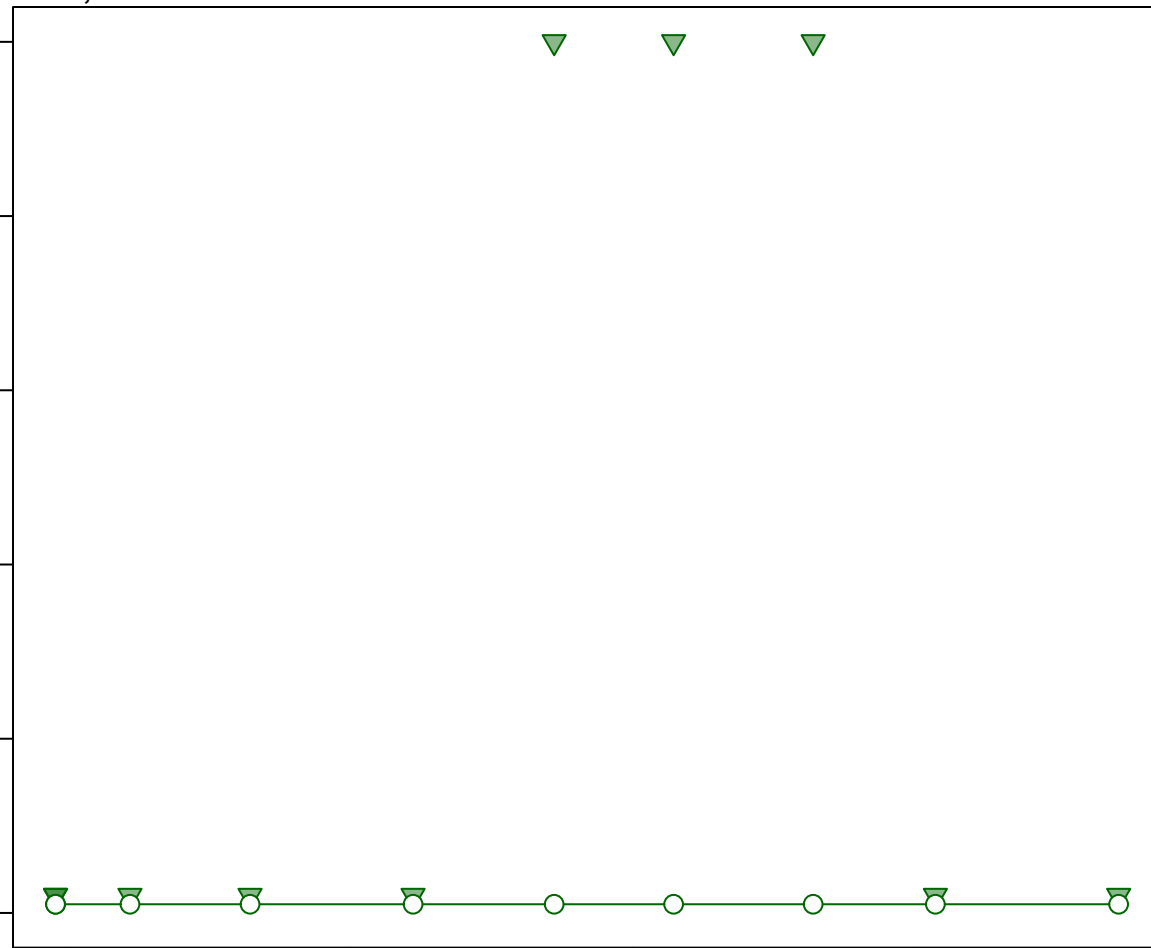
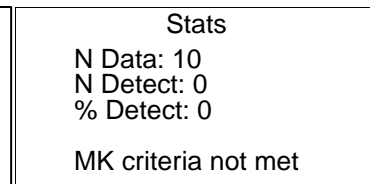
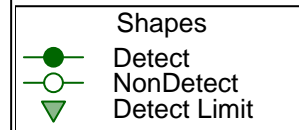
10
8
6
4
2
0

Jul
2021

Jan
2022

Jul
2022

Jan
2023



Scatterplots and Trend Analysis

D113, Sulfate (as SO4)

Concentration (mg/L)

2000
1500
1000
500
0

Jul
2021

Jan
2022

Jul
2022

Jan
2023

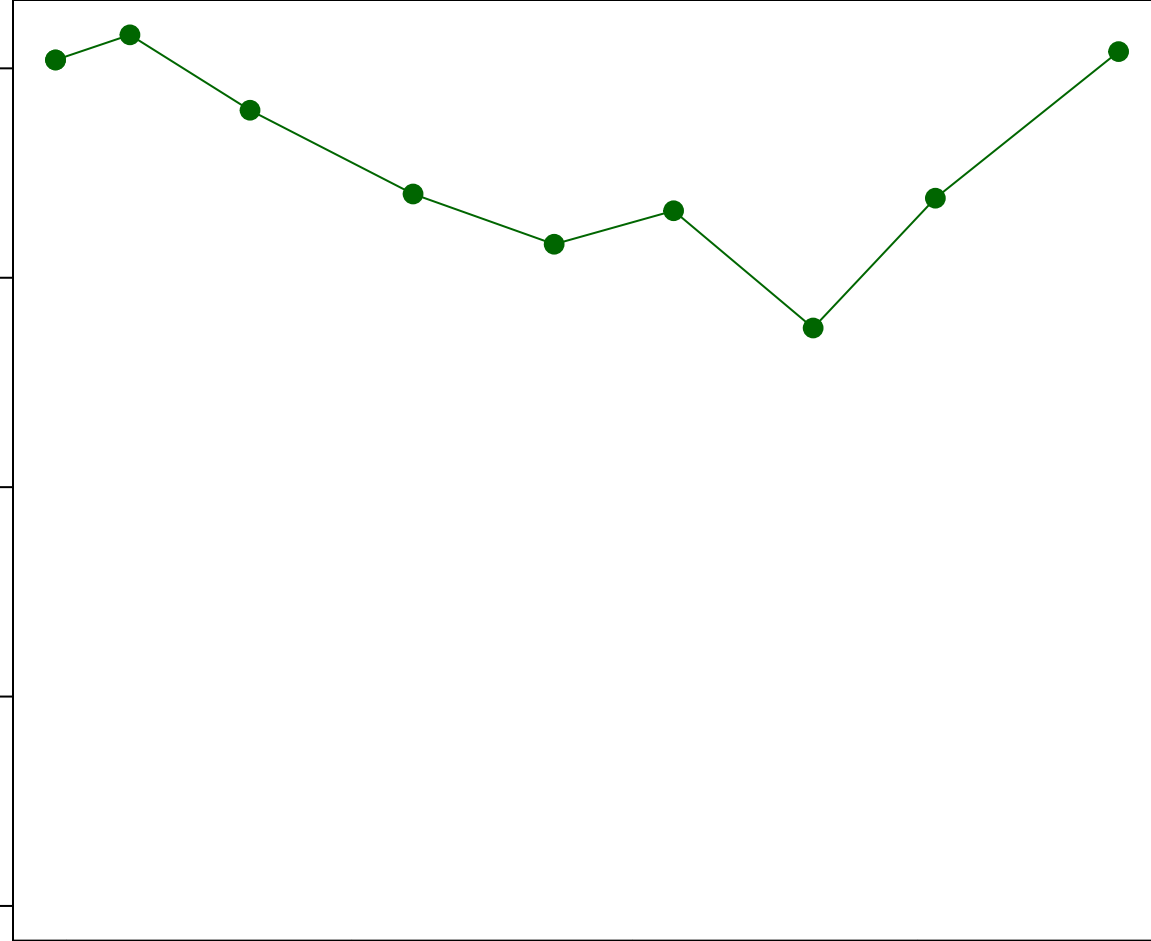
Stats

N Data: 10
N Detect: 10
% Detect: 100

95% Confidence
MK Trend: NS
MK p-val: 0.149

Shapes

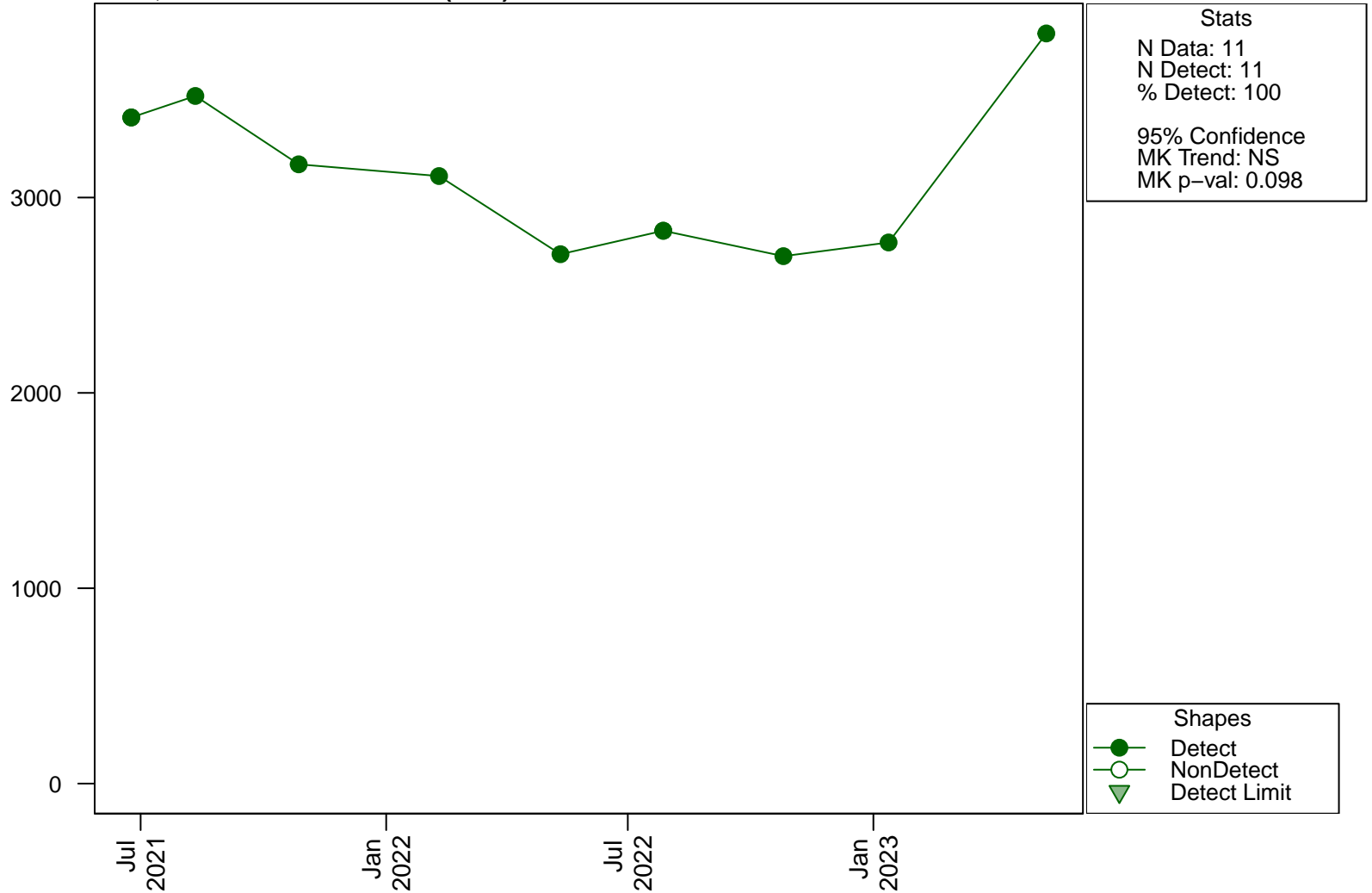
● Detect
○ NonDetect
▼ Detect Limit



Scatterplots and Trend Analysis

D113, Total Dissolved Solids (TDS)

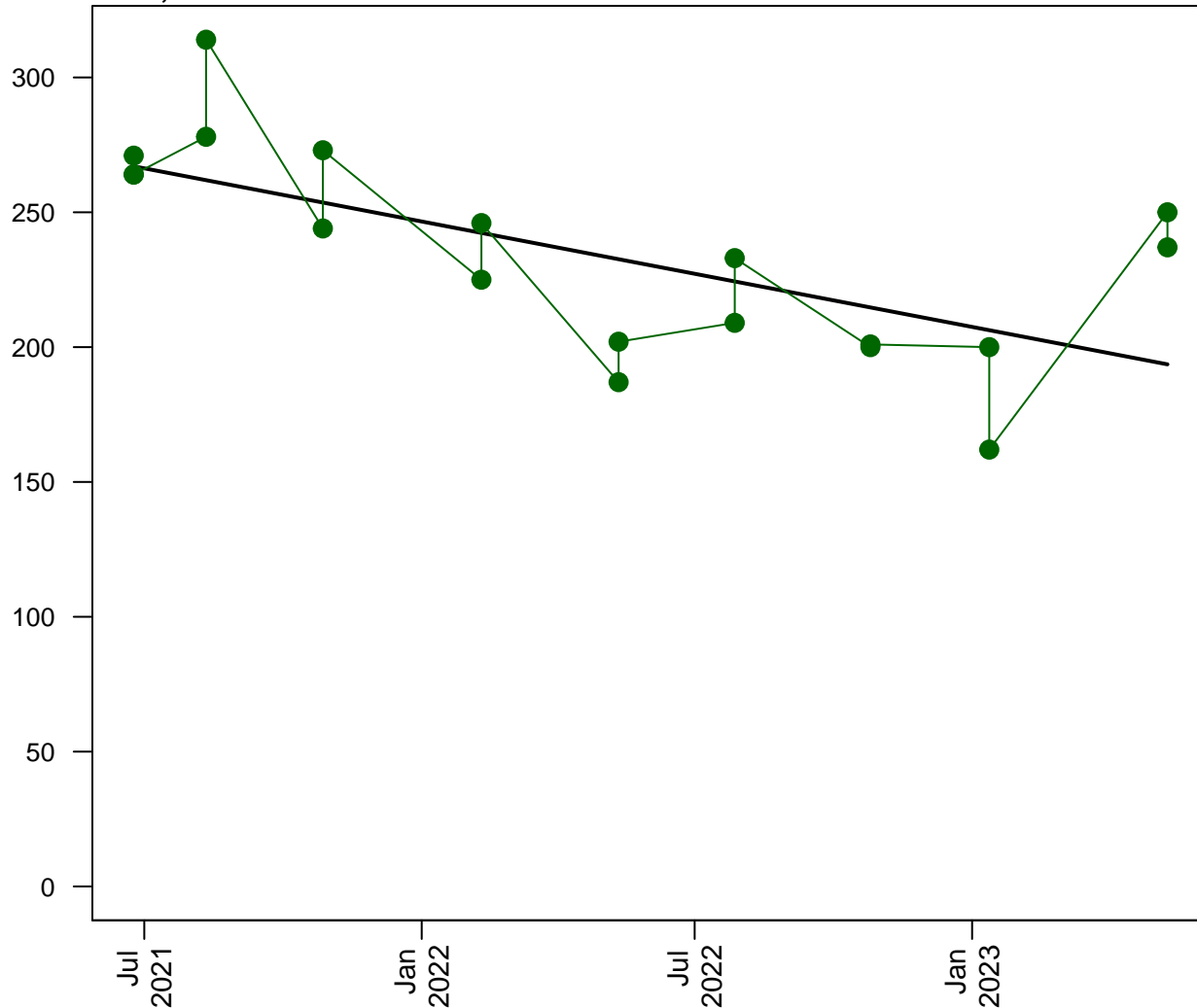
Concentration (mg/L)



Scatterplots and Trend Analysis

D113, Zinc

Concentration (µg/L)



Stats

N Data: 19
N Detect: 19
% Detect: 100

95% Confidence
MK Trend: Significant
MK p-val: 0.00341
Direction: Decreasing

Lines

— Linear Fit

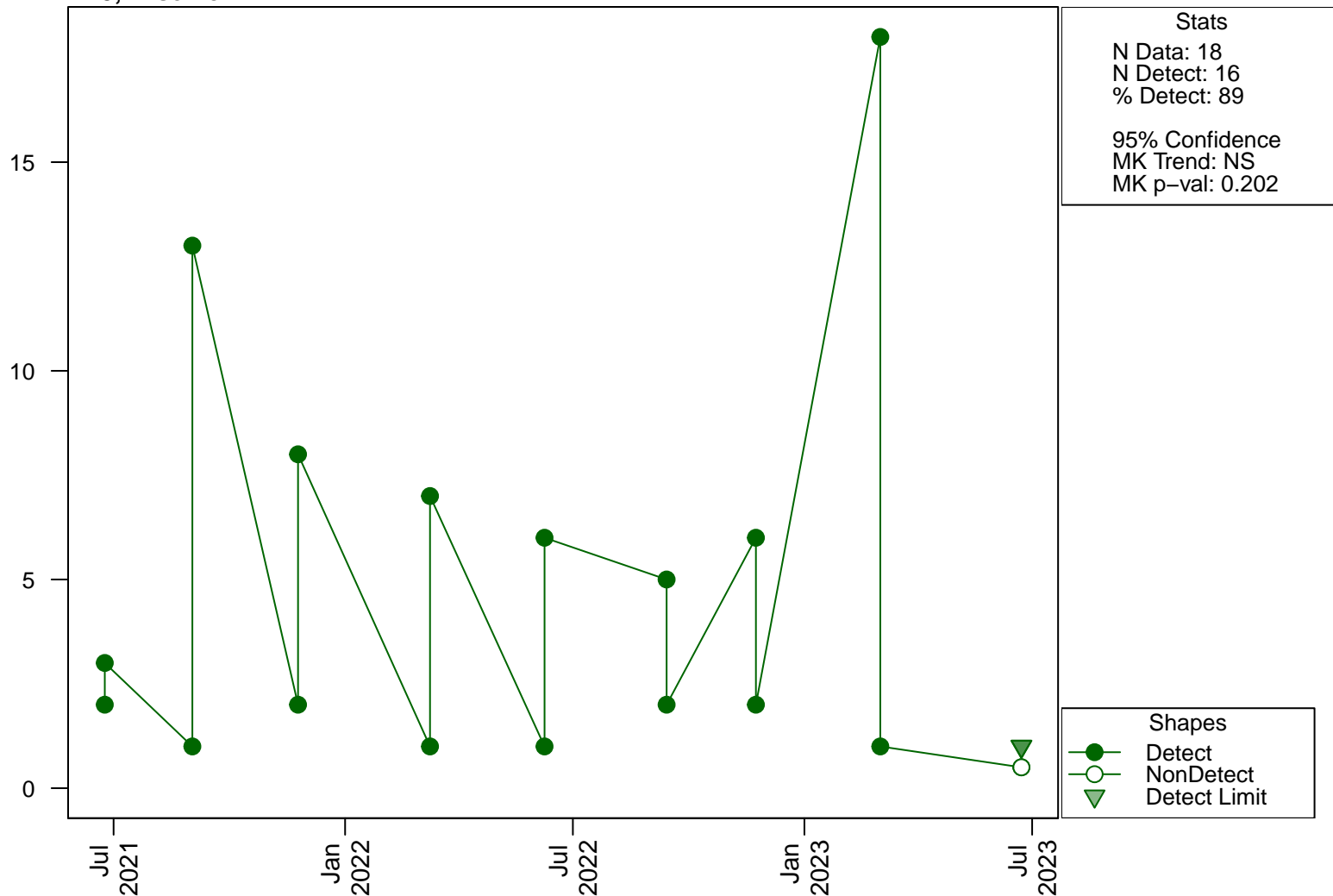
Shapes

● Detect
○ NonDetect
▼ Detect Limit

Scatterplots and Trend Analysis

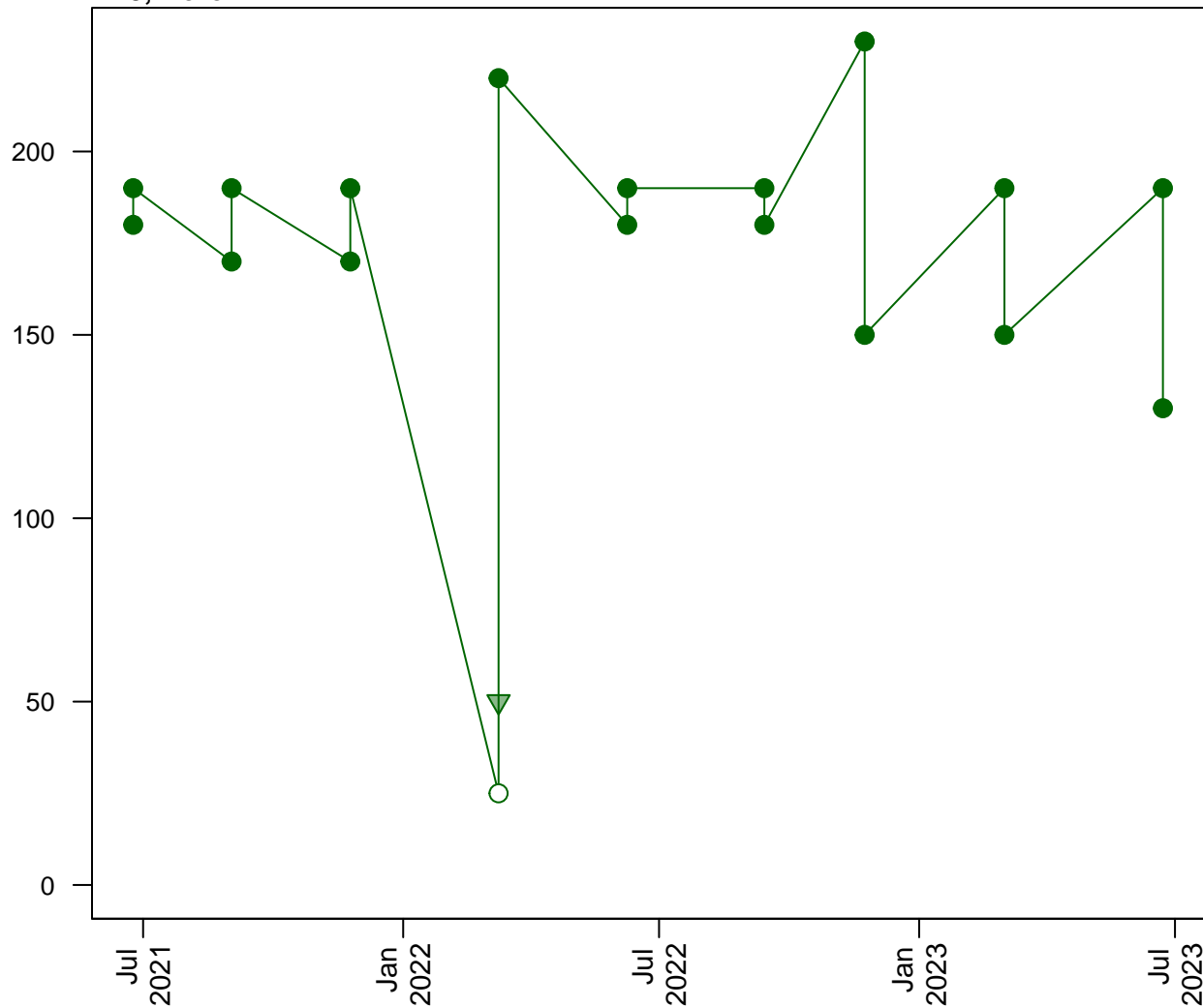
D15, Arsenic

Concentration (µg/L)



Scatterplots and Trend Analysis D15, Boron

Concentration (µg/L)



Stats
N Data: 18
N Detect: 17
% Detect: 94

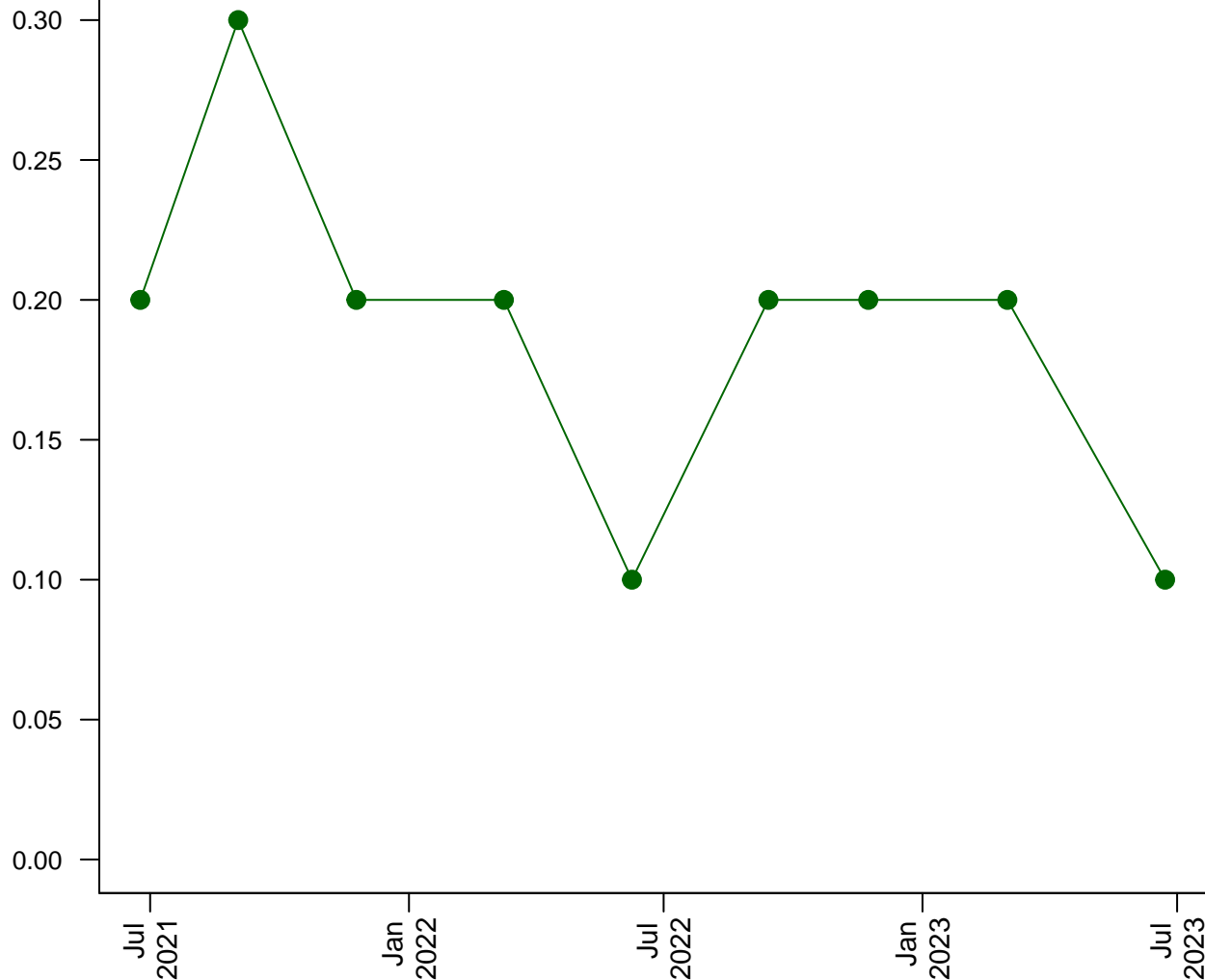
95% Confidence
MK Trend: NS
MK p-val: 0.693

Shapes
● Detect
○ Non-Detect
▼ Detect Limit

Scatterplots and Trend Analysis

D15, Cadmium

Concentration (µg/L)



Stats

N Data: 9

N Detect: 9

% Detect: 100

95% Confidence

MK Trend: NS

MK p-val: 0.13

Shapes

●

Detect

○

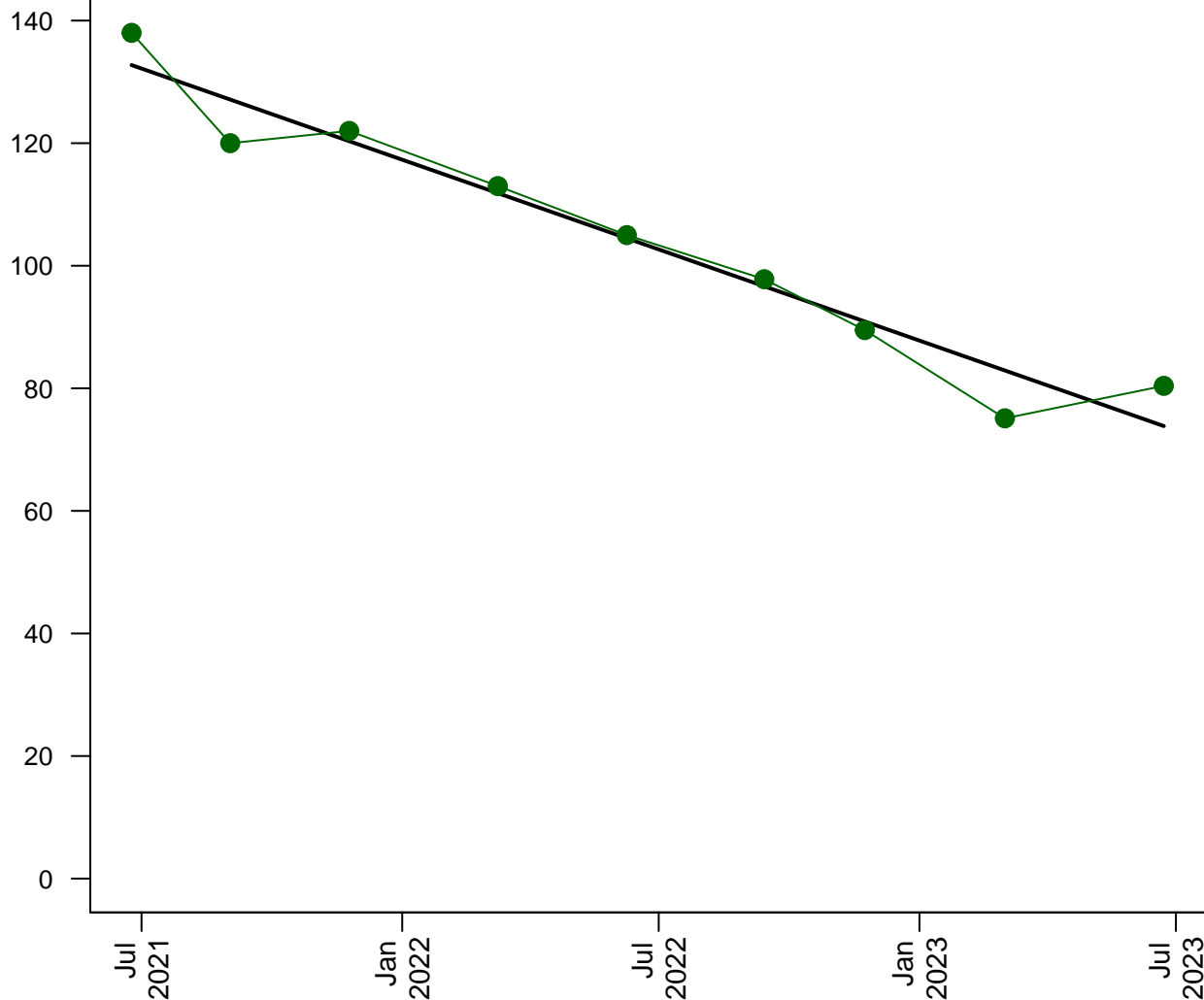
NonDetect

▼

Detect Limit

Scatterplots and Trend Analysis D15, Chloride

Concentration (mg/L)



Stats

N Data: 9

N Detect: 9

% Detect: 100

95% Confidence

MK Trend: Significant

MK p-val: <0.001

Direction: Decreasing

Lines

Linear Fit

Shapes

Detect

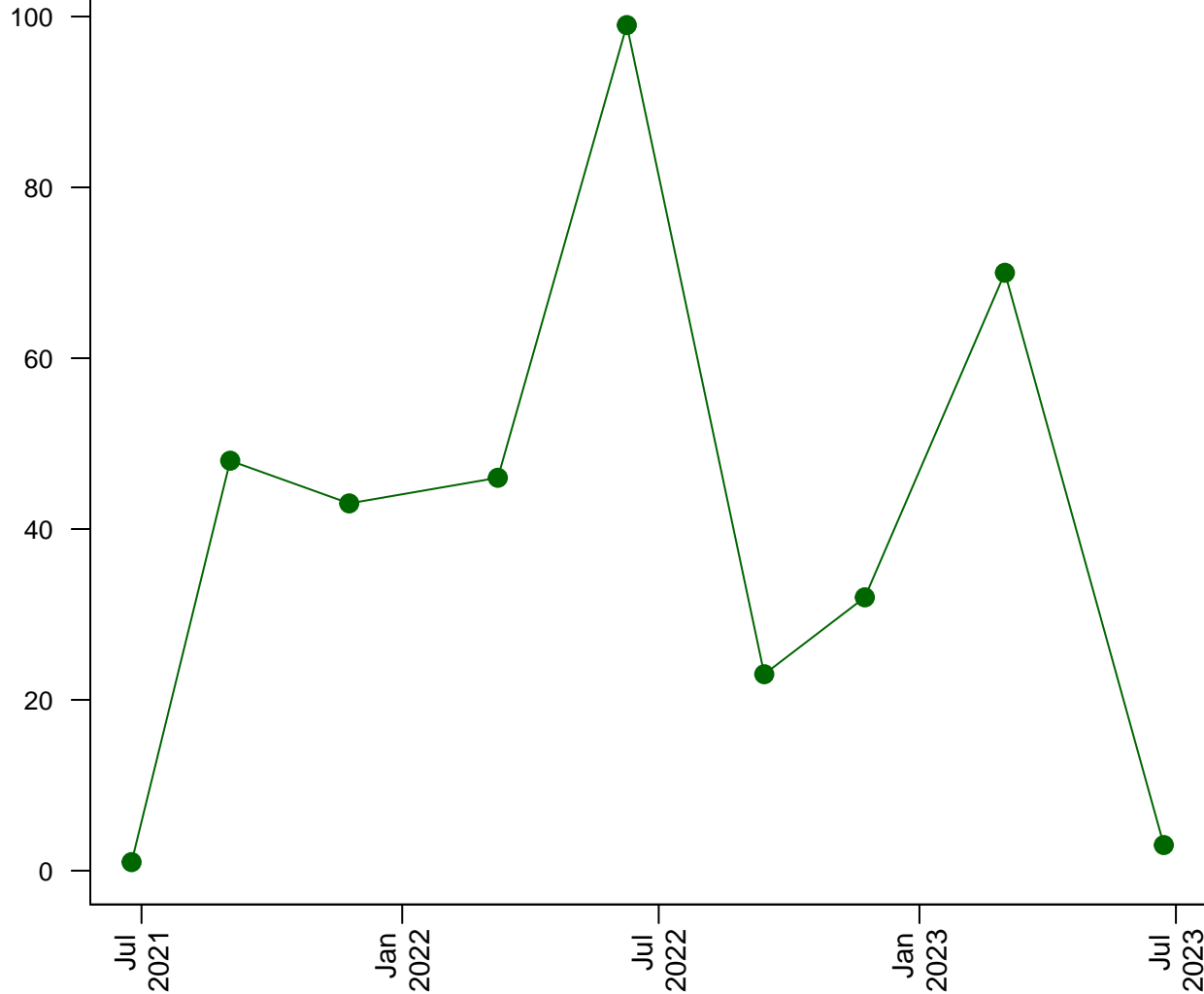
NonDetect

Detect Limit

Scatterplots and Trend Analysis

D15, Chromium

Concentration (µg/L)



Stats

N Data: 9
N Detect: 9
% Detect: 100

95% Confidence
MK Trend: NS
MK p-val: 1

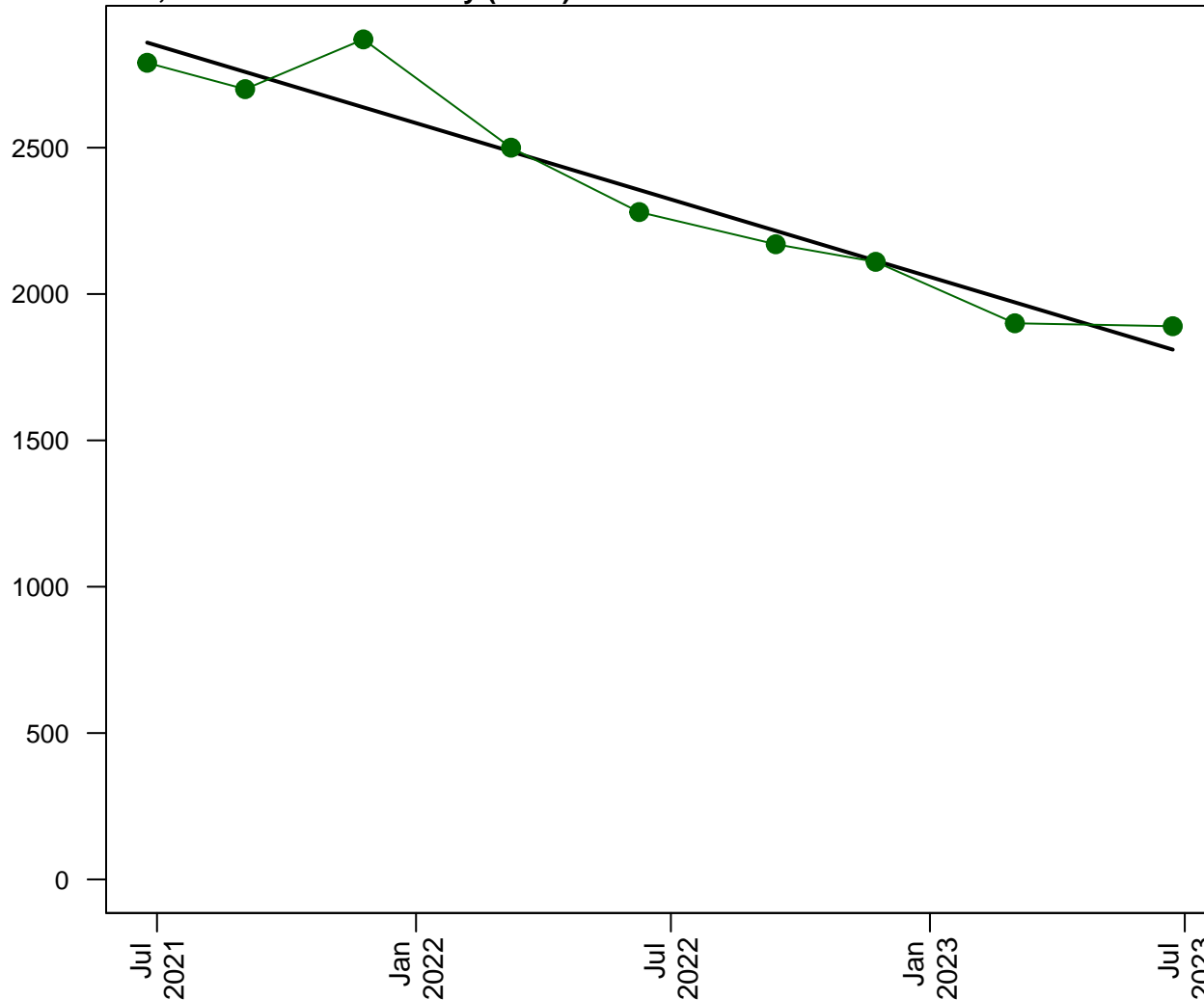
Shapes

● Detect
○ NonDetect
▼ Detect Limit

Scatterplots and Trend Analysis

D15, Electrical Conductivity (Field)

Concentration (uS/cm)



Stats

N Data: 9

N Detect: 9

% Detect: 100

95% Confidence

MK Trend: Significant

MK p-val: <0.001

Direction: Decreasing

Lines

Linear Fit

Shapes

Detect

NonDetect

Detect Limit

Detect

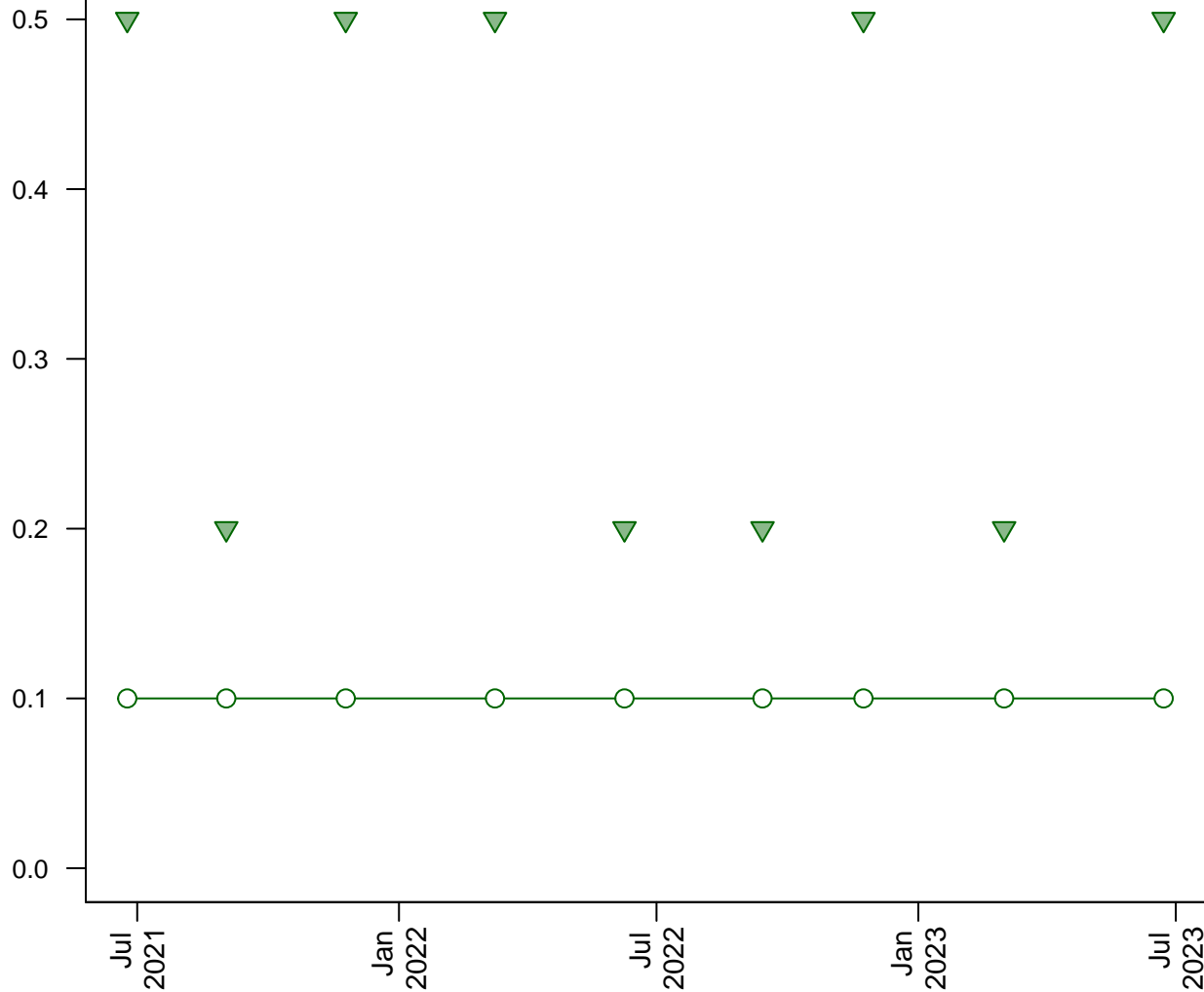
NonDetect

Detect Limit

Scatterplots and Trend Analysis

D15, Fluoride

Concentration (mg/L)



Stats

N Data: 9
N Detect: 0
% Detect: 0

MK criteria not met

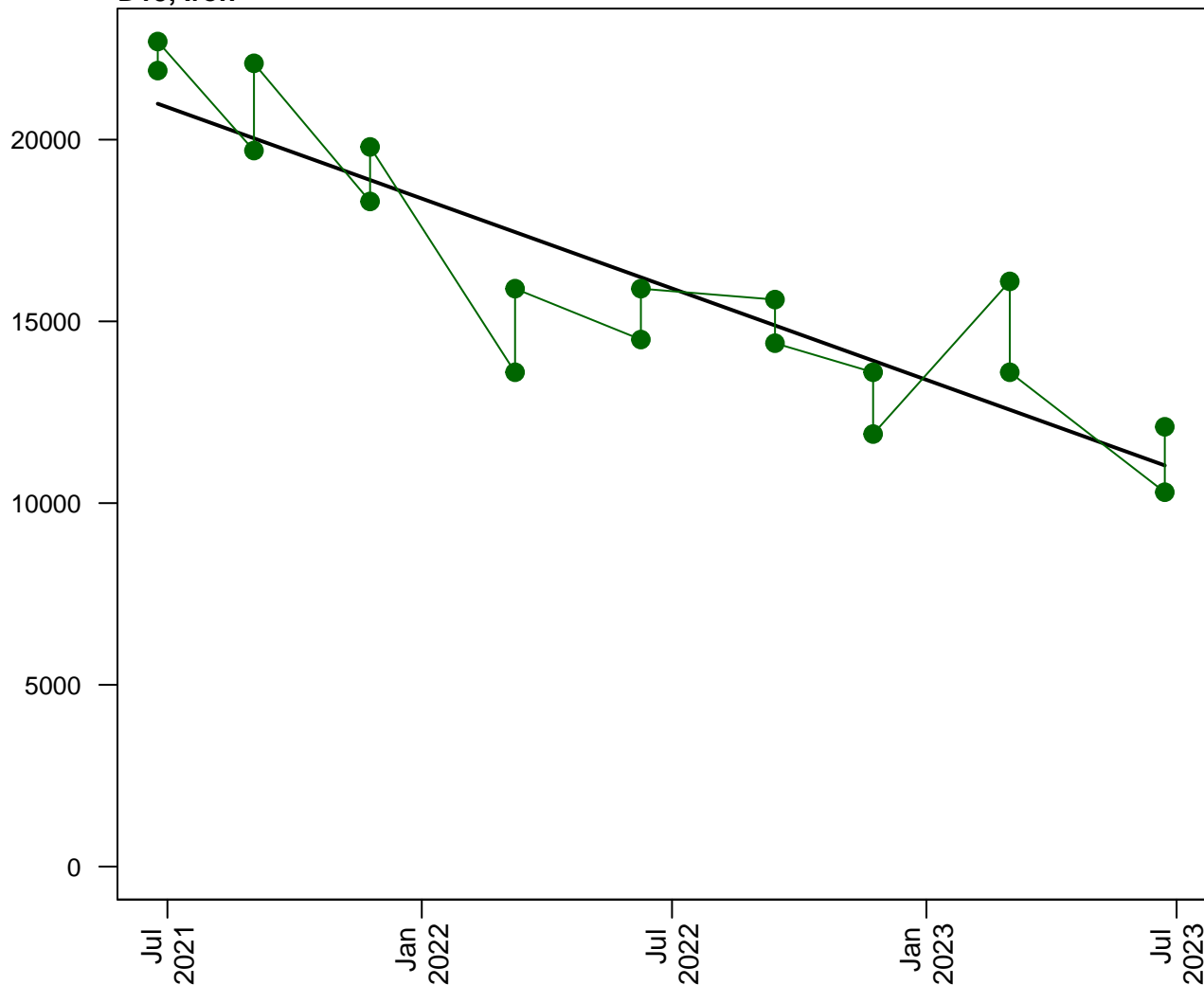
Shapes

● Detect
○ NonDetect
▼ Detect Limit

Scatterplots and Trend Analysis

D15, Iron

Concentration (µg/L)



Stats

N Data: 18

N Detect: 18

% Detect: 100

95% Confidence

MK Trend: Significant

MK p-val: <0.001

Direction: Decreasing

Lines

— Linear Fit

Shapes

● Detect

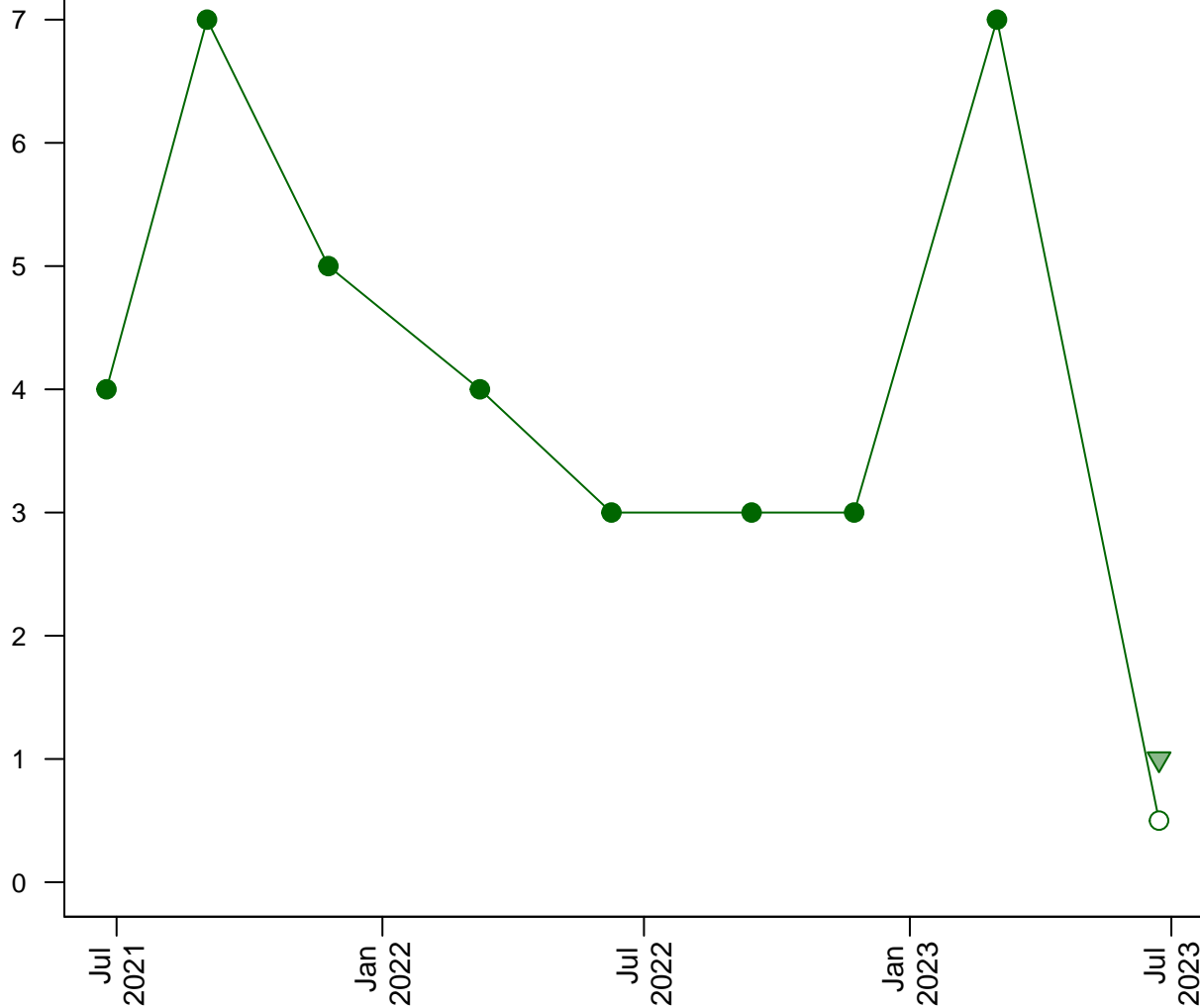
○ NonDetect

▼ Detect Limit

Scatterplots and Trend Analysis

D15, Lead

Concentration (µg/L)



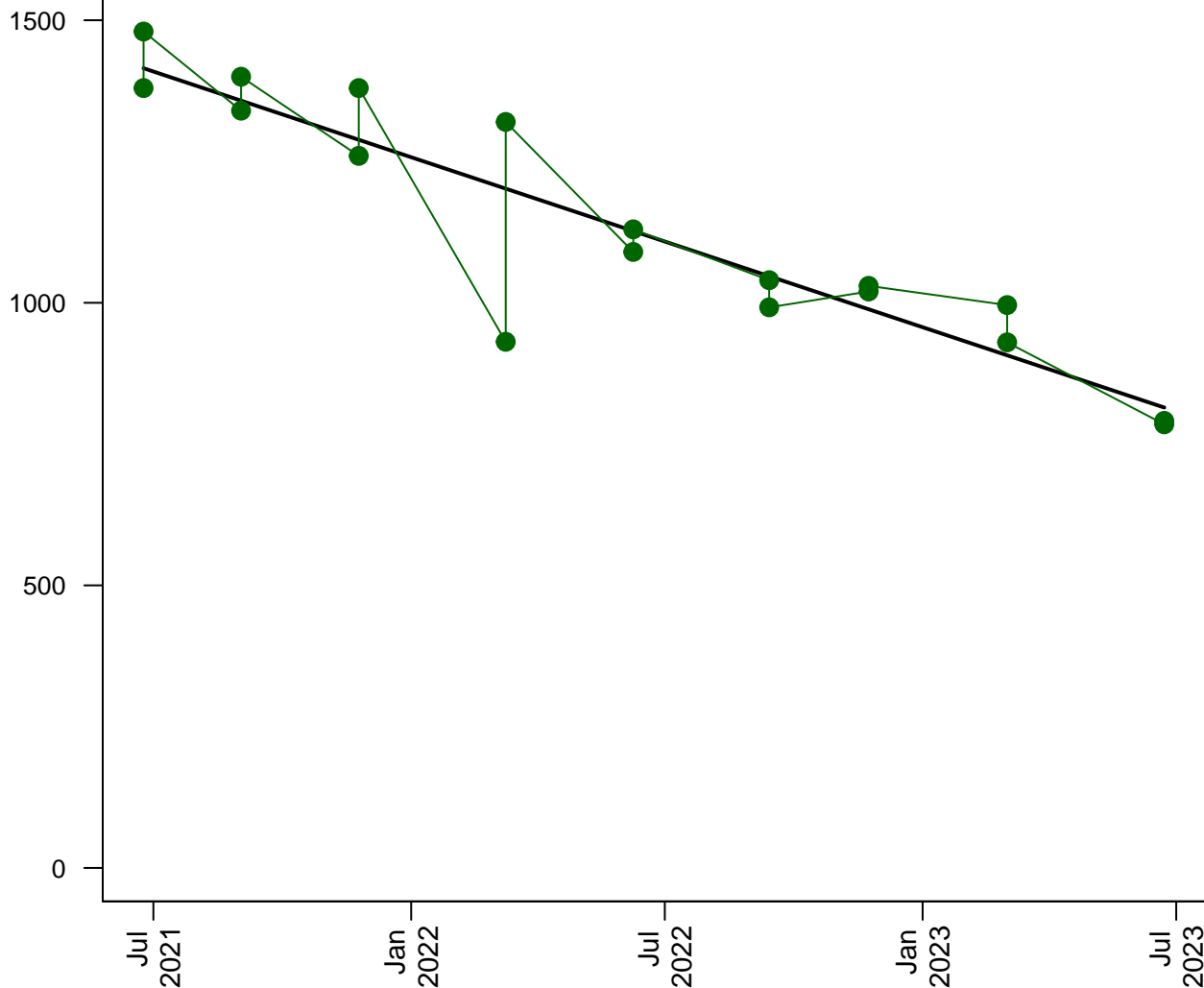
Stats
N Data: 9
N Detect: 8
% Detect: 89

95% Confidence
MK Trend: NS
MK p-val: 0.106

Shapes
● Detect
○ NonDetect
▼ Detect Limit

Scatterplots and Trend Analysis D15, Manganese

Concentration (µg/L)



Stats

N Data: 18

N Detect: 18

% Detect: 100

95% Confidence

MK Trend: Significant

MK p-val: <0.001

Direction: Decreasing

Lines

Linear Fit

Shapes

● Detect

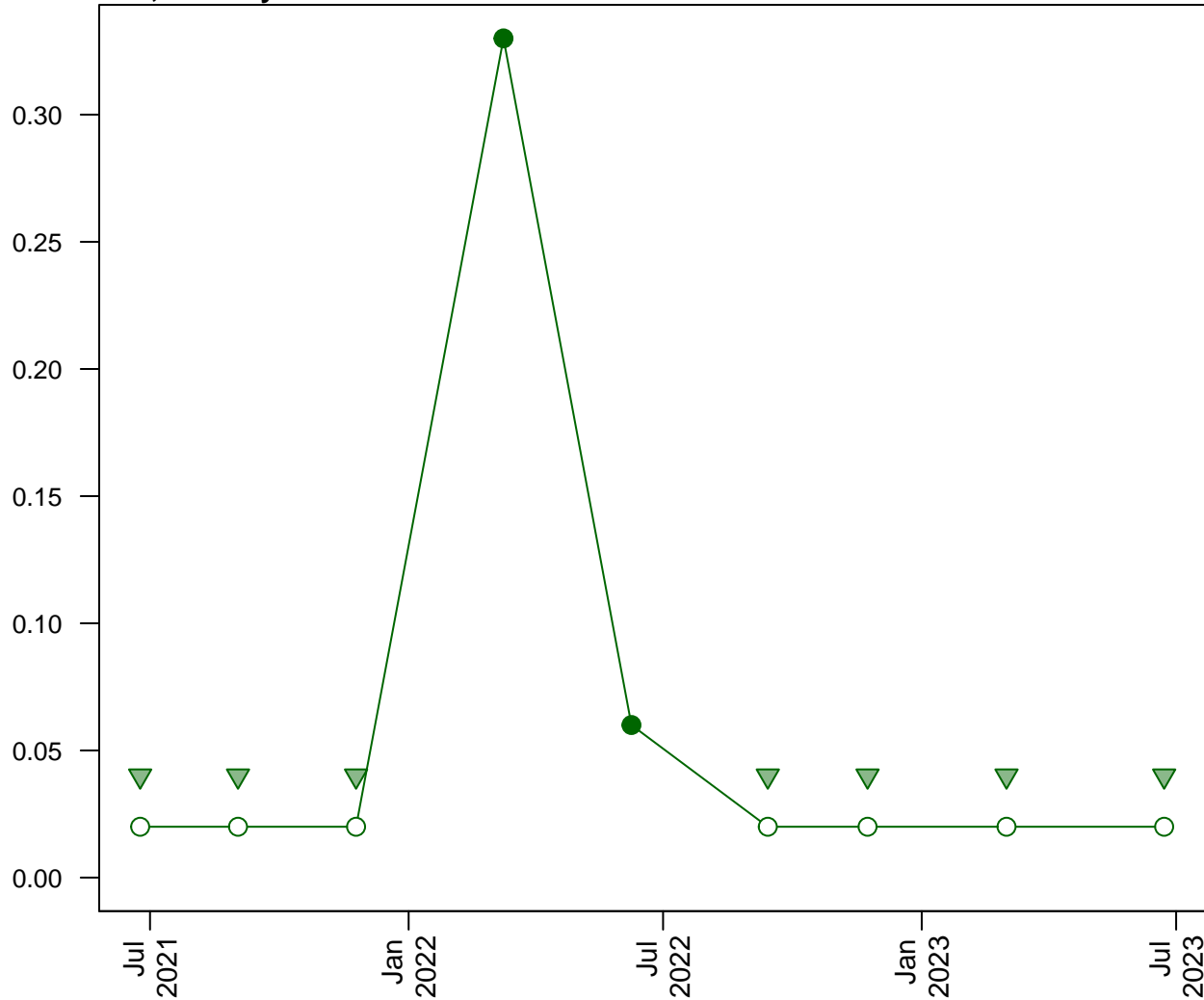
○ NonDetect

▼ Detect Limit

Scatterplots and Trend Analysis

D15, Mercury

Concentration ($\mu\text{g/L}$)



Stats

N Data: 9

N Detect: 2

% Detect: 22

MK criteria not met

Shapes

● Detect

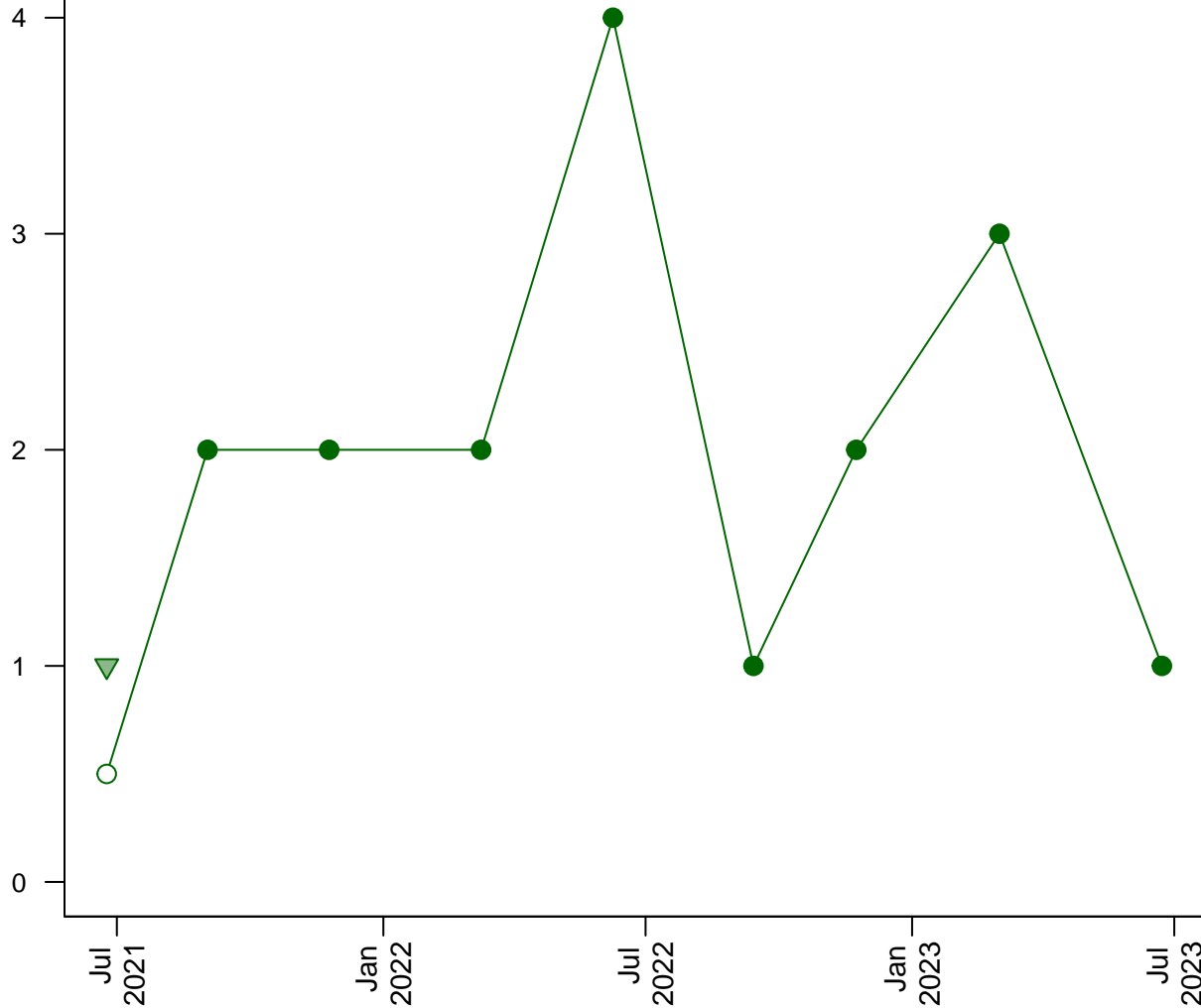
○ NonDetect

▼ Detect Limit

Detect Limit

Scatterplots and Trend Analysis D15, Molybdenum

Concentration (µg/L)



Stats

N Data: 9
N Detect: 8
% Detect: 89

95% Confidence
MK Trend: NS
MK p-val: 0.582

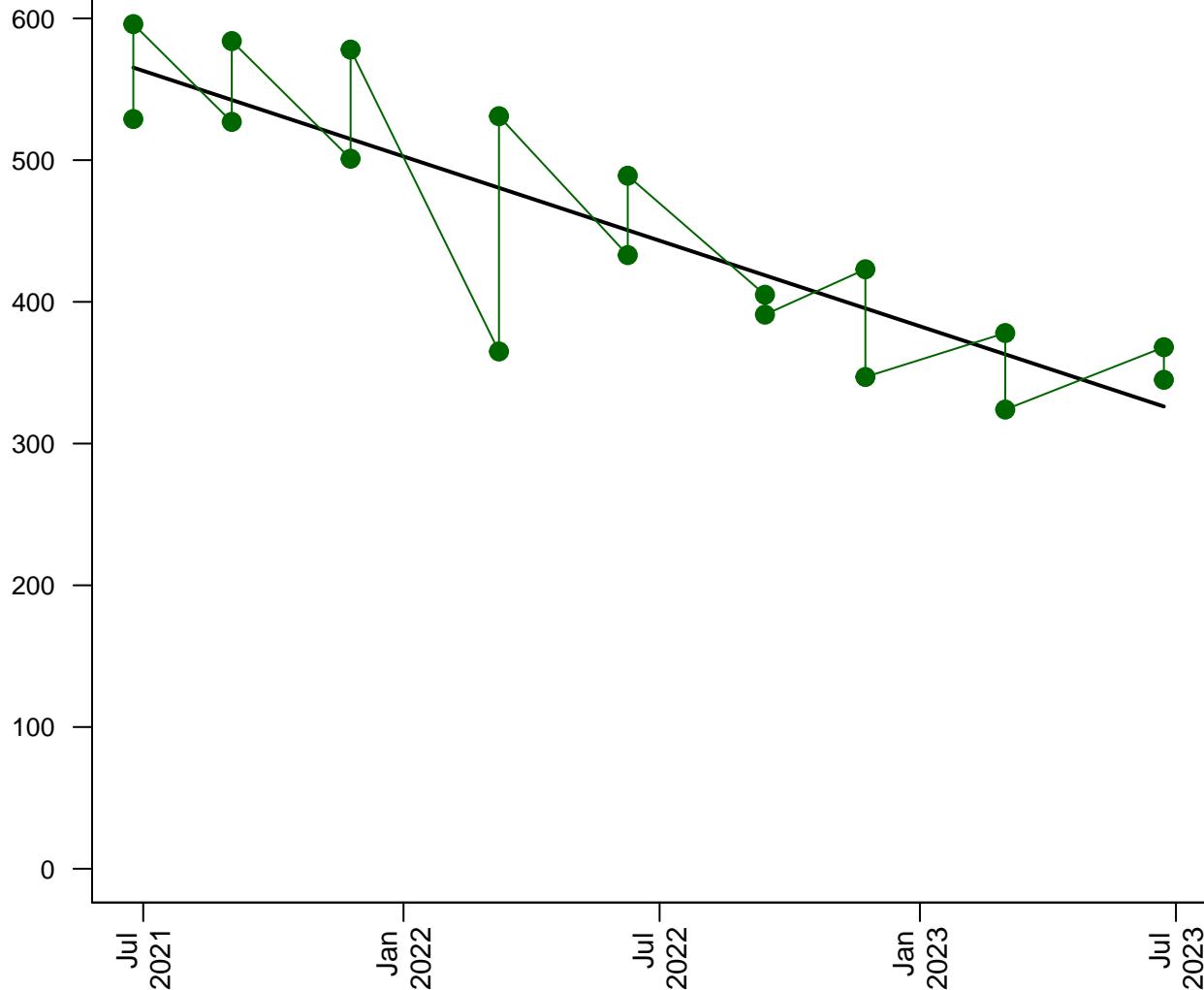
Shapes

● Detect
○ NonDetect
▼ Detect Limit

Scatterplots and Trend Analysis

D15, Nickel

Concentration (µg/L)



Stats

N Data: 18
N Detect: 18
% Detect: 100

95% Confidence
MK Trend: Significant
MK p-val: <0.001
Direction: Decreasing

Lines

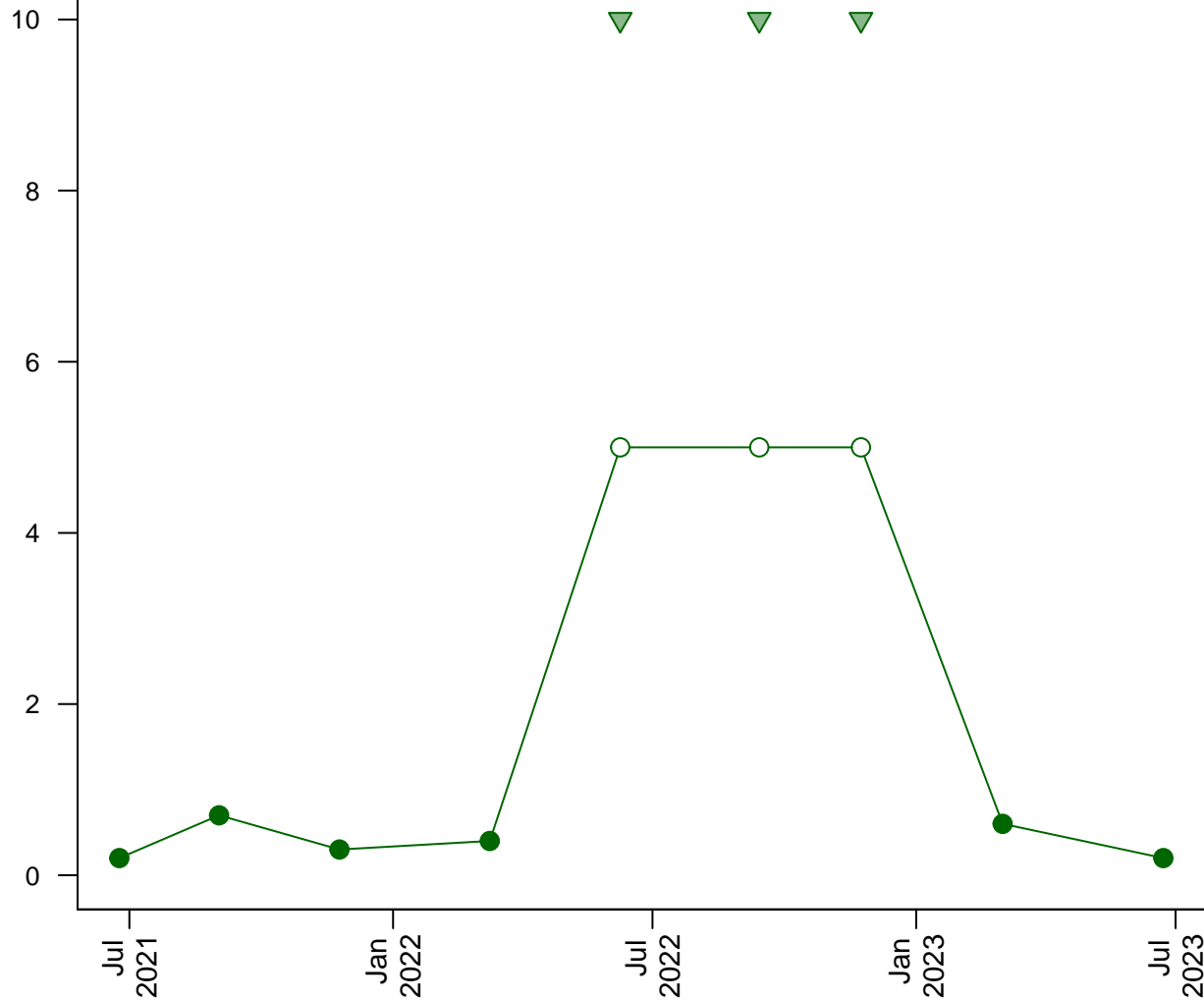
— Linear Fit

Shapes

● Detect
○ NonDetect
▼ Detect Limit

Scatterplots and Trend Analysis D15, Selenium

Concentration (µg/L)



Stats
N Data: 9
N Detect: 6
% Detect: 67

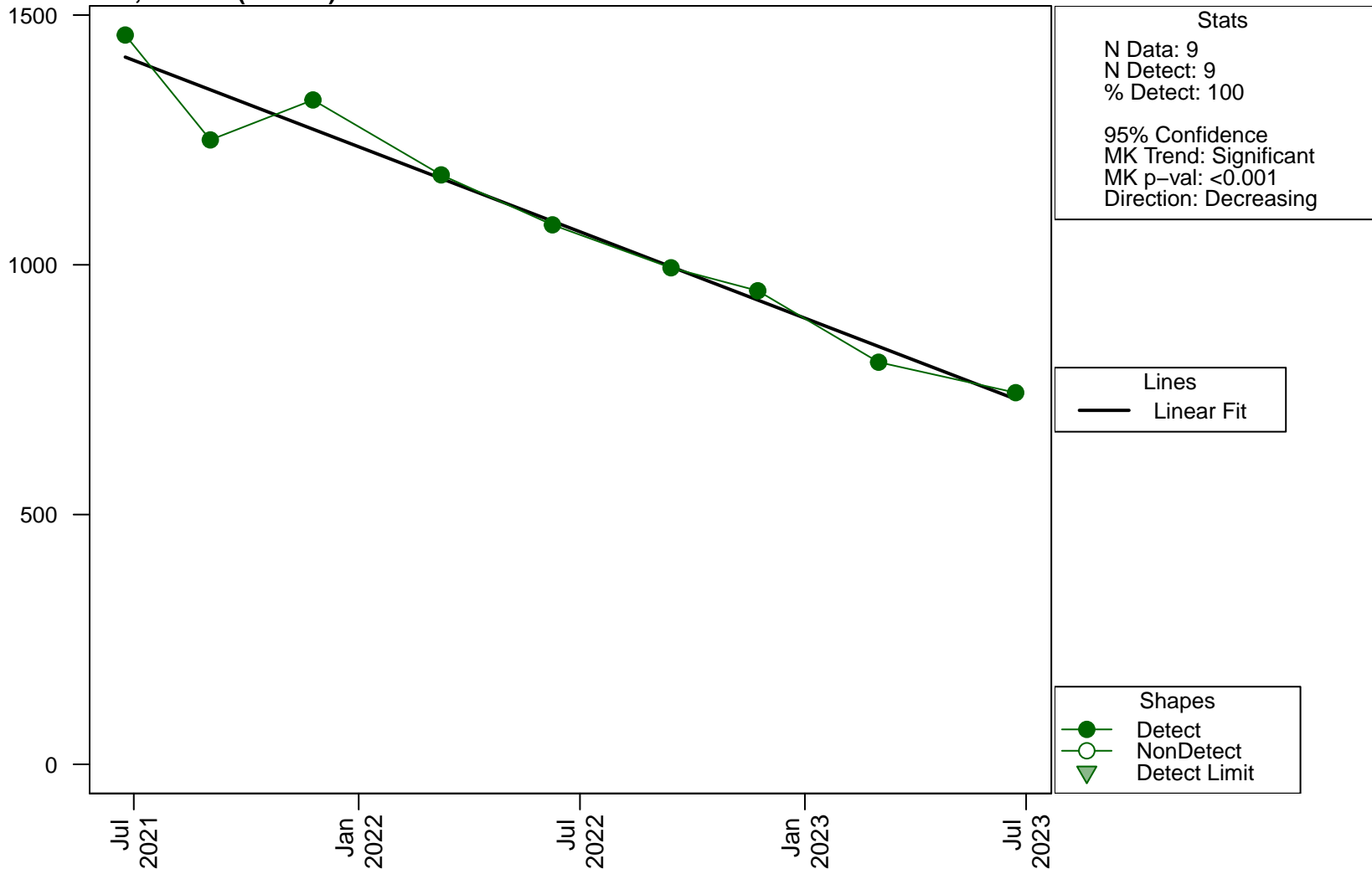
95% Confidence
MK Trend: NS
MK p-val: 0.521

Shapes
● Detect
○ NonDetect
▼ Detect Limit

Scatterplots and Trend Analysis

D15, Sulfate (as SO4)

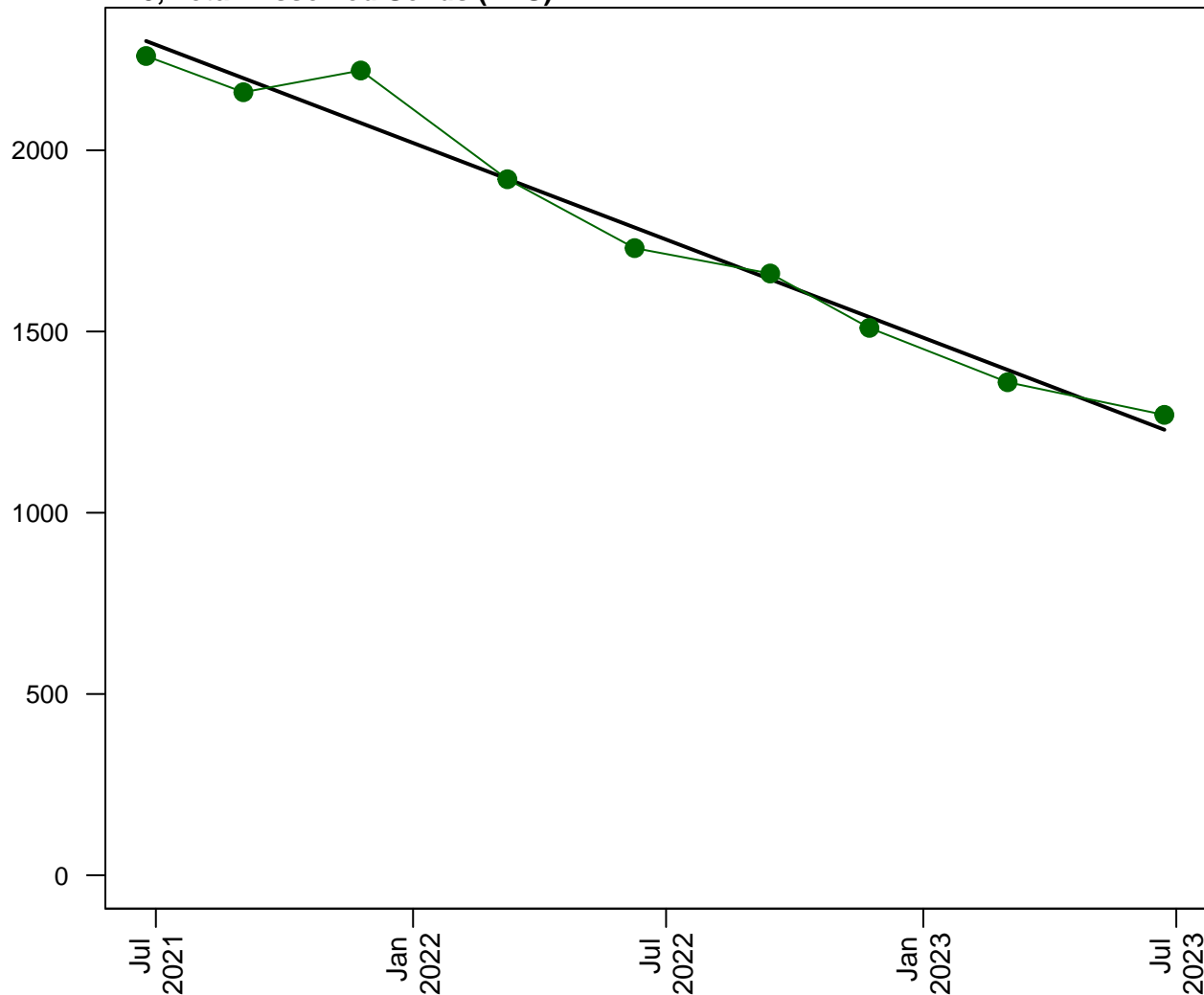
Concentration (mg/L)



Scatterplots and Trend Analysis

D15, Total Dissolved Solids (TDS)

Concentration (mg/L)



Stats

N Data: 9

N Detect: 9

% Detect: 100

95% Confidence

MK Trend: Significant

MK p-val: <0.001

Direction: Decreasing

Lines

Linear Fit

Shapes

Detect

NonDetect

Detect Limit

●

○

▼

Scatterplots and Trend Analysis

D15, Zinc

Concentration (µg/L)

1000
800
600
400
200
0

Jul
2021

Jan
2022

Jul
2022

Jan
2023

Jul
2023

Stats

N Data: 18

N Detect: 18

% Detect: 100

95% Confidence

MK Trend: Significant

MK p-val: <0.001

Direction: Decreasing

Lines

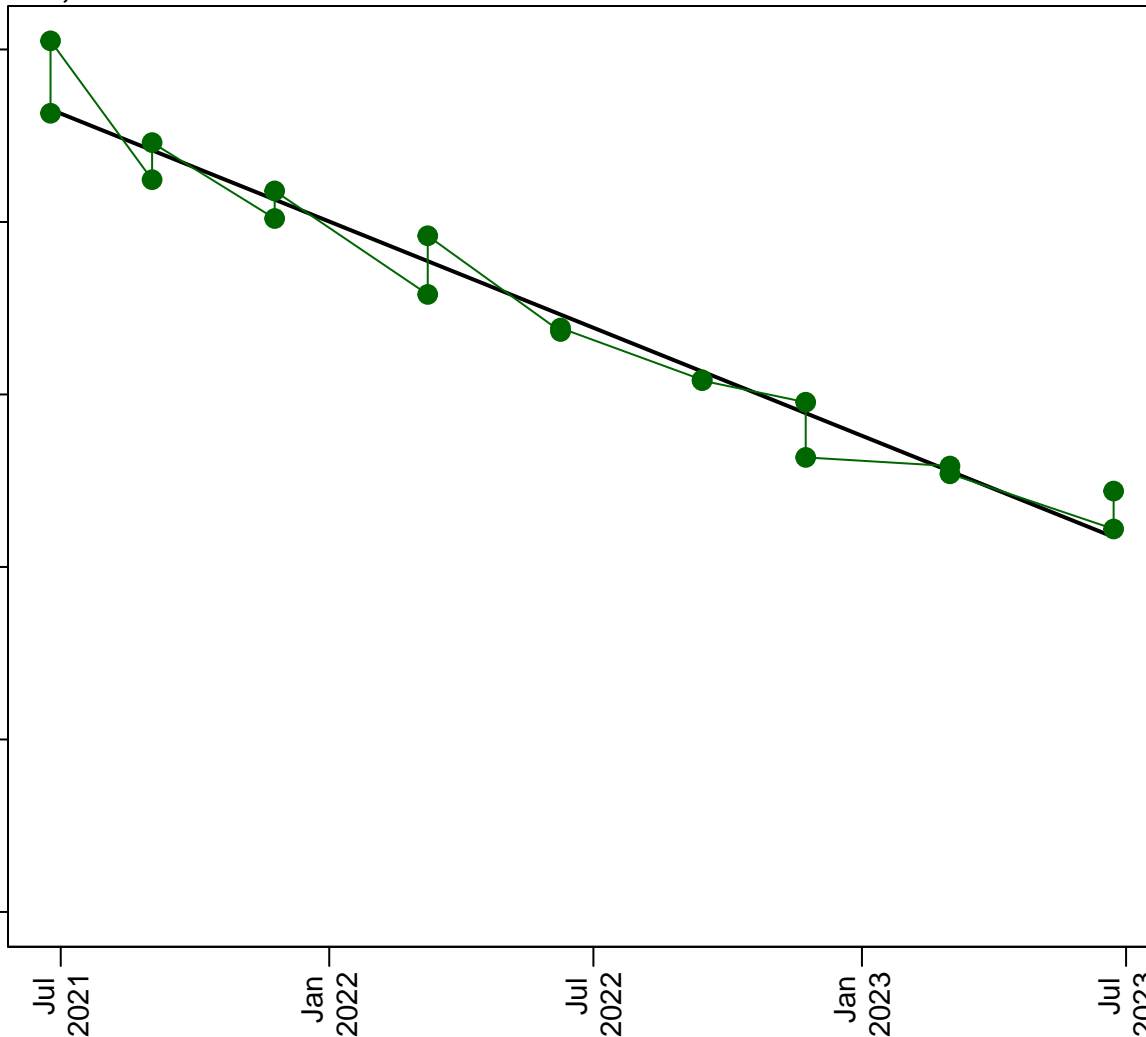
Linear Fit

Shapes

Detect

NonDetect

Detect Limit



Scatterplots and Trend Analysis

D16, Arsenic

Concentration (µg/L)

1.0
0.8
0.6
0.4
0.2
0.0

Jun
2021

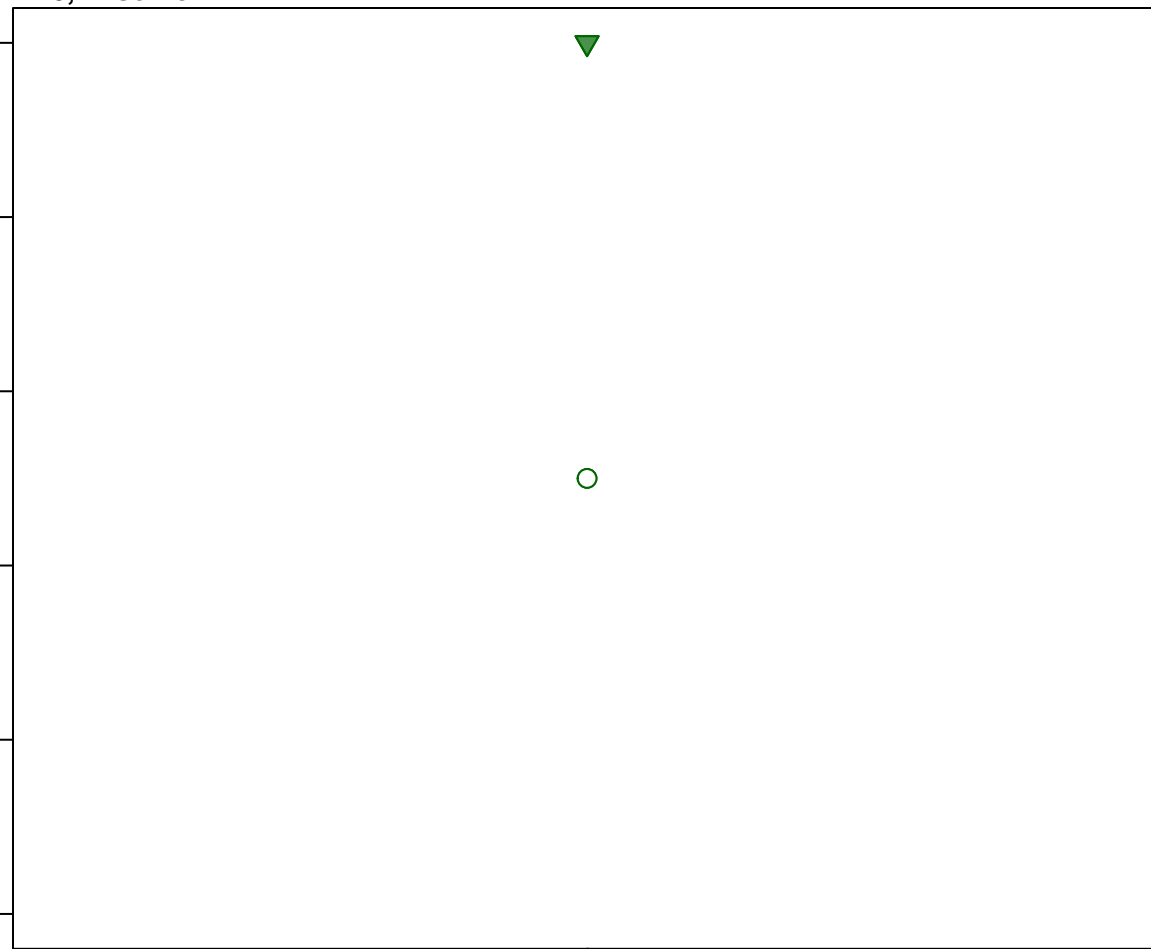
Stats

N Data: 2
N Detect: 0
% Detect: 0

MK criteria not met

Shapes

● Detect
○ NonDetect
▼ Detect Limit



Scatterplots and Trend Analysis

D16, Boron

Concentration (µg/L)

50
40
30
20
10
0

Jun
2021

Stats

N Data: 2

N Detect: 0

% Detect: 0

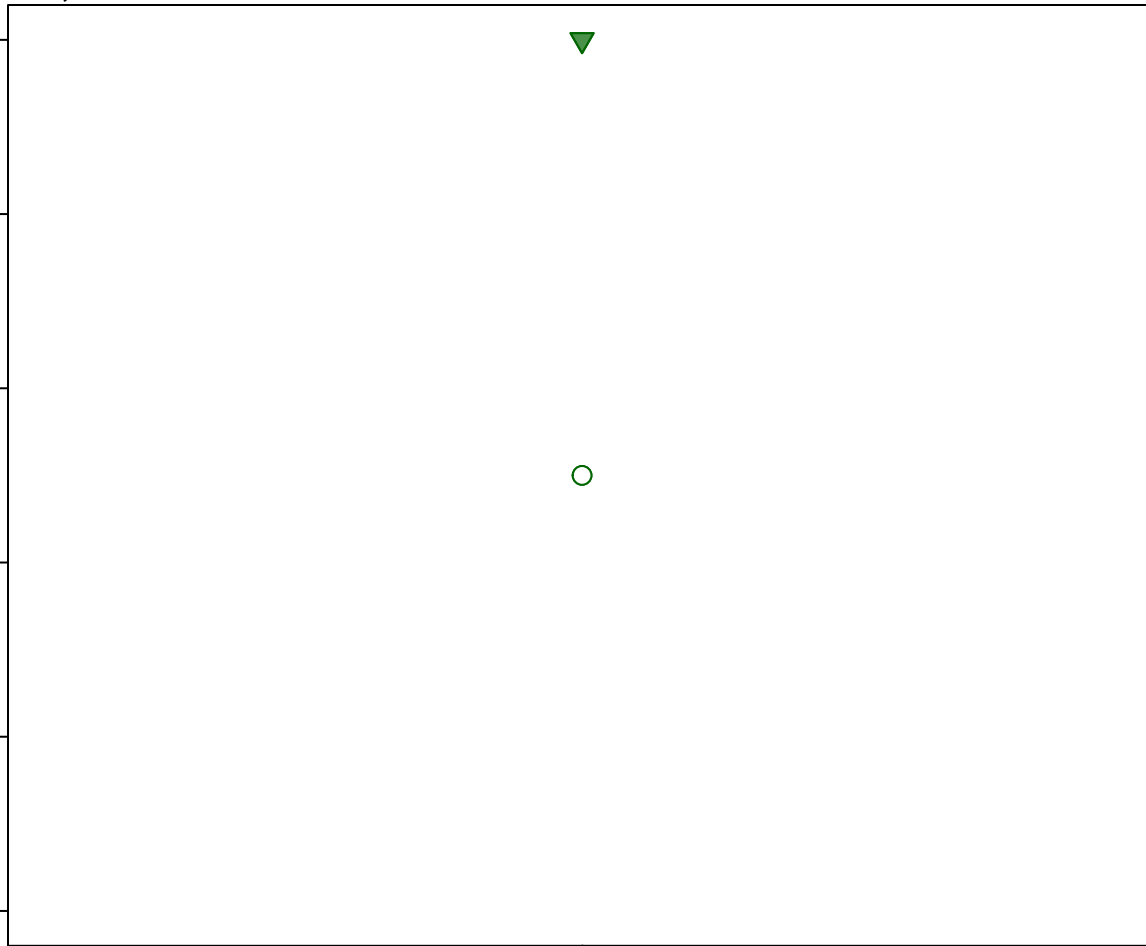
MK criteria not met

Shapes

● Detect

○ NonDetect

▼ Detect Limit



Scatterplots and Trend Analysis

D16, Cadmium

Concentration (µg/L)

0.10
0.08
0.06
0.04
0.02
0.00

Jun
2021

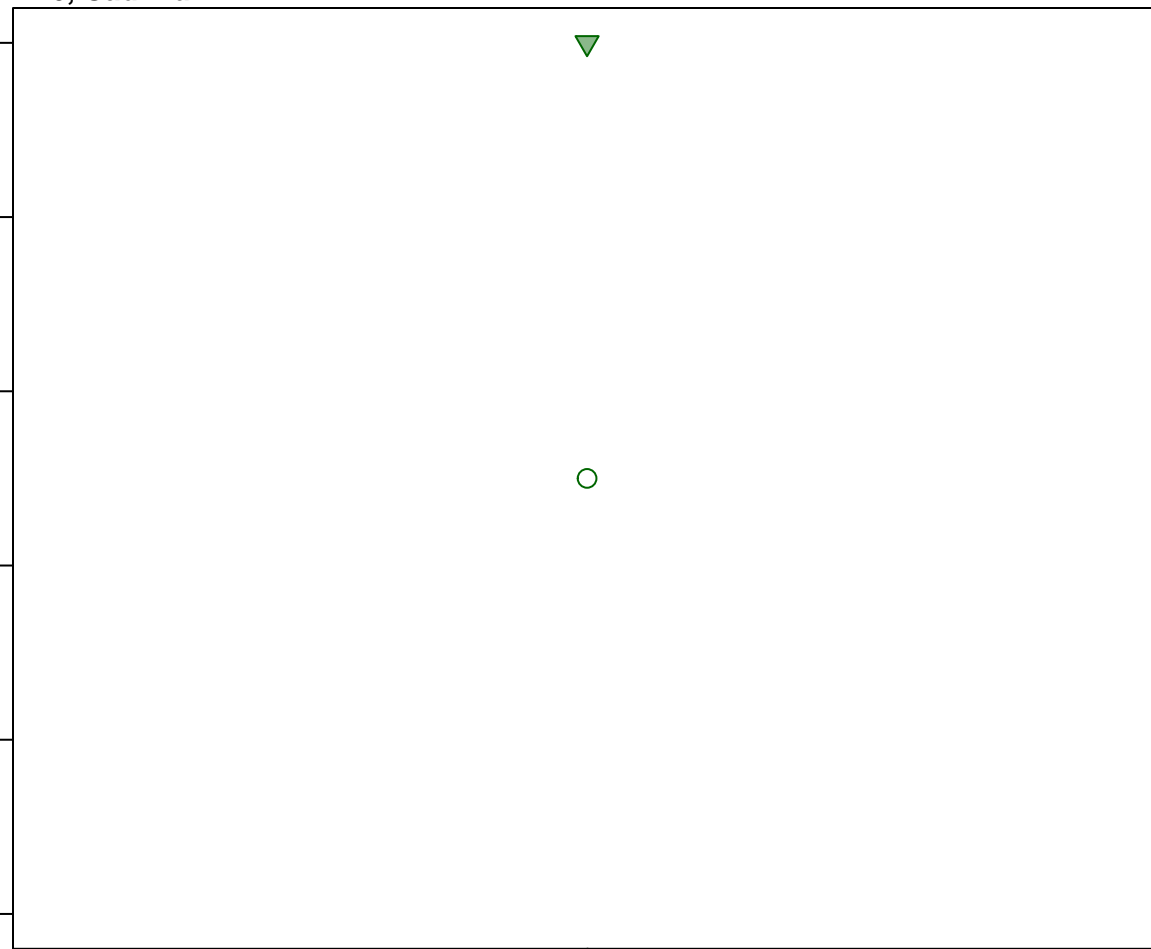
Stats

N Data: 1
N Detect: 0
% Detect: 0

MK criteria not met

Shapes

● Detect
○ NonDetect
▼ Detect Limit



Scatterplots and Trend Analysis

D16, Chloride

Concentration (mg/L)

100
80
60
40
20
0

Jun
2021

Stats

N Data: 1

N Detect: 1

% Detect: 100

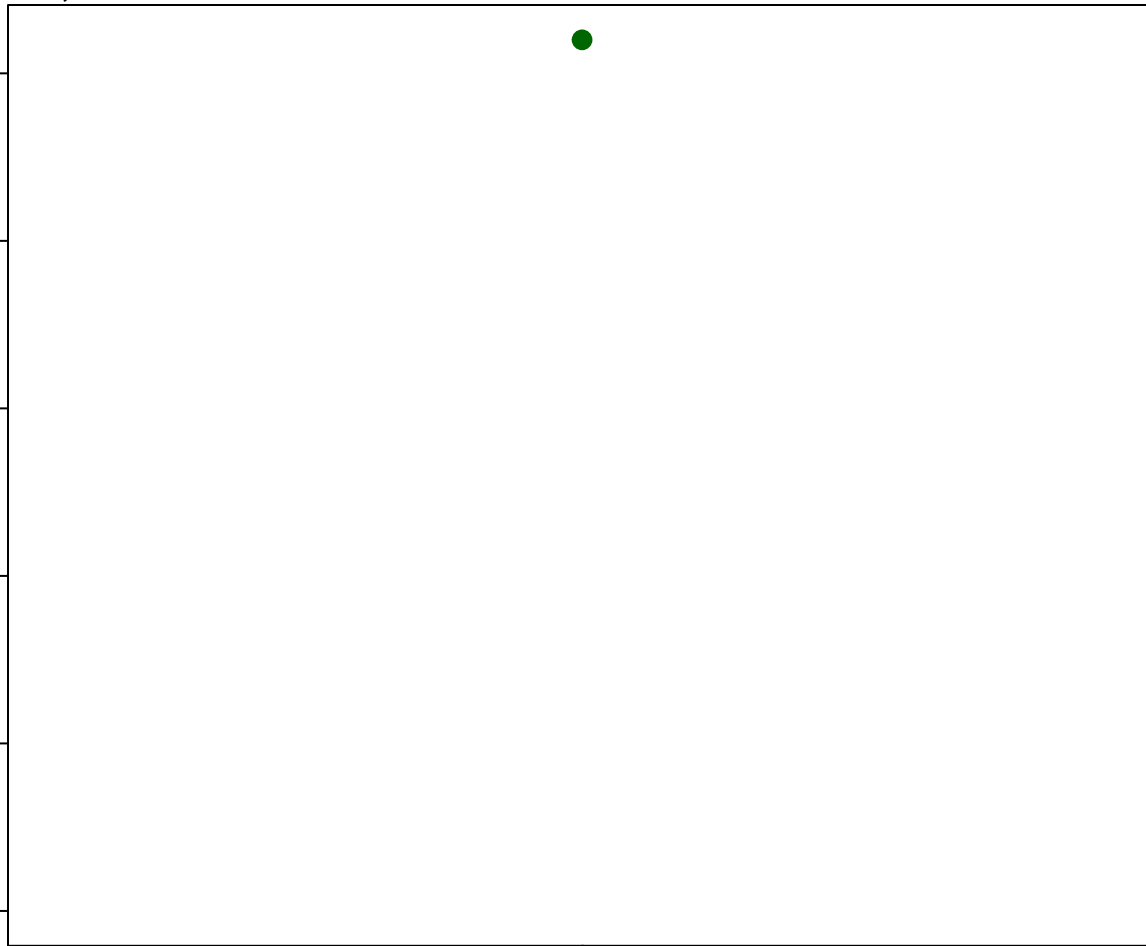
MK criteria not met

Shapes

● Detect

○ NonDetect

▼ Detect Limit



Scatterplots and Trend Analysis

D16, Chromium

Concentration (µg/L)

5
4
3
2
1
0

Jun
2021

Stats

N Data: 1

N Detect: 1

% Detect: 100

MK criteria not met

Shapes

● Detect

○ NonDetect

▼ Detect Limit

5
4
3
2
1
0

Scatterplots and Trend Analysis

D16, Electrical Conductivity (Field)

Concentration (uS/cm)

2000
1500
1000
500
0

Jun
2021

Stats

N Data: 1

N Detect: 1

% Detect: 100

MK criteria not met

Shapes

● Detect

○ NonDetect

▼ Detect Limit



Scatterplots and Trend Analysis

D16, Fluoride

Concentration (mg/L)

0.20
0.15
0.10
0.05
0.00

Jun
2021

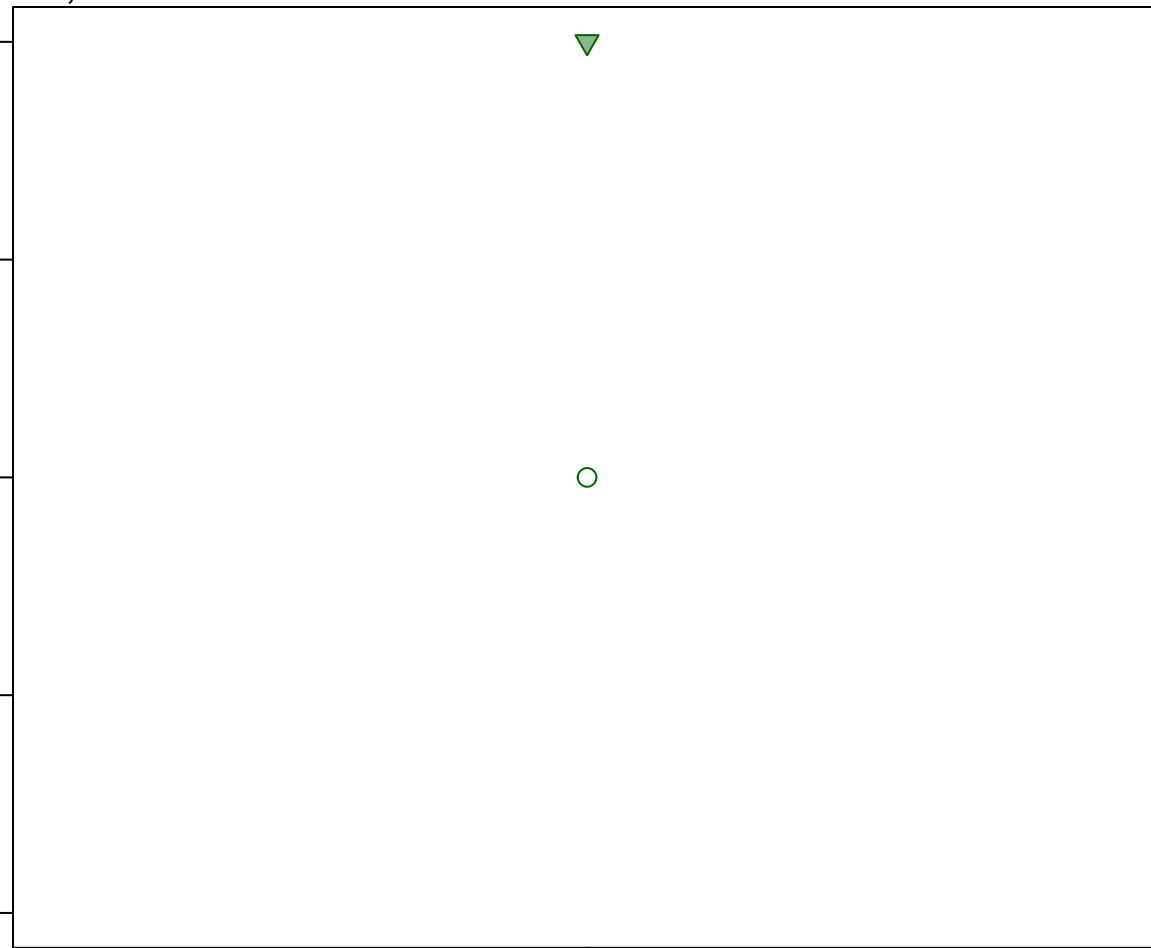
Stats

N Data: 1
N Detect: 0
% Detect: 0

MK criteria not met

Shapes

● Detect
○ NonDetect
▼ Detect Limit



Scatterplots and Trend Analysis

D16, Iron

Concentration (µg/L)

3000
2500
2000
1500
1000
500
0

Jun
2021

Stats

N Data: 2

N Detect: 2

% Detect: 100

MK criteria not met

Shapes

● Detect

○ NonDetect

▼ Detect Limit

Scatterplots and Trend Analysis

D16, Lead

Concentration (µg/L)

1.0
0.8
0.6
0.4
0.2
0.0

Jun
2021

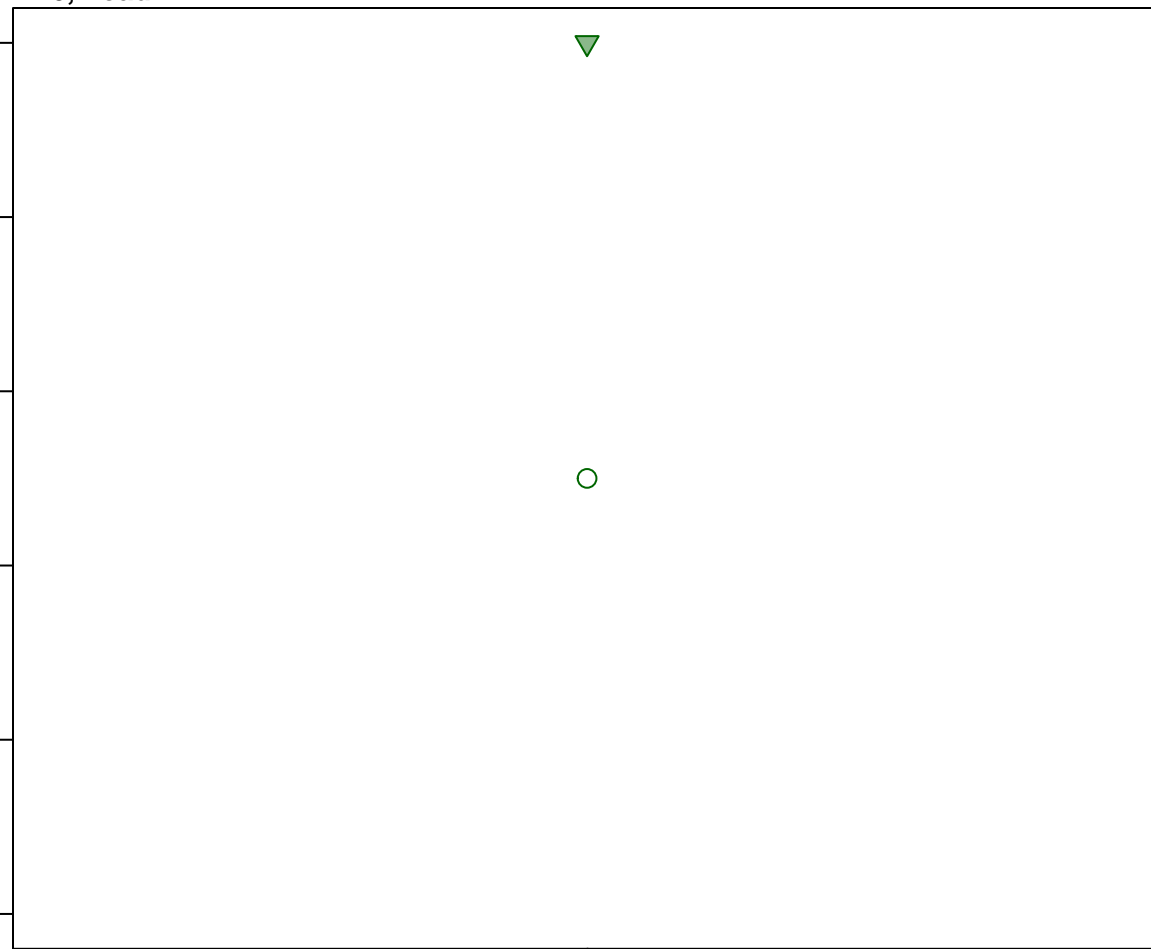
Stats

N Data: 1
N Detect: 0
% Detect: 0

MK criteria not met

Shapes

● Detect
○ NonDetect
▼ Detect Limit



Scatterplots and Trend Analysis

D16, Manganese

Concentration (µg/L)

50
40
30
20
10
0

Jun
2021

Stats

N Data: 2

N Detect: 2

% Detect: 100

MK criteria not met

Shapes

● Detect

○ NonDetect

▼ Detect Limit

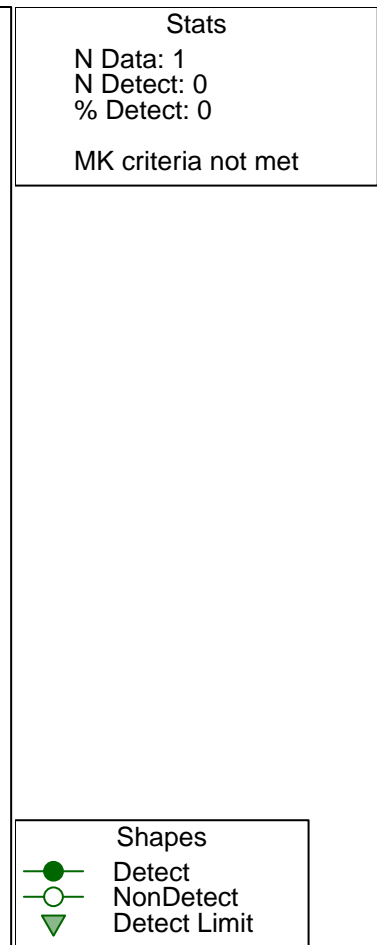
Scatterplots and Trend Analysis

D16, Mercury

Concentration (µg/L)

0.04
0.03
0.02
0.01
0.00

Jun
2021



Scatterplots and Trend Analysis

D16, Molybdenum

Concentration (µg/L)

1.0
0.8
0.6
0.4
0.2
0.0

Jun
2021

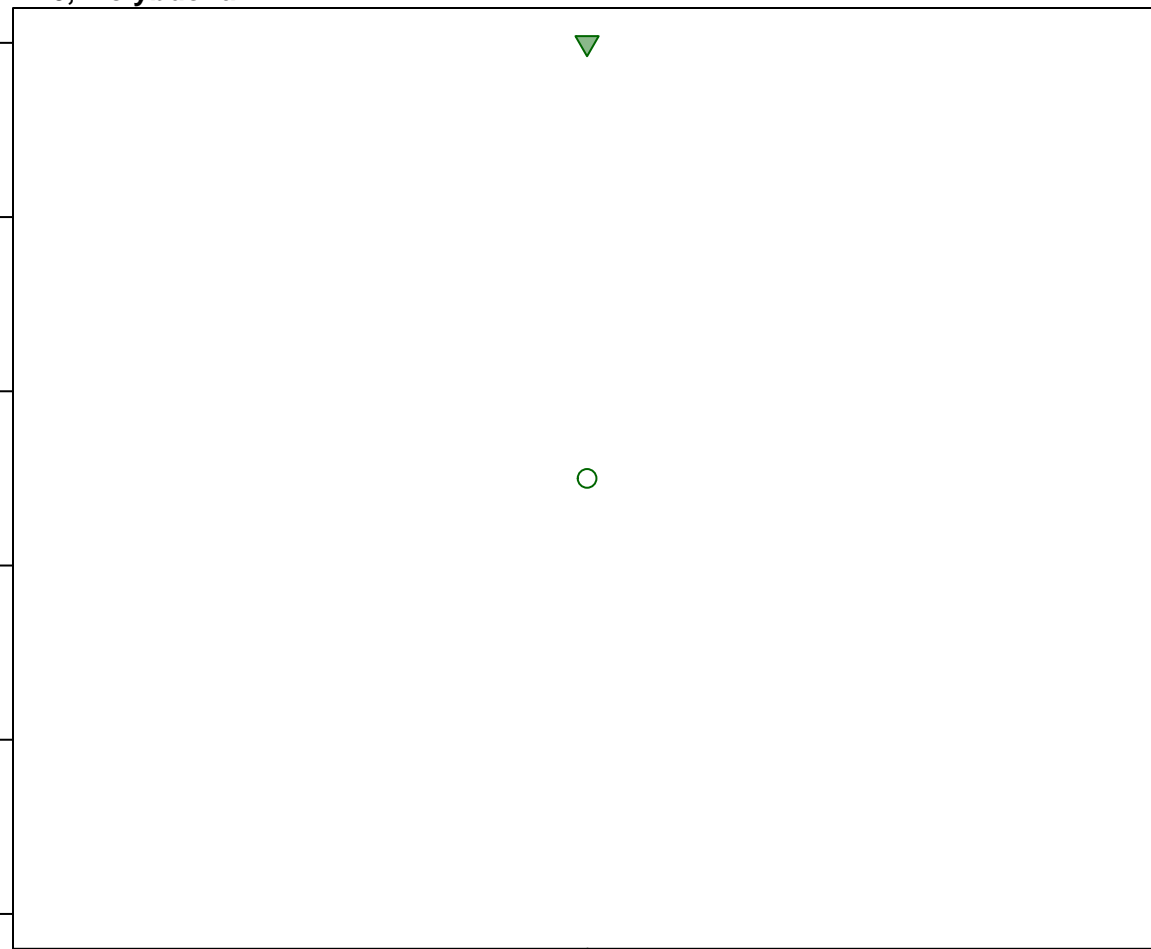
Stats

N Data: 1
N Detect: 0
% Detect: 0

MK criteria not met

Shapes

● Detect
○ NonDetect
▼ Detect Limit



Scatterplots and Trend Analysis

D16, Nickel

Concentration (µg/L)

15

10

5

0

Jun
2021

Stats

N Data: 2

N Detect: 2

% Detect: 100

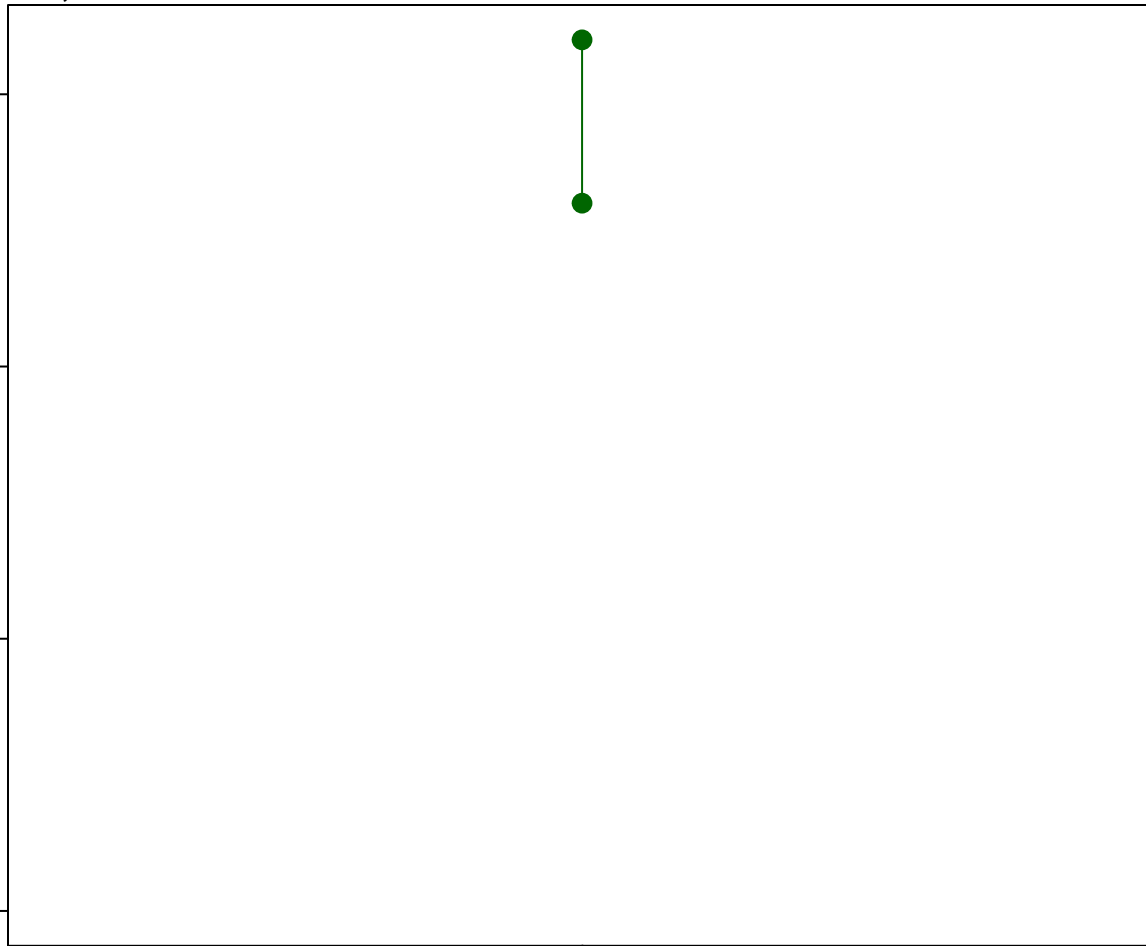
MK criteria not met

Shapes

● Detect

○ NonDetect

▼ Detect Limit



Scatterplots and Trend Analysis

D16, Selenium

Concentration (µg/L)

0.20
0.15
0.10
0.05
0.00

Jun
2021

Stats

N Data: 1

N Detect: 0

% Detect: 0

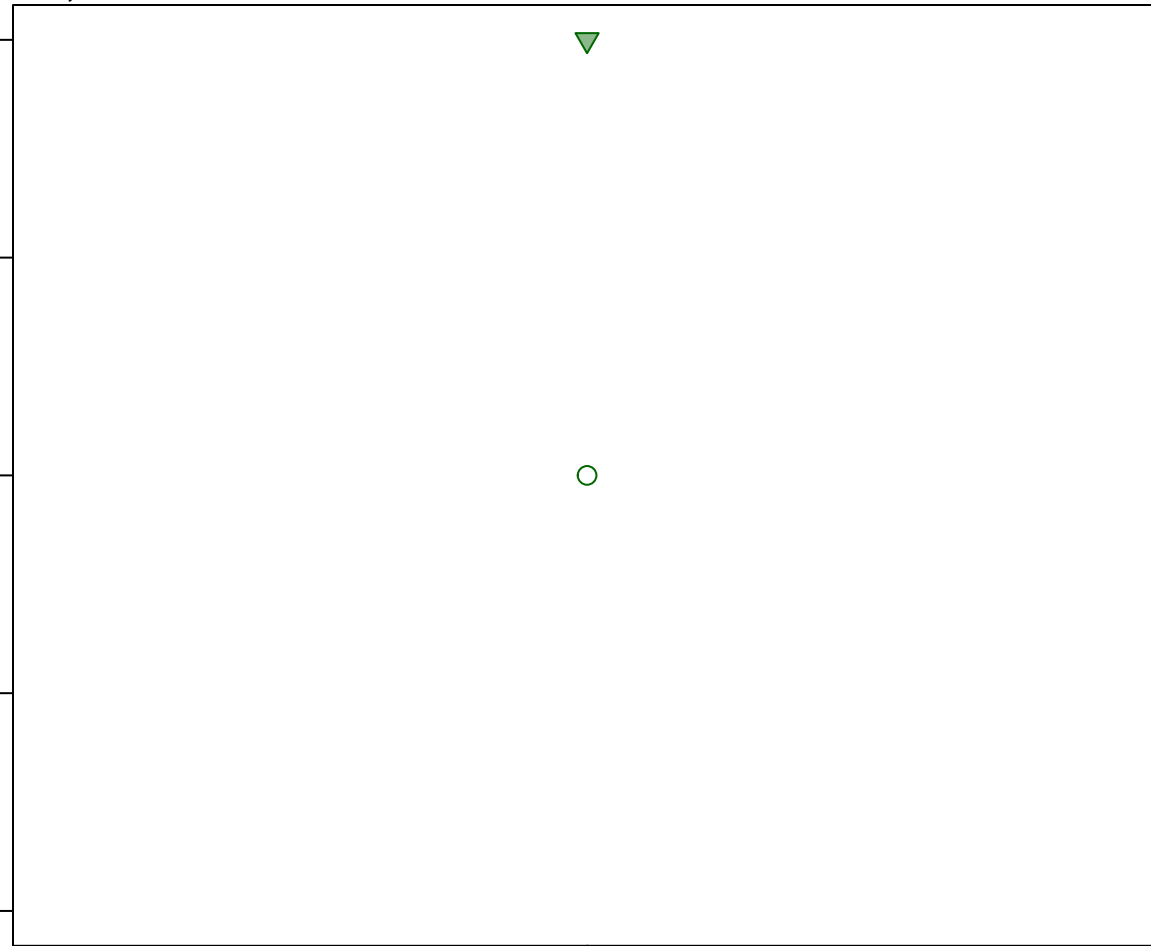
MK criteria not met

Shapes

● Detect

○ NonDetect

▼ Detect Limit



Scatterplots and Trend Analysis

D16, Sulfate (as SO4)

Concentration (mg/L)

800
600
400
200
0

Jun
2021

Stats

N Data: 1

N Detect: 1

% Detect: 100

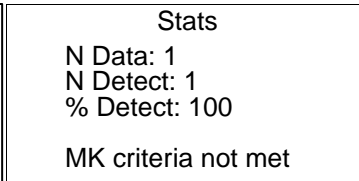
MK criteria not met

Shapes

● Detect

○ NonDetect

▼ Detect Limit



Scatterplots and Trend Analysis

D16, Total Dissolved Solids (TDS)

Concentration (mg/L)

1500
1000
500
0

Jun
2021

Stats

N Data: 1

N Detect: 1

% Detect: 100

MK criteria not met

Shapes

● Detect

○ NonDetect

▼ Detect Limit

Scatterplots and Trend Analysis

D16, Zinc

Concentration (µg/L)

5
4
3
2
1
0

Jun
2021

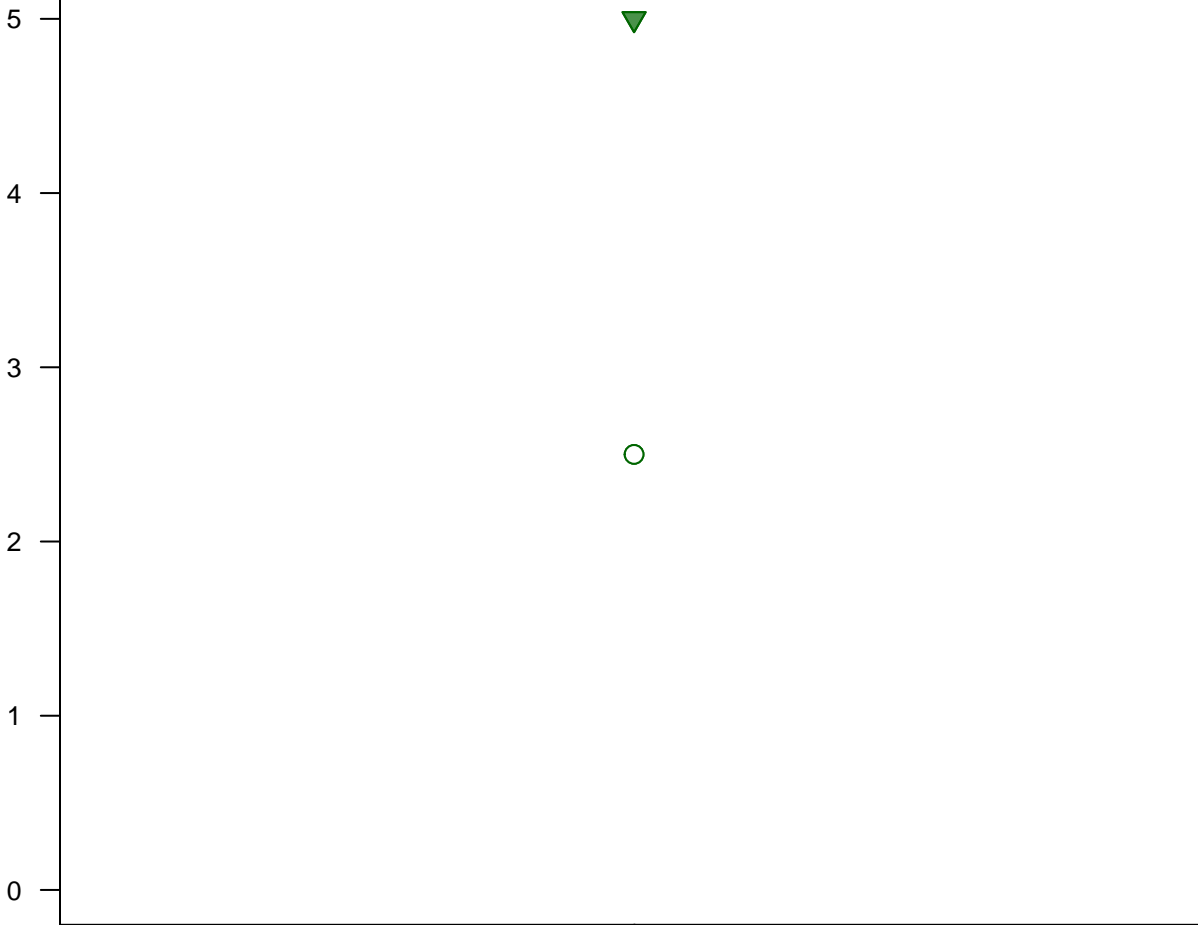
Stats

N Data: 2
N Detect: 0
% Detect: 0

MK criteria not met

Shapes

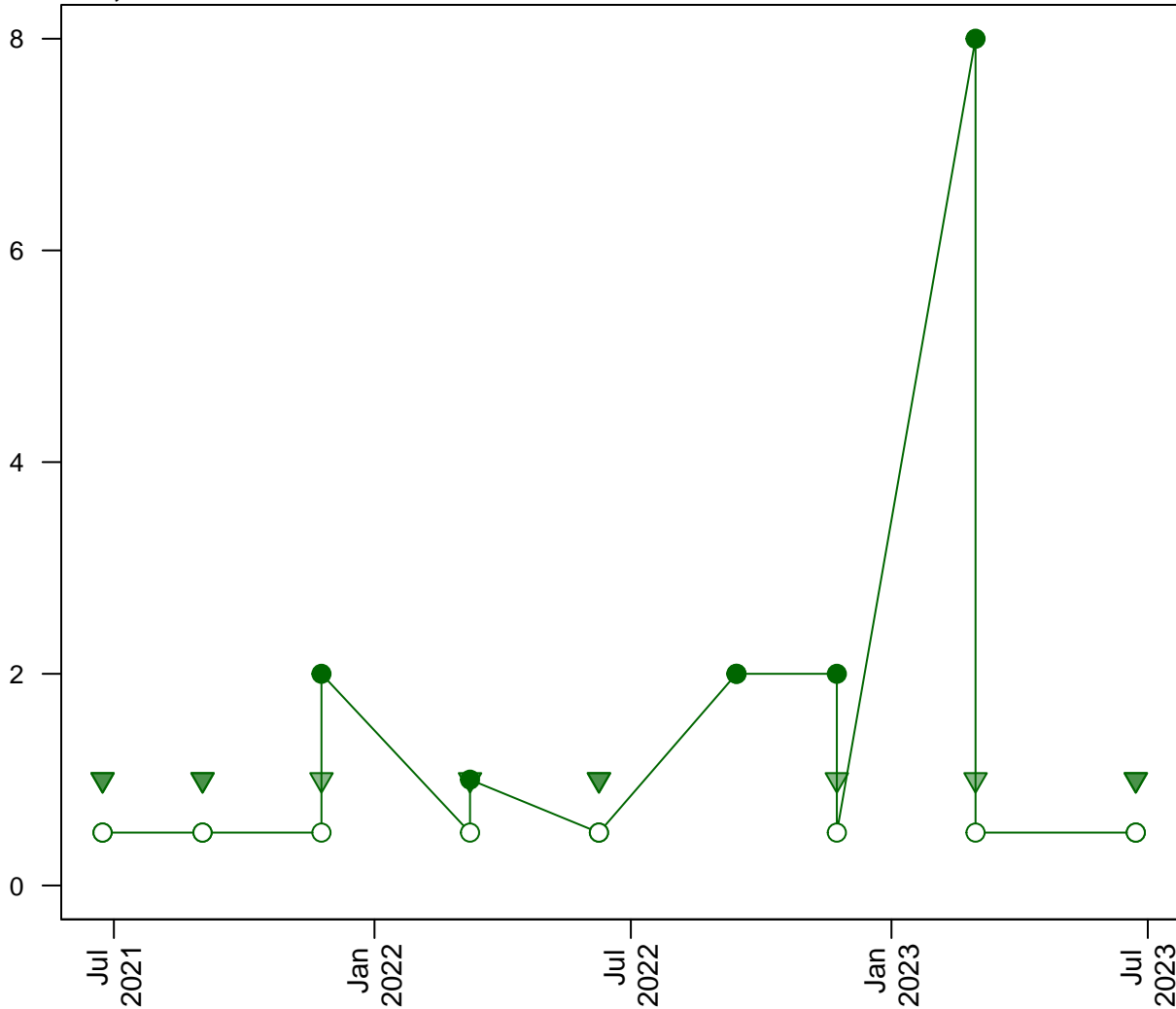
● Detect
○ NonDetect
▼ Detect Limit



Scatterplots and Trend Analysis

D17, Arsenic

Concentration (µg/L)



Stats

N Data: 18
N Detect: 6
% Detect: 33

MK criteria not met

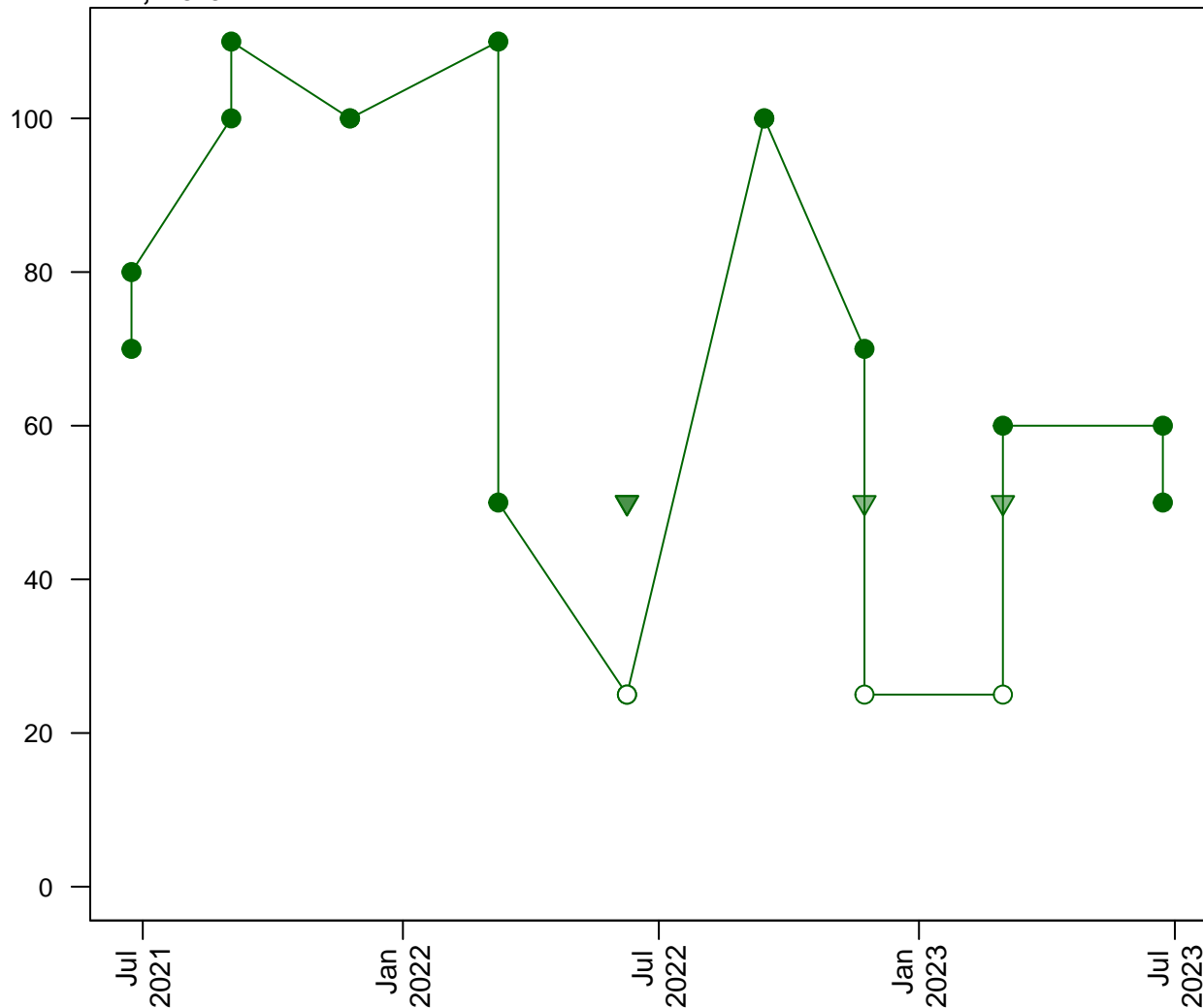
Shapes

- Detect
- NonDetect
- ▼ Detect Limit

Scatterplots and Trend Analysis

D17, Boron

Concentration (µg/L)



Stats

N Data: 18

N Detect: 14

% Detect: 78

95% Confidence

MK Trend: NS

MK p-val: 0.0564

Shapes

● Detect

○ NonDetect

▼ Detect Limit

Scatterplots and Trend Analysis

D17, Cadmium

Concentration (µg/L)

0.10
0.08
0.06
0.04
0.02
0.00

Jul
2021

Jan
2022

Jul
2022

Jan
2023

Jul
2023

Stats

N Data: 9
N Detect: 0
% Detect: 0

MK criteria not met

Shapes

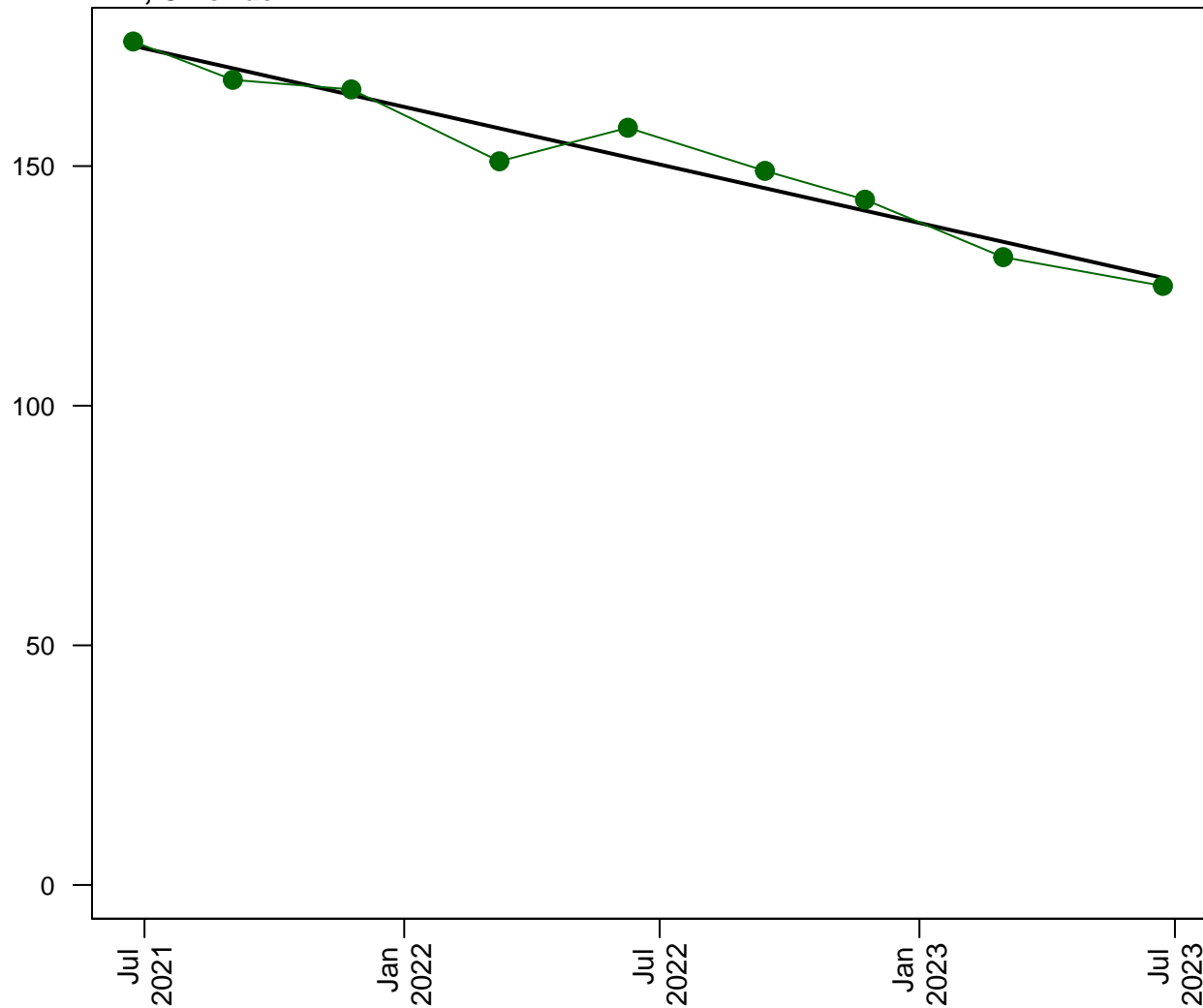
● Detect
○ NonDetect
▼ Detect Limit



Scatterplots and Trend Analysis

D17, Chloride

Concentration (mg/L)



Stats

N Data: 9

N Detect: 9

% Detect: 100

95% Confidence

MK Trend: Significant

MK p-val: <0.001

Direction: Decreasing

Lines

Linear Fit

Shapes

Detect

NonDetect

Detect Limit

Detect

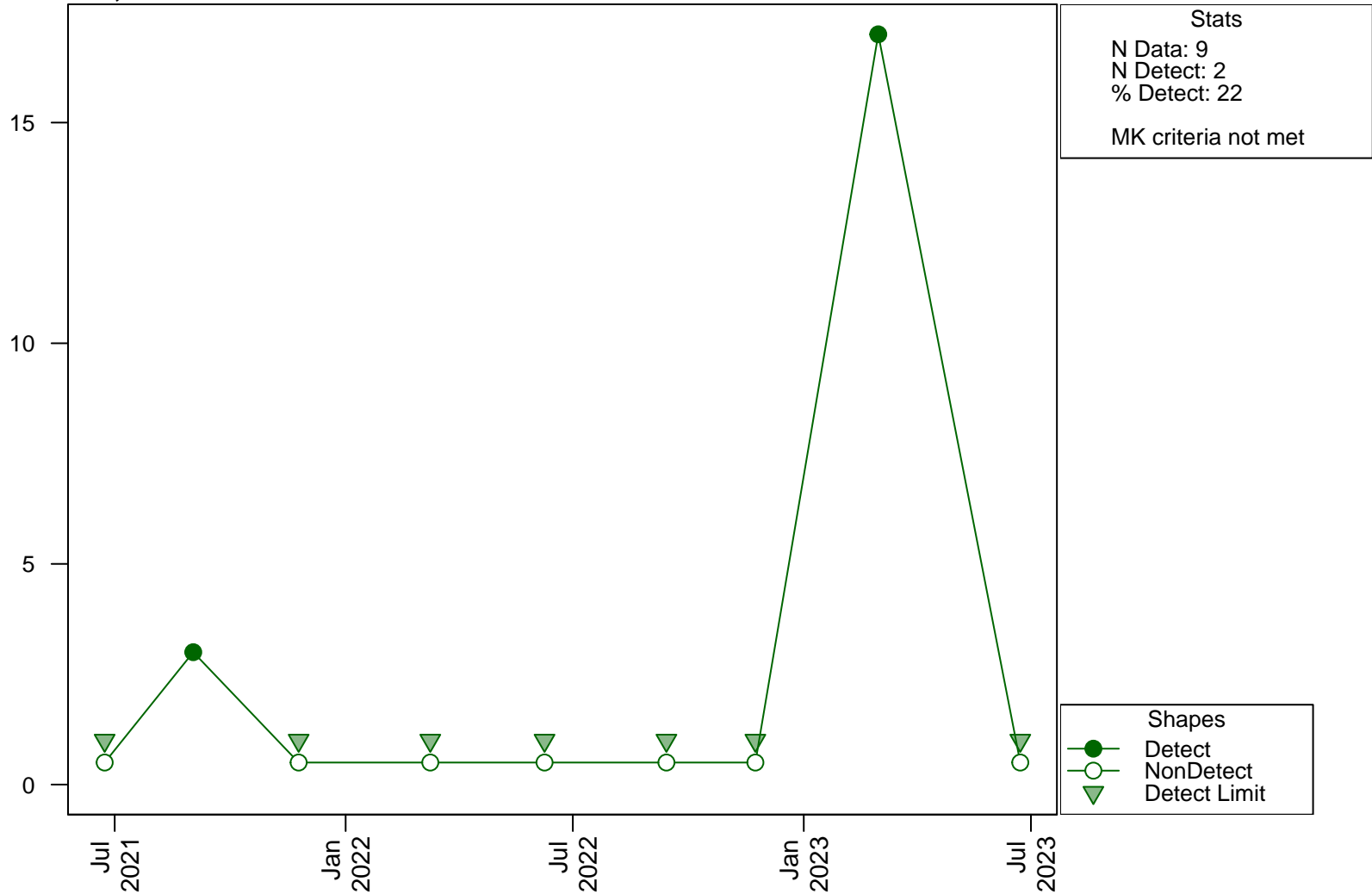
NonDetect

Detect Limit

Scatterplots and Trend Analysis

D17, Chromium

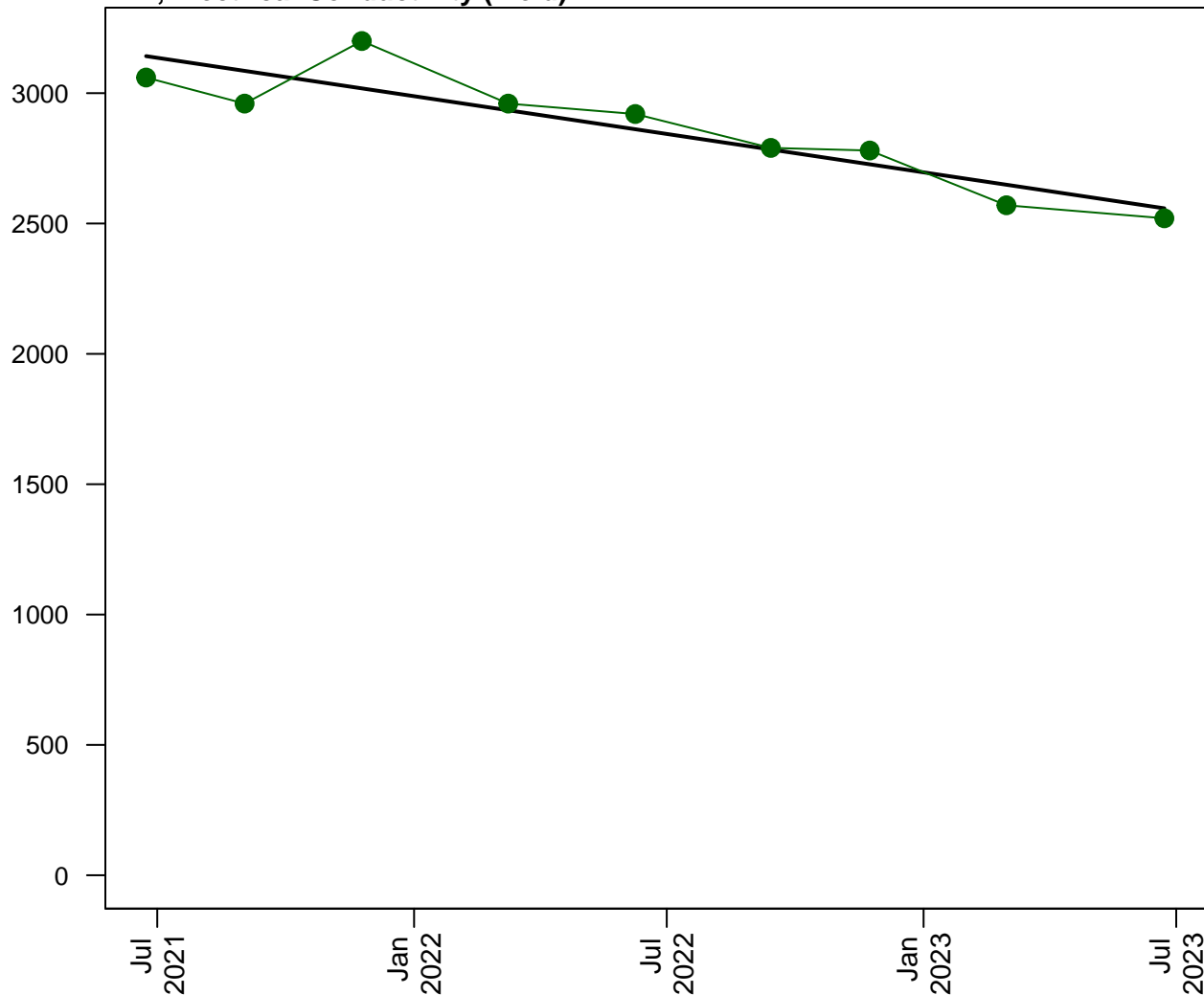
Concentration (µg/L)



Scatterplots and Trend Analysis

D17, Electrical Conductivity (Field)

Concentration (uS/cm)



Stats

N Data: 9

N Detect: 9

% Detect: 100

95% Confidence

MK Trend: Significant

MK p-val: 0.00116

Direction: Decreasing

Lines

— Linear Fit

Shapes

● Detect

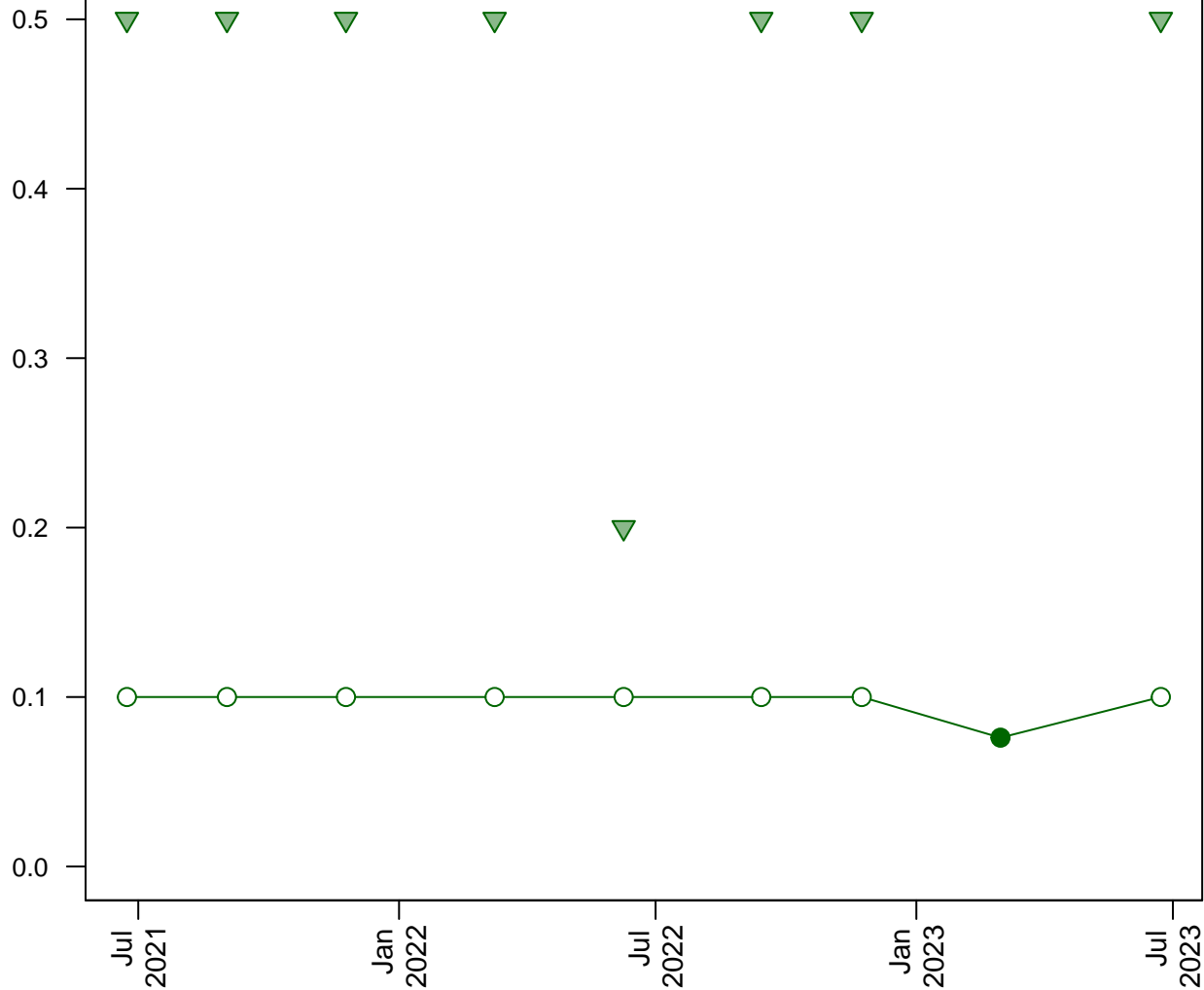
○ NonDetect

▼ Detect Limit

Scatterplots and Trend Analysis

D17, Fluoride

Concentration (mg/L)



Stats

N Data: 9

N Detect: 1

% Detect: 11

MK criteria not met

Shapes

● Detect

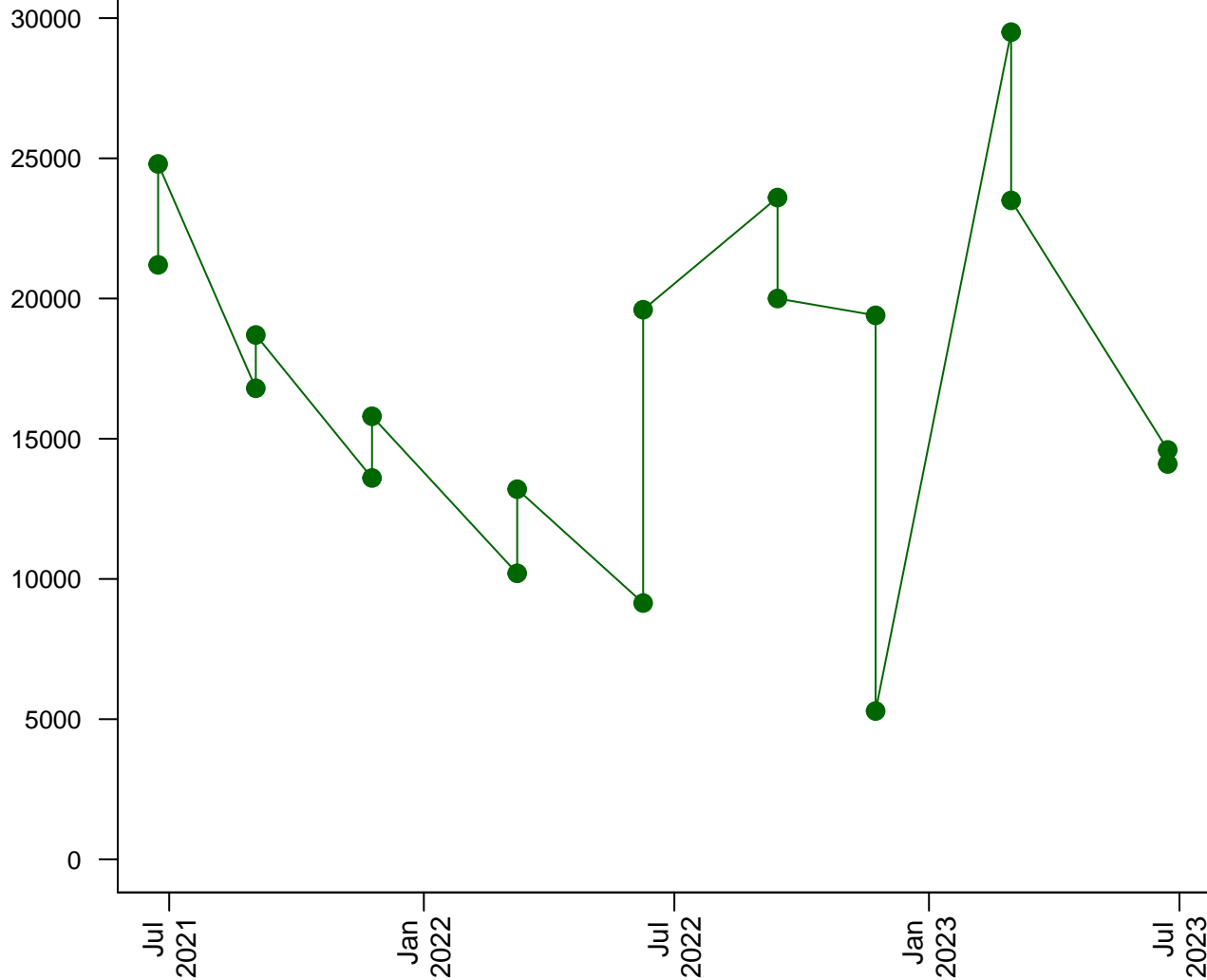
○ NonDetect

▼ Detect Limit

Scatterplots and Trend Analysis

D17, Iron

Concentration (µg/L)



Stats
N Data: 18
N Detect: 18
% Detect: 100

95% Confidence
MK Trend: NS
MK p-val: 0.647

Shapes
Detect
NonDetect
Detect Limit

Scatterplots and Trend Analysis

D17, Lead

Concentration (µg/L)

1.0
0.8
0.6
0.4
0.2
0.0

Jul
2021

Jan
2022

Jul
2022

Jan
2023

Jul
2023

Stats

N Data: 9

N Detect: 0

% Detect: 0

MK criteria not met

Shapes

●

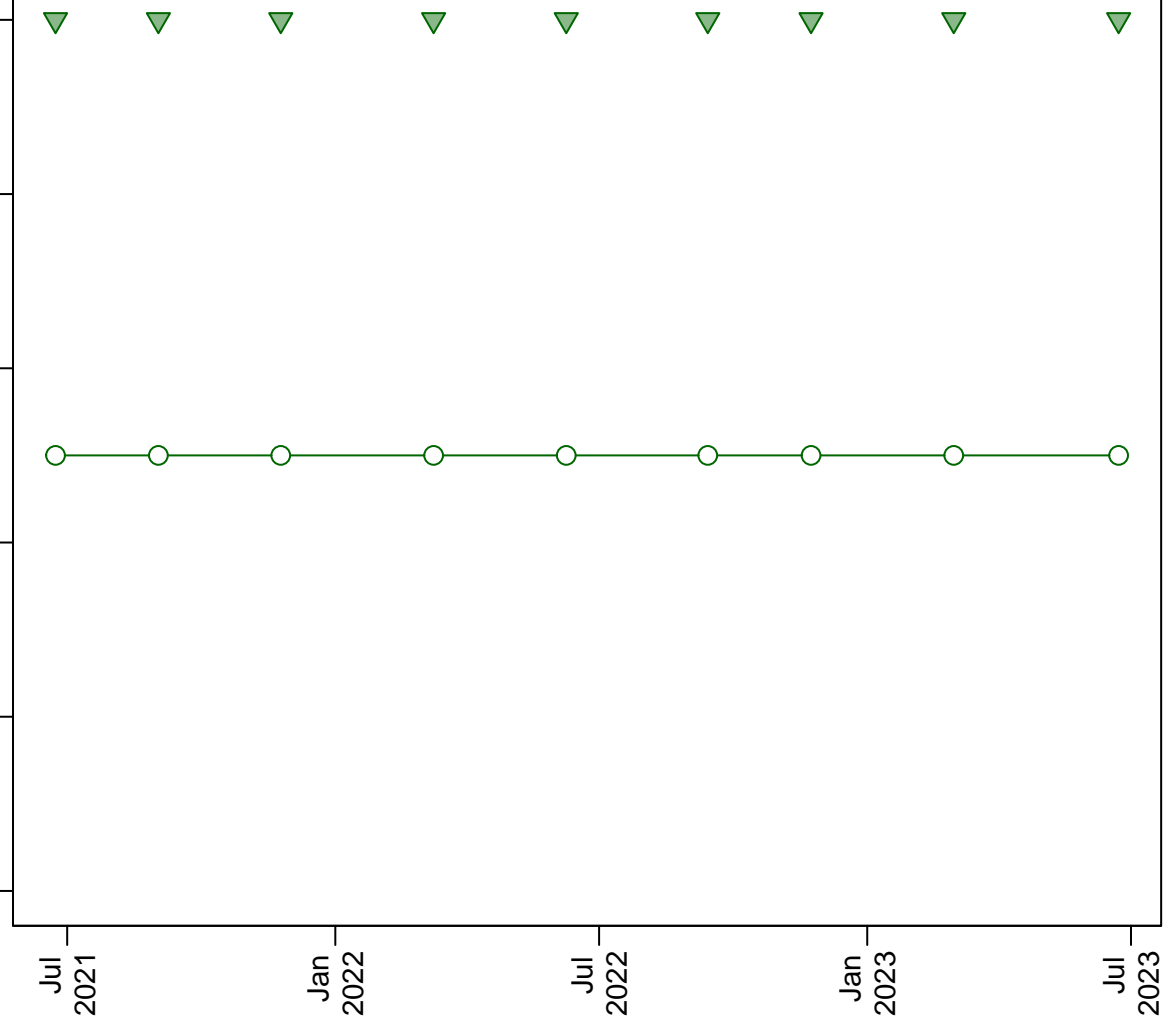
Detect

○

NonDetect

▼

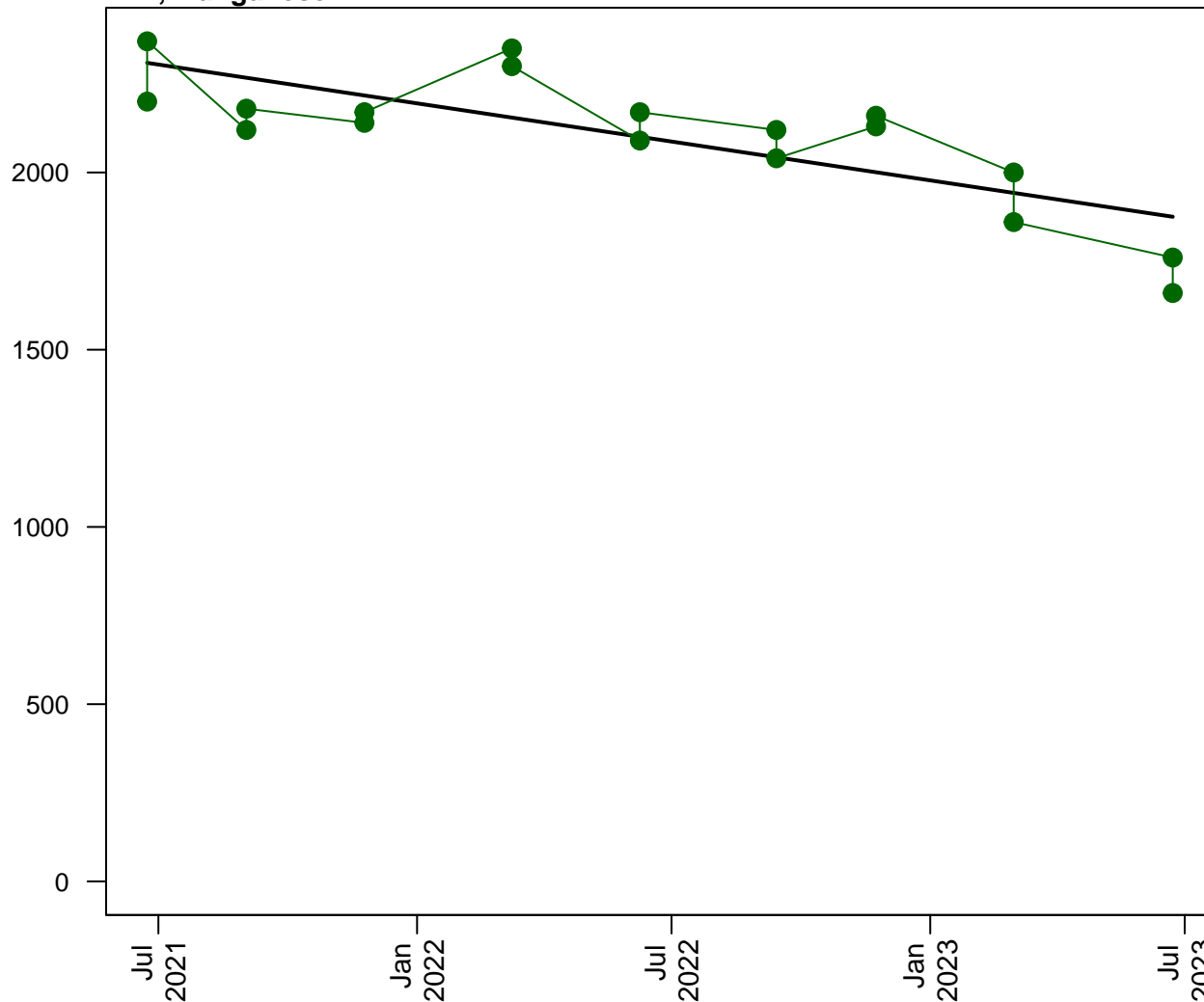
Detect Limit



Scatterplots and Trend Analysis

D17, Manganese

Concentration (µg/L)



Stats

N Data: 18
N Detect: 18
% Detect: 100

95% Confidence
MK Trend: Significant
MK p-val: <0.001
Direction: Decreasing

Lines

Linear Fit

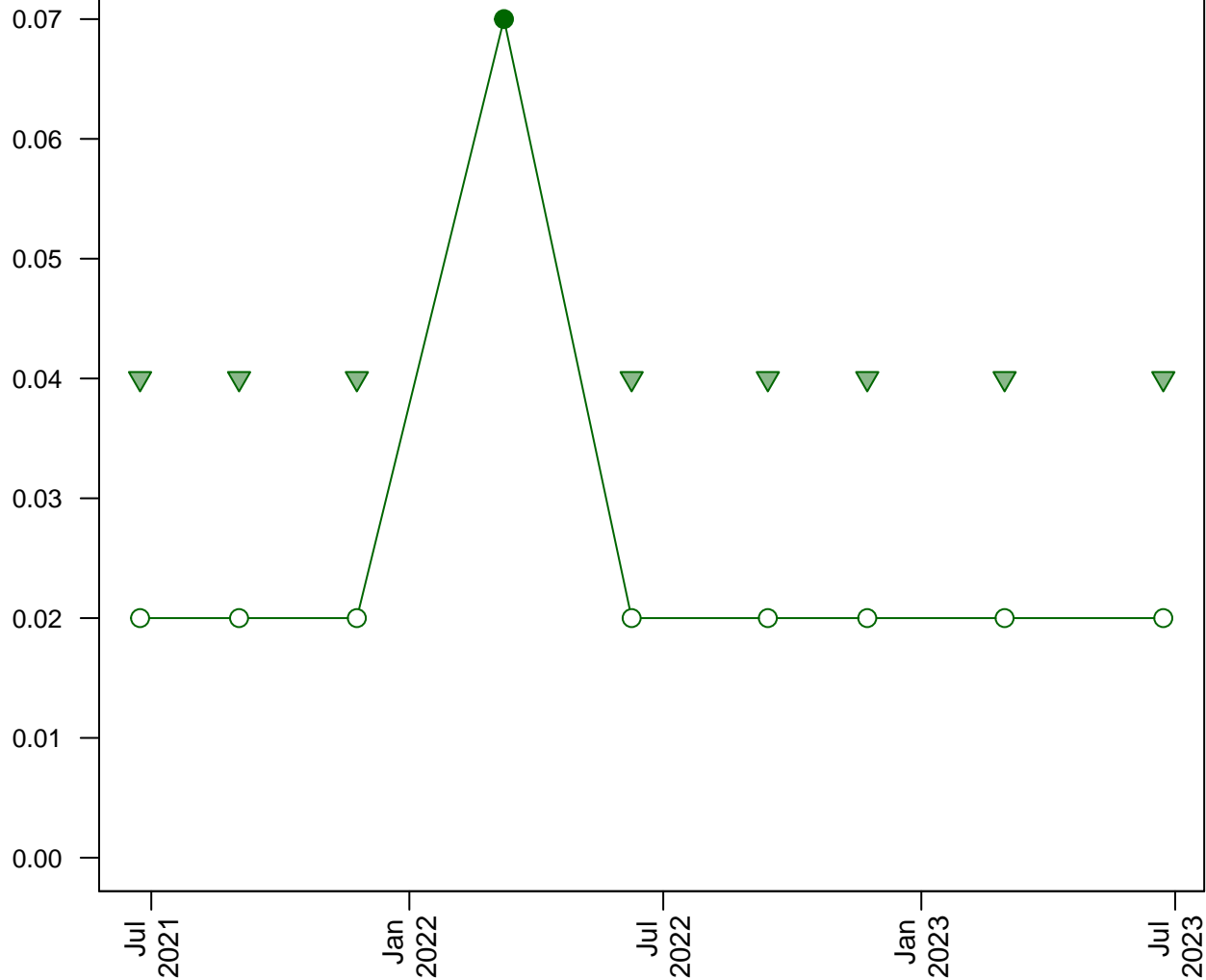
Shapes

● Detect
○ NonDetect
▼ Detect Limit

Scatterplots and Trend Analysis

D17, Mercury

Concentration (µg/L)



Stats

N Data: 9

N Detect: 1

% Detect: 11

MK criteria not met

Shapes



Detect



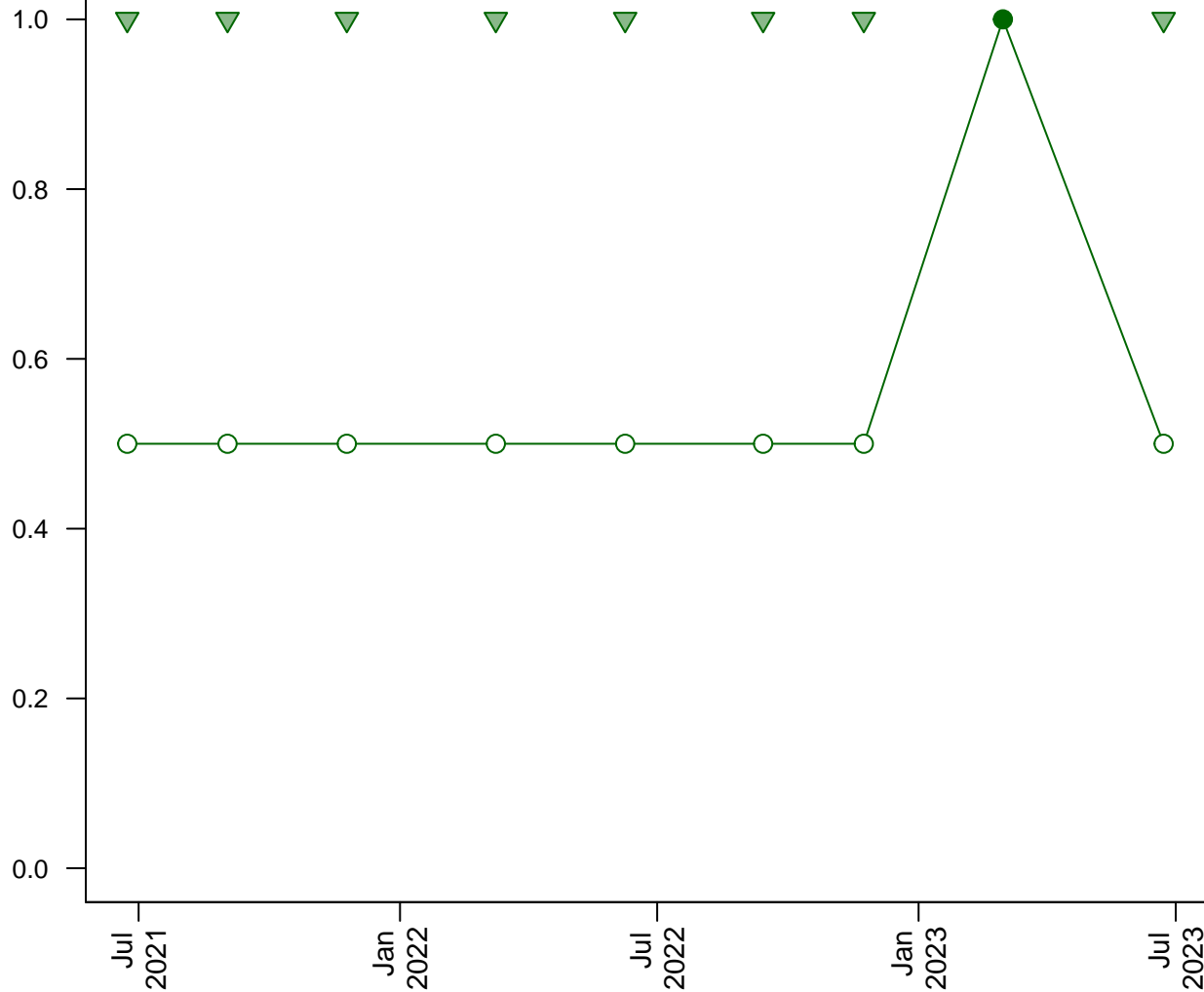
NonDetect



Detect Limit

Scatterplots and Trend Analysis D17, Molybdenum

Concentration (µg/L)



Stats

N Data: 9
N Detect: 1
% Detect: 11

MK criteria not met

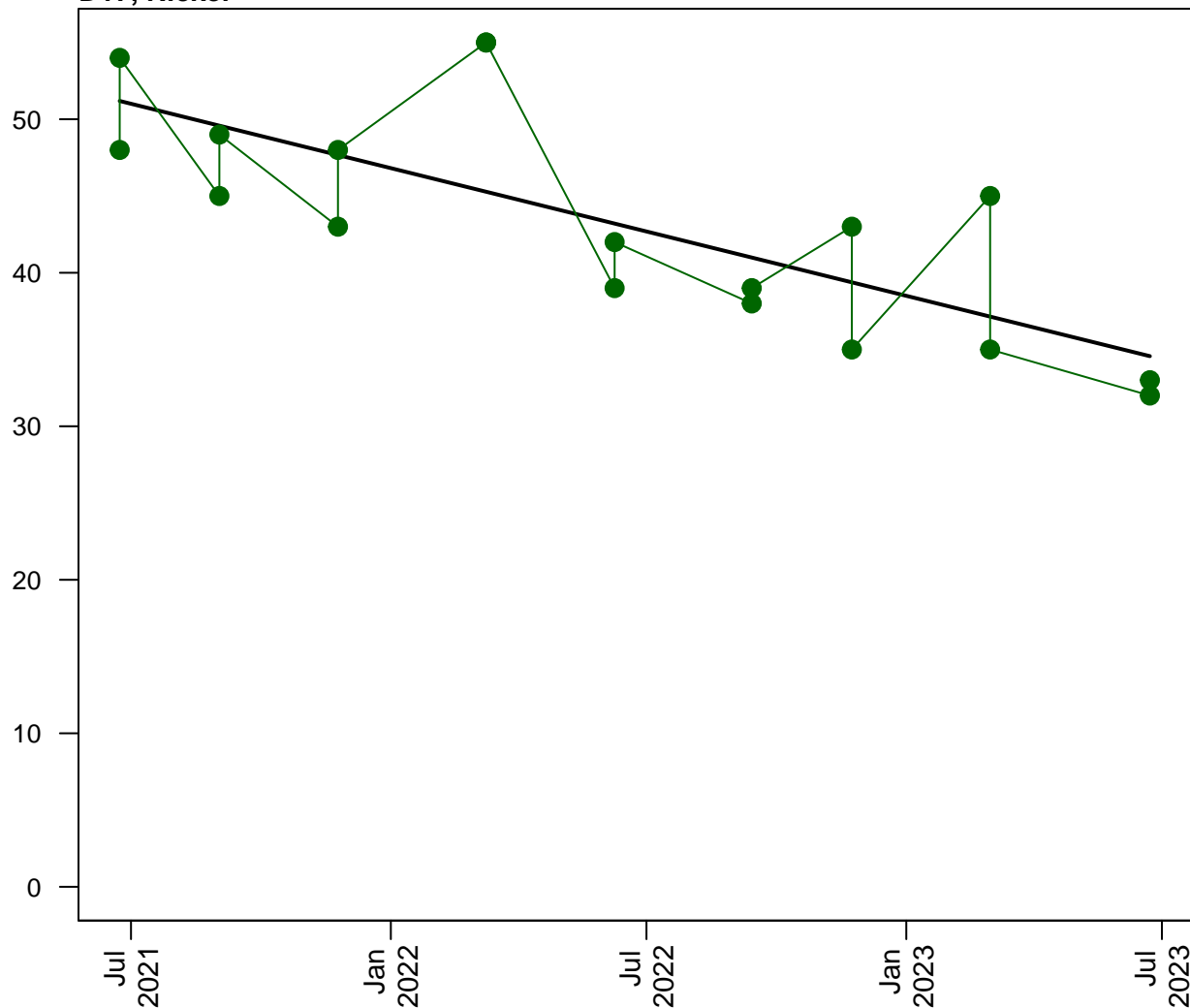
Shapes

● Detect
○ NonDetect
▼ Detect Limit

Scatterplots and Trend Analysis

D17, Nickel

Concentration (µg/L)



Stats

N Data: 18
N Detect: 18
% Detect: 100

95% Confidence
MK Trend: Significant
MK p-val: <0.001
Direction: Decreasing

Lines

Linear Fit

Shapes

● Detect
○ NonDetect
▼ Detect Limit

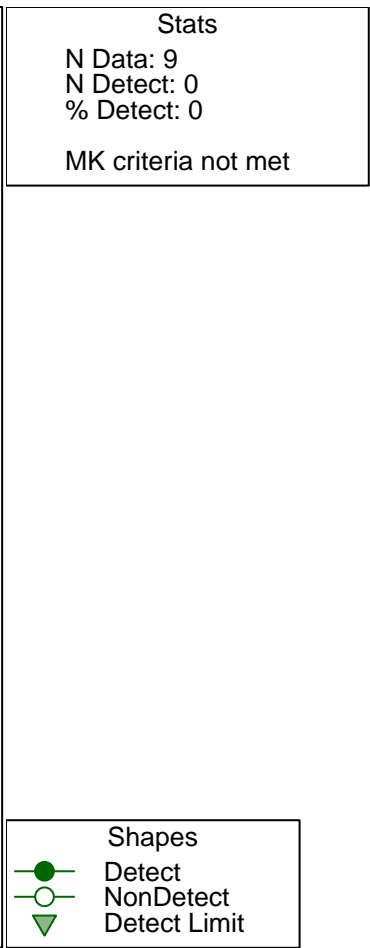
Scatterplots and Trend Analysis

D17, Selenium

Concentration (µg/L)

10
8
6
4
2
0

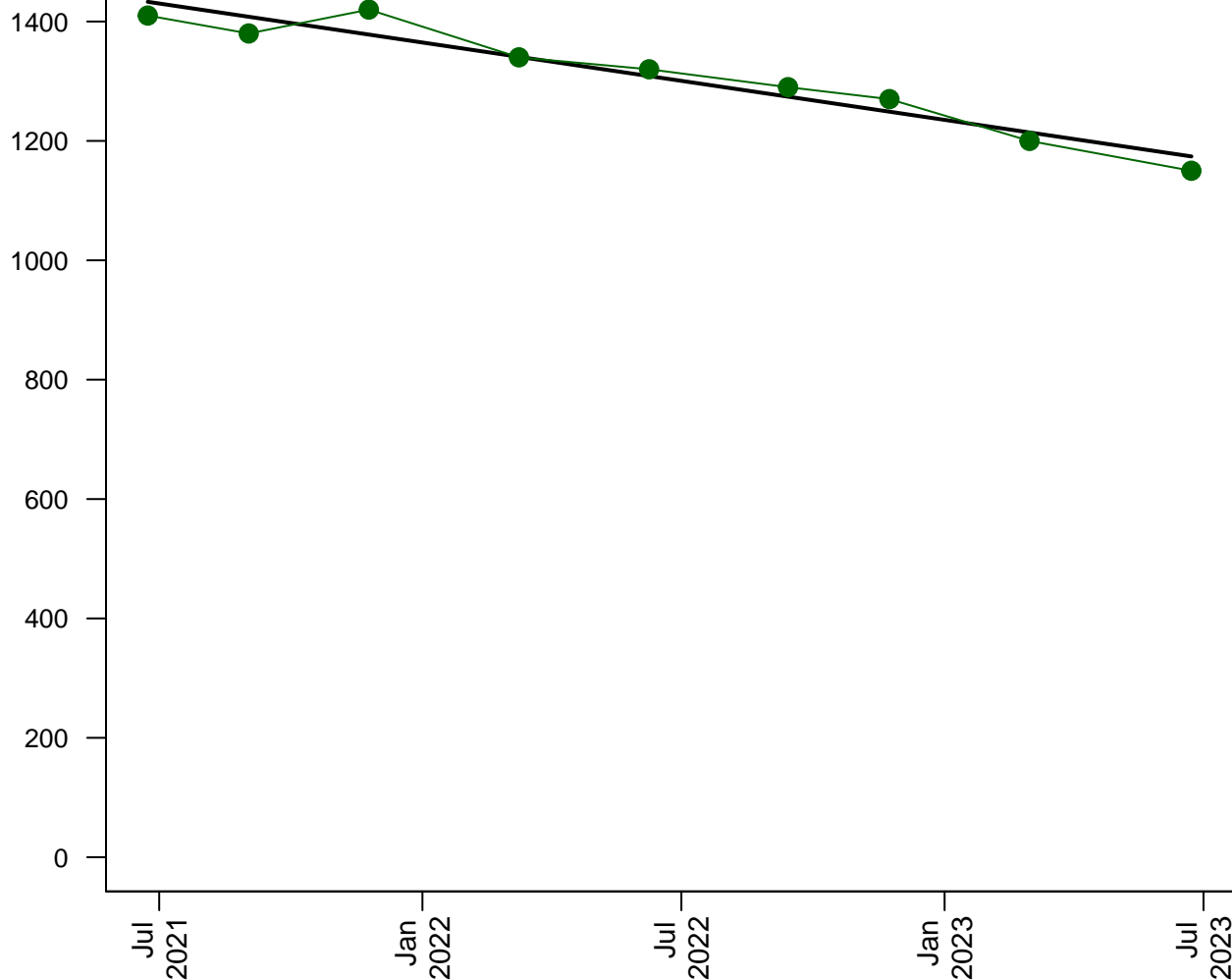
Jul 2021
Jan 2022
Jul 2022
Jan 2023
Jul 2023



Scatterplots and Trend Analysis

D17, Sulfate (as SO4)

Concentration (mg/L)



Stats

N Data: 9

N Detect: 9

% Detect: 100

95% Confidence

MK Trend: Significant

MK p-val: <0.001

Direction: Decreasing

Lines

Linear Fit

Shapes

Detect

NonDetect

Detect Limit

Scatterplots and Trend Analysis

D17, Total Dissolved Solids (TDS)

Concentration (mg/L)

2500
2000
1500
1000
500
0

Jul 2021 Jan 2022 Jul 2022 Jan 2023 Jul 2023

Stats

N Data: 9
N Detect: 9
% Detect: 100

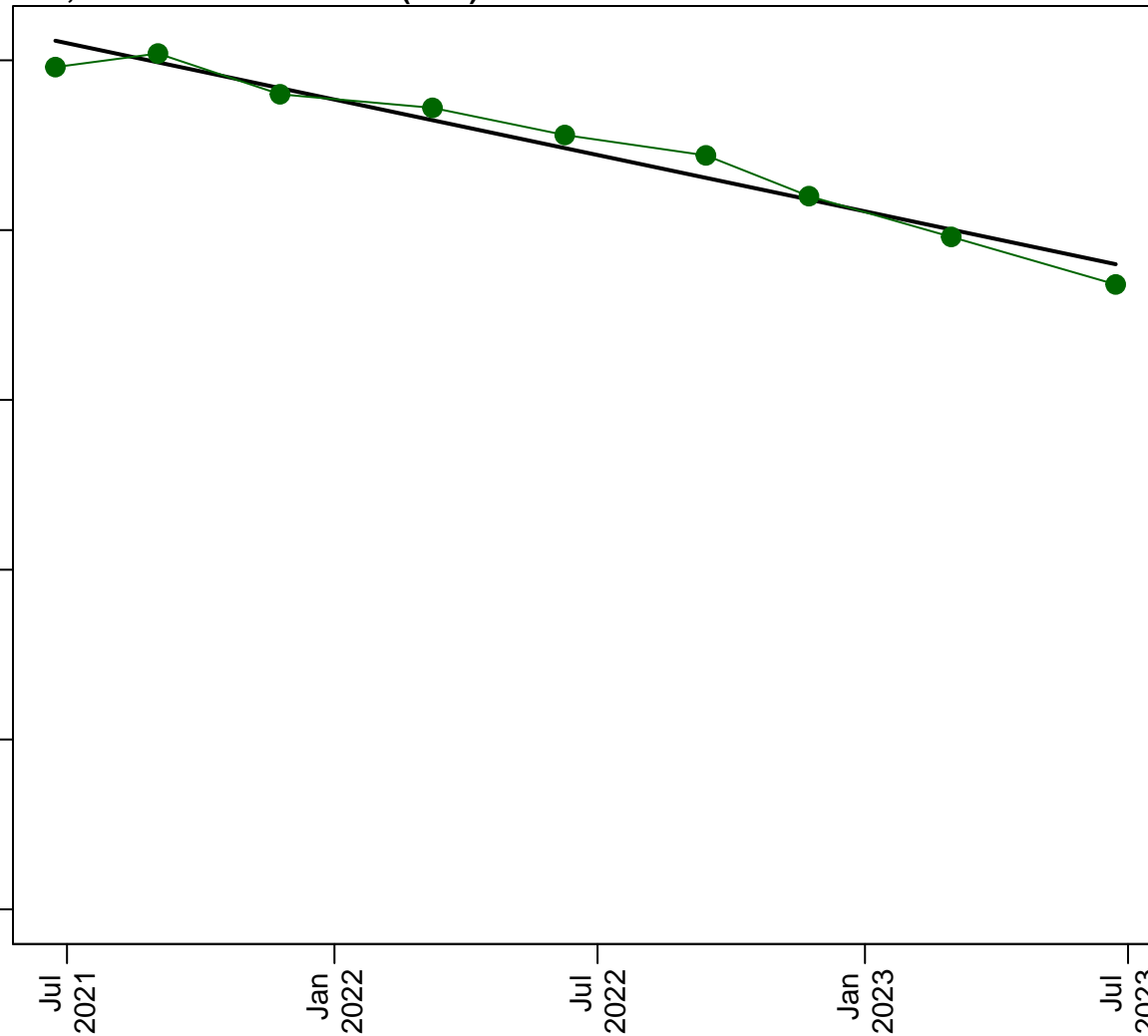
95% Confidence
MK Trend: Significant
MK p-val: <0.001
Direction: Decreasing

Lines

— Linear Fit

Shapes

● Detect
○ NonDetect
▼ Detect Limit



Scatterplots and Trend Analysis

D17, Zinc

Concentration (µg/L)

60
50
40
30
20
10
0

Jul
2021

Jan
2022

Jul
2022

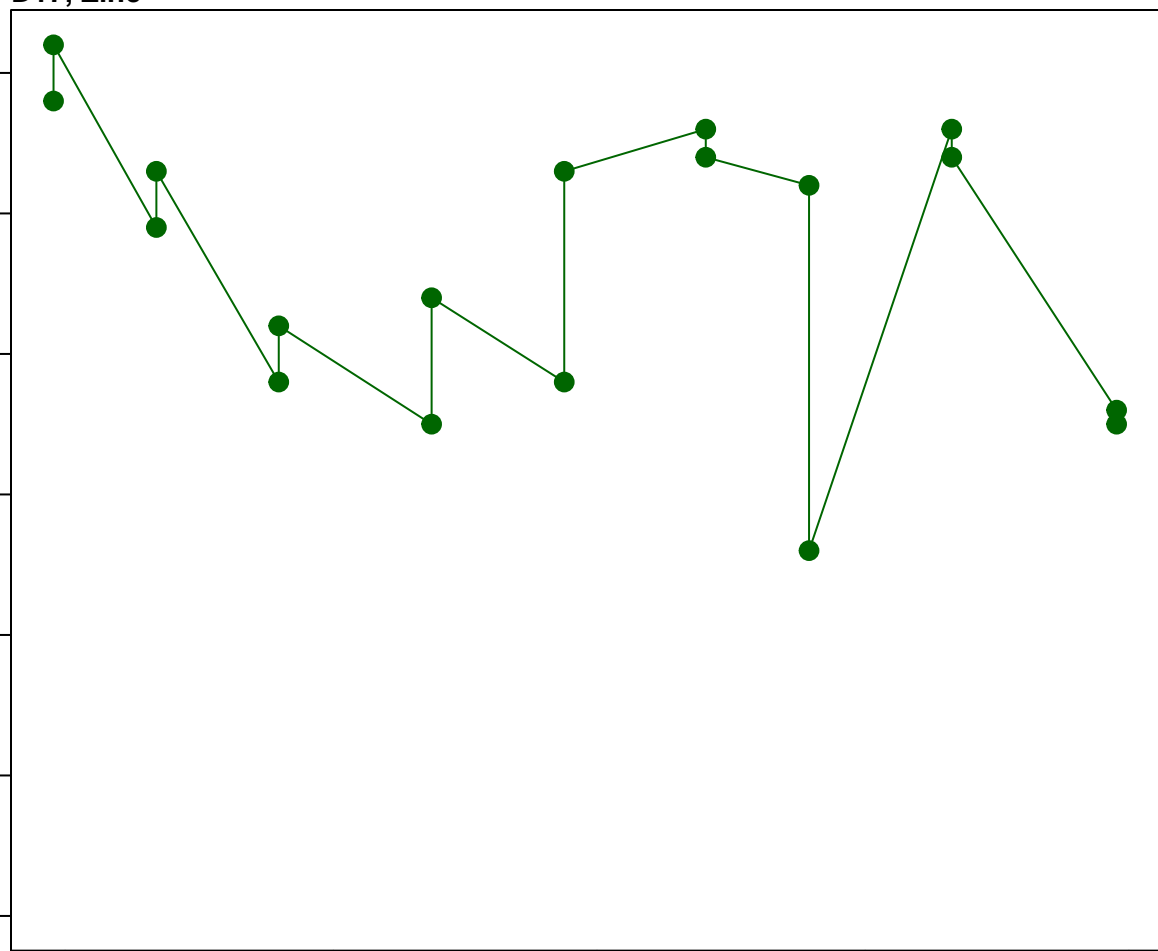
Jan
2023

Jul
2023

Stats
N Data: 18
N Detect: 18
% Detect: 100

95% Confidence
MK Trend: NS
MK p-val: 0.236

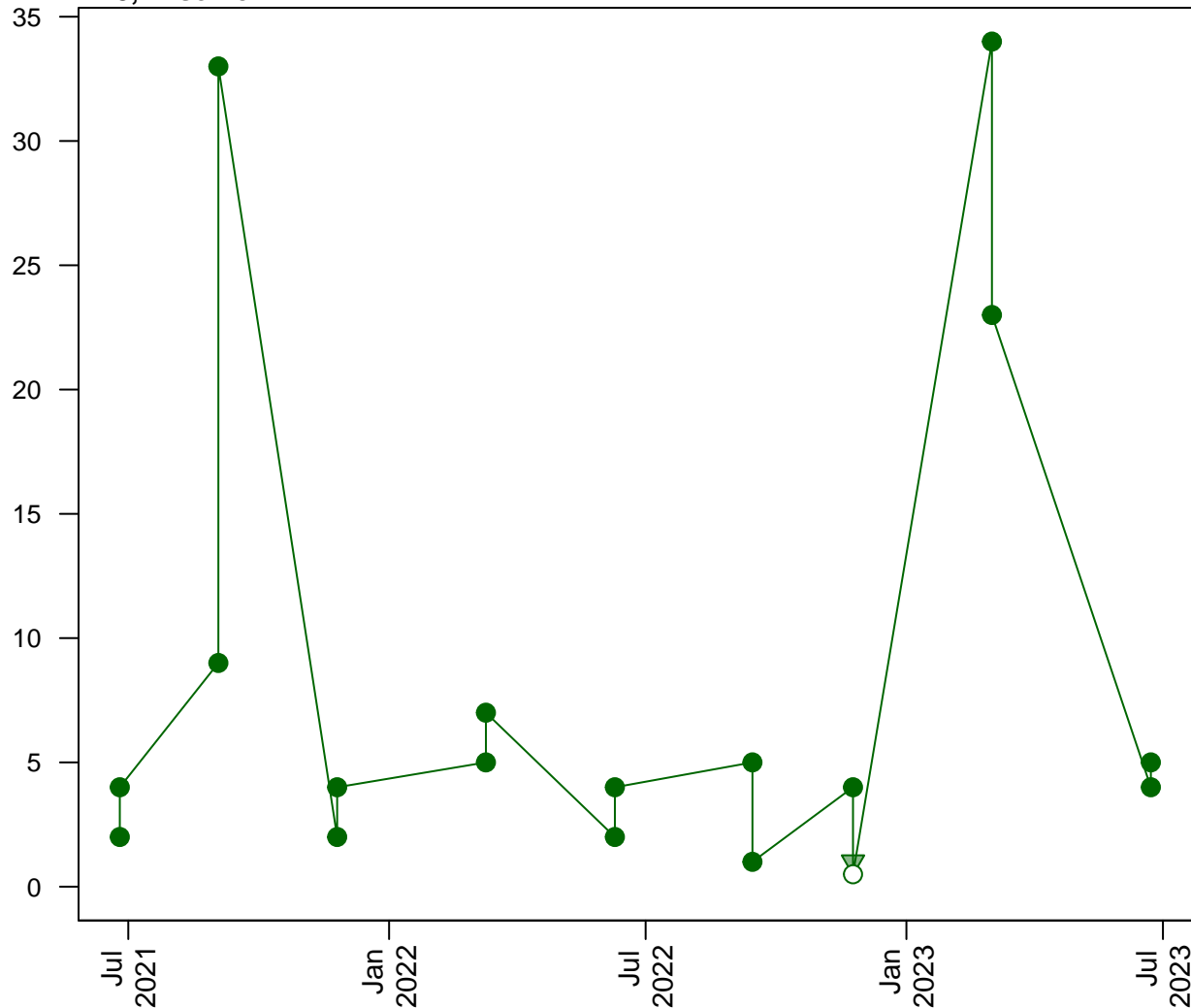
Shapes
● Detect
○ NonDetect
▼ Detect Limit



Scatterplots and Trend Analysis

D18, Arsenic

Concentration (µg/L)



Stats

N Data: 18

N Detect: 17

% Detect: 94

95% Confidence

MK Trend: NS

MK p-val: 0.877

Shapes

● Detect

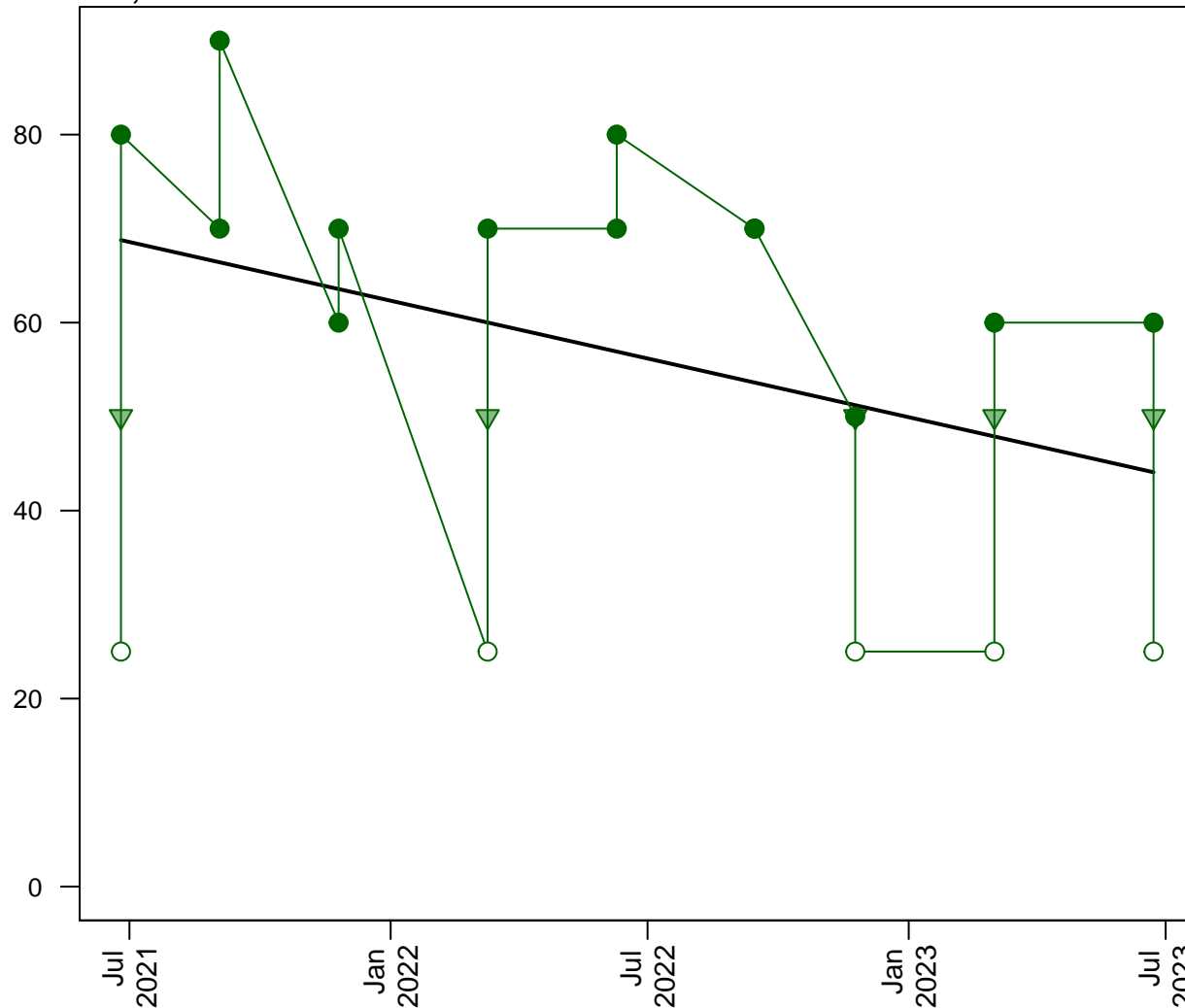
○ NonDetect

▼ Detect Limit

Scatterplots and Trend Analysis

D18, Boron

Concentration (µg/L)



Stats

N Data: 18
N Detect: 13
% Detect: 72

95% Confidence
MK Trend: Significant
MK p-val: 0.0481
Direction: Decreasing

Lines

— Linear Fit

Shapes

● Detect
○ NonDetect
▼ Detect Limit

Scatterplots and Trend Analysis

D18, Cadmium

Concentration (µg/L)

0.10
0.08
0.06
0.04
0.02
0.00

Jul
2021

Jan
2022

Jul
2022

Jan
2023

Jul
2023

Stats

N Data: 9
N Detect: 0
% Detect: 0

MK criteria not met

Shapes

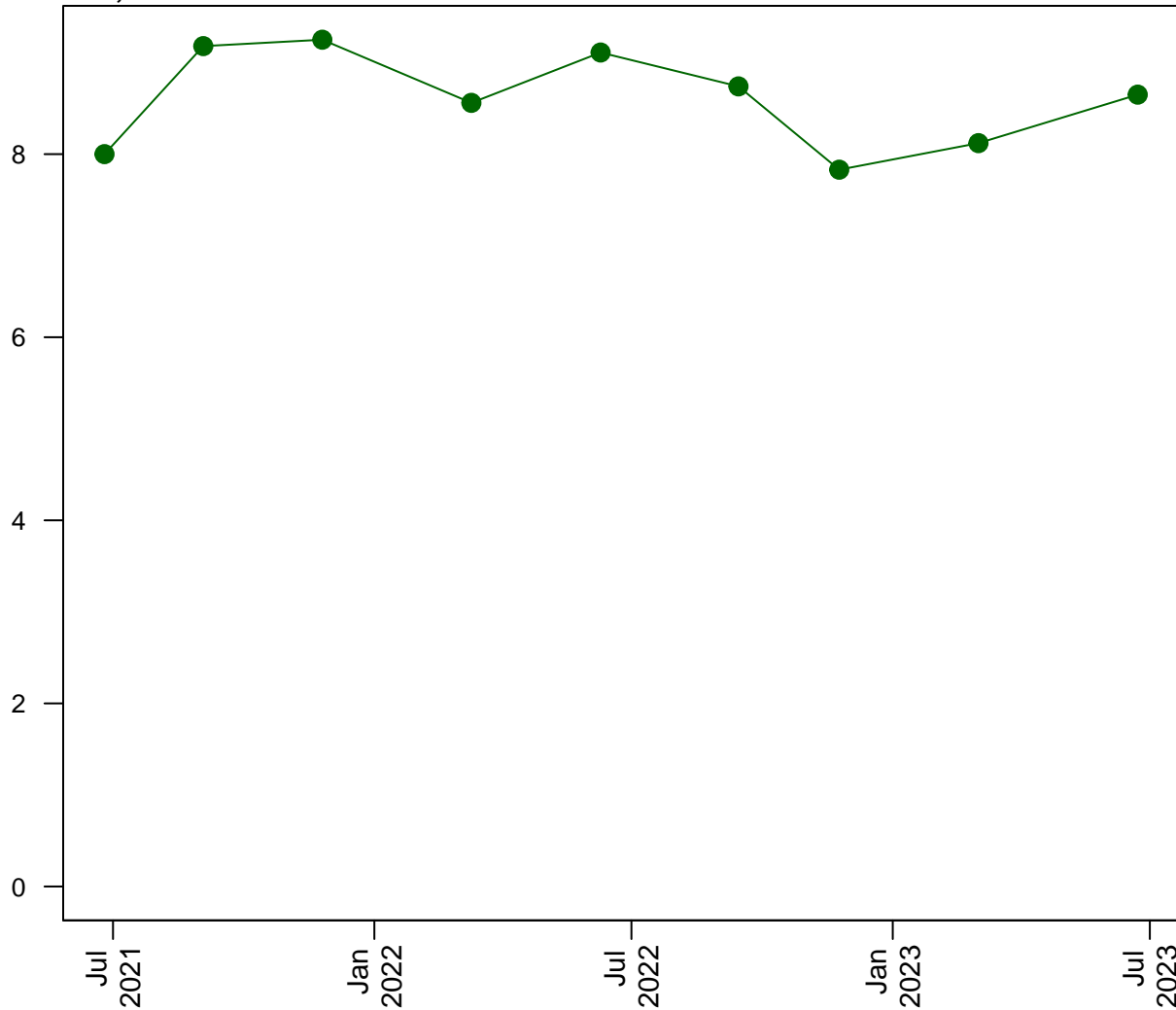
● Detect
○ NonDetect
▼ Detect Limit



Scatterplots and Trend Analysis

D18, Chloride

Concentration (mg/L)



Stats

N Data: 9

N Detect: 9

% Detect: 100

95% Confidence

MK Trend: NS

MK p-val: 0.477

Shapes

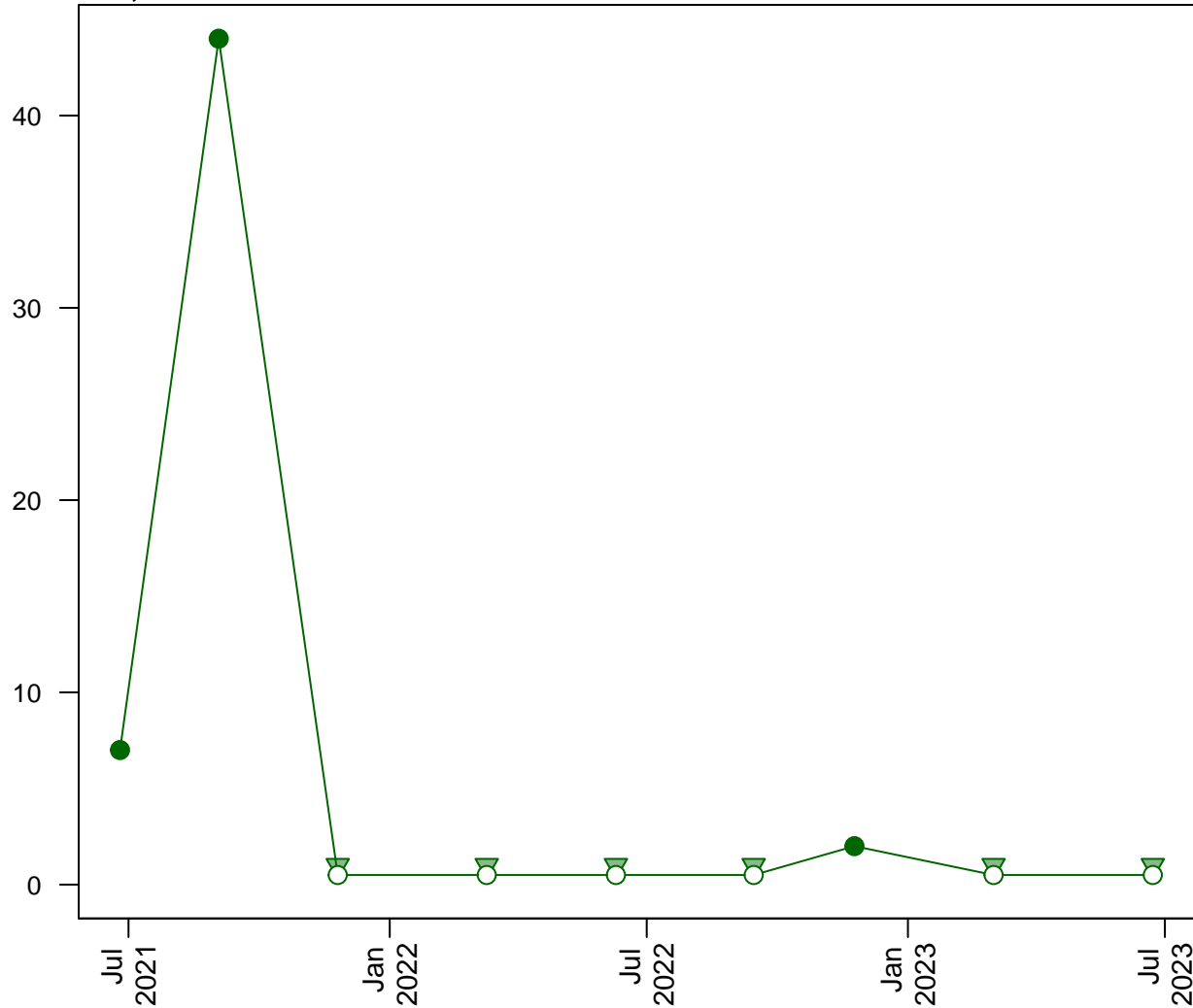
● Detect

○ NonDetect

▼ Detect Limit

Scatterplots and Trend Analysis D18, Chromium

Concentration (µg/L)



Stats

N Data: 9

N Detect: 3

% Detect: 33

MK criteria not met

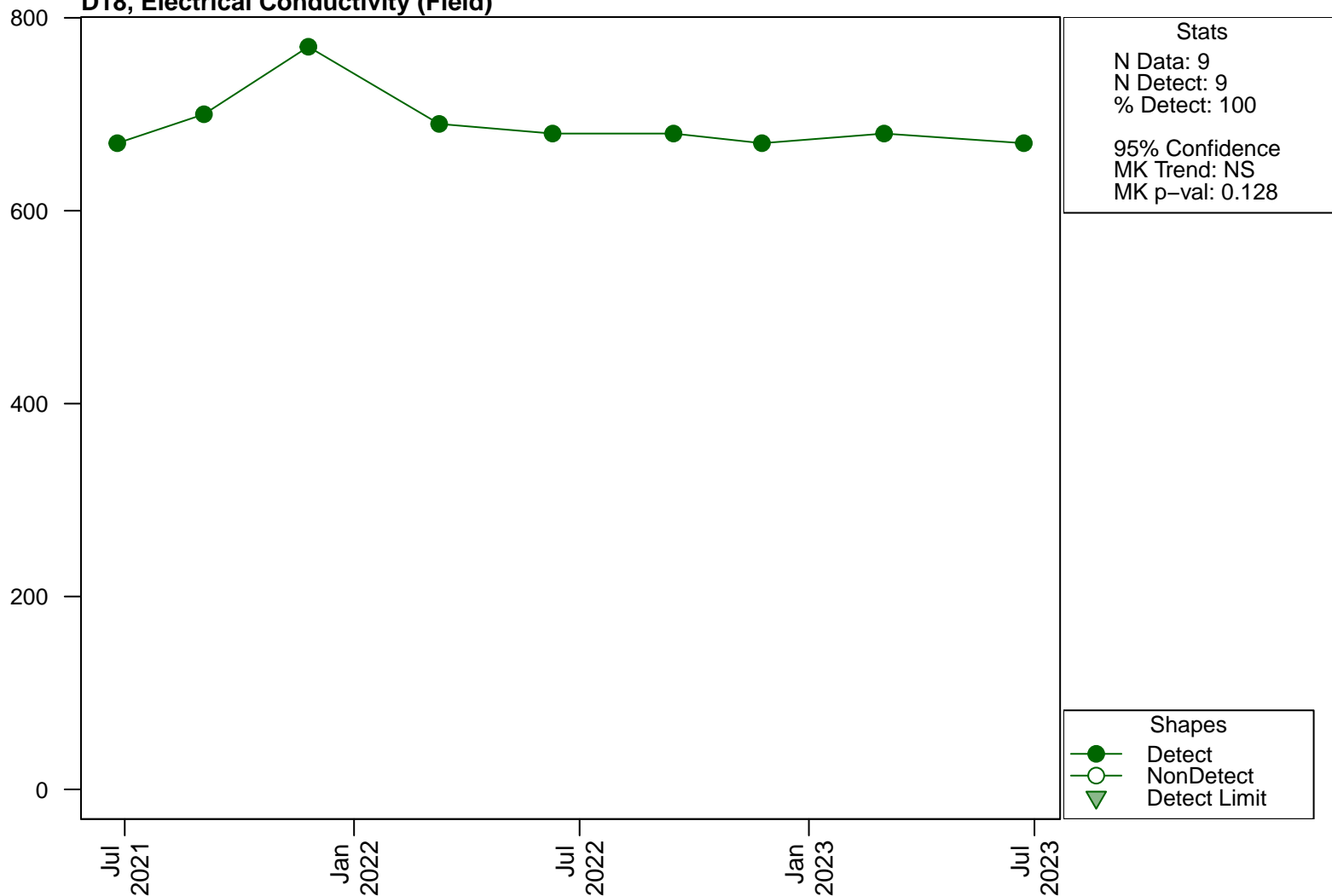
Shapes

- Detect
- NonDetect
- ▼ Detect Limit

Scatterplots and Trend Analysis

D18, Electrical Conductivity (Field)

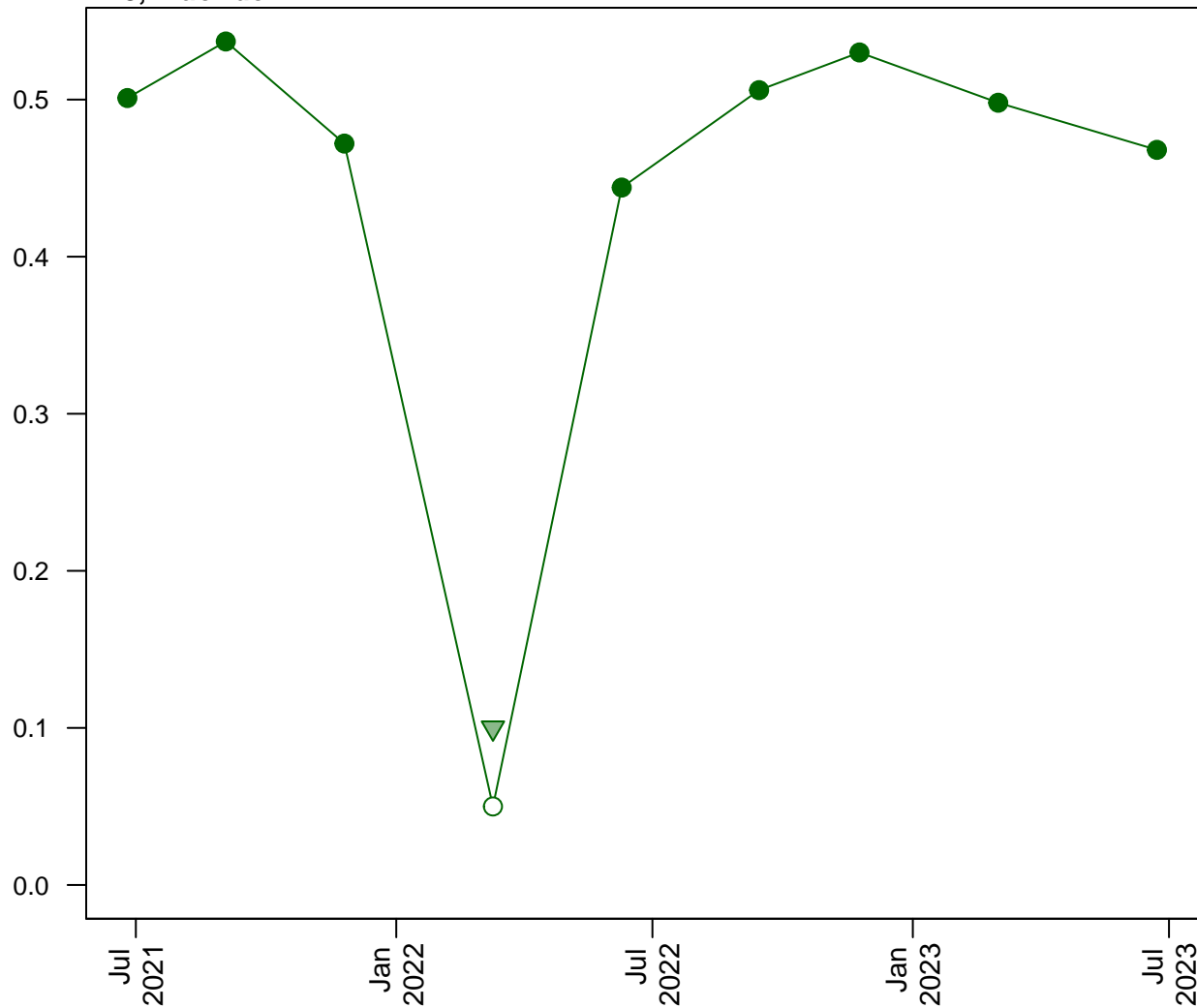
Concentration (uS/cm)



Scatterplots and Trend Analysis

D18, Fluoride

Concentration (mg/L)



Stats

N Data: 9
N Detect: 8
% Detect: 89

95% Confidence
MK Trend: NS
MK p-val: 0.761

Shapes

● Detect
○ NonDetect
▼ Detect Limit

Scatterplots and Trend Analysis

D18, Iron

Concentration (µg/L)

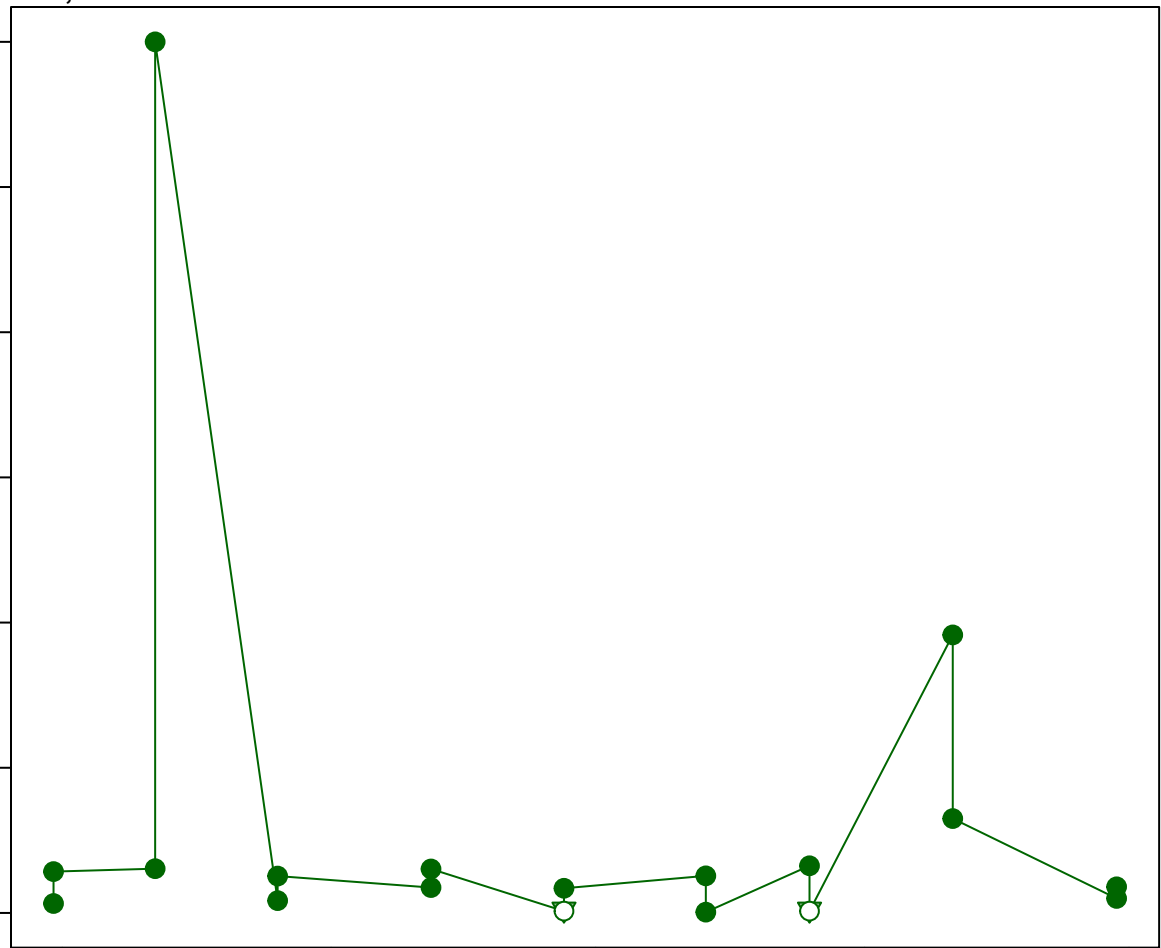
12000
10000
8000
6000
4000
2000
0

Jul 2021
Jan 2022
Jul 2022
Jan 2023
Jul 2023

Stats
N Data: 18
N Detect: 16
% Detect: 89

95% Confidence
MK Trend: NS
MK p-val: 0.909

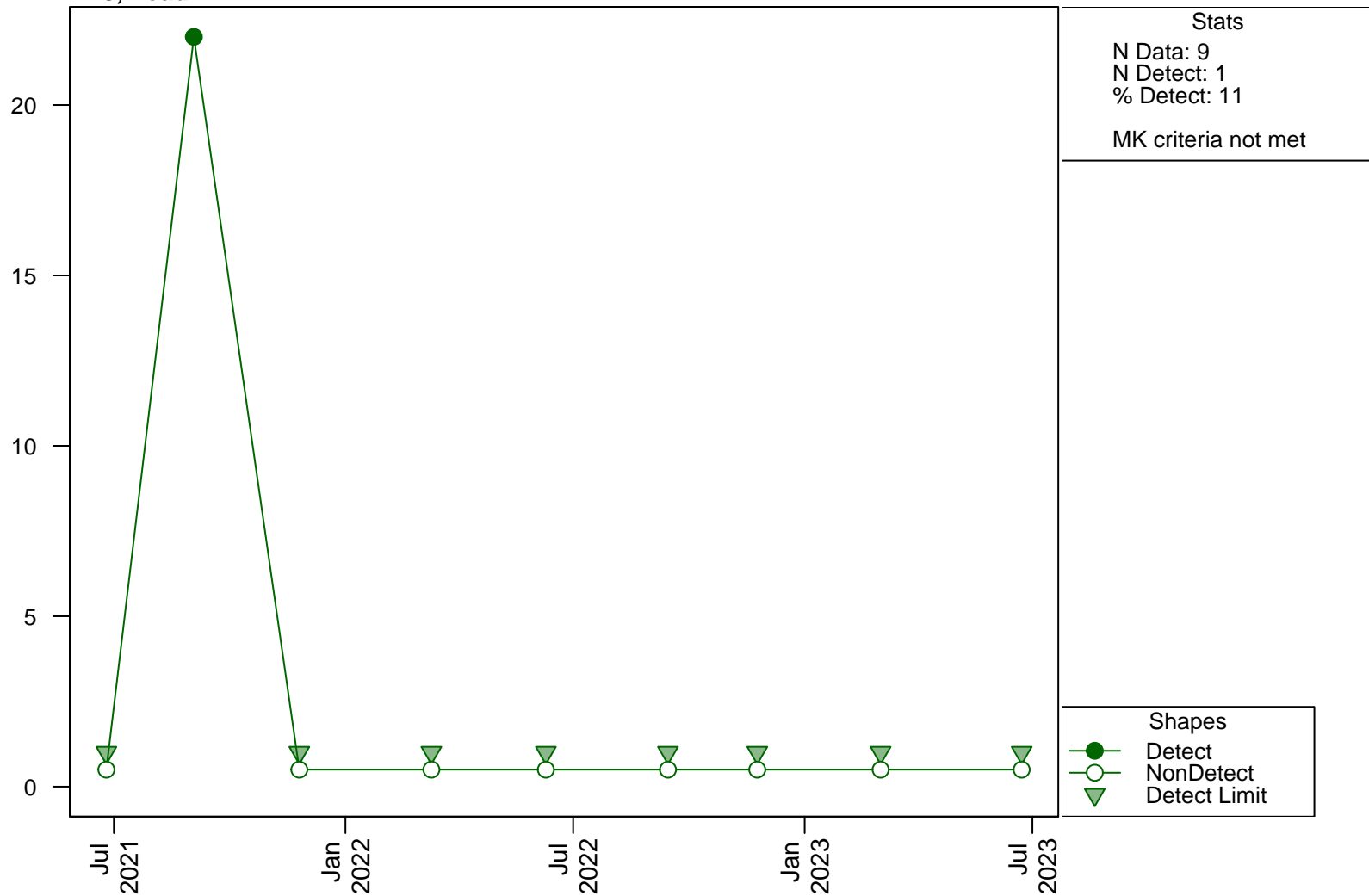
Shapes
Detect
NonDetect
Detect Limit



Scatterplots and Trend Analysis

D18, Lead

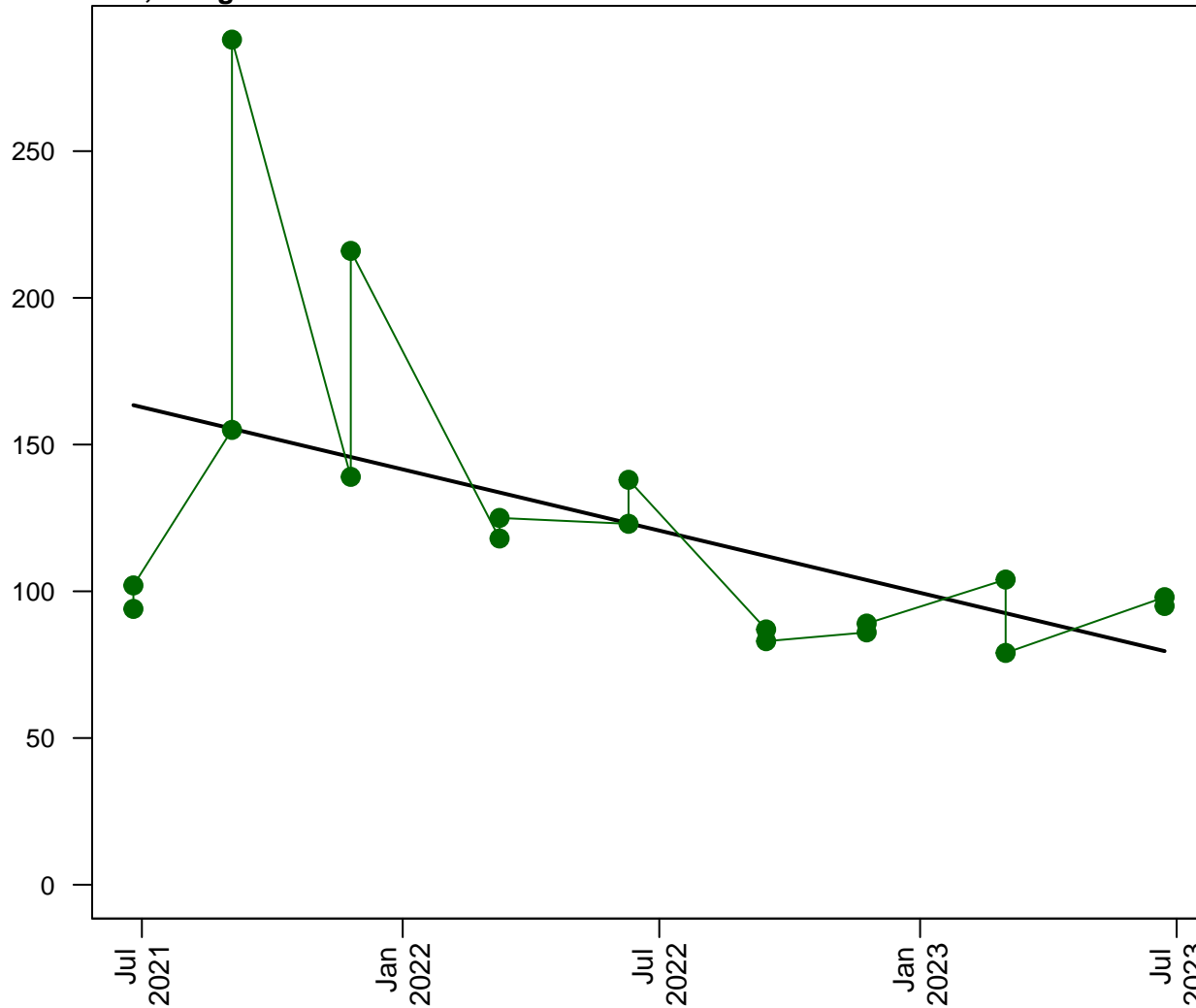
Concentration (µg/L)



Scatterplots and Trend Analysis

D18, Manganese

Concentration (µg/L)



Stats

N Data: 18
N Detect: 18
% Detect: 100

95% Confidence
MK Trend: Significant
MK p-val: 0.0181
Direction: Decreasing

Lines

— Linear Fit

Shapes

● Detect
○ NonDetect
▼ Detect Limit

Scatterplots and Trend Analysis

D18, Mercury

Concentration ($\mu\text{g/L}$)

0.10
0.08
0.06
0.04
0.02
0.00

Jul
2021

Jan
2022

Jul
2022

Jan
2023

Jul
2023

Stats

N Data: 9

N Detect: 1

% Detect: 11

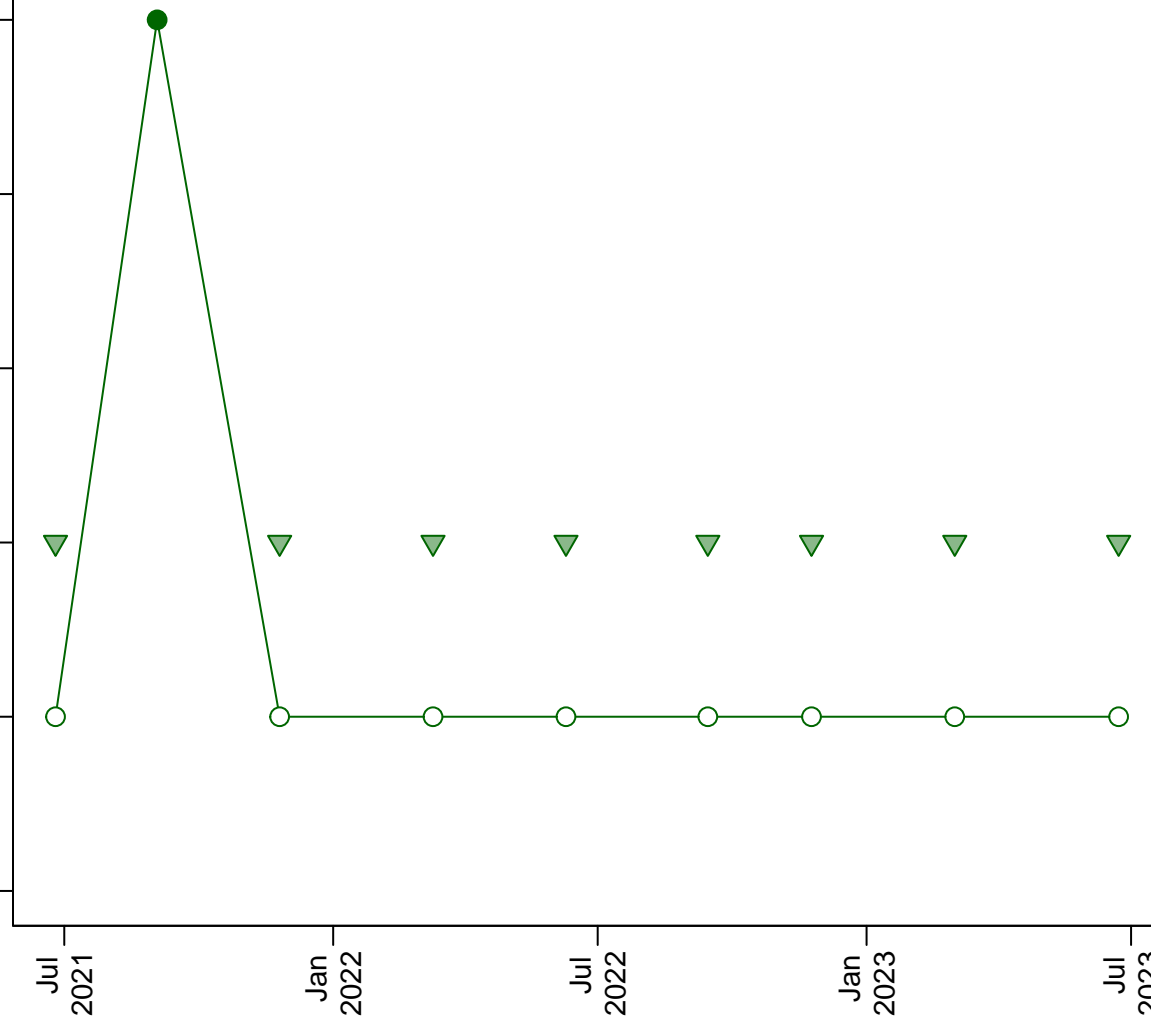
MK criteria not met

Shapes

● Detect

○ NonDetect

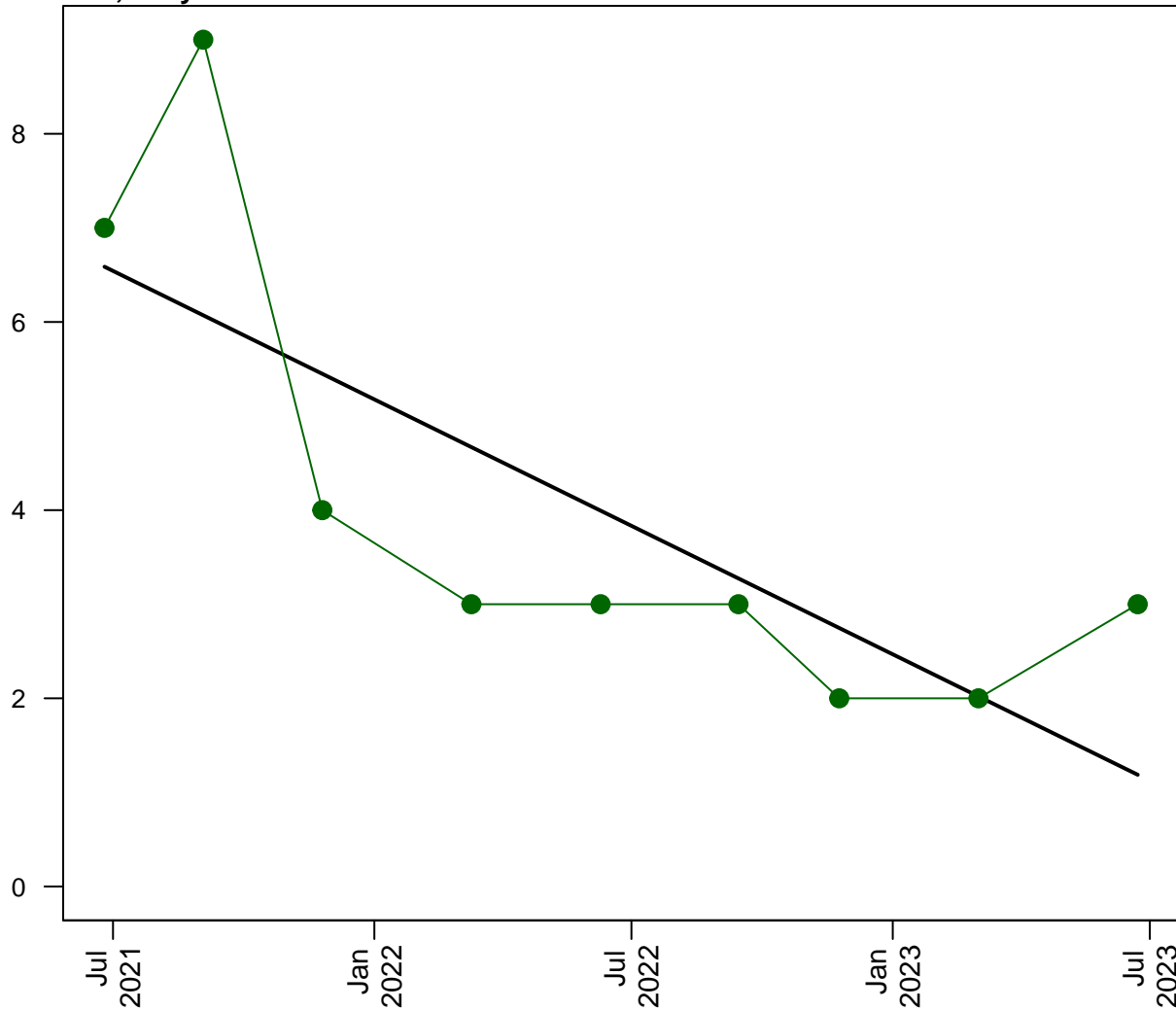
▼ Detect Limit



Scatterplots and Trend Analysis

D18, Molybdenum

Concentration (µg/L)



Stats

N Data: 9

N Detect: 9

% Detect: 100

95% Confidence

MK Trend: Significant

MK p-val: 0.0113

Direction: Decreasing

Lines

— Linear Fit

Shapes

● Detect

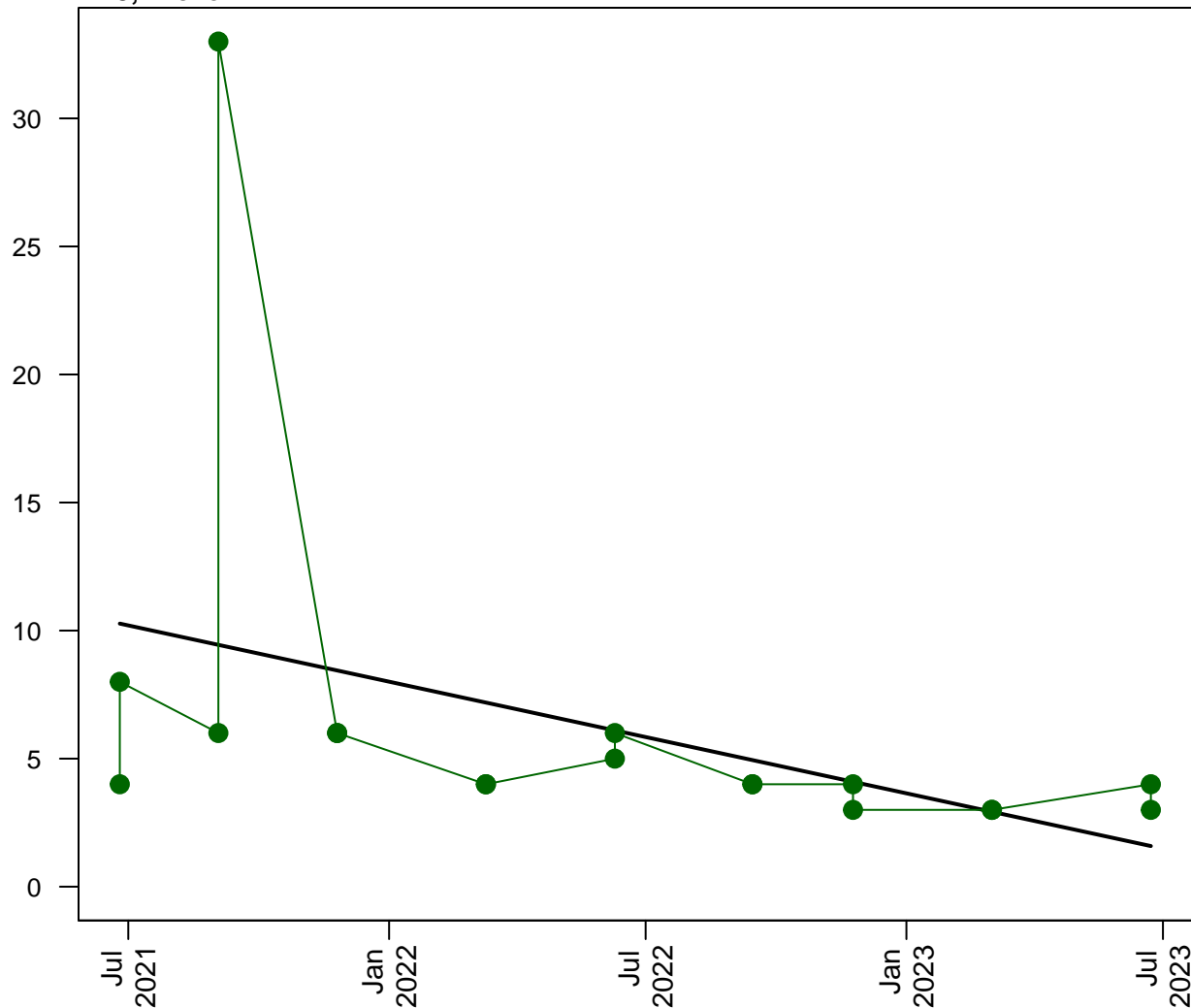
○ NonDetect

▼ Detect Limit

Scatterplots and Trend Analysis

D18, Nickel

Concentration (µg/L)



Stats

N Data: 18

N Detect: 18

% Detect: 100

95% Confidence

MK Trend: Significant

MK p-val: <0.001

Direction: Decreasing

Lines

Linear Fit

Shapes

Detect

NonDetect

Detect Limit

Scatterplots and Trend Analysis D18, Selenium

Concentration (µg/L)

10
8
6
4
2
0

Jul
2021

Jan
2022

Jul
2022

Jan
2023

Jul
2023

Stats

N Data: 9

N Detect: 2

% Detect: 22

MK criteria not met

Shapes



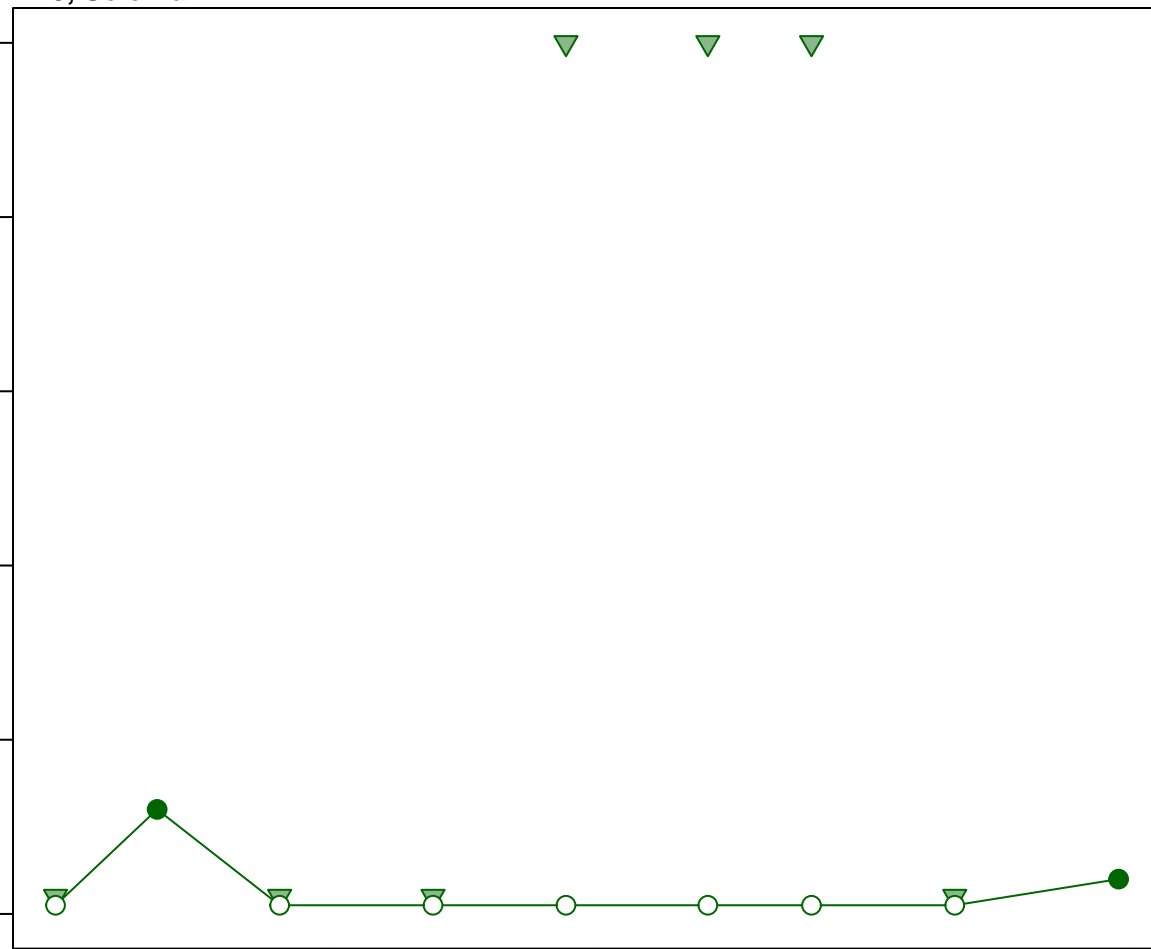
Detect



NonDetect



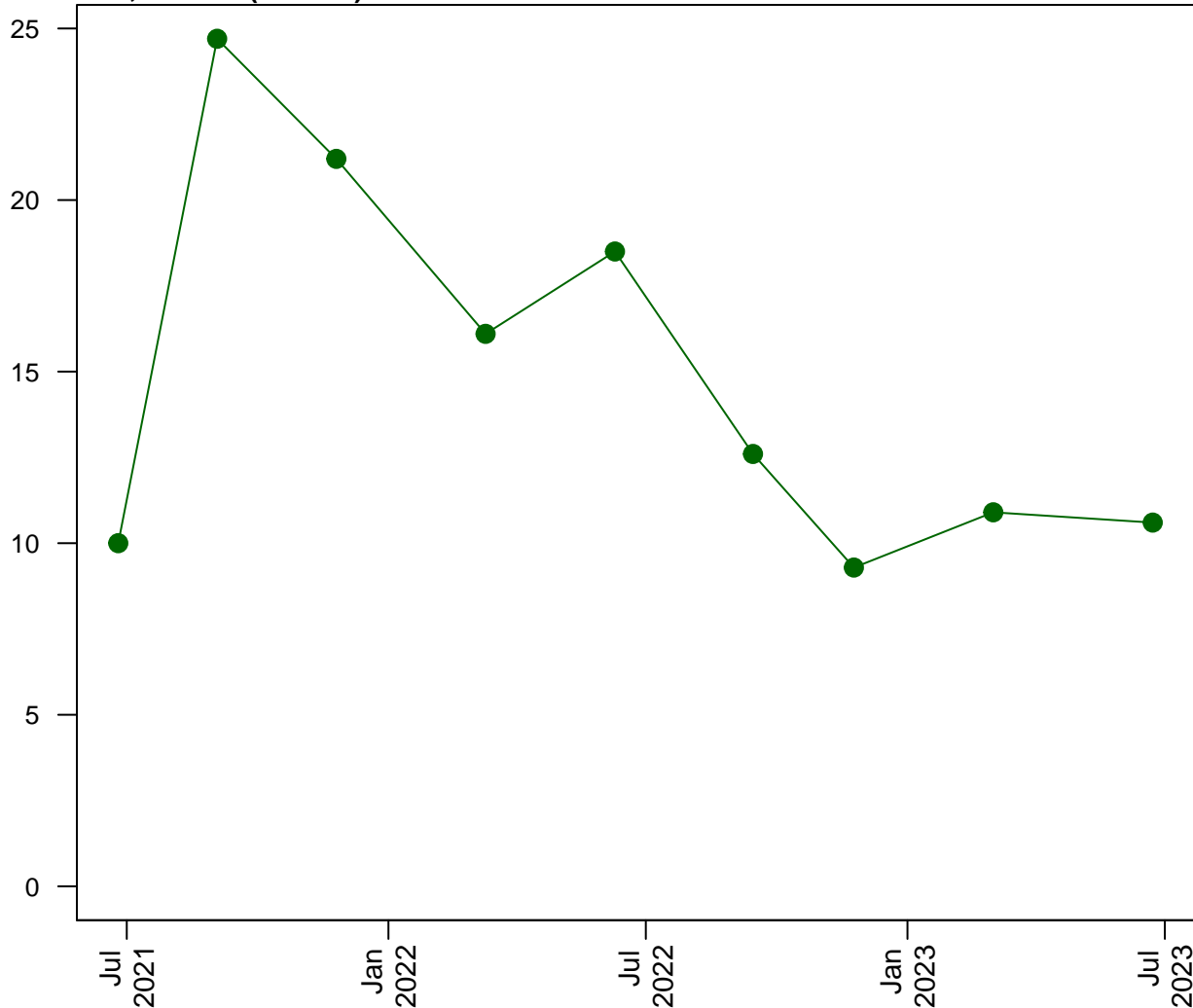
Detect Limit



Scatterplots and Trend Analysis

D18, Sulfate (as SO4)

Concentration (mg/L)



Stats

N Data: 9
N Detect: 9
% Detect: 100

95% Confidence
MK Trend: NS
MK p-val: 0.119

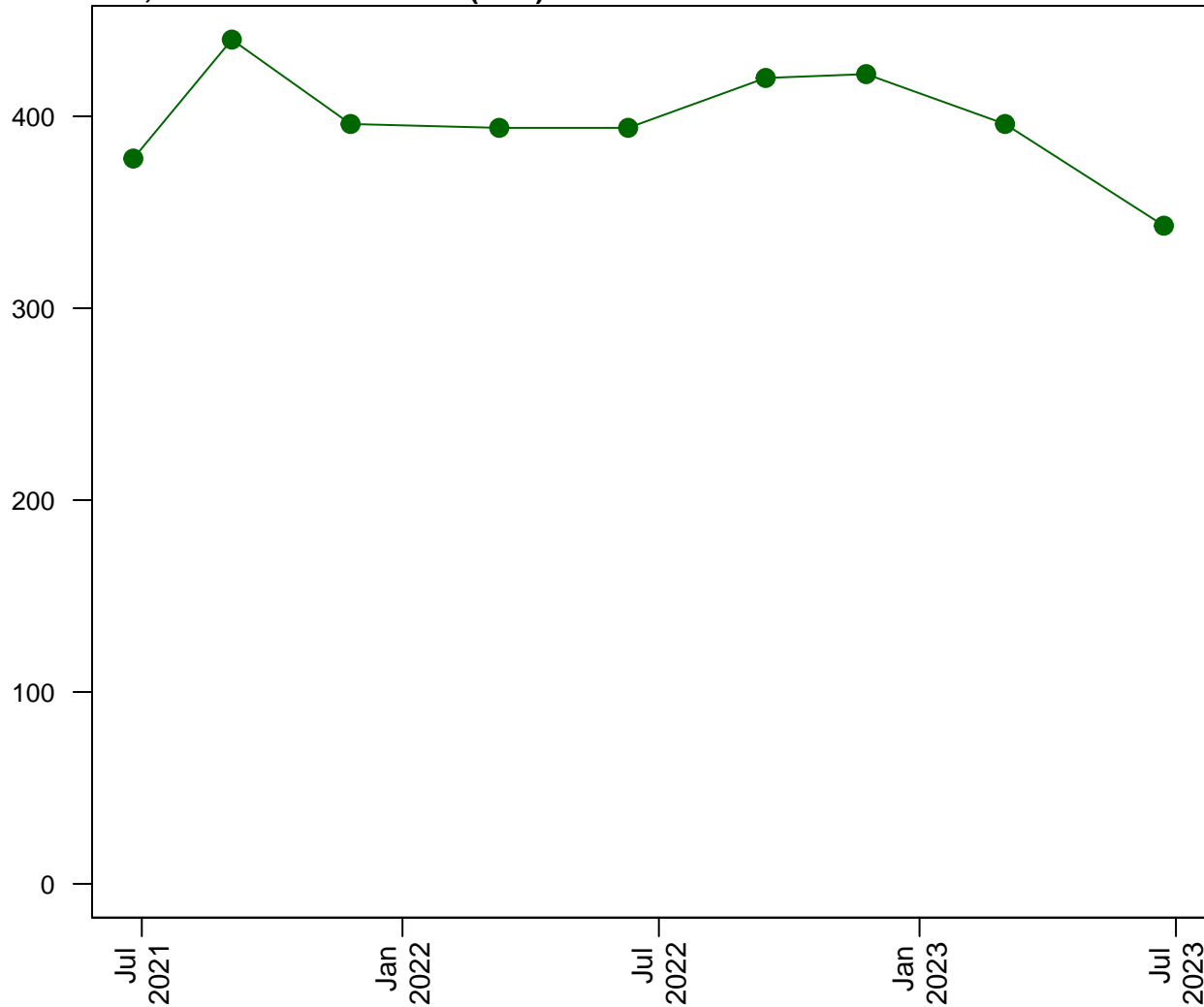
Shapes

● Detect
○ NonDetect
▼ Detect Limit

Scatterplots and Trend Analysis

D18, Total Dissolved Solids (TDS)

Concentration (mg/L)



Stats

N Data: 9
N Detect: 9
% Detect: 100

95% Confidence
MK Trend: NS
MK p-val: 0.833

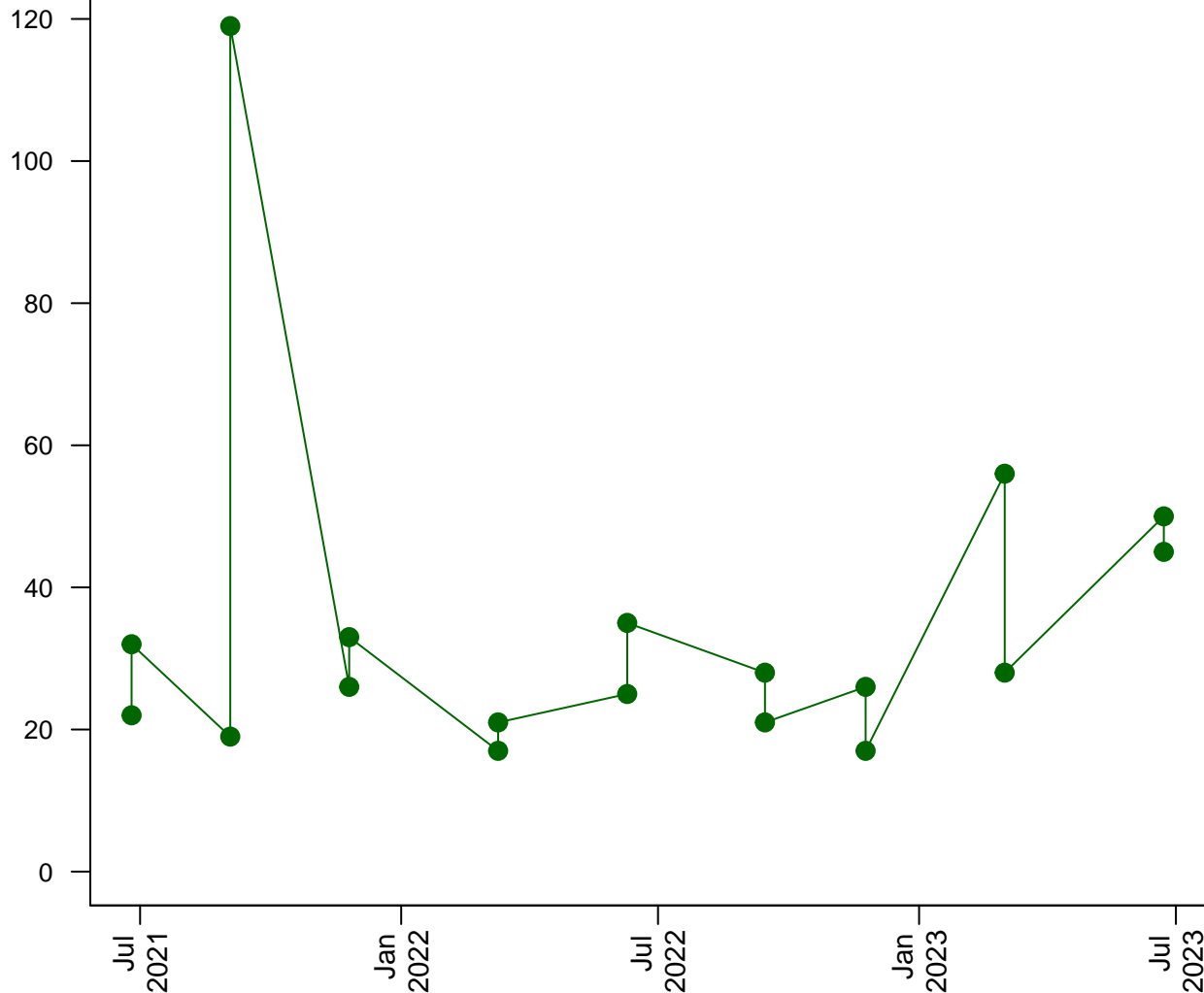
Shapes

● Detect
○ NonDetect
▼ Detect Limit

Scatterplots and Trend Analysis

D18, Zinc

Concentration (µg/L)



Stats

N Data: 18

N Detect: 18

% Detect: 100

95% Confidence

MK Trend: NS

MK p-val: 0.32

Shapes



Detect



NonDetect

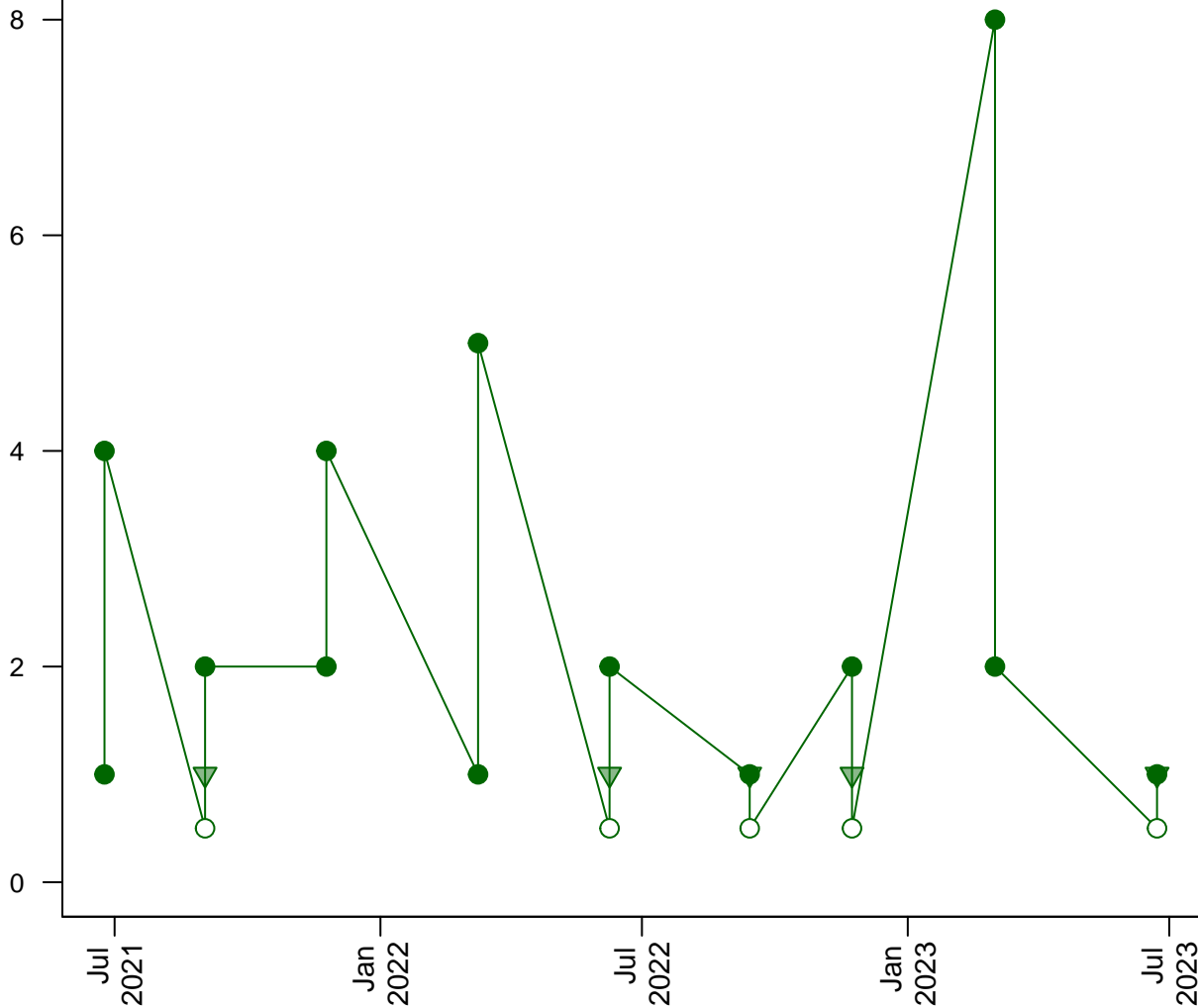


Detect Limit

Scatterplots and Trend Analysis

D19, Arsenic

Concentration (µg/L)



Stats

N Data: 18

N Detect: 13

% Detect: 72

95% Confidence

MK Trend: NS

MK p-val: 0.455

Shapes



Detect



NonDetect

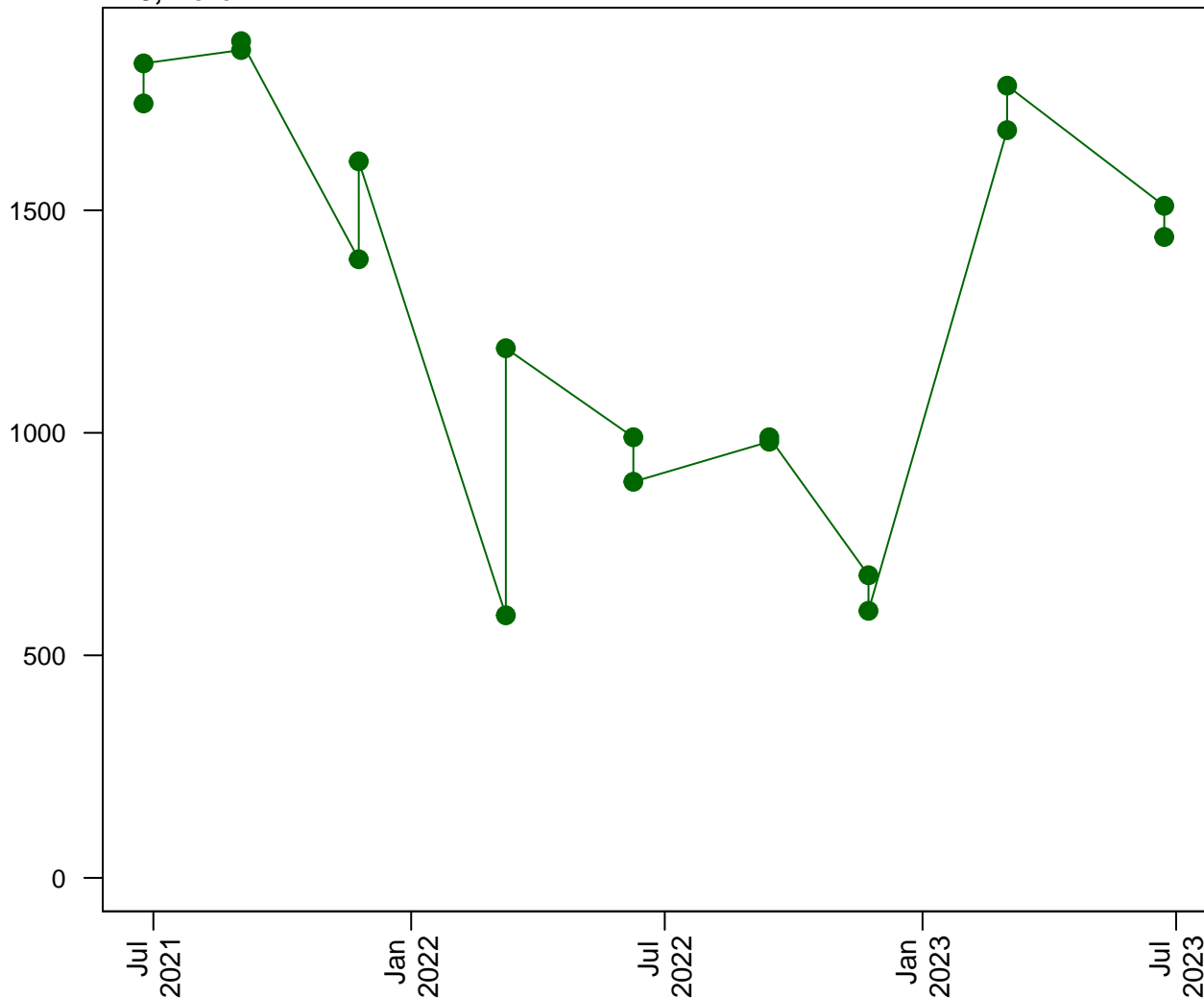


Detect Limit

Scatterplots and Trend Analysis

D19, Boron

Concentration (µg/L)



Stats

N Data: 18
N Detect: 18
% Detect: 100

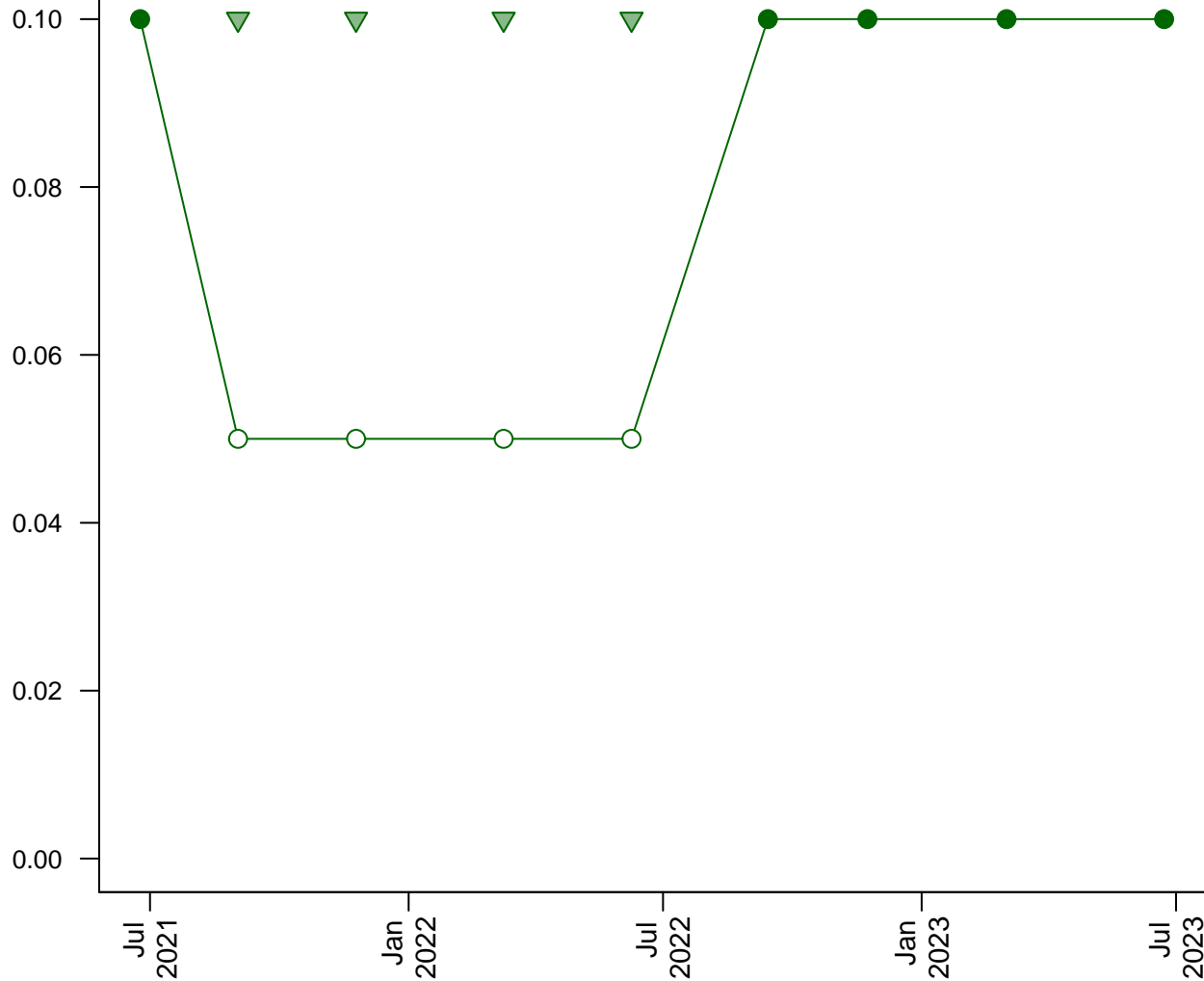
95% Confidence
MK Trend: NS
MK p-val: 0.118

Shapes

● Detect
○ NonDetect
▼ Detect Limit

Scatterplots and Trend Analysis D19, Cadmium

Concentration (µg/L)



Stats
N Data: 9
N Detect: 5
% Detect: 56

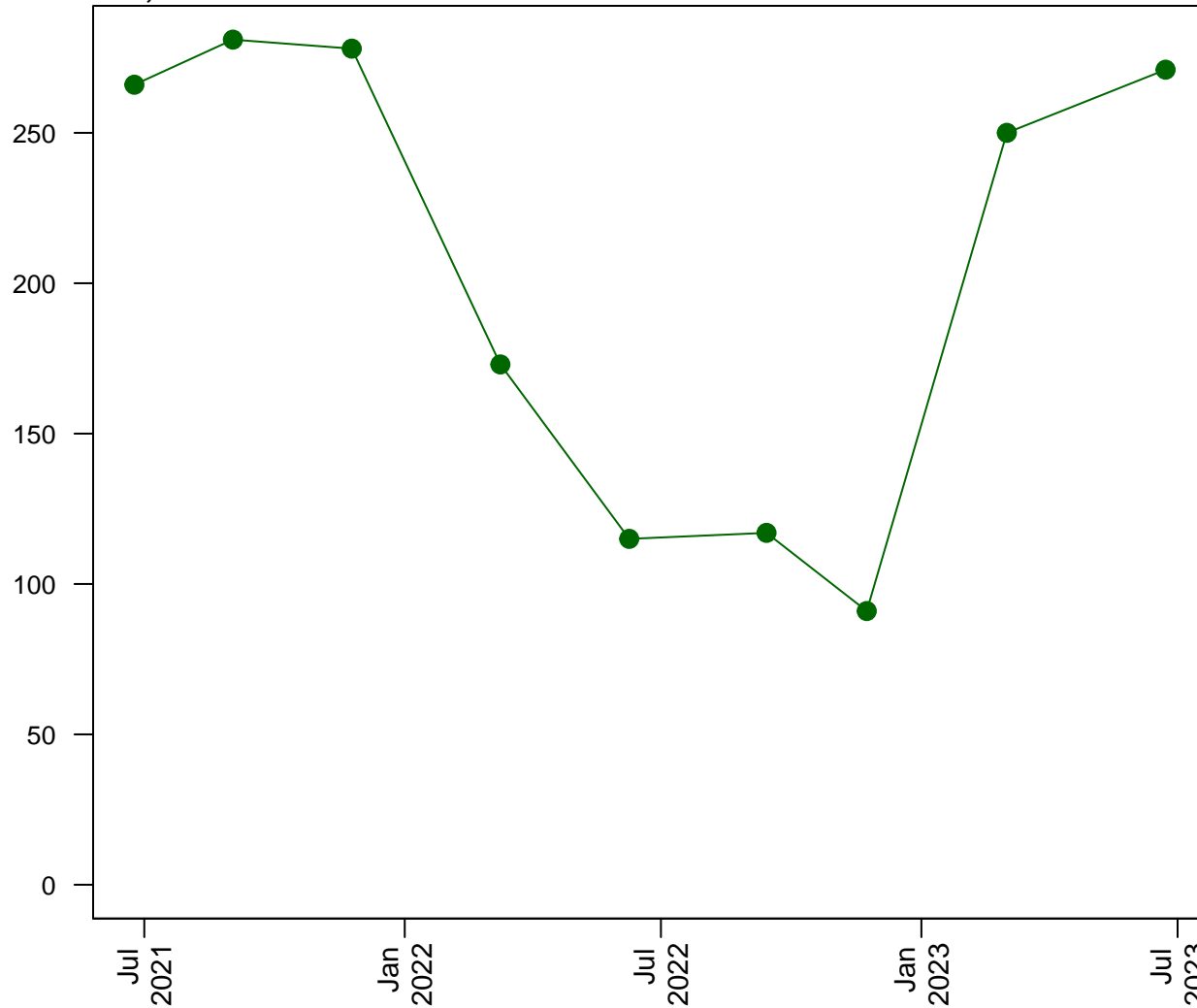
95% Confidence
MK Trend: NS
MK p-val: 0.142

Shapes
● Detect
○ NonDetect
▼ Detect Limit

Scatterplots and Trend Analysis

D19, Chloride

Concentration (mg/L)



Stats

N Data: 9
N Detect: 9
% Detect: 100

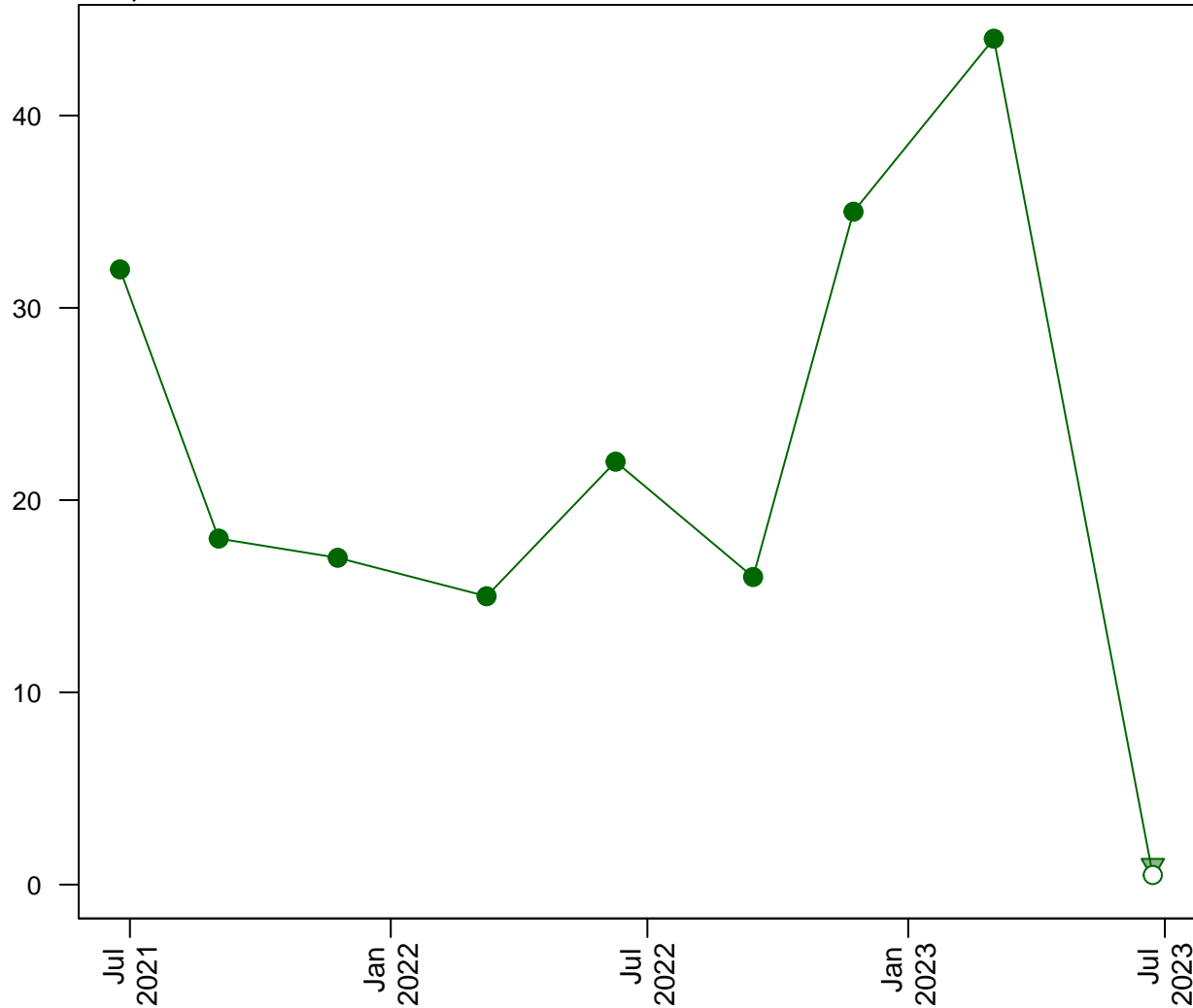
95% Confidence
MK Trend: NS
MK p-val: 0.358

Shapes

● Detect
○ NonDetect
▼ Detect Limit

Scatterplots and Trend Analysis D19, Chromium

Concentration (µg/L)



Stats

N Data: 9
N Detect: 8
% Detect: 89

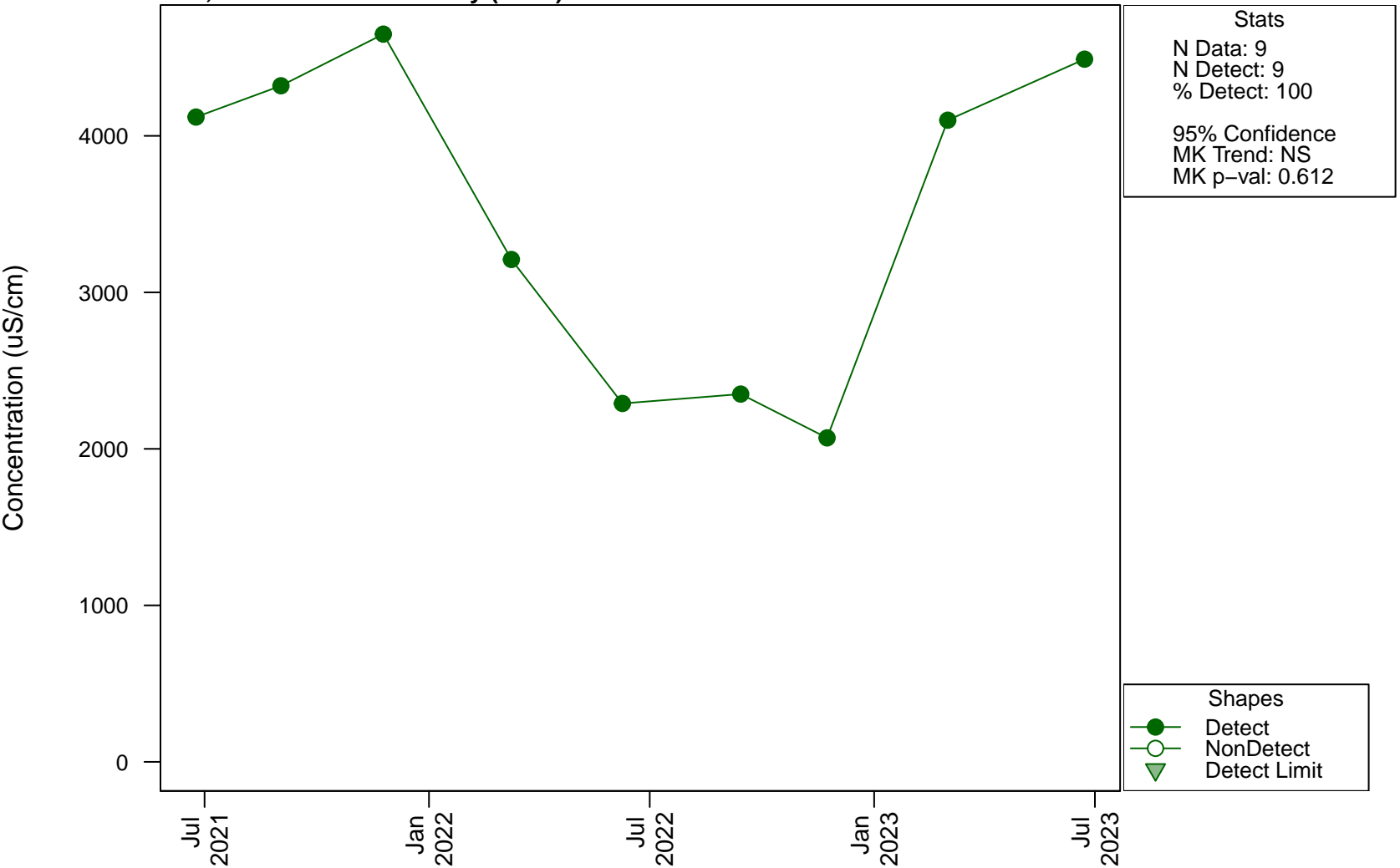
95% Confidence
MK Trend: NS
MK p-val: 0.919

Shapes

● Detect
○ NonDetect
▼ Detect Limit

Scatterplots and Trend Analysis

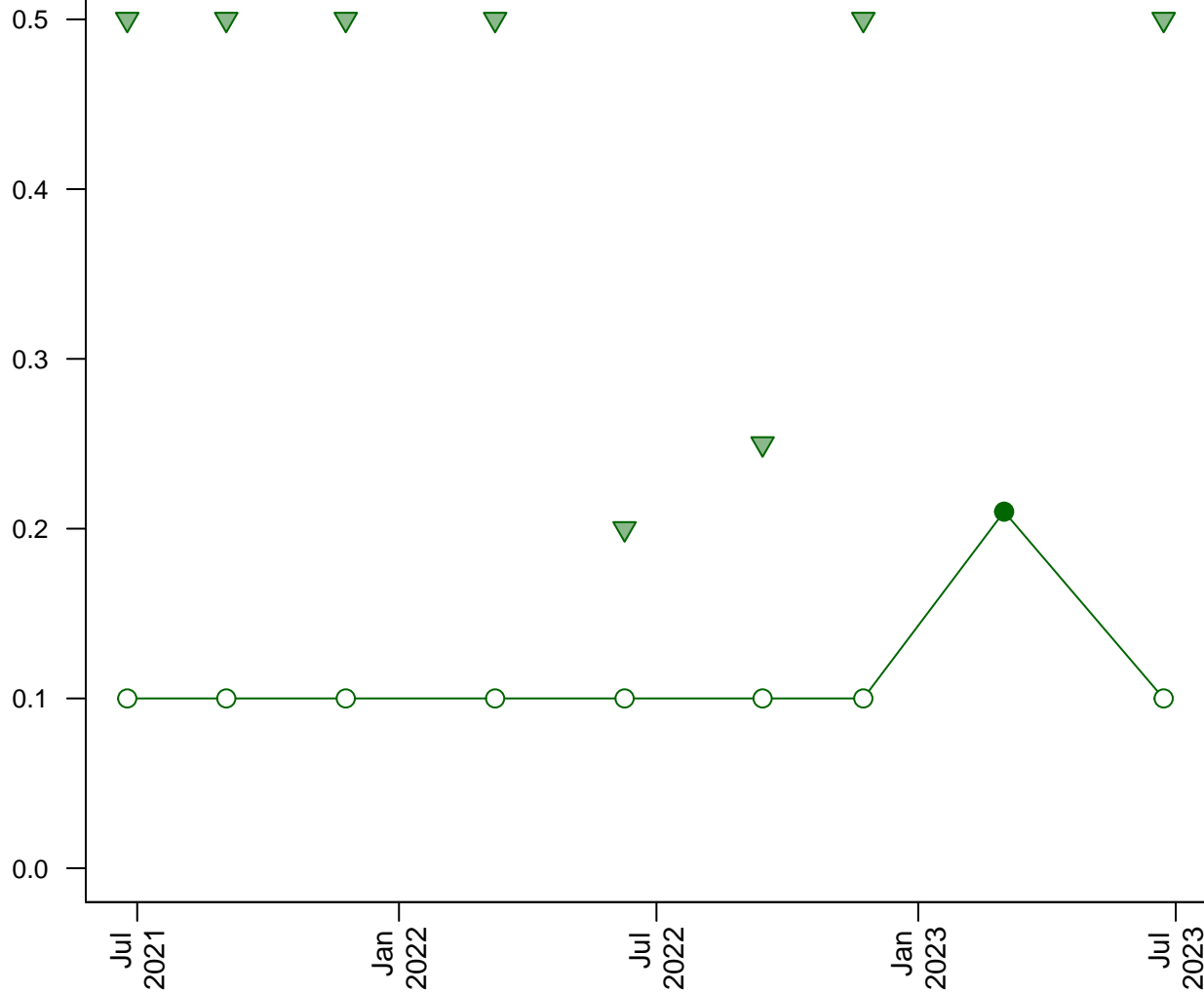
D19, Electrical Conductivity (Field)



Scatterplots and Trend Analysis

D19, Fluoride

Concentration (mg/L)



Stats

N Data: 9

N Detect: 1

% Detect: 11

MK criteria not met

Shapes



Detect



NonDetect

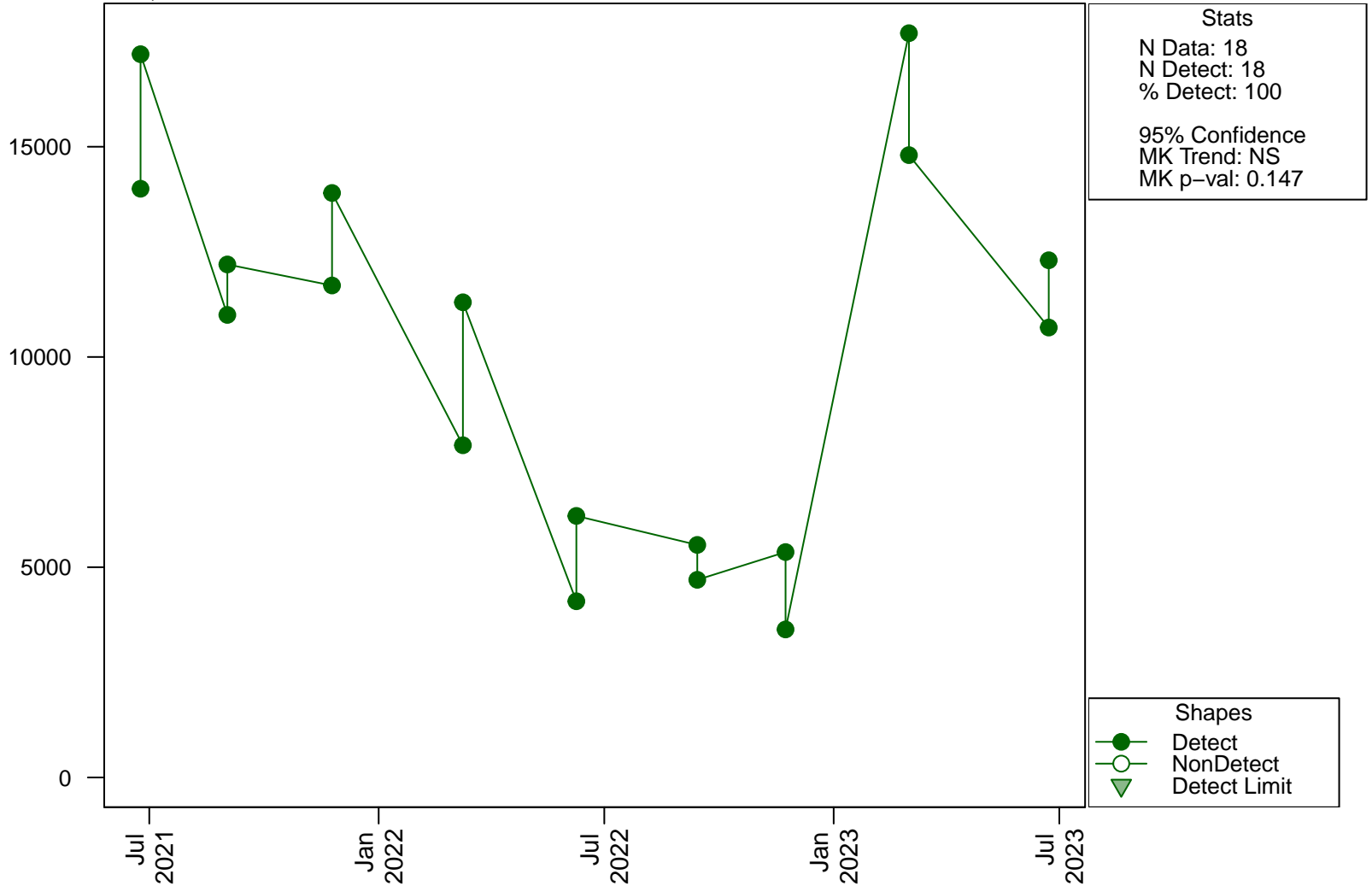


Detect Limit

Scatterplots and Trend Analysis

D19, Iron

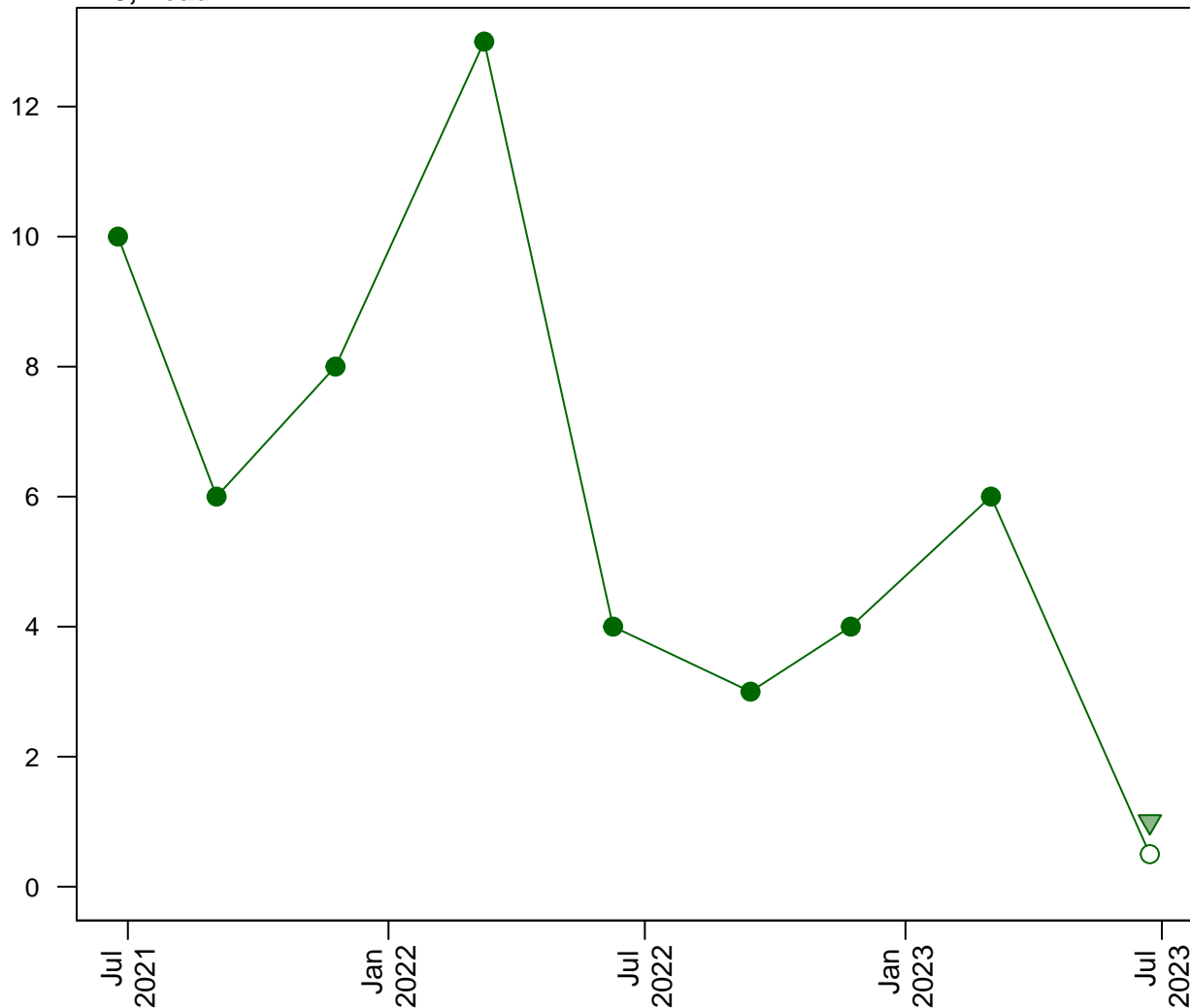
Concentration (µg/L)



Scatterplots and Trend Analysis

D19, Lead

Concentration (µg/L)



Stats

N Data: 9

N Detect: 8

% Detect: 89

95% Confidence

MK Trend: NS

MK p-val: 0.0578

Shapes



Detect



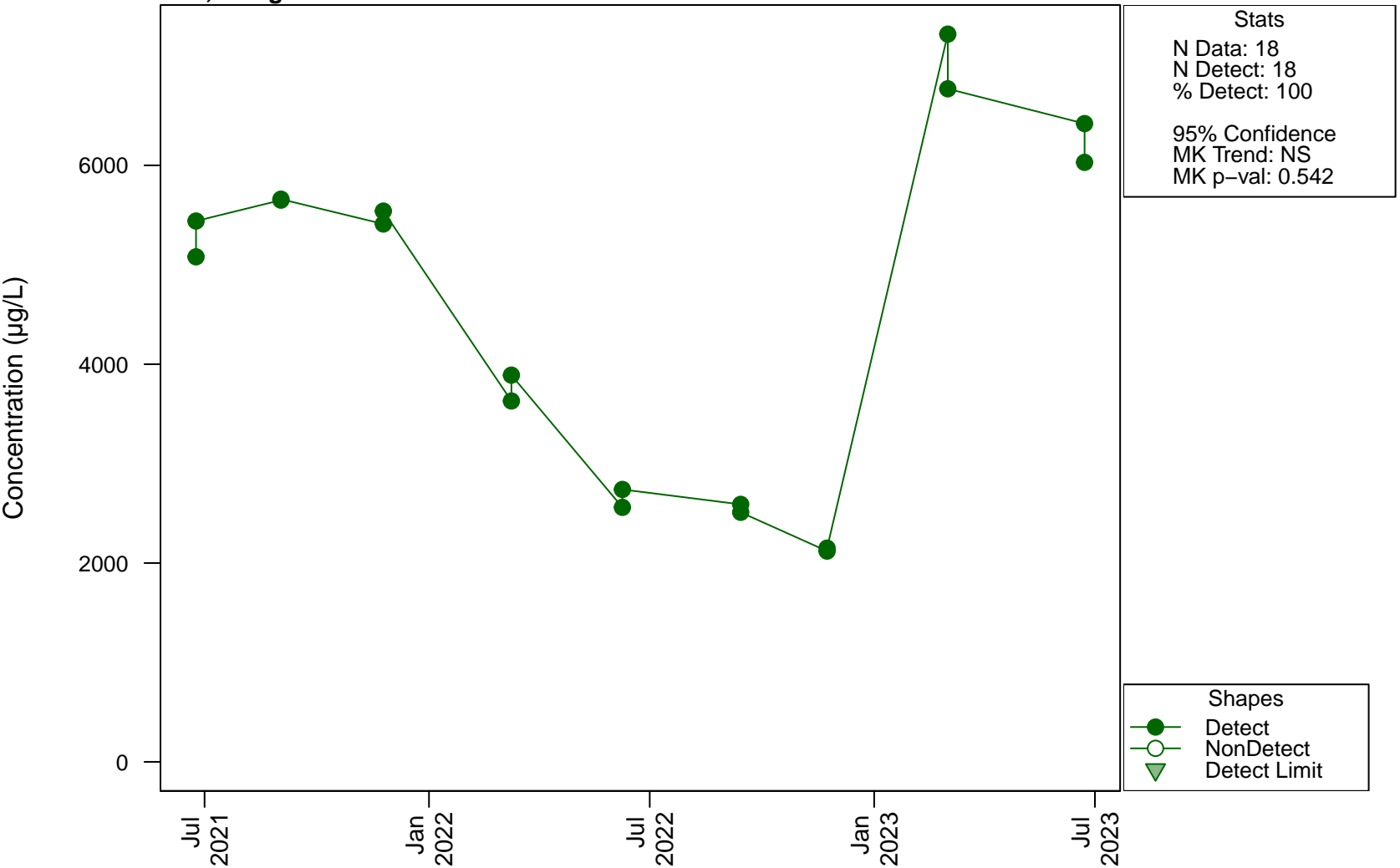
NonDetect



Detect Limit

Scatterplots and Trend Analysis

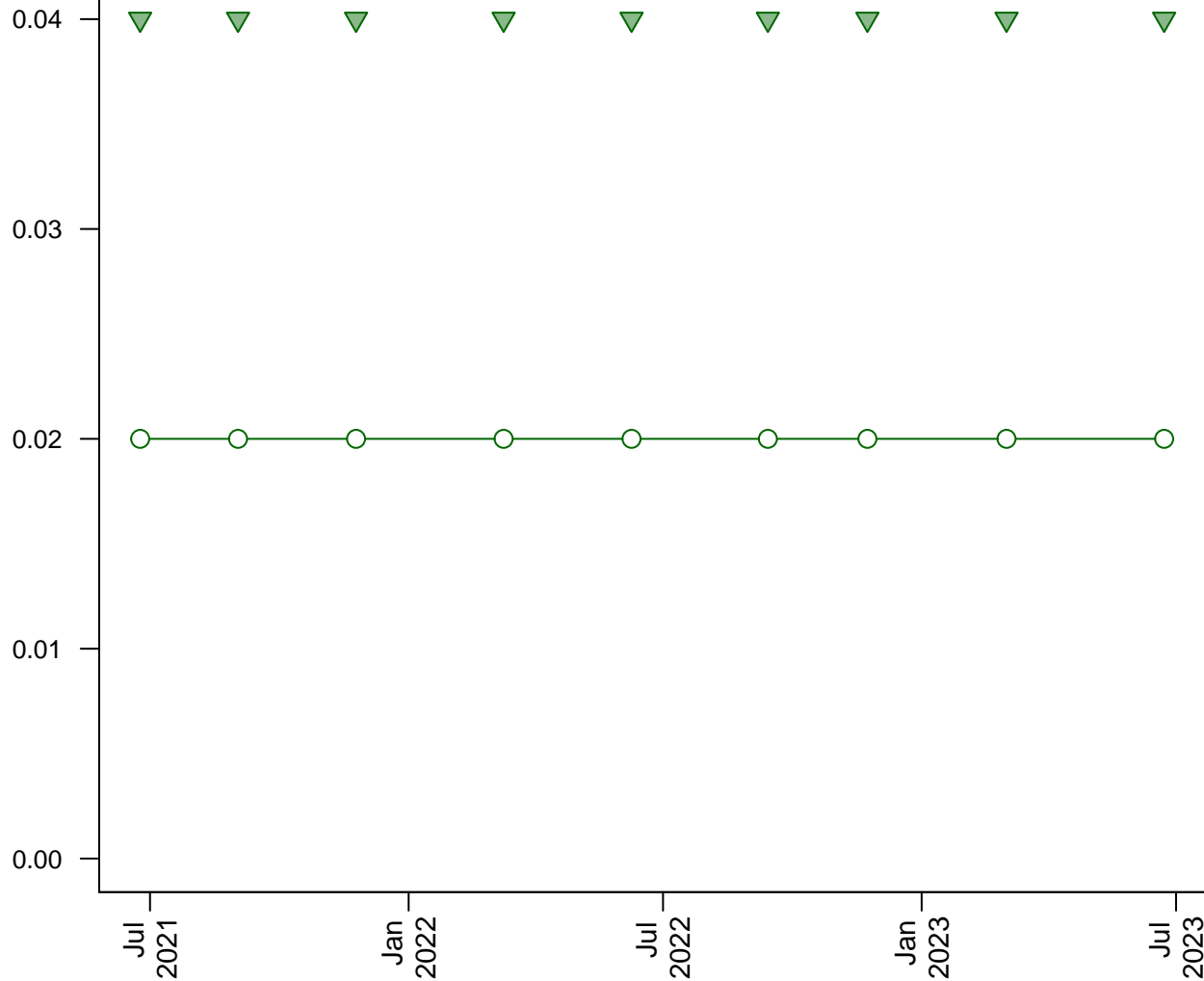
D19, Manganese



Scatterplots and Trend Analysis

D19, Mercury

Concentration ($\mu\text{g/L}$)



Stats

N Data: 9

N Detect: 0

% Detect: 0

MK criteria not met

Shapes



Detect



NonDetect

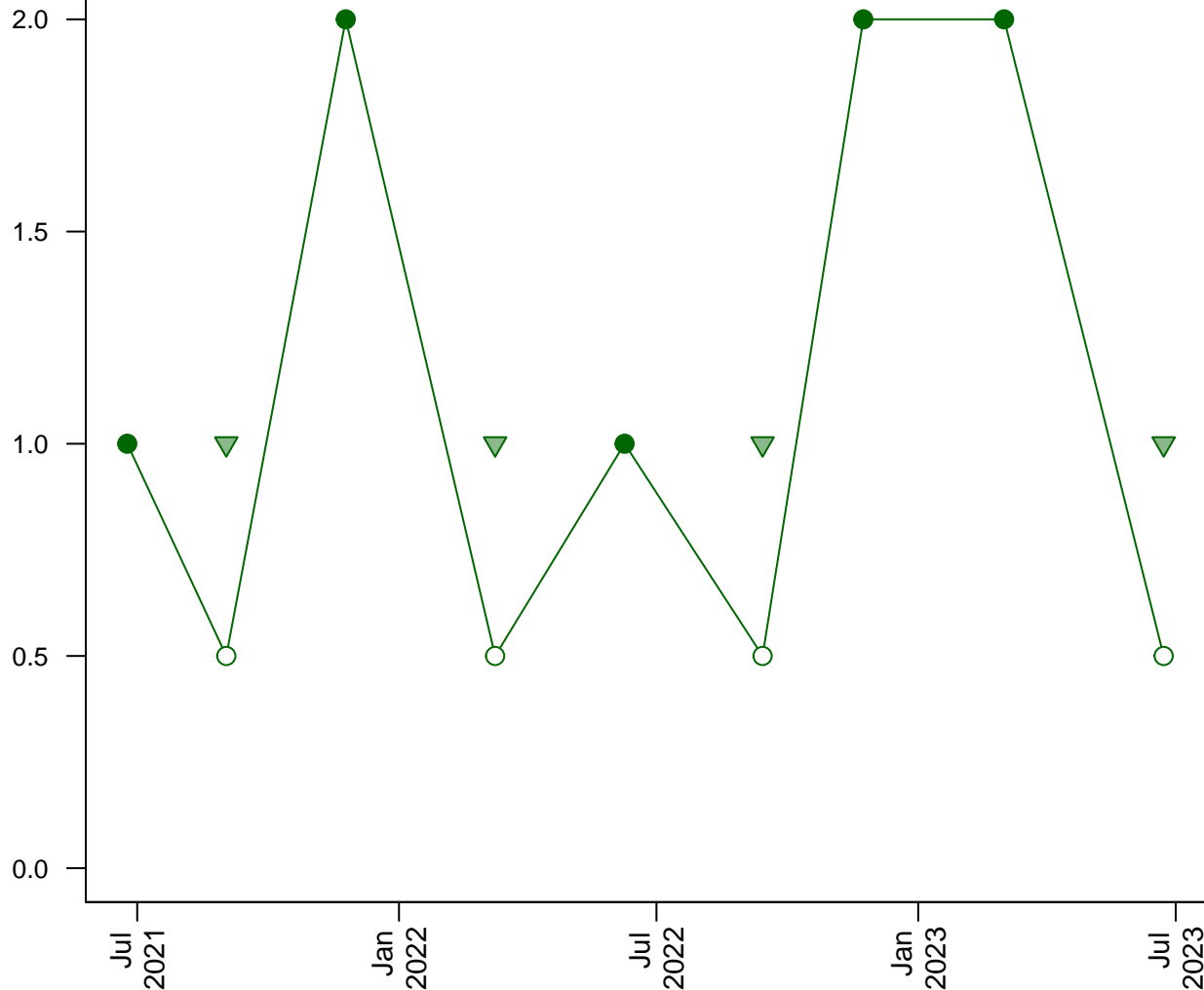


Detect Limit

Scatterplots and Trend Analysis

D19, Molybdenum

Concentration (µg/L)



Stats
N Data: 9
N Detect: 5
% Detect: 56

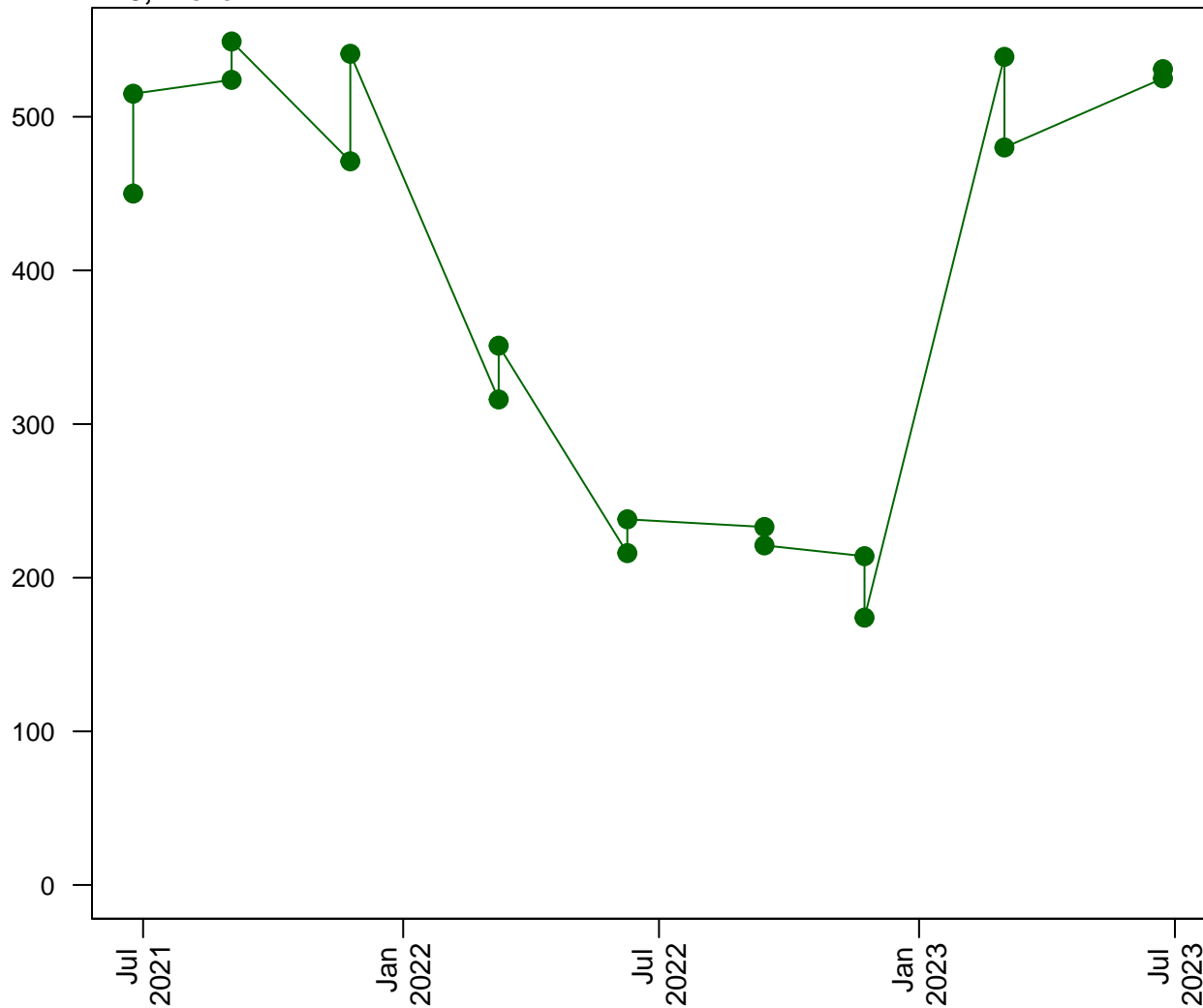
95% Confidence
MK Trend: NS
MK p-val: 0.822

Shapes
● Detect
○ NonDetect
▼ Detect Limit

Scatterplots and Trend Analysis

D19, Nickel

Concentration (µg/L)



Stats

N Data: 18
N Detect: 18
% Detect: 100

95% Confidence
MK Trend: NS
MK p-val: 0.286

Shapes

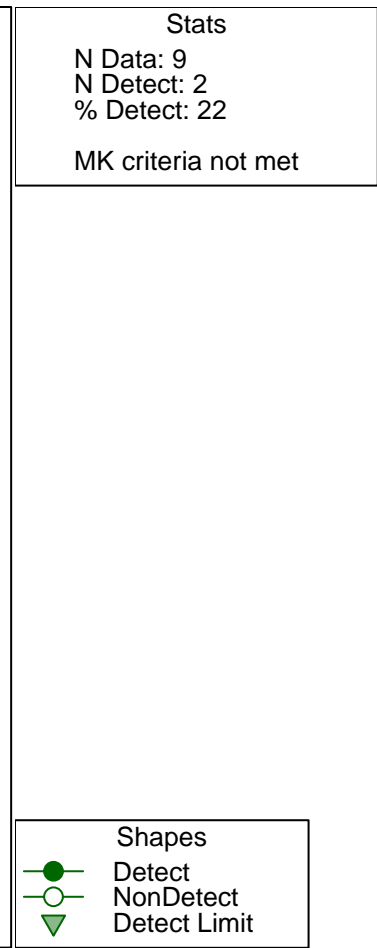
● Detect
○ NonDetect
▼ Detect Limit

Scatterplots and Trend Analysis D19, Selenium

Concentration (µg/L)

10
8
6
4
2
0

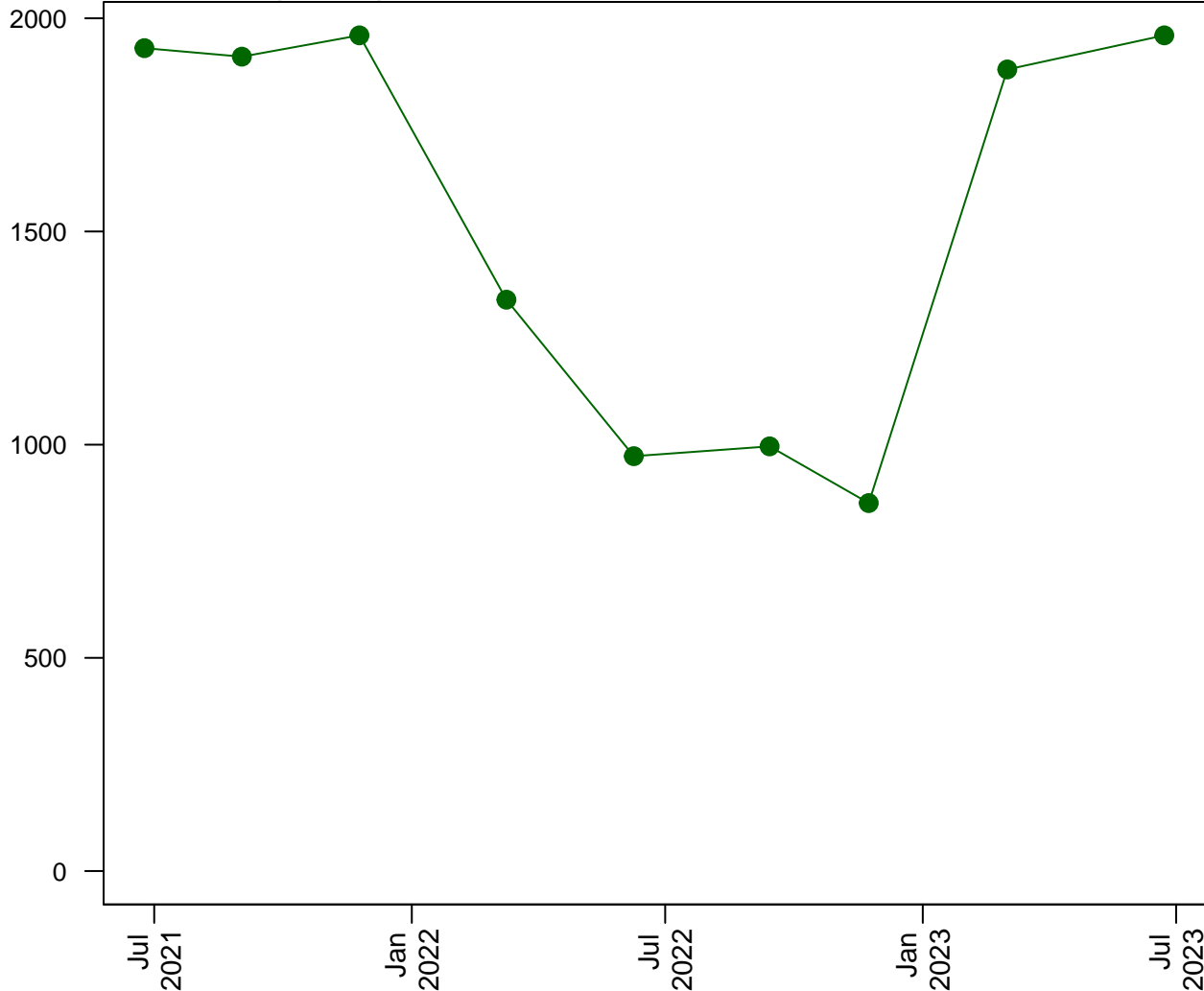
Jul 2021
Jan 2022
Jul 2022
Jan 2023
Jul 2023



Scatterplots and Trend Analysis

D19, Sulfate (as SO4)

Concentration (mg/L)



Stats

N Data: 9
N Detect: 9
% Detect: 100

95% Confidence
MK Trend: NS
MK p-val: 0.463

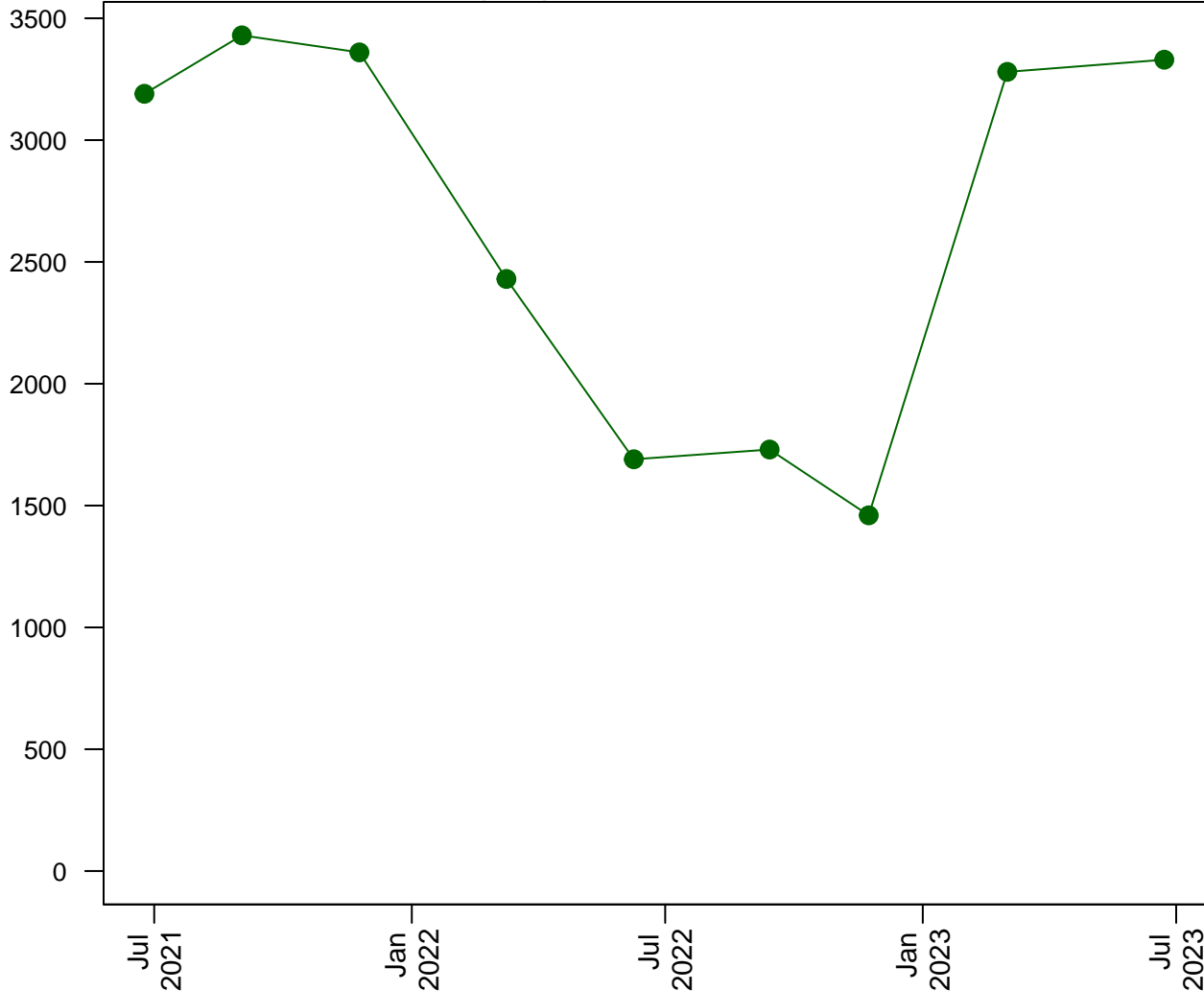
Shapes

● Detect
○ NonDetect
▼ Detect Limit

Scatterplots and Trend Analysis

D19, Total Dissolved Solids (TDS)

Concentration (mg/L)



Stats

N Data: 9

N Detect: 9

% Detect: 100

95% Confidence

MK Trend: NS

MK p-val: 0.477

Shapes



Detect



NonDetect

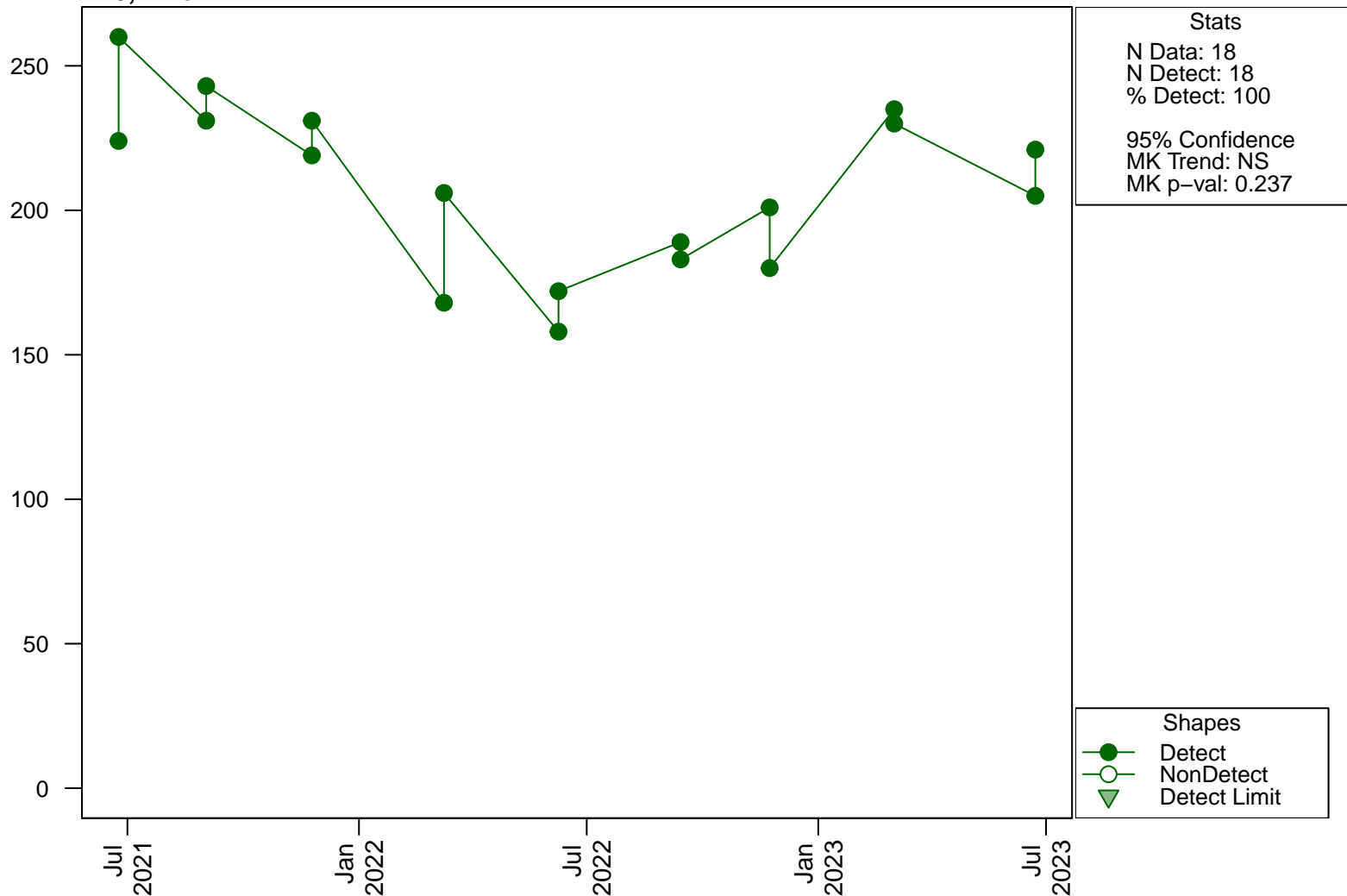


Detect Limit

Scatterplots and Trend Analysis

D19, Zinc

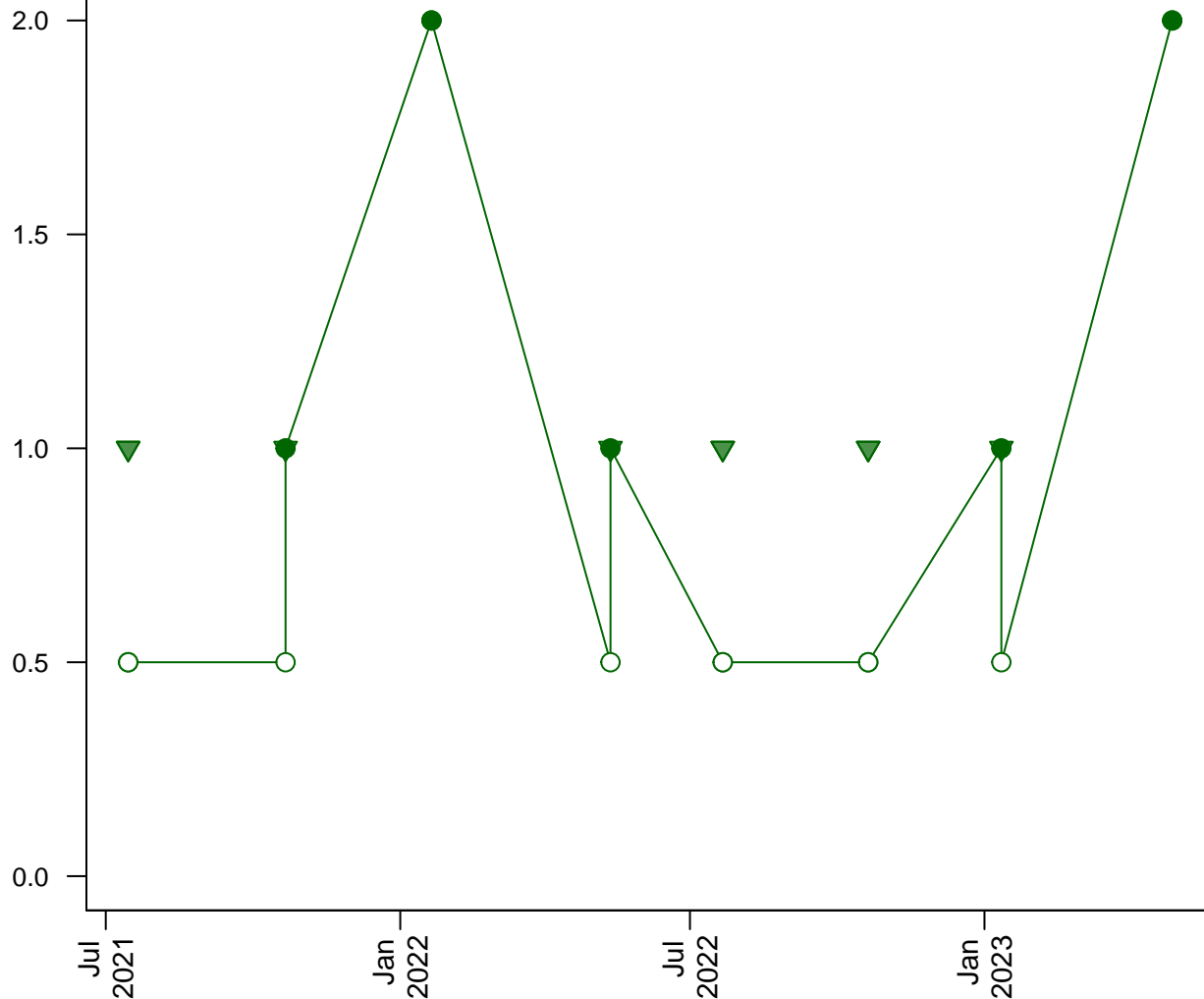
Concentration (µg/L)



Scatterplots and Trend Analysis

D2, Arsenic

Concentration (µg/L)



Stats

N Data: 16

N Detect: 7

% Detect: 44

MK criteria not met

Shapes

● Detect

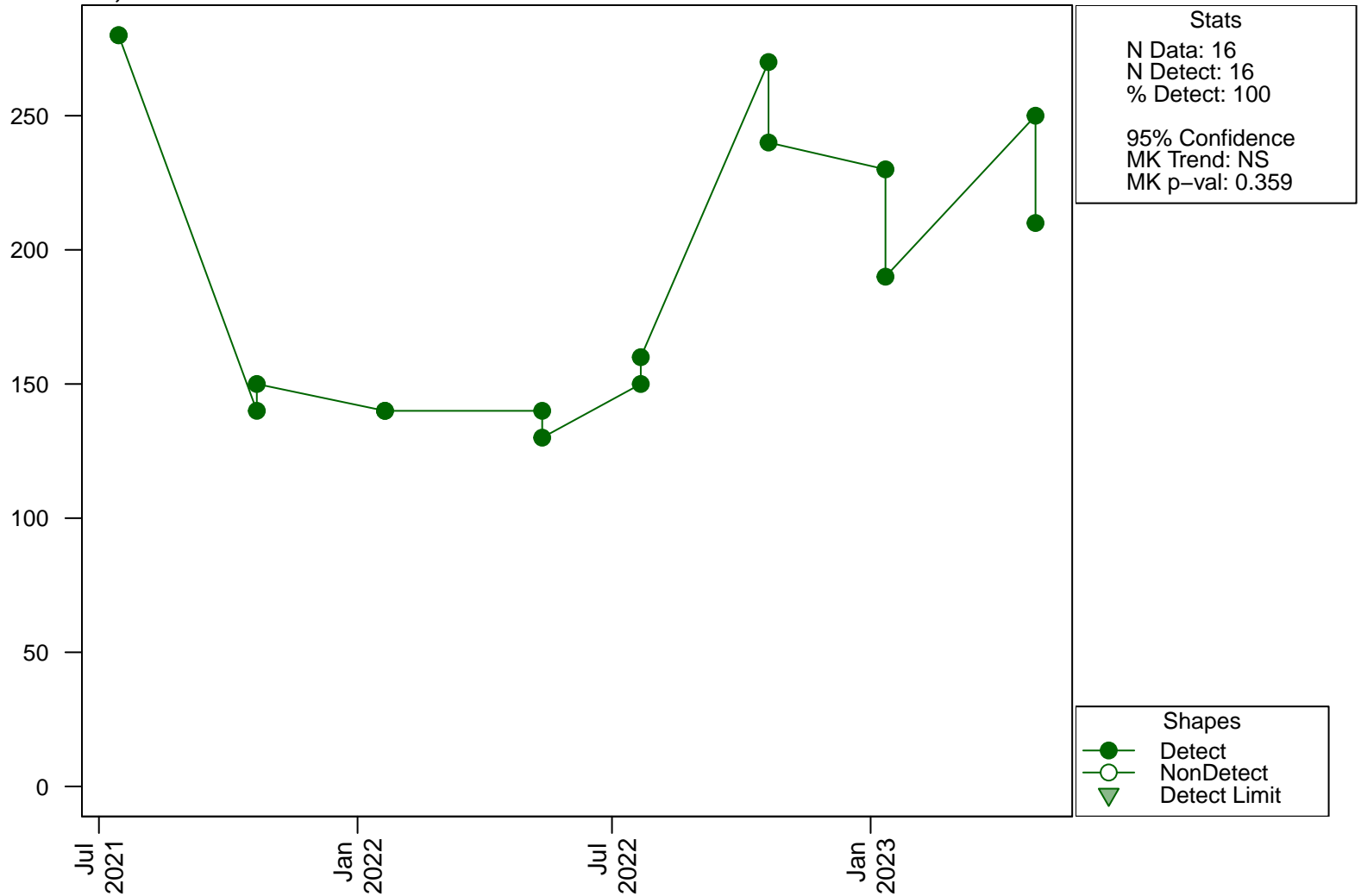
○ NonDetect

▼ Detect Limit

Scatterplots and Trend Analysis

D2, Boron

Concentration (µg/L)



Scatterplots and Trend Analysis

D2, Cadmium

Concentration (µg/L)

0.10
0.08
0.06
0.04
0.02
0.00

Jul
2021

Jan
2022

Jul
2022

Jan
2023

Stats

N Data: 8

N Detect: 2

% Detect: 25

MK criteria not met

Shapes

● Detect

○ NonDetect

▼ Detect Limit

Jul
2021

Jan
2022

Jul
2022

Jan
2023

Stats

N Data: 8

N Detect: 2

% Detect: 25

MK criteria not met

Shapes

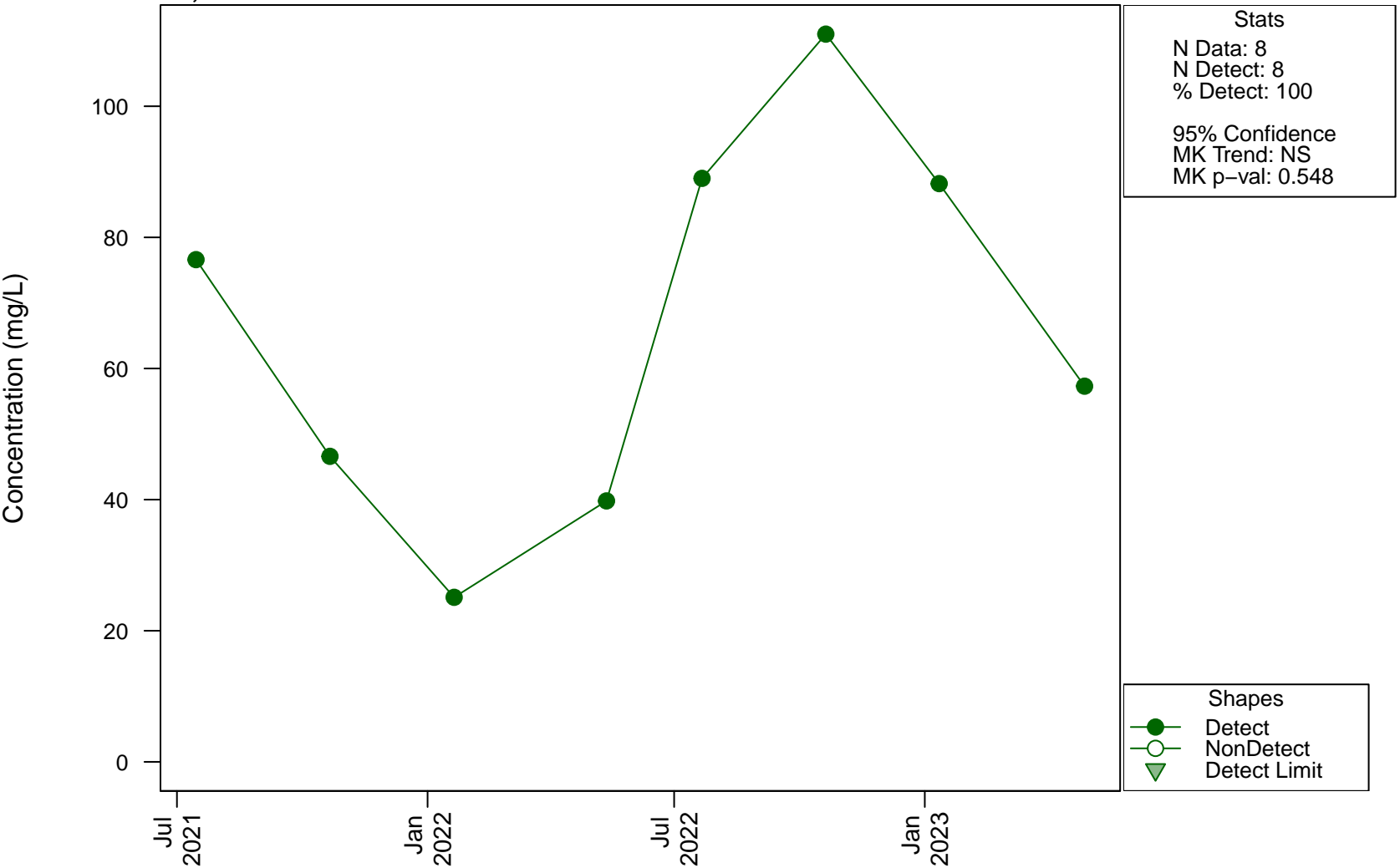
● Detect

○ NonDetect

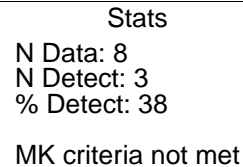
▼ Detect Limit

Scatterplots and Trend Analysis

D2, Chloride



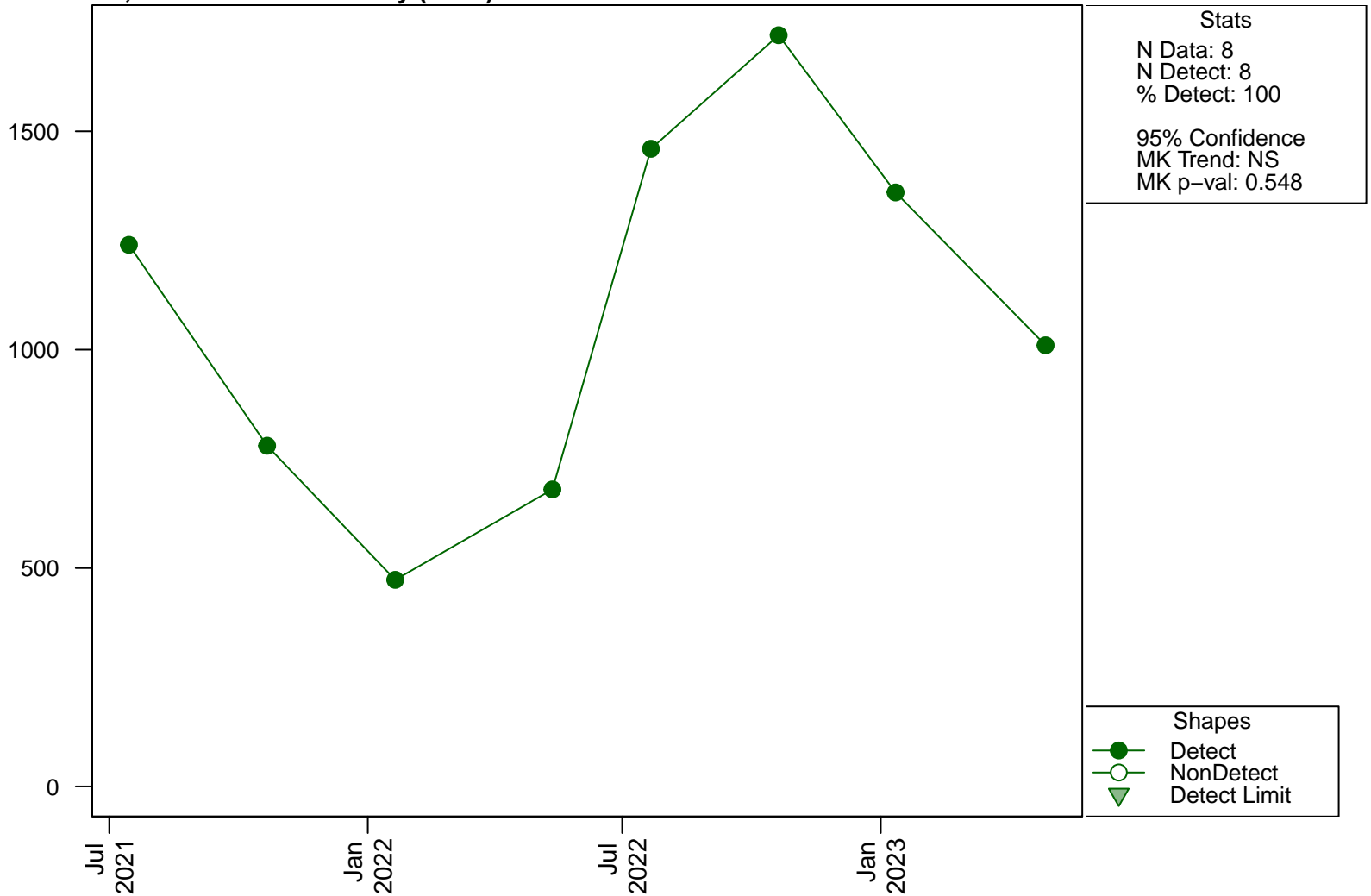
D2, Chromium



Scatterplots and Trend Analysis

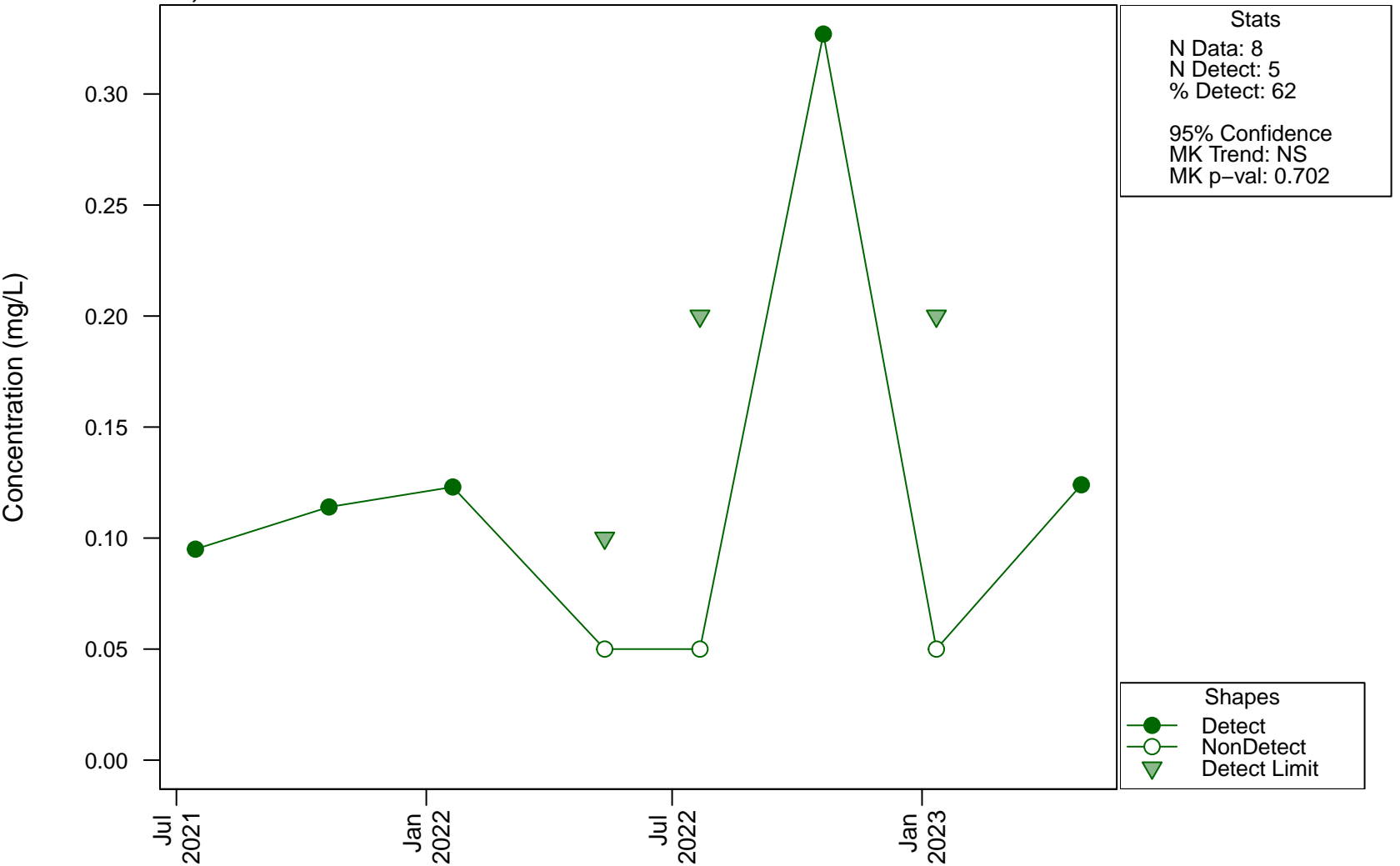
D2, Electrical Conductivity (Field)

Concentration (uS/cm)



Scatterplots and Trend Analysis

D2, Fluoride



Scatterplots and Trend Analysis

D2, Iron

Concentration (µg/L)

8000
6000
4000
2000
0

Jul
2021

Jan
2022

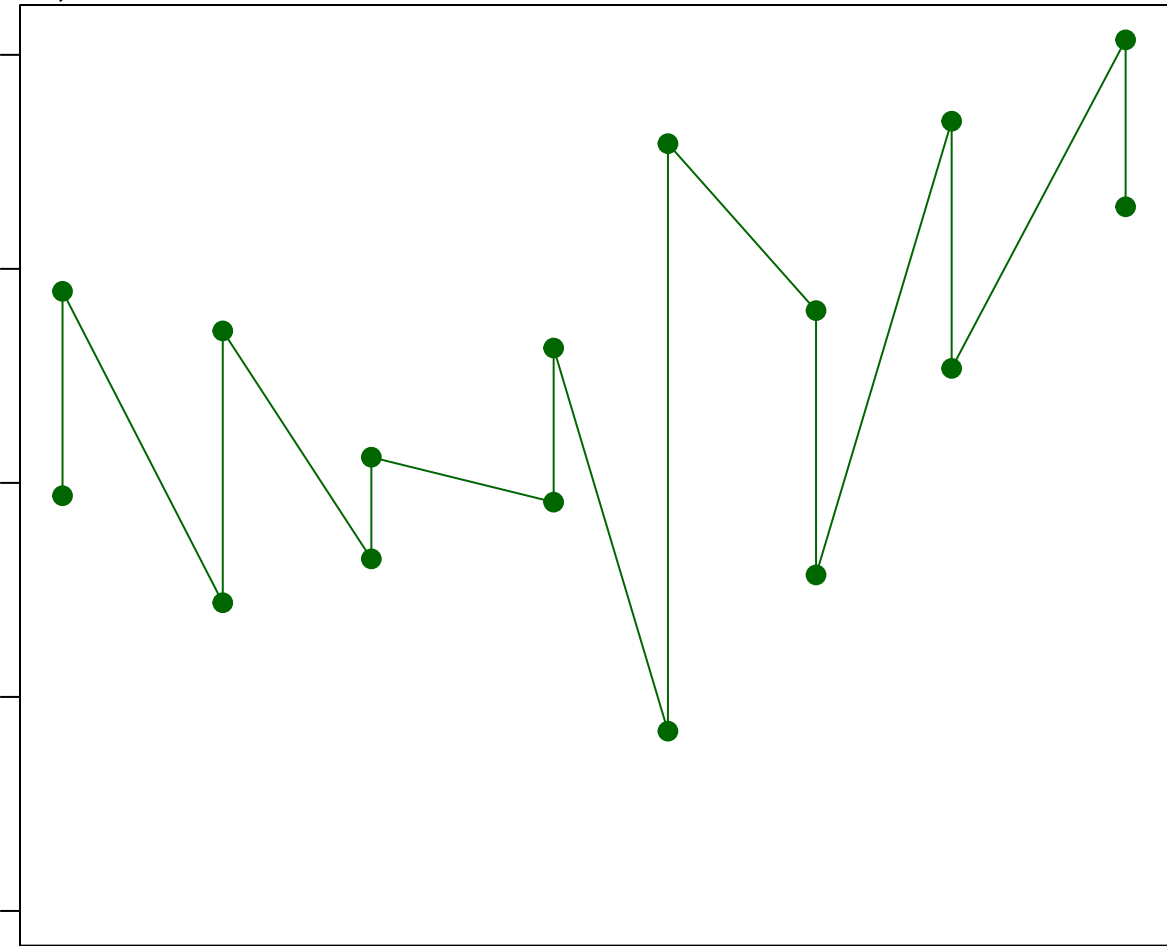
Jul
2022

Jan
2023

Stats
N Data: 16
N Detect: 16
% Detect: 100

95% Confidence
MK Trend: NS
MK p-val: 0.123

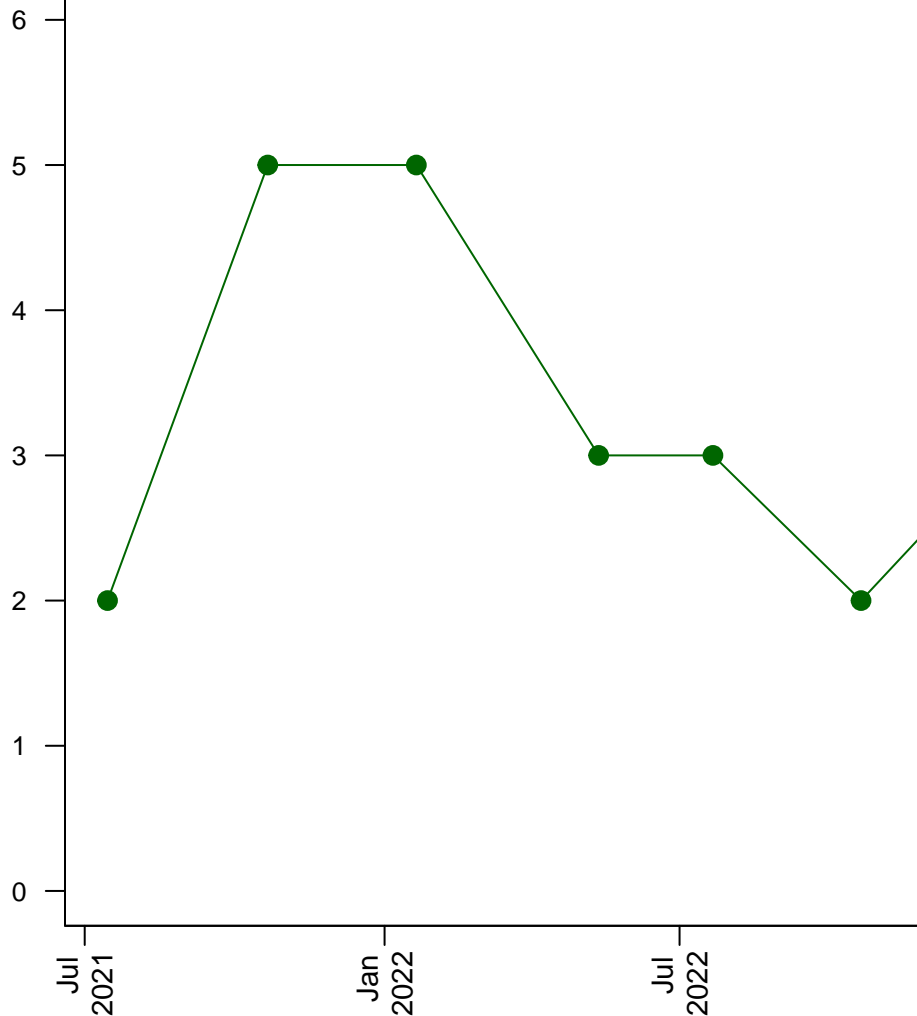
Shapes
● Detect
○ NonDetect
▼ Detect Limit



Scatterplots and Trend Analysis

D2, Lead

Concentration (µg/L)



Stats

N Data: 8

N Detect: 8

% Detect: 100

95% Confidence

MK Trend: NS

MK p-val: 0.698

Shapes

● Detect

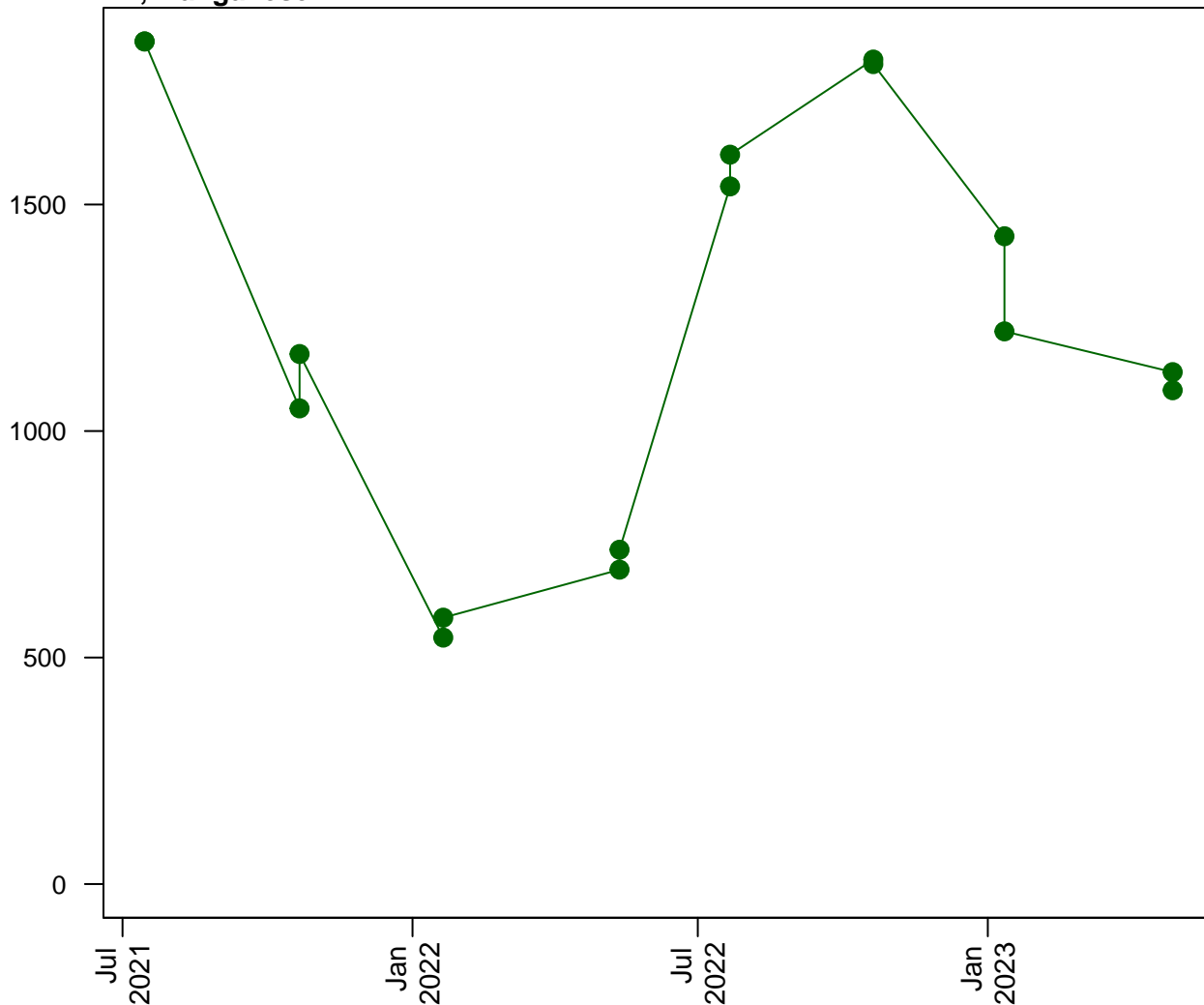
○ NonDetect

▼ Detect Limit

Scatterplots and Trend Analysis

D2, Manganese

Concentration (µg/L)



Stats

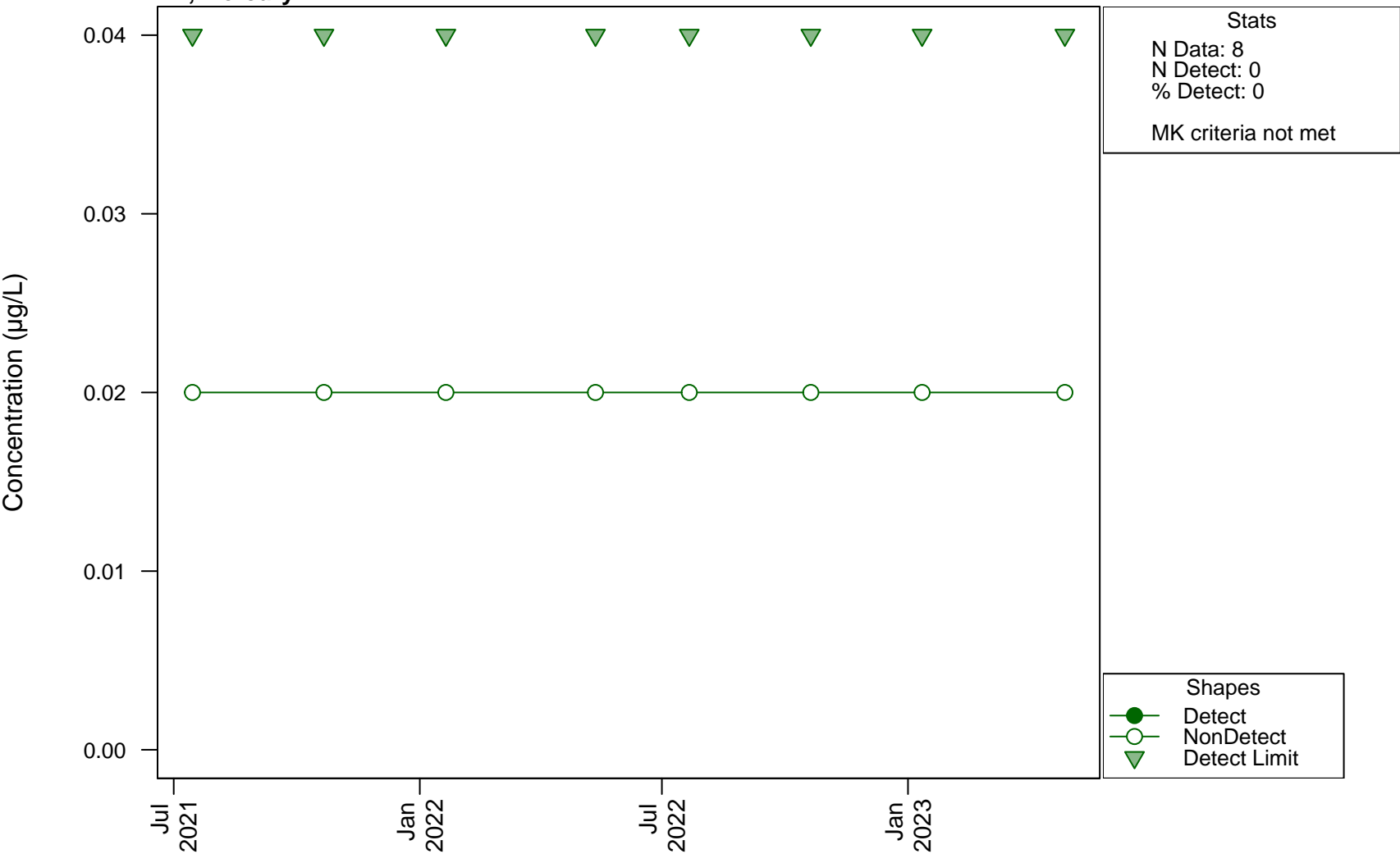
N Data: 16
N Detect: 16
% Detect: 100

95% Confidence
MK Trend: NS
MK p-val: 0.856

Shapes

● Detect
○ NonDetect
▼ Detect Limit

D2, Mercury



Scatterplots and Trend Analysis

D2, Molybdenum

Concentration (µg/L)

1.0
0.8
0.6
0.4
0.2
0.0

Jul
2021

Jan
2022

Jul
2022

Jan
2023

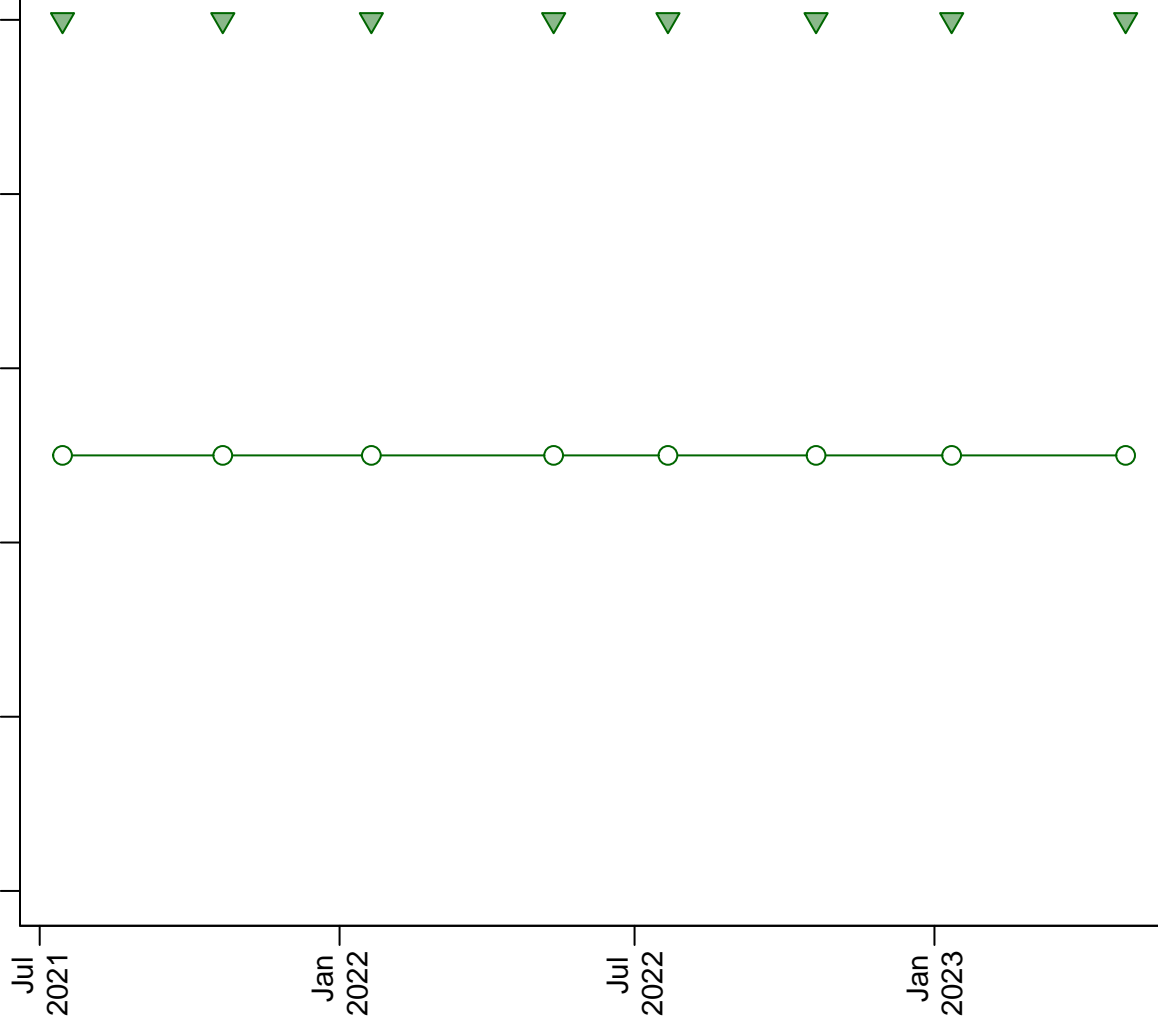
Stats

N Data: 8
N Detect: 0
% Detect: 0

MK criteria not met

Shapes

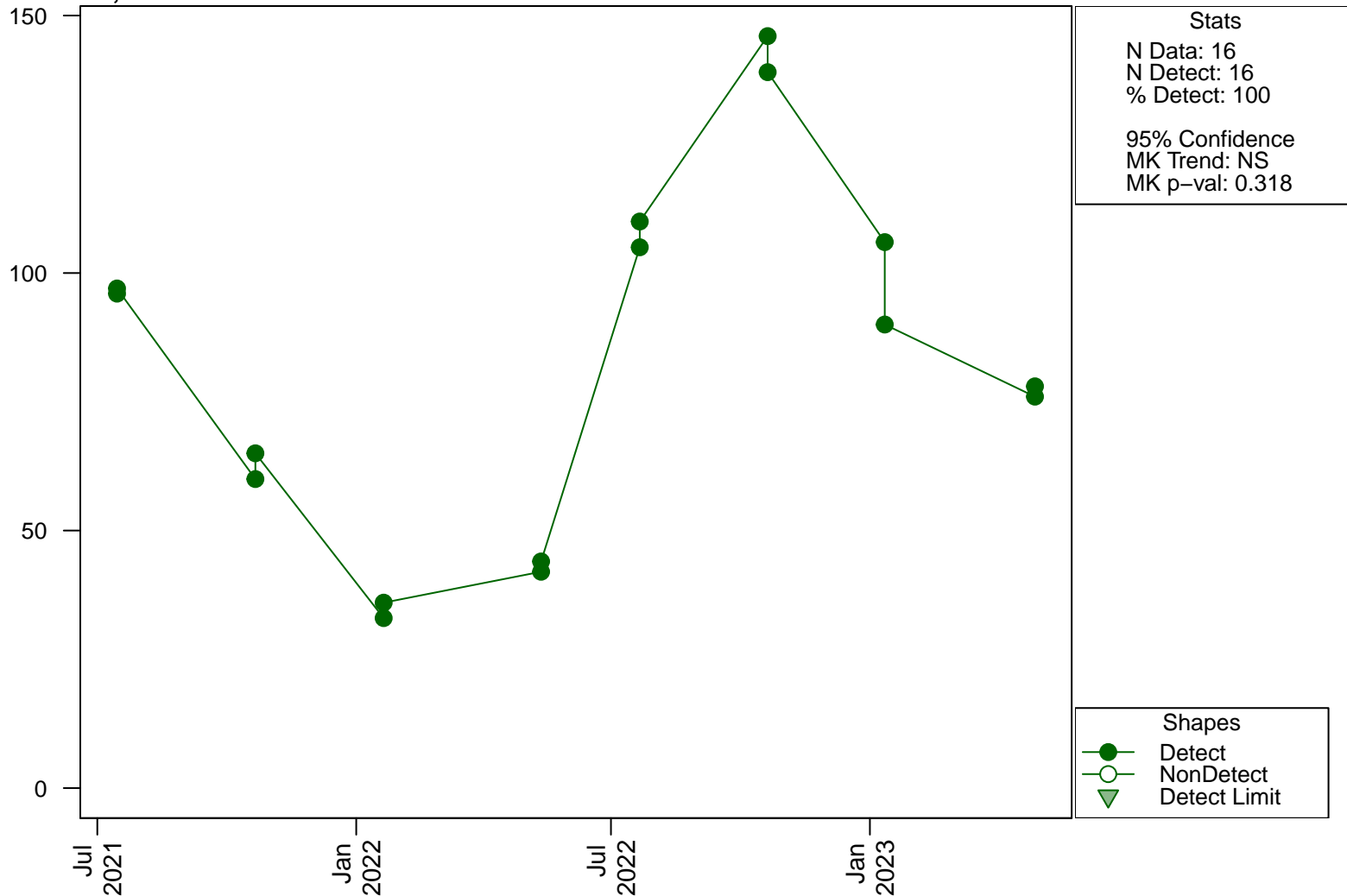
● Detect
○ NonDetect
▼ Detect Limit



Scatterplots and Trend Analysis

D2, Nickel

Concentration (µg/L)



Scatterplots and Trend Analysis

D2, Selenium

Concentration (µg/L)

10
8
6
4
2
0

Jul
2021

Jan
2022

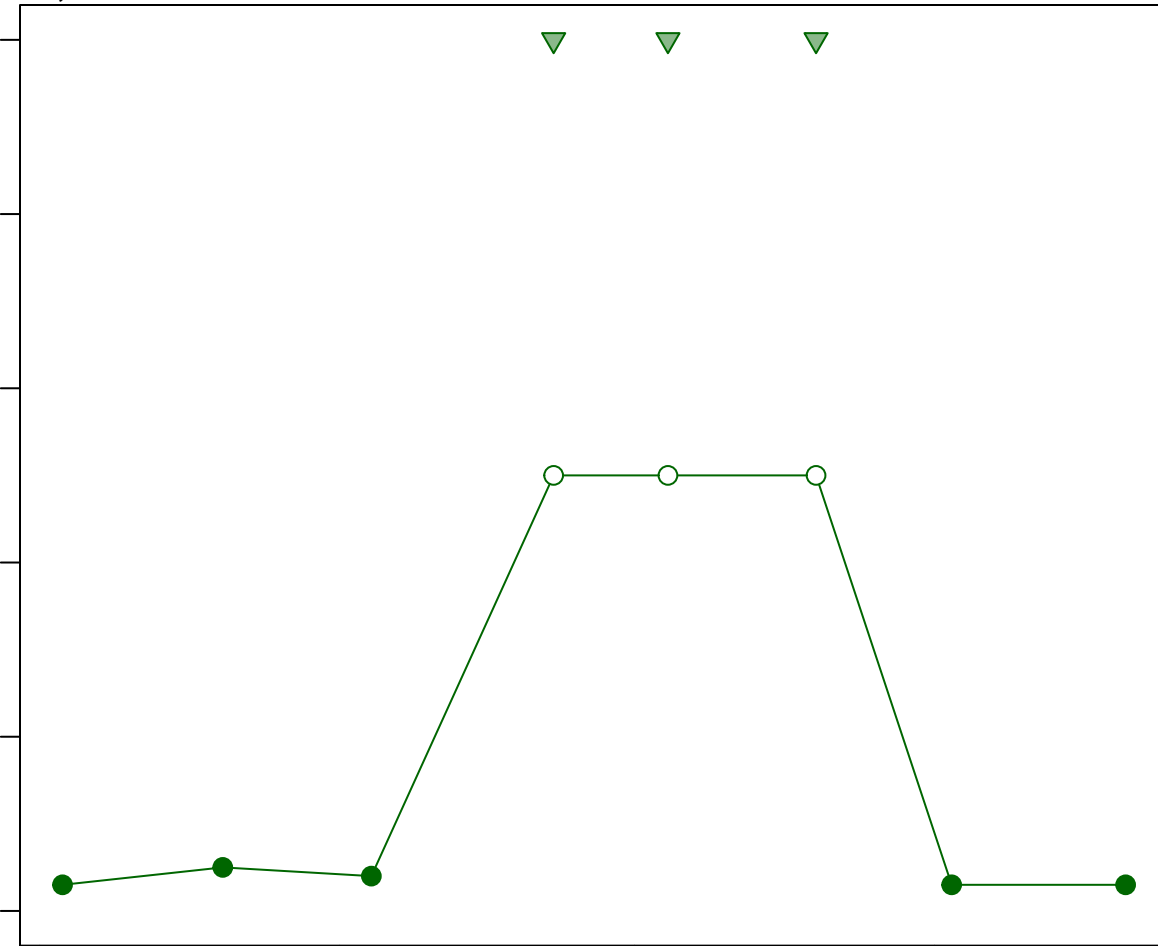
Jul
2022

Jan
2023

Stats
N Data: 8
N Detect: 5
% Detect: 62

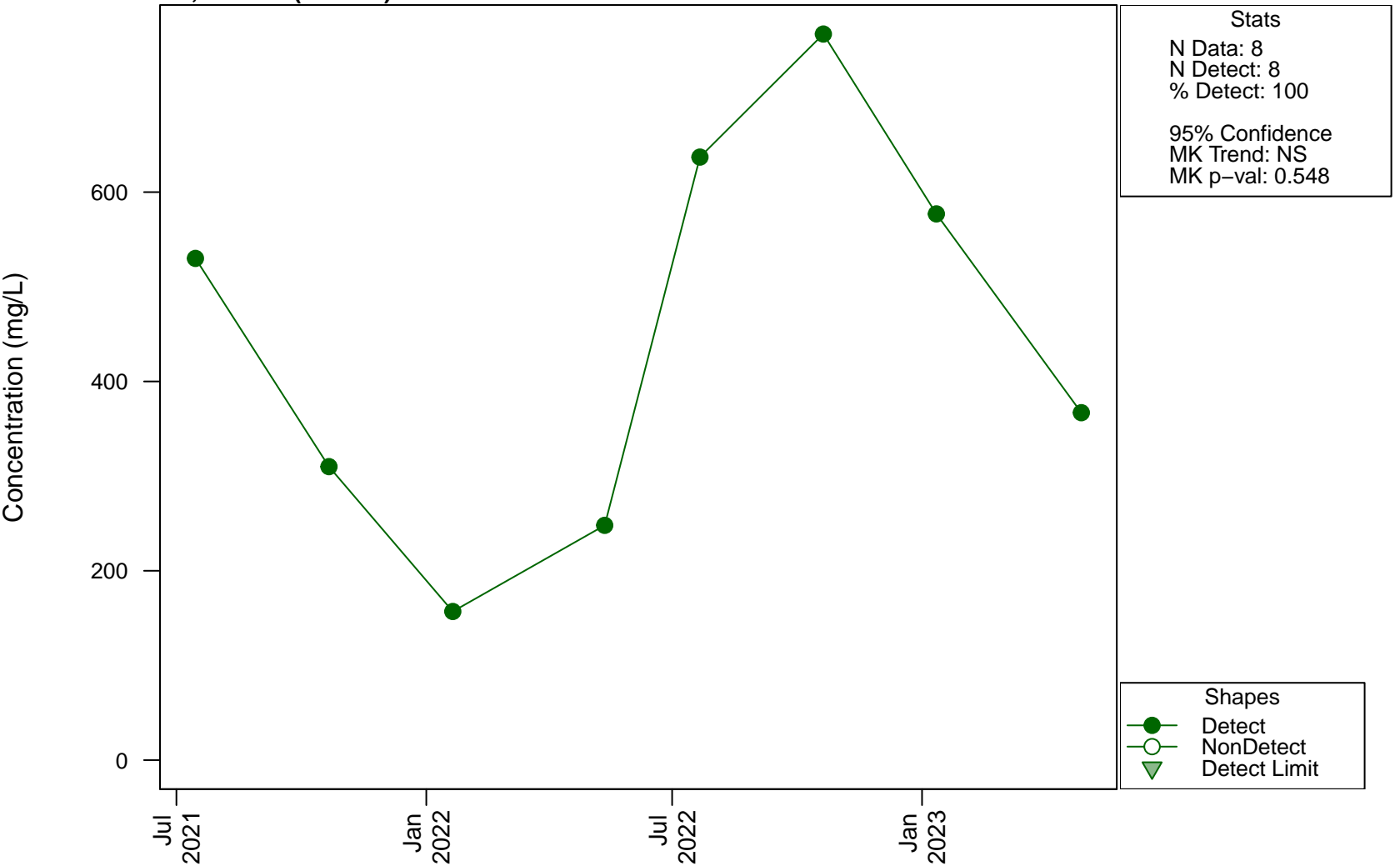
95% Confidence
MK Trend: NS
MK p-val: 1

Shapes
● Detect
○ NonDetect
▼ Detect Limit



Scatterplots and Trend Analysis

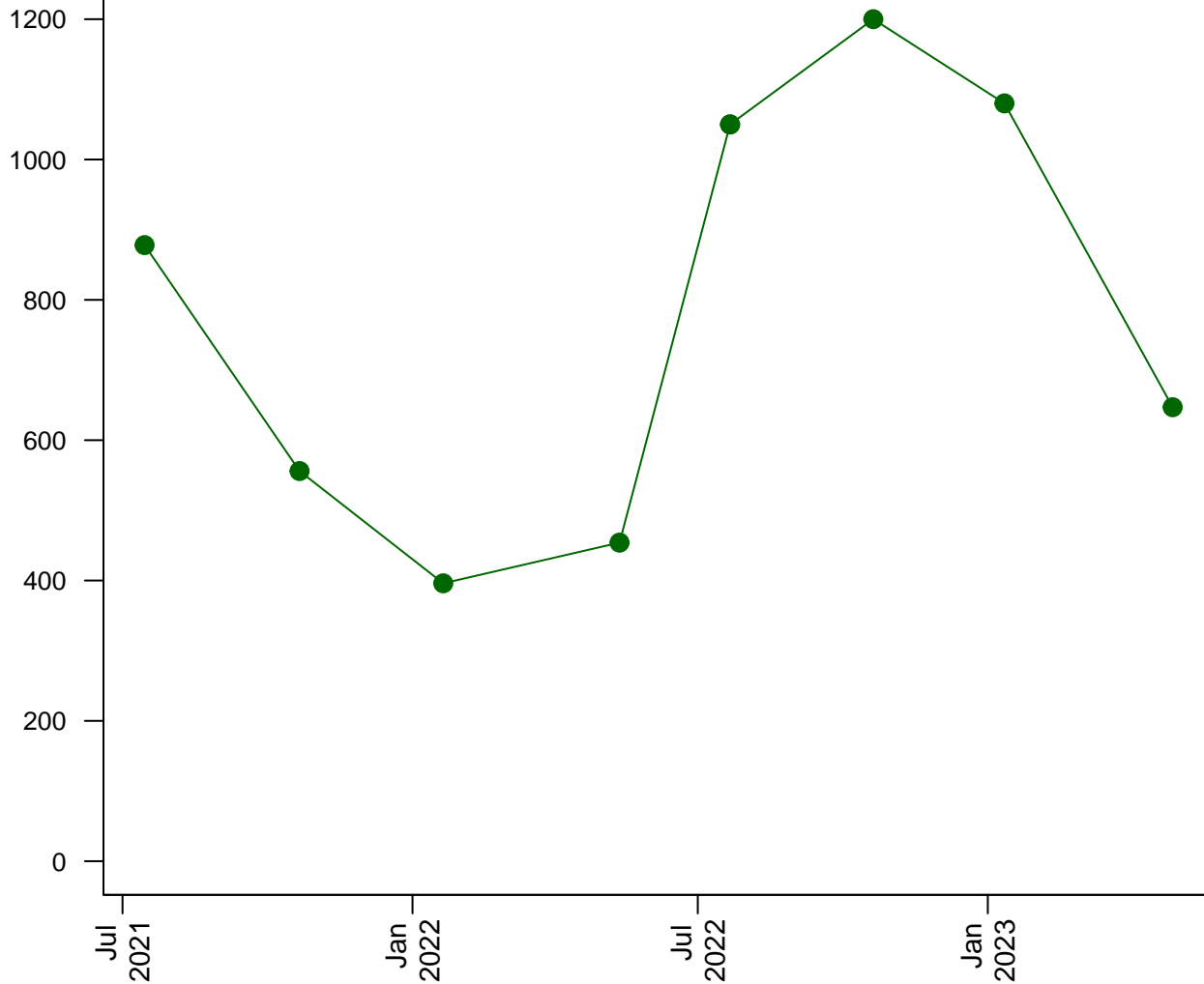
D2, Sulfate (as SO4)



Scatterplots and Trend Analysis

D2, Total Dissolved Solids (TDS)

Concentration (mg/L)



Stats

N Data: 9

N Detect: 9

% Detect: 100

95% Confidence

MK Trend: NS

MK p-val: 0.171

Shapes

● Detect

○ NonDetect

▼ Detect Limit

Scatterplots and Trend Analysis

D2, Zinc

Concentration (µg/L)

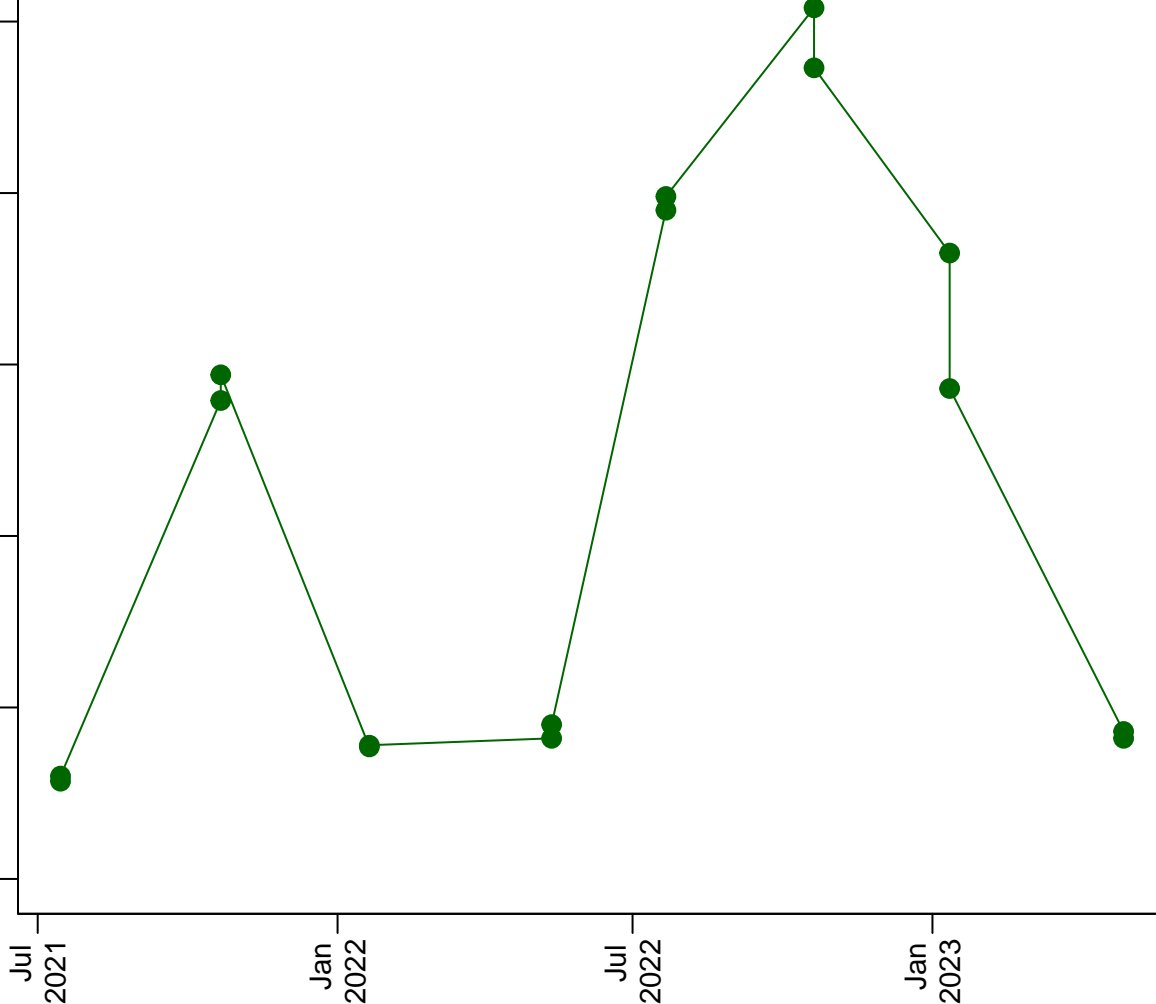
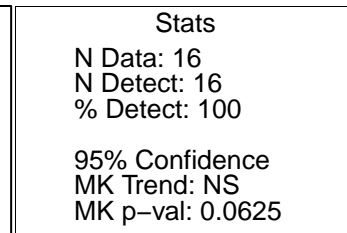
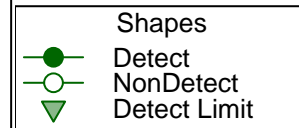
500
400
300
200
100
0

Jul
2021

Jan
2022

Jul
2022

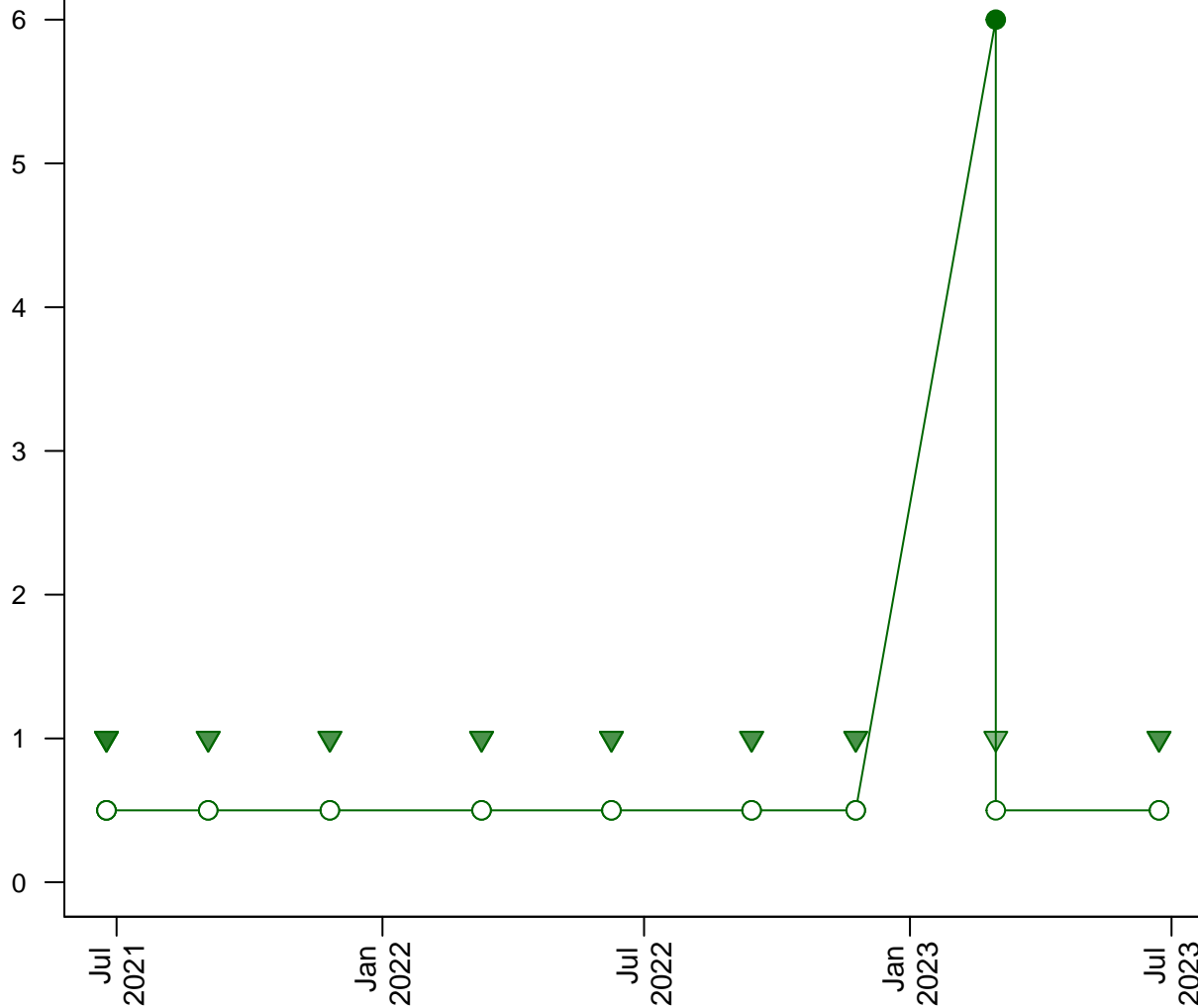
Jan
2023



Scatterplots and Trend Analysis

D3, Arsenic

Concentration (µg/L)



Stats

N Data: 19

N Detect: 1

% Detect: 5

MK criteria not met

Shapes

● Detect

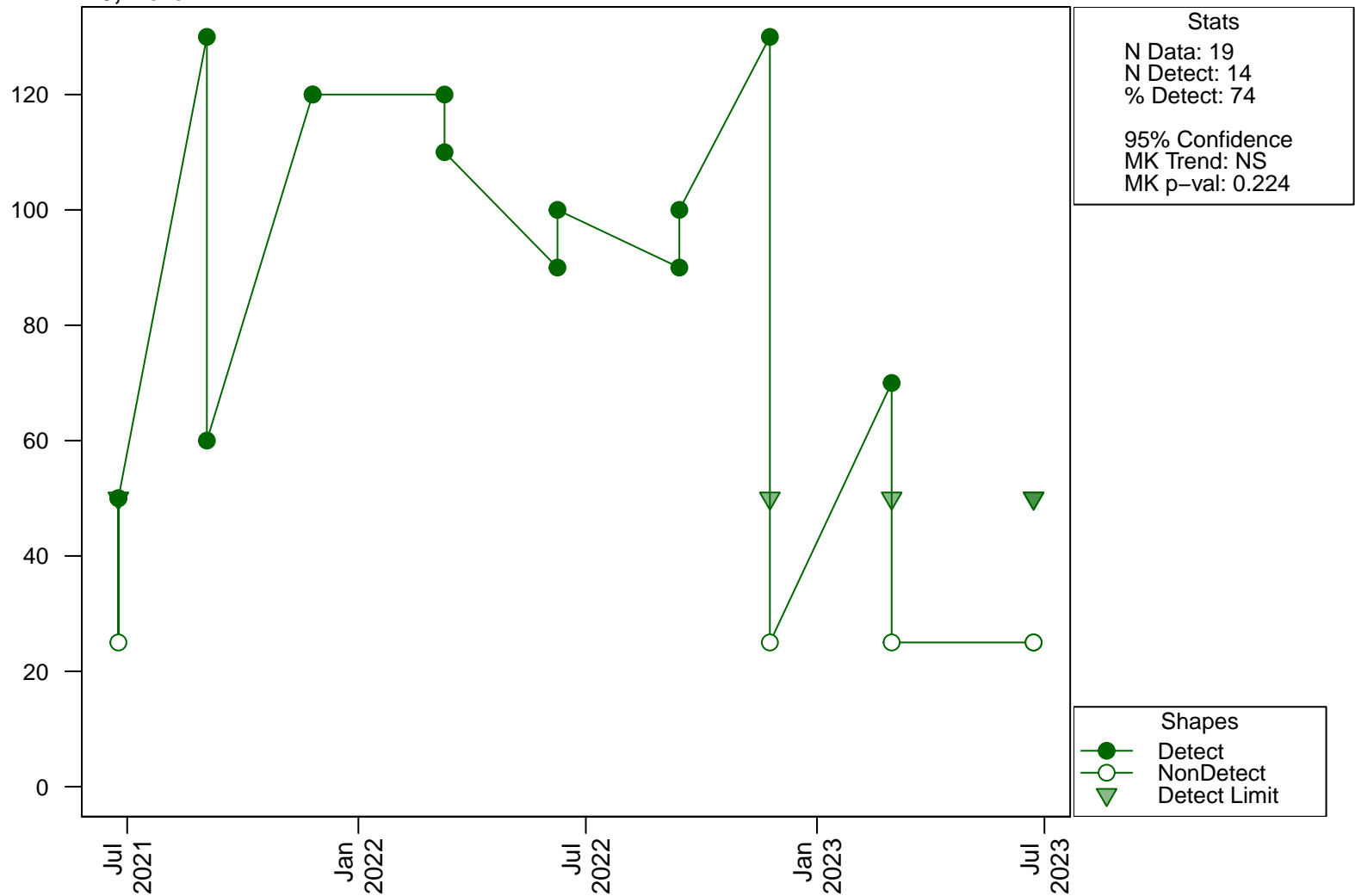
○ NonDetect

▼ Detect Limit

Scatterplots and Trend Analysis

D3, Boron

Concentration (µg/L)



Scatterplots and Trend Analysis

D3, Cadmium

Concentration (µg/L)

0.10
0.08
0.06
0.04
0.02
0.00

Jul
2021

Jan
2022

Jul
2022

Jan
2023

Jul
2023

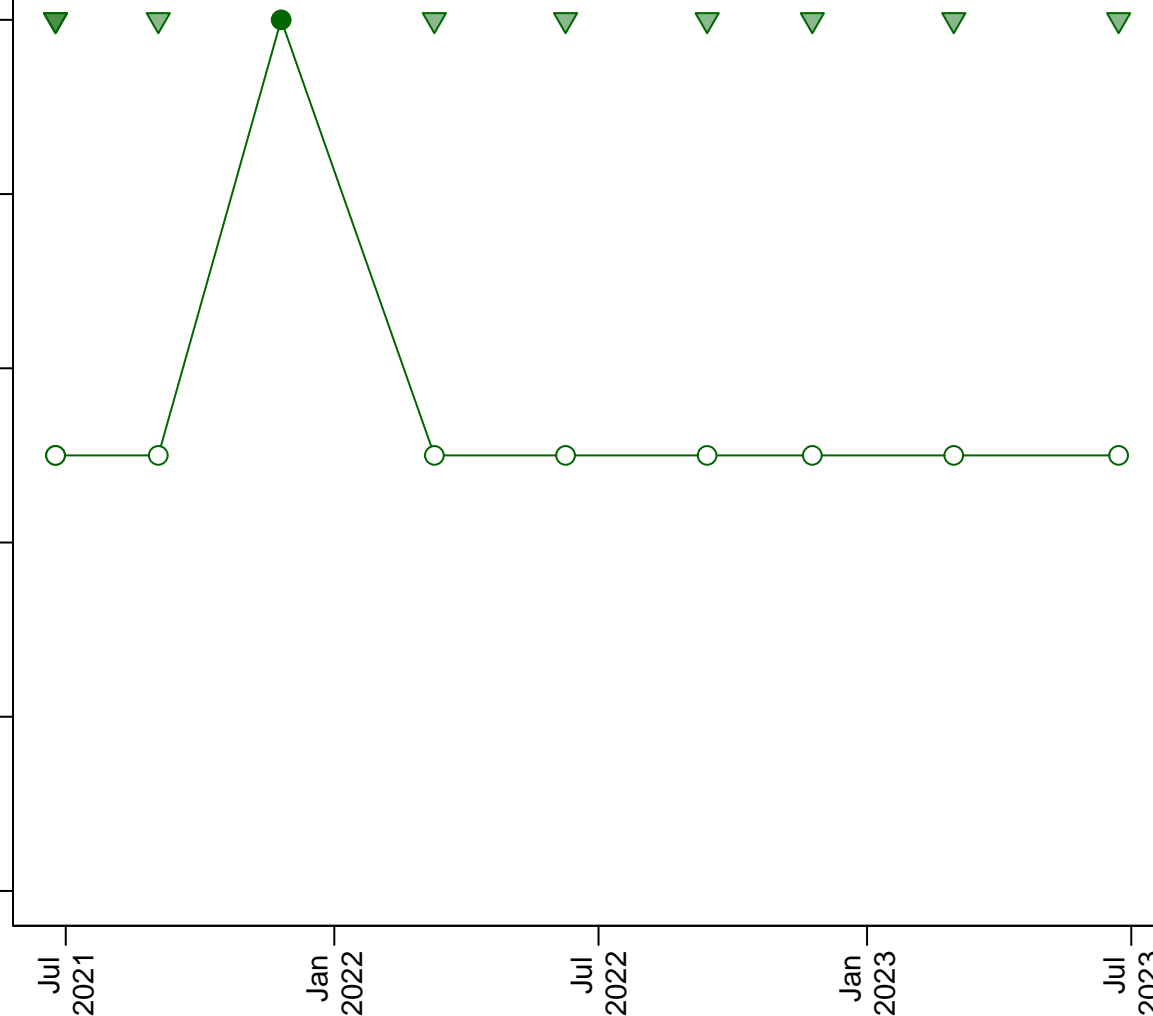
Stats

N Data: 10
N Detect: 1
% Detect: 10

MK criteria not met

Shapes

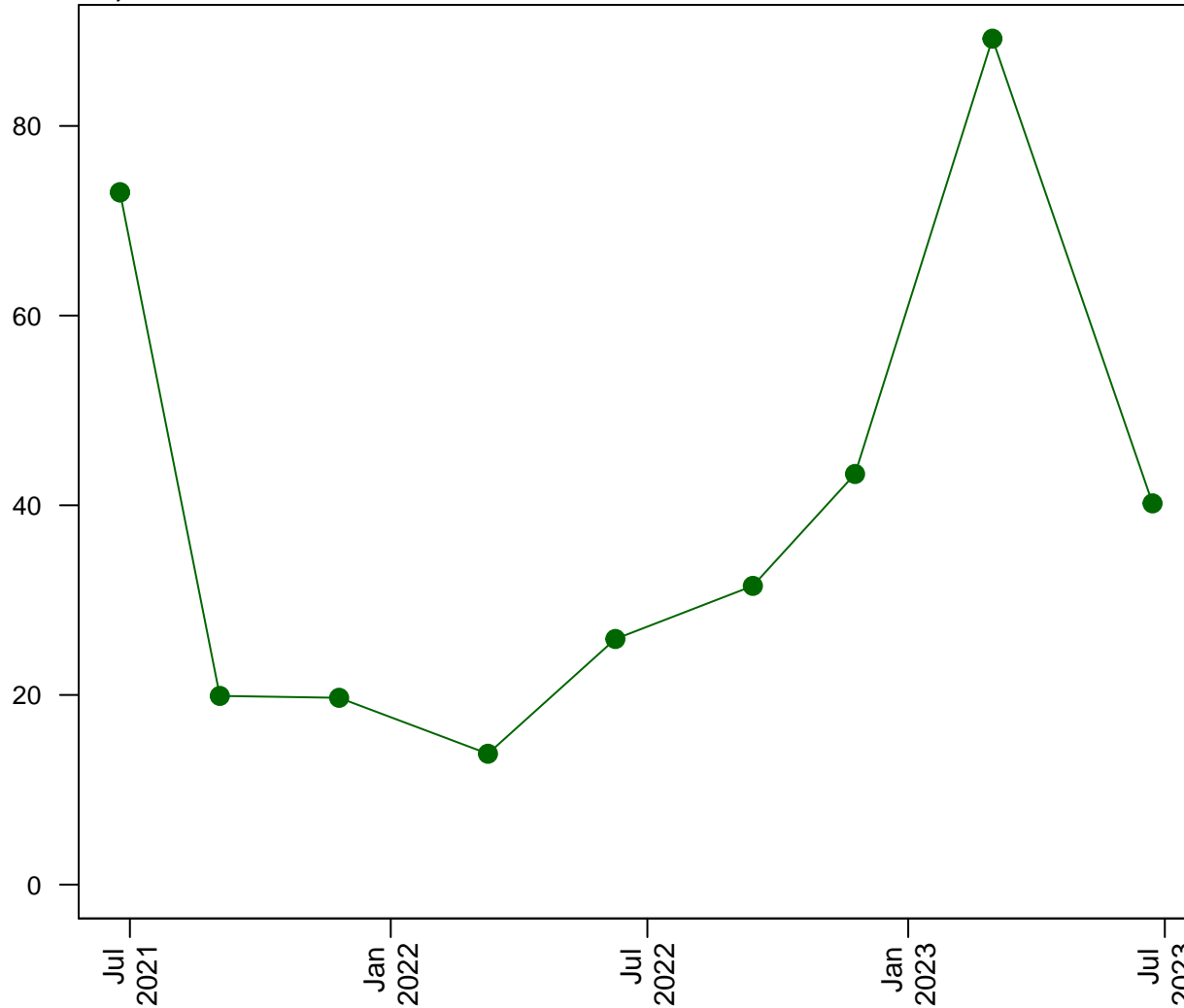
● Detect
○ NonDetect
▼ Detect Limit



Scatterplots and Trend Analysis

D3, Chloride

Concentration (mg/L)



Stats

N Data: 10
N Detect: 10
% Detect: 100

95% Confidence
MK Trend: NS
MK p-val: 0.589

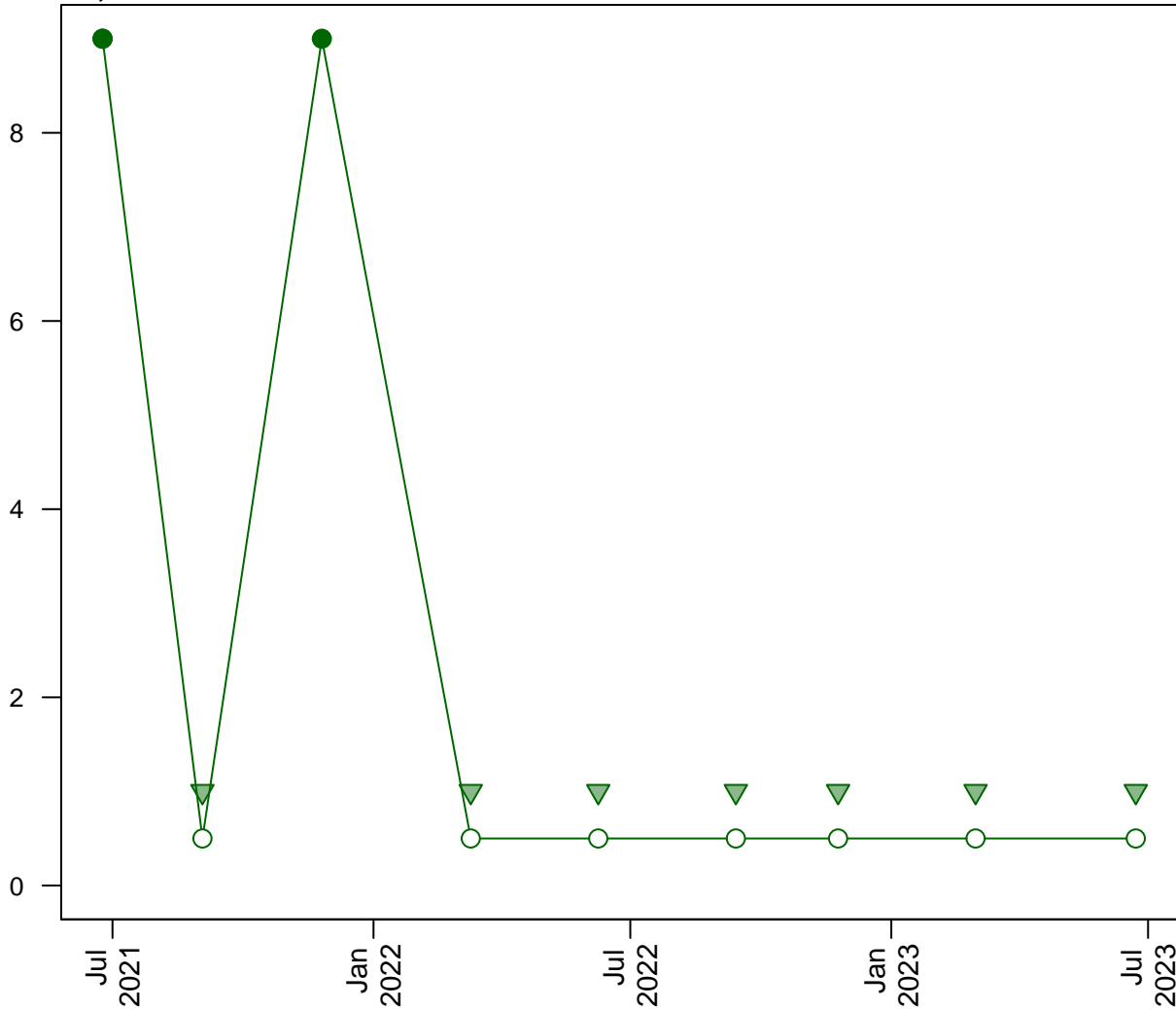
Shapes

● Detect
○ NonDetect
▼ Detect Limit

Scatterplots and Trend Analysis

D3, Chromium

Concentration (µg/L)



Stats

N Data: 10

N Detect: 3

% Detect: 30

MK criteria not met

Shapes



Detect



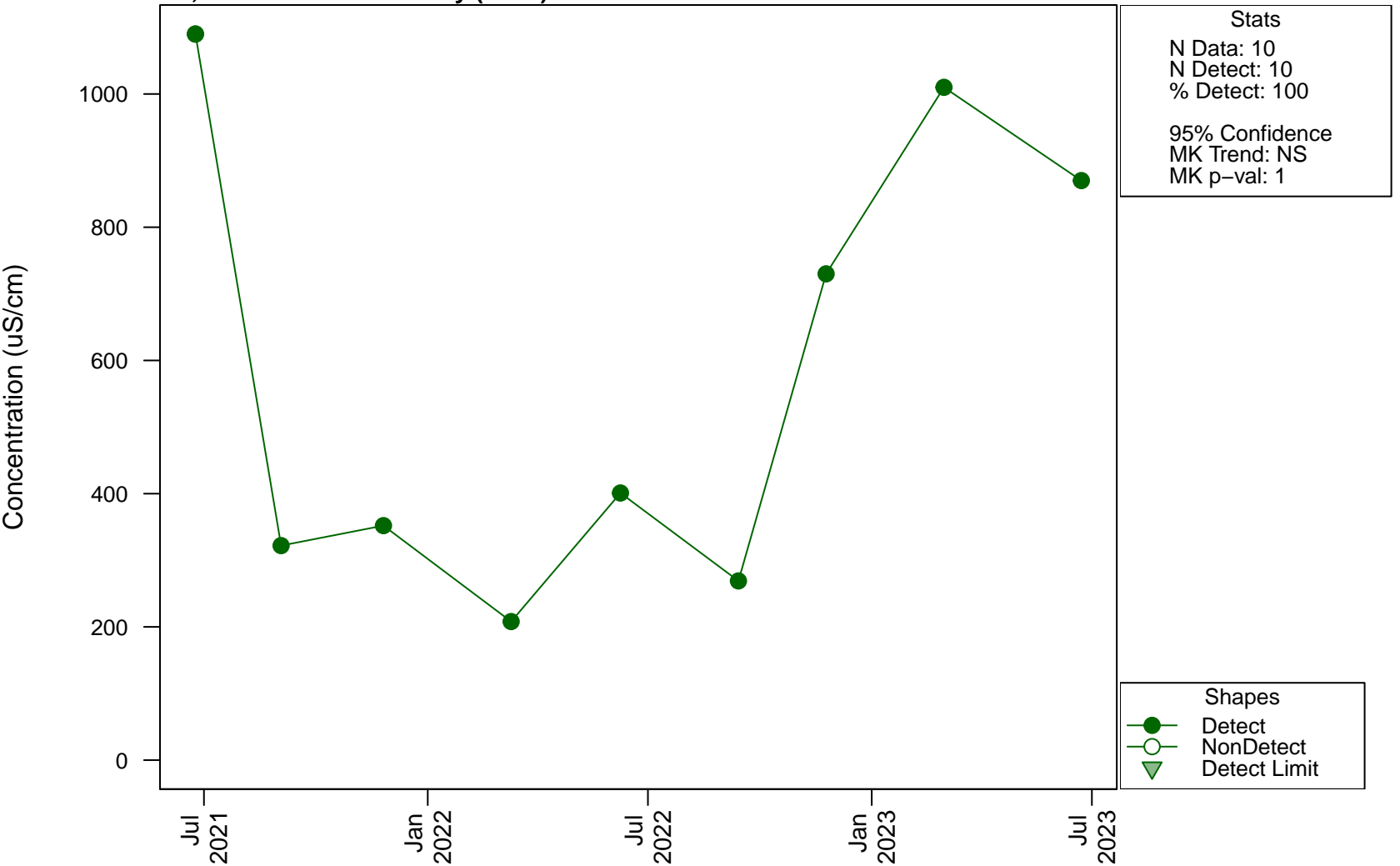
NonDetect



Detect Limit

Scatterplots and Trend Analysis

D3, Electrical Conductivity (Field)



Scatterplots and Trend Analysis

D3, Fluoride

Concentration (mg/L)

0.20
0.15
0.10
0.05
0.00

Jul
2021

Jan
2022

Jul
2022

Jan
2023

Jul
2023

Stats

N Data: 10

N Detect: 2

% Detect: 20

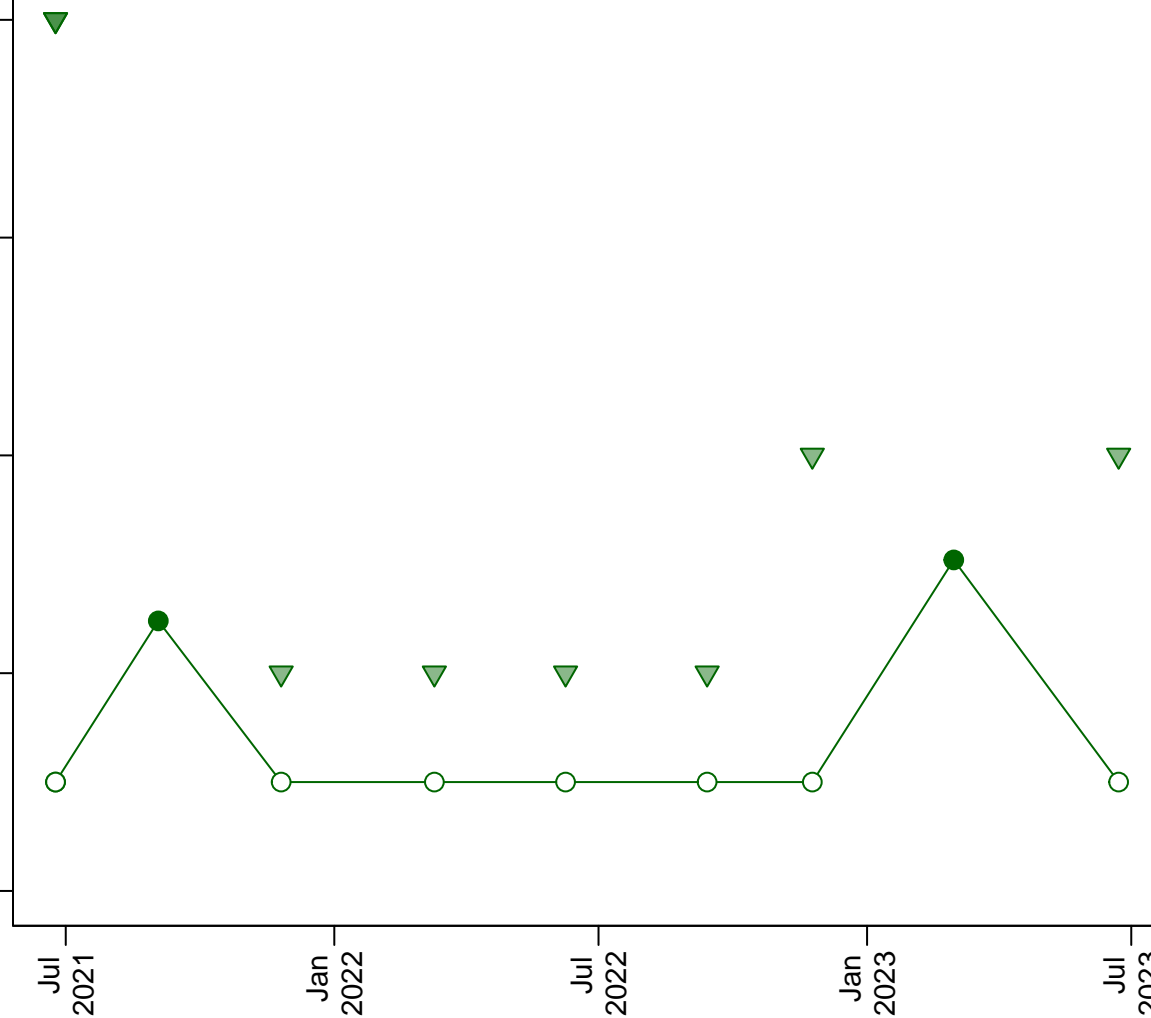
MK criteria not met

Shapes

● Detect

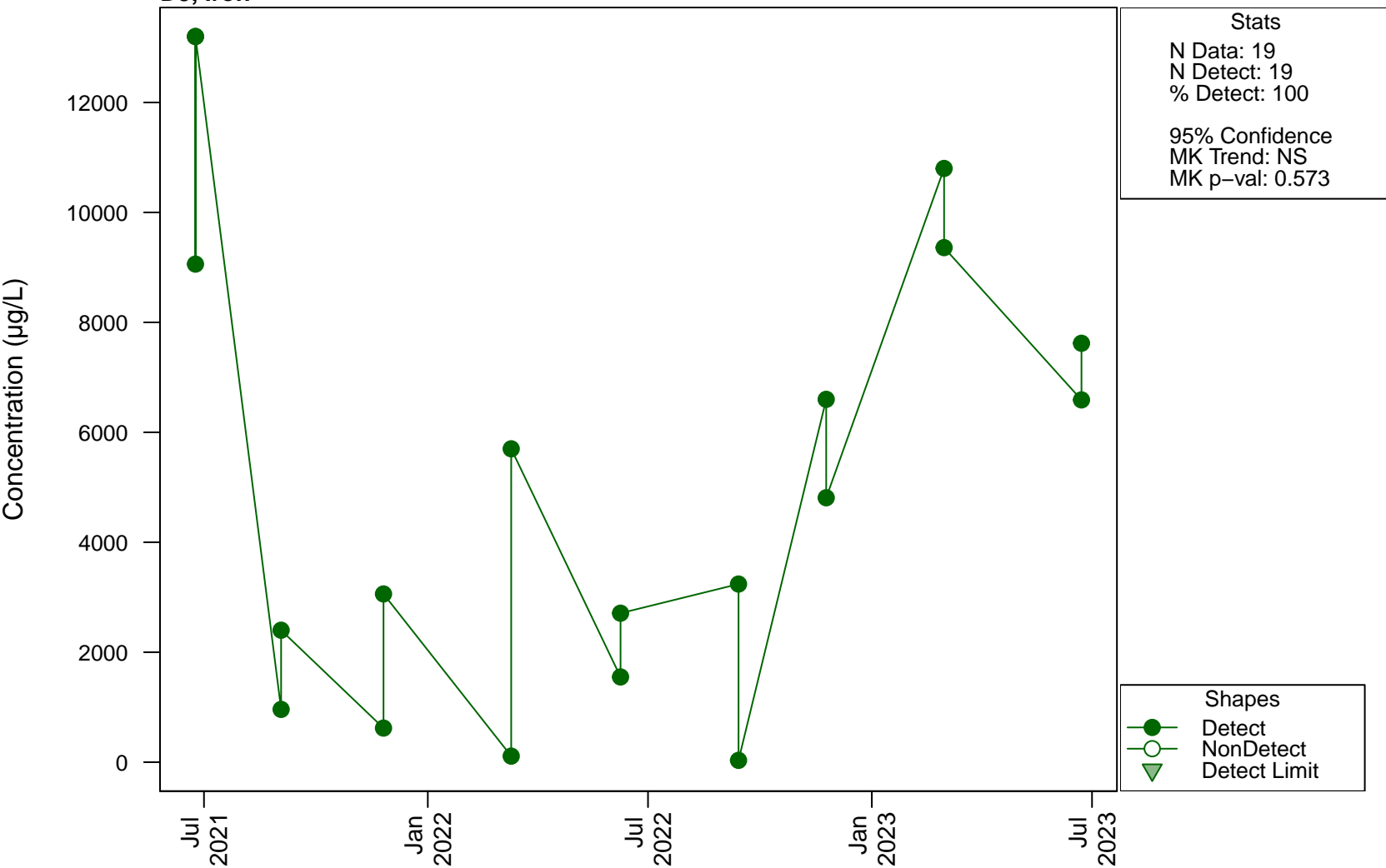
○ NonDetect

▼ Detect Limit

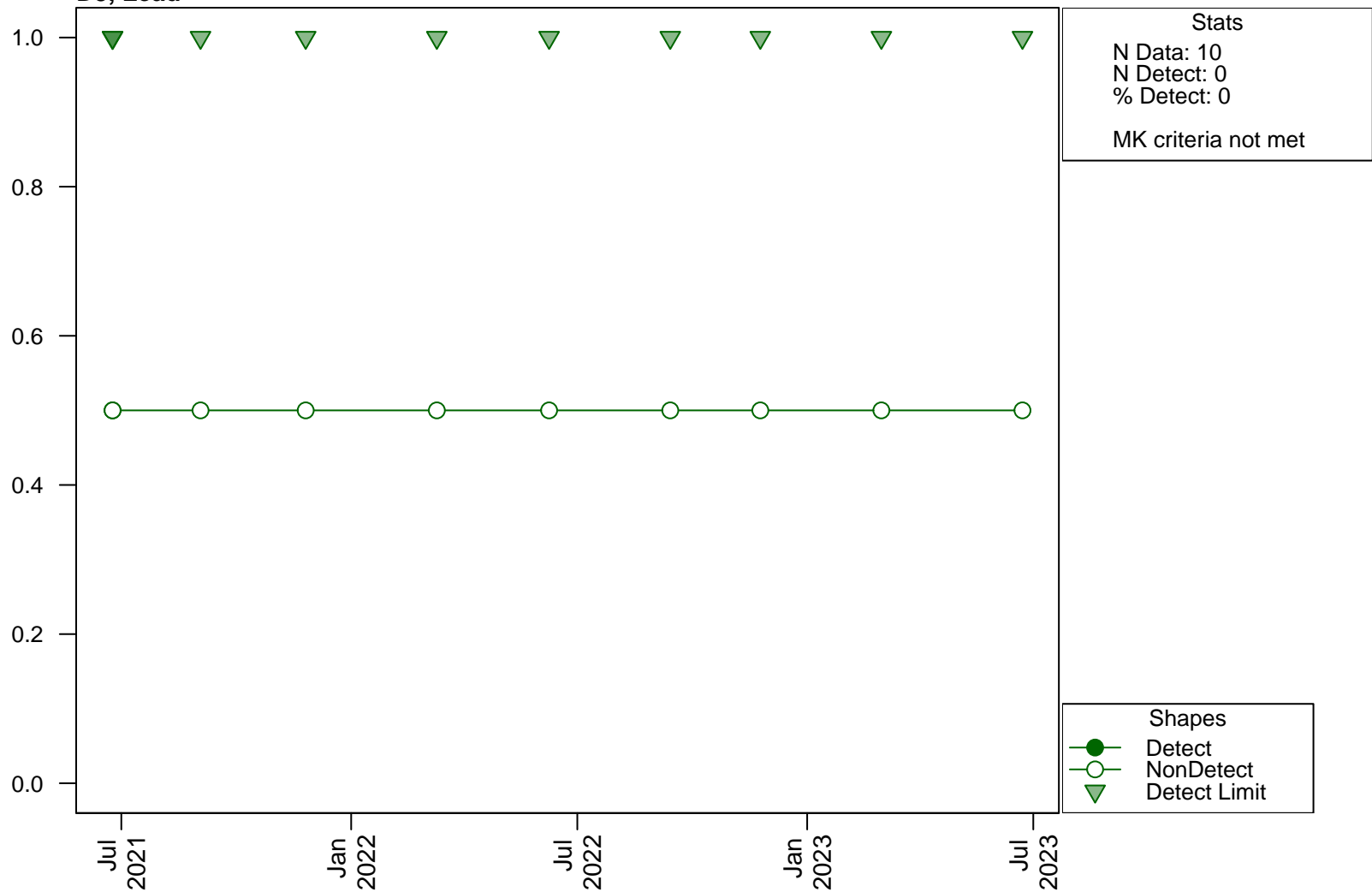


Scatterplots and Trend Analysis

D3, Iron



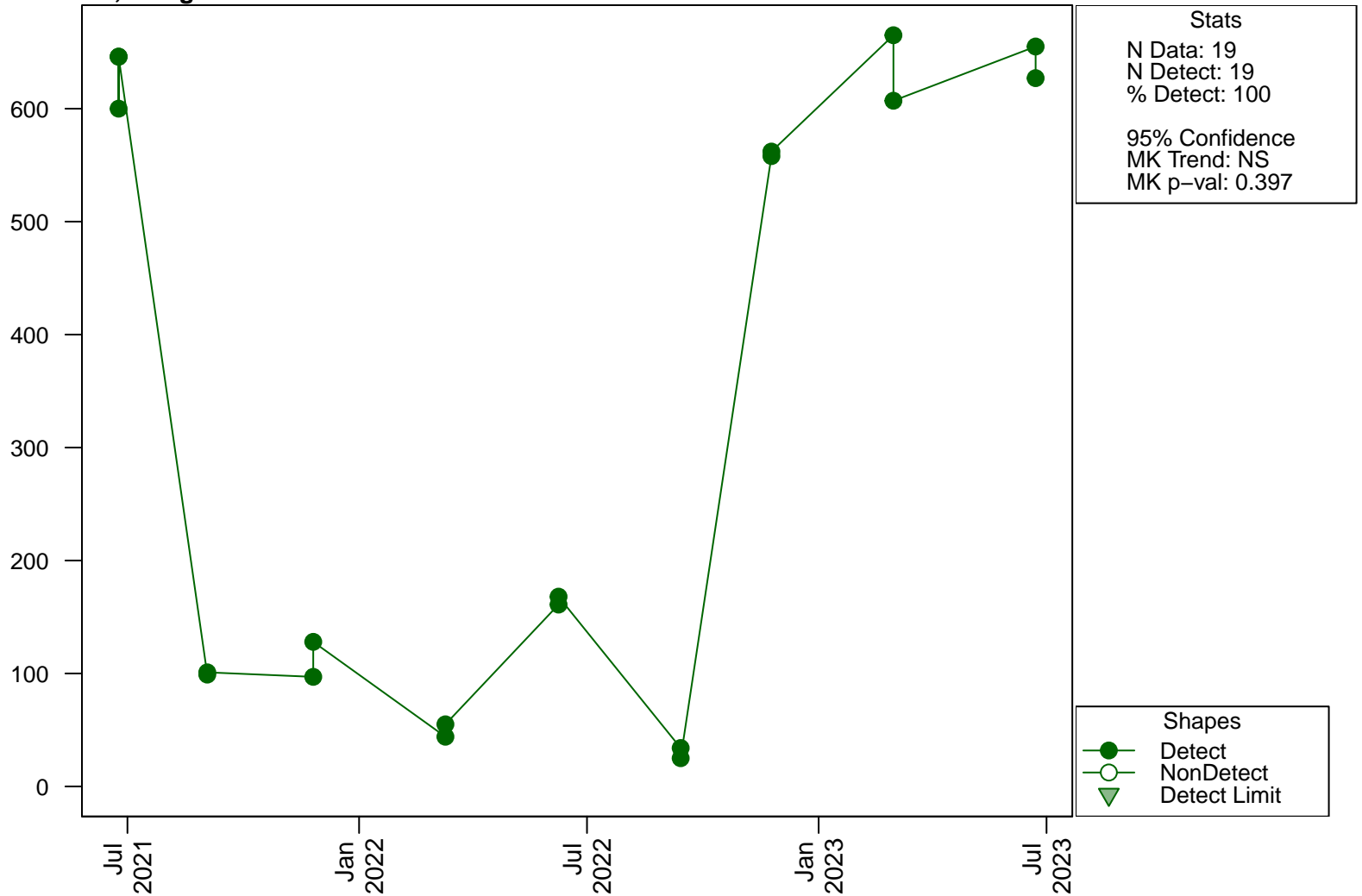
D3, Lead



Scatterplots and Trend Analysis

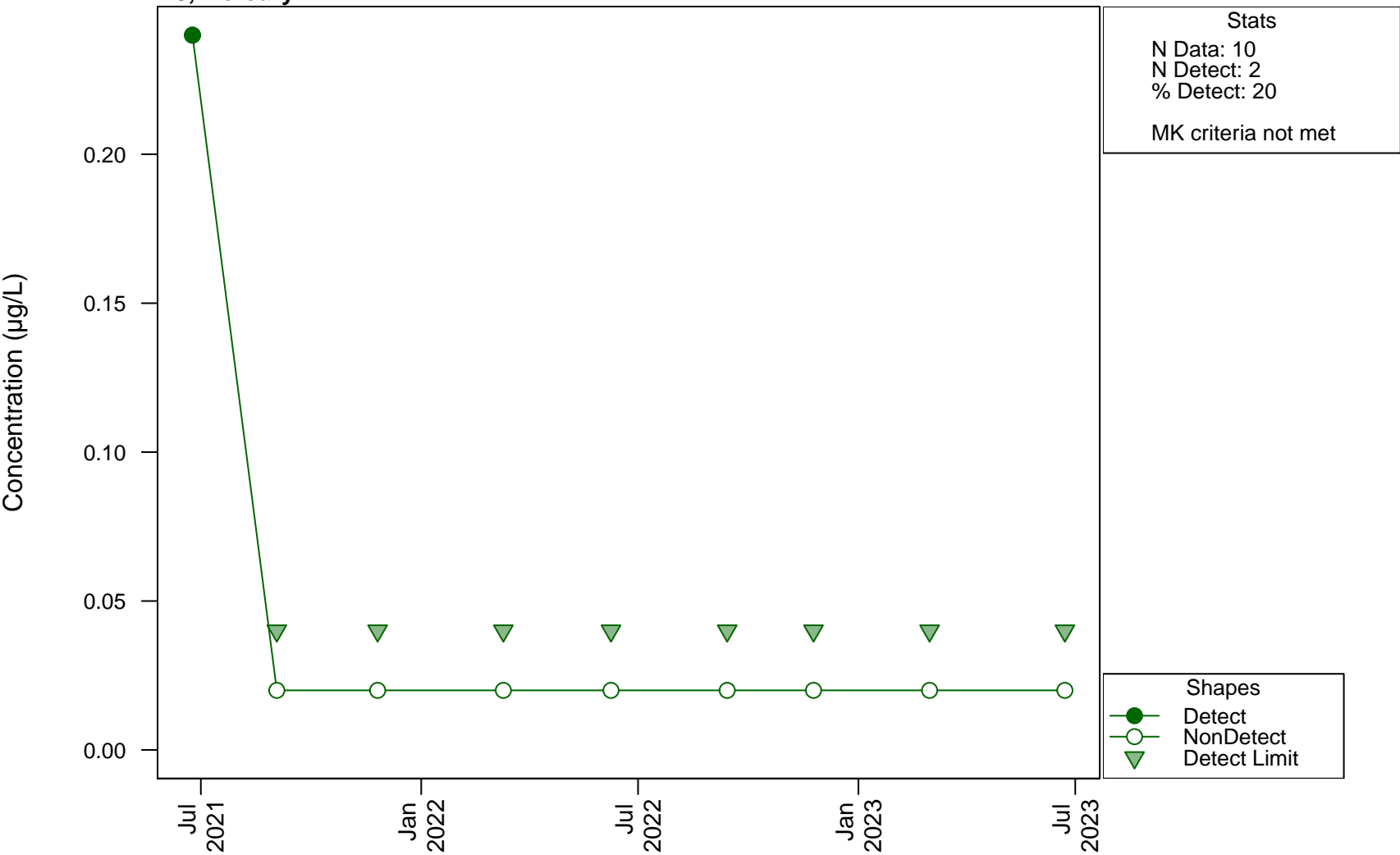
D3, Manganese

Concentration (µg/L)



Scatterplots and Trend Analysis

D3, Mercury



Scatterplots and Trend Analysis

D3, Molybdenum

Concentration (µg/L)

1.0
0.8
0.6
0.4
0.2
0.0

Jul
2021

Jan
2022

Jul
2022

Jan
2023

Jul
2023

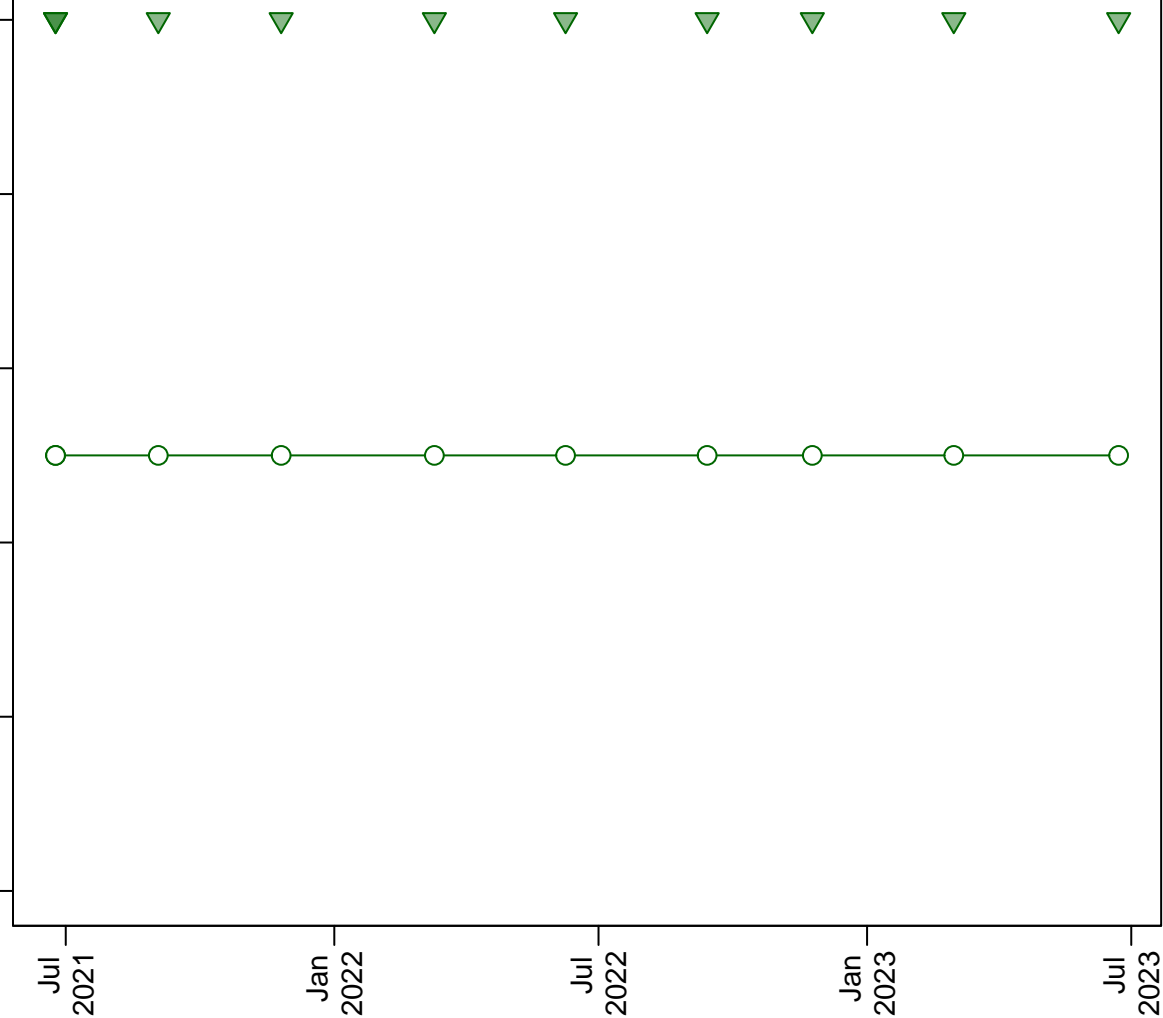
Stats

N Data: 10
N Detect: 0
% Detect: 0

MK criteria not met

Shapes

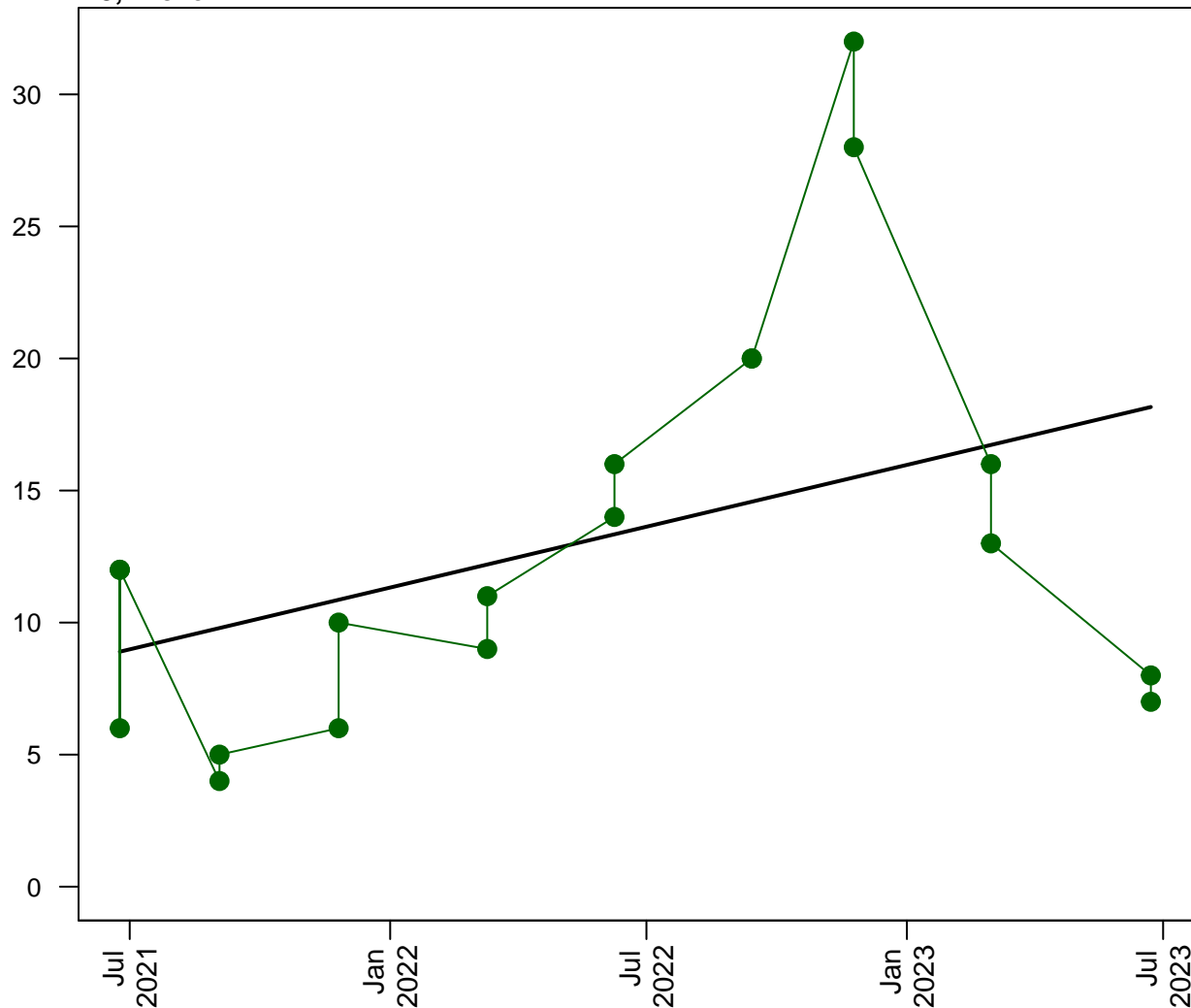
● Detect
○ NonDetect
▼ Detect Limit



Scatterplots and Trend Analysis

D3, Nickel

Concentration (µg/L)



Stats

N Data: 19
N Detect: 19
% Detect: 100

95% Confidence
MK Trend: Significant
MK p-val: 0.0479
Direction: Increasing

Lines

Linear Fit

Shapes

Detect
NonDetect
Detect Limit

Scatterplots and Trend Analysis

D3, Selenium

Concentration (µg/L)

10
8
6
4
2
0

Jul 2021
Jan 2022
Jul 2022
Jan 2023
Jul 2023

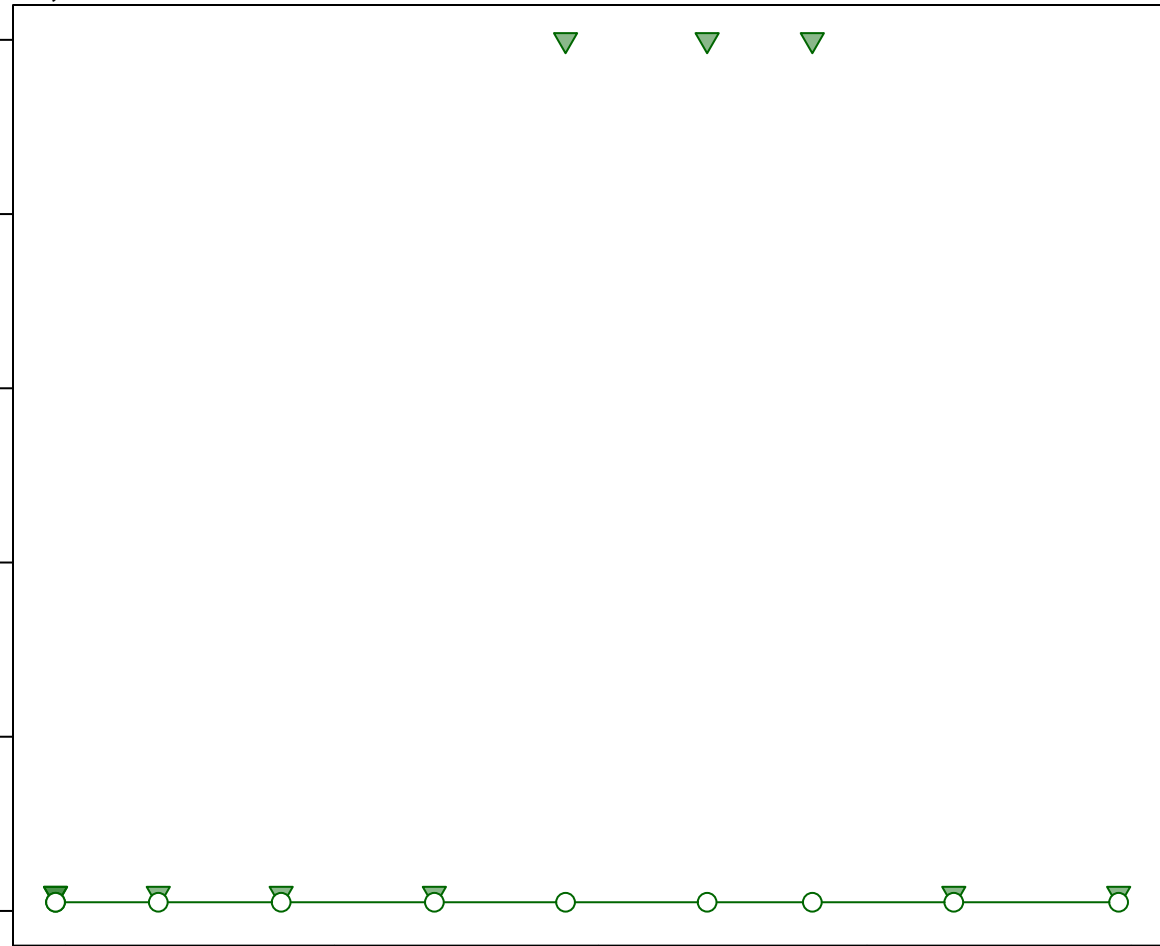
Stats

N Data: 10
N Detect: 0
% Detect: 0

MK criteria not met

Shapes

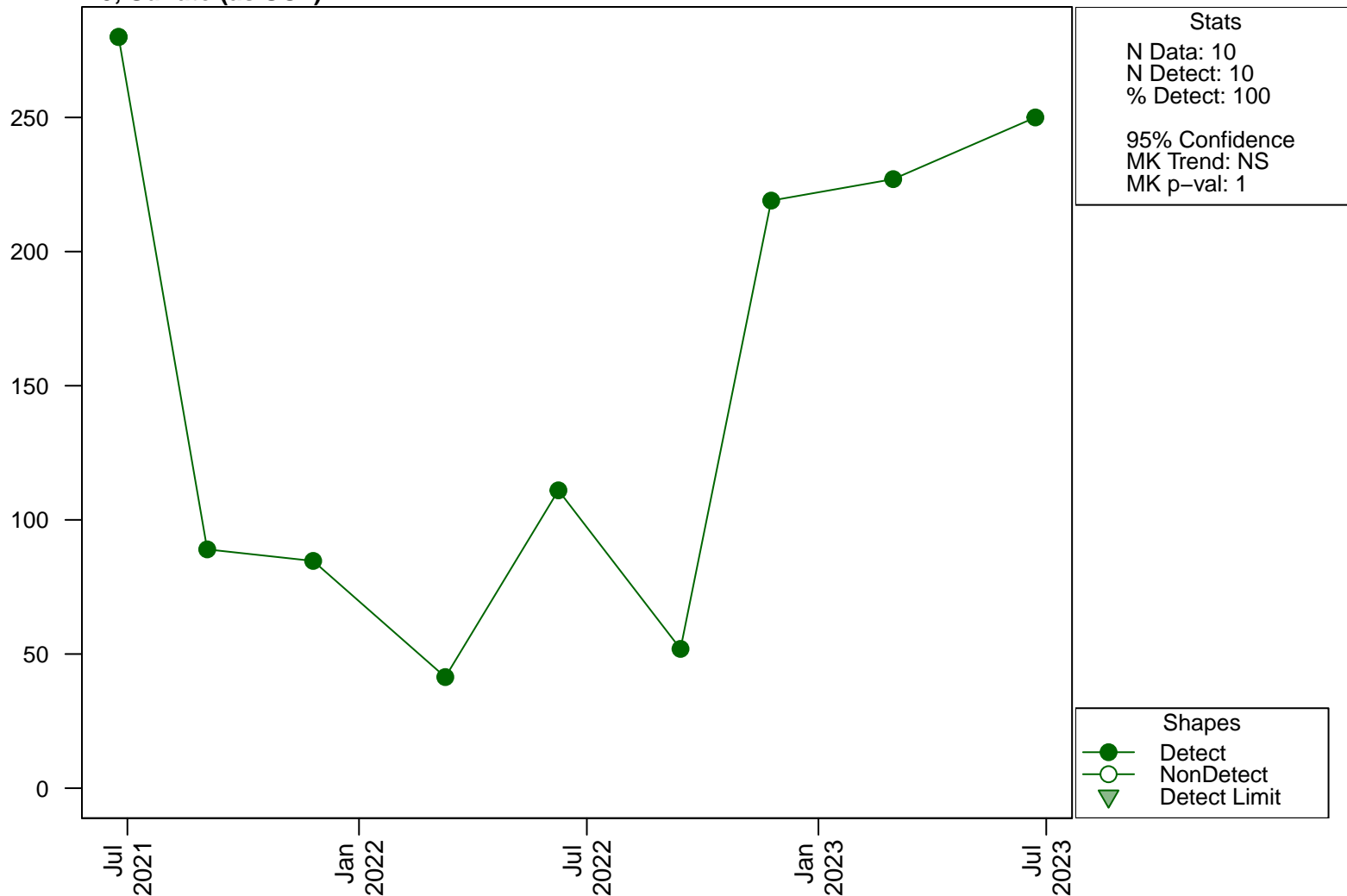
● Detect
○ NonDetect
▼ Detect Limit



Scatterplots and Trend Analysis

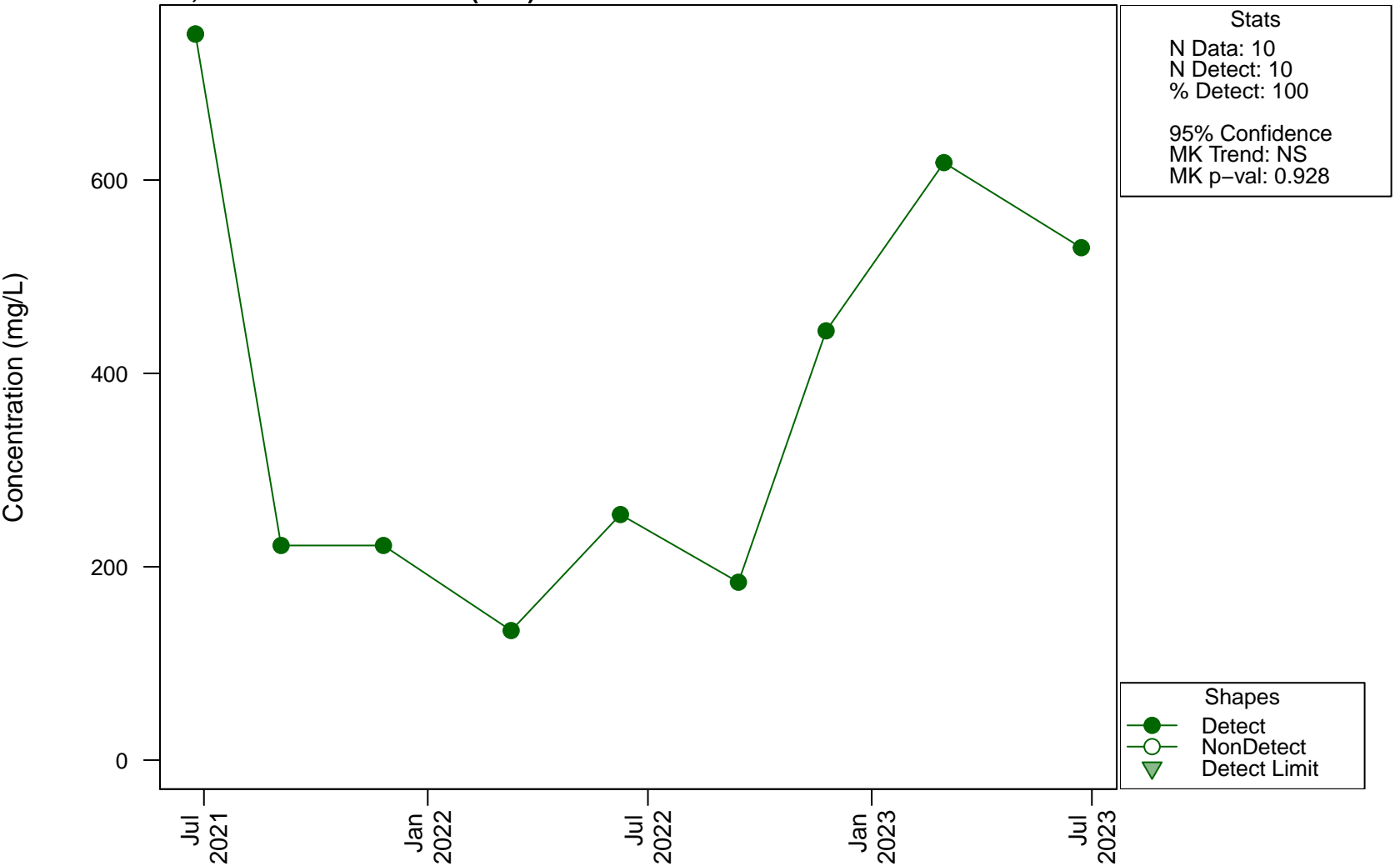
D3, Sulfate (as SO4)

Concentration (mg/L)



Scatterplots and Trend Analysis

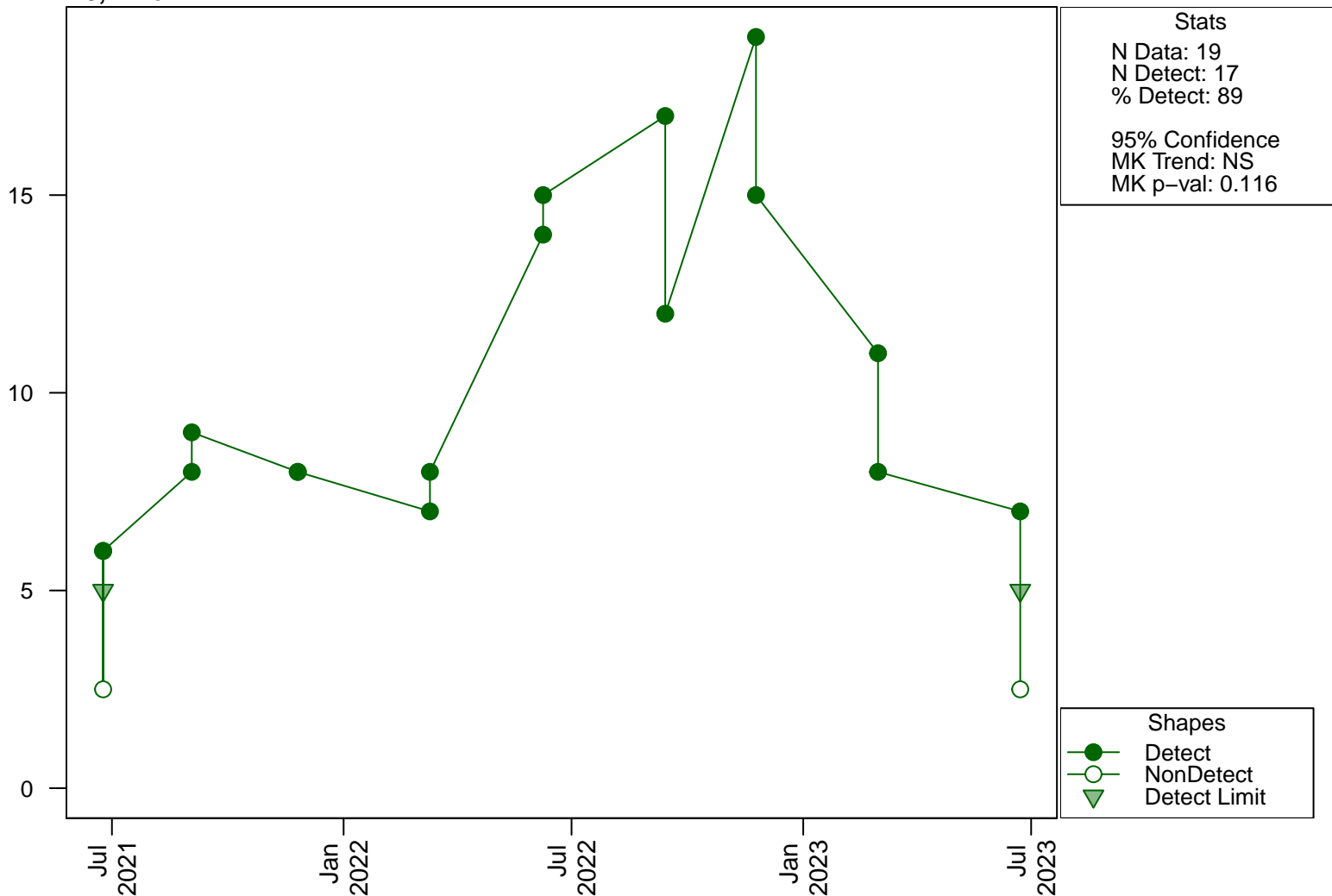
D3, Total Dissolved Solids (TDS)



Scatterplots and Trend Analysis

D3, Zinc

Concentration (µg/L)



Scatterplots and Trend Analysis

D4, Arsenic

Concentration (µg/L)

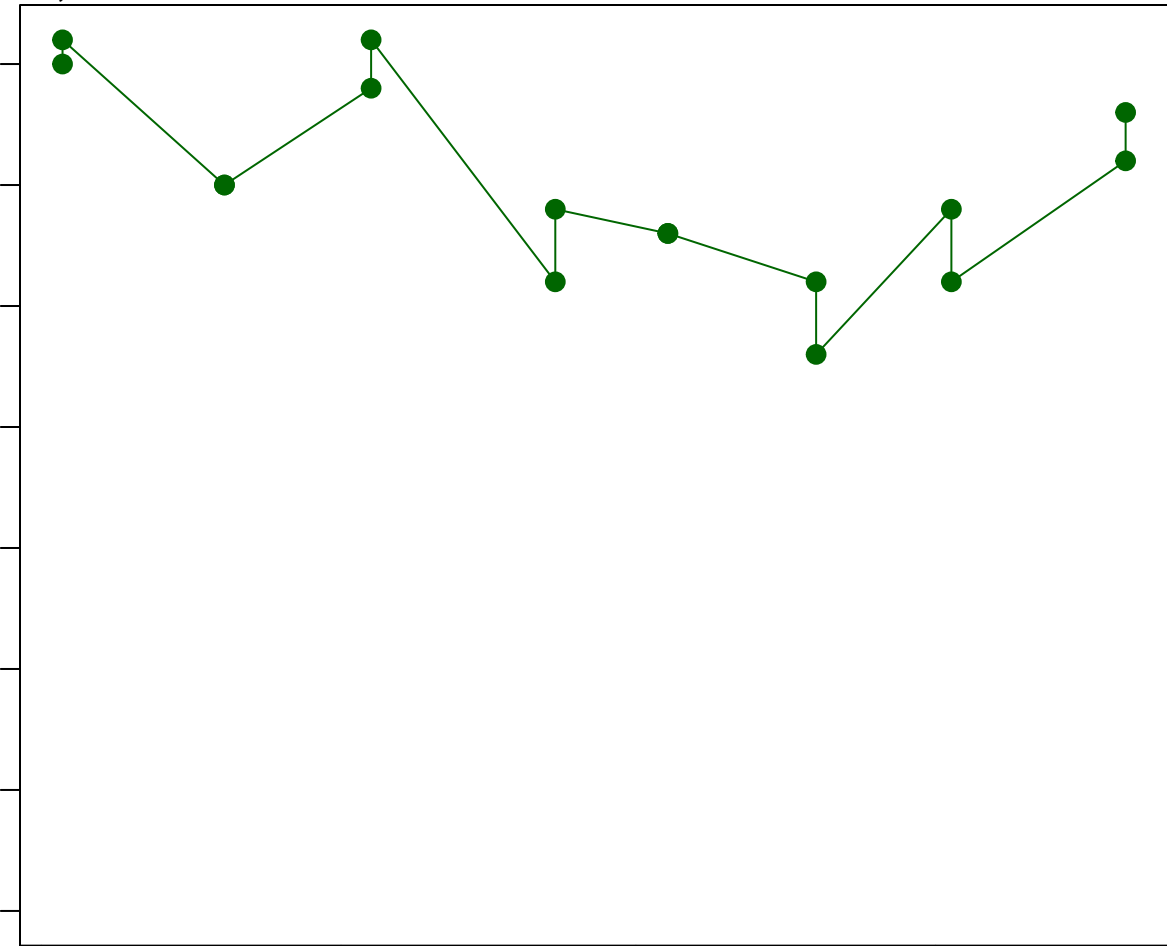
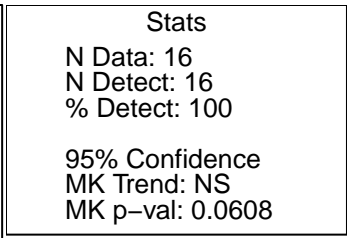
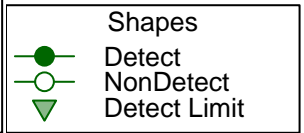
35
30
25
20
15
10
5
0

Jul
2021

Jan
2022

Jul
2022

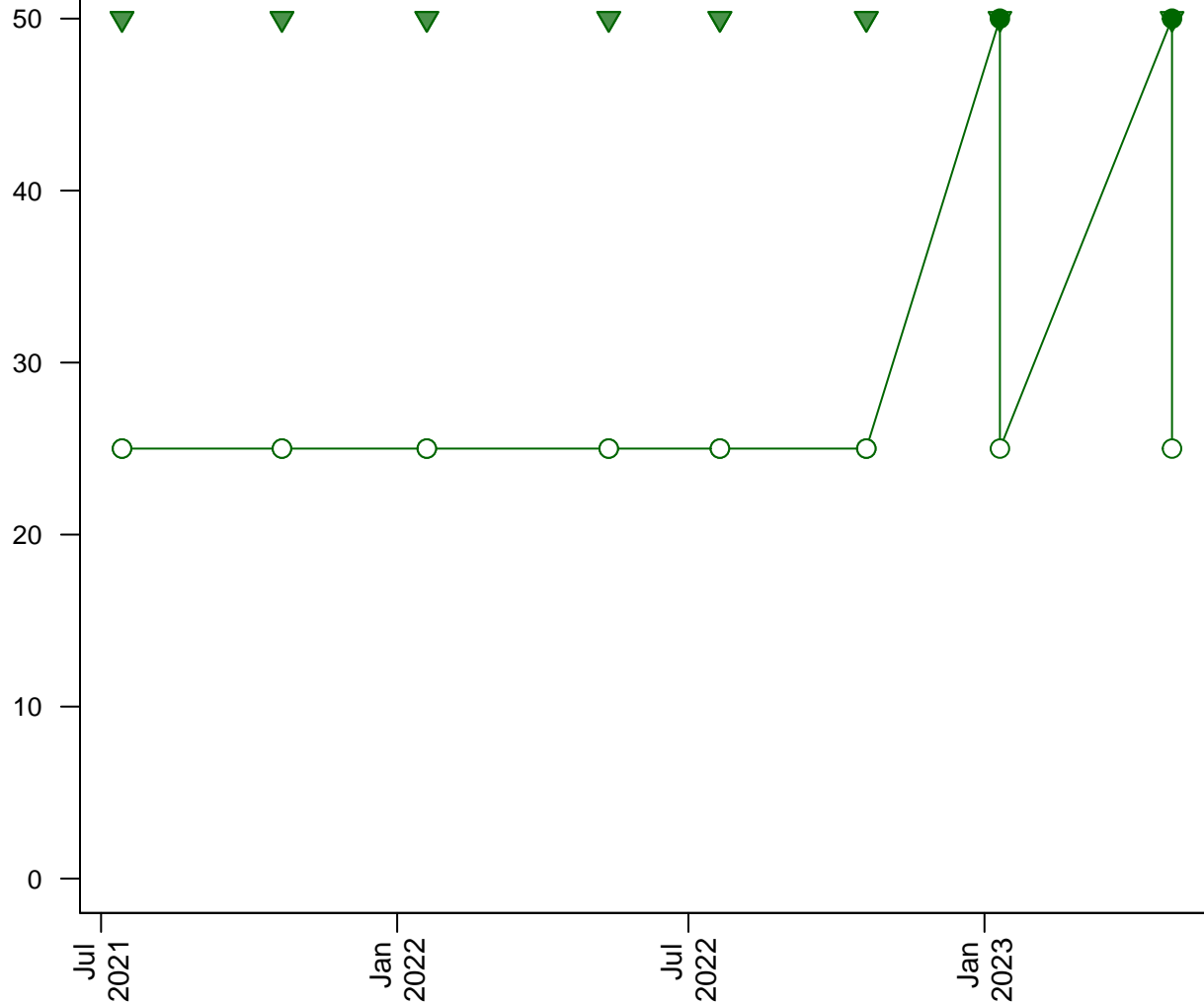
Jan
2023



Scatterplots and Trend Analysis

D4, Boron

Concentration (µg/L)



Stats

N Data: 16
N Detect: 2
% Detect: 12

MK criteria not met

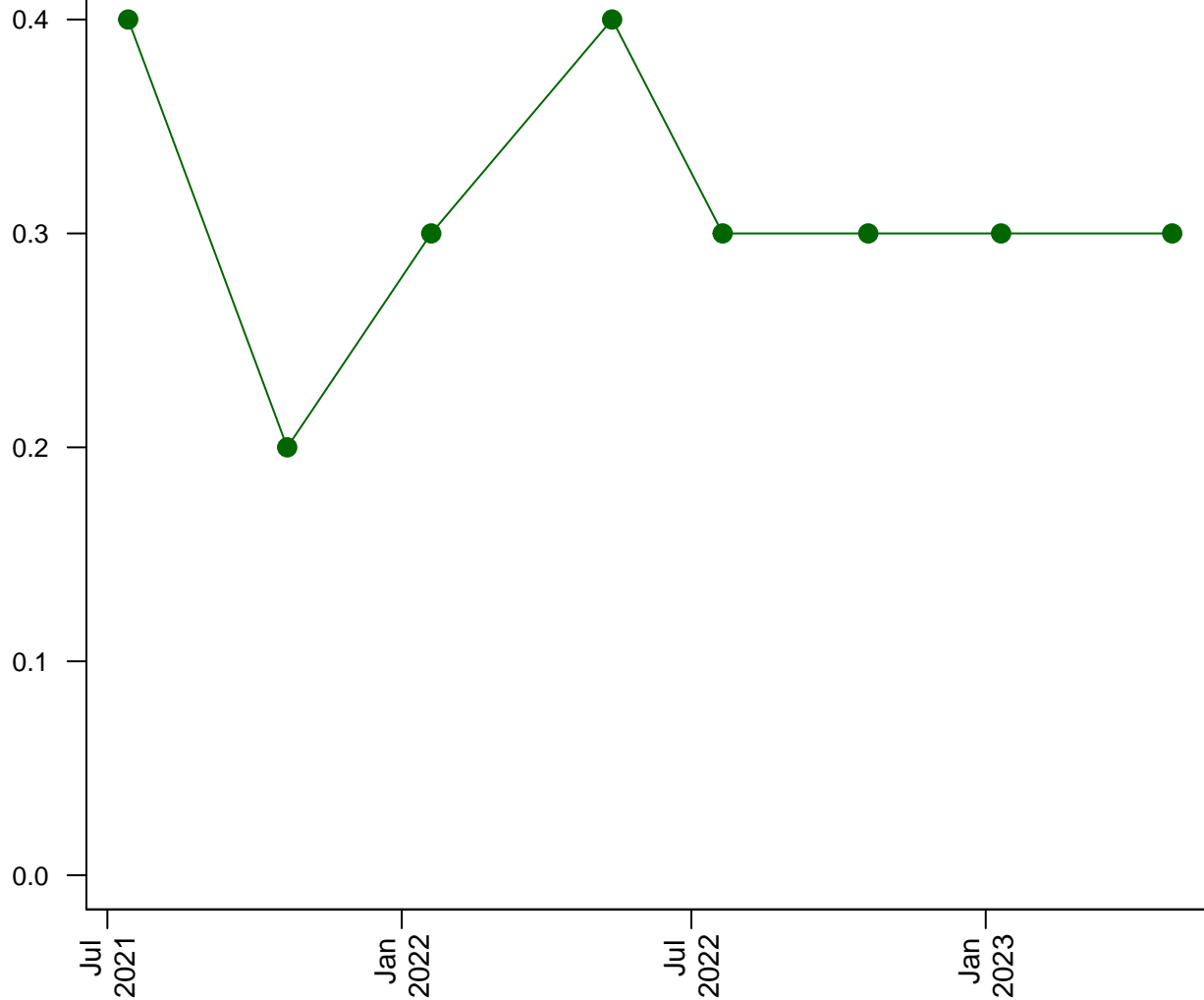
Shapes

● Detect
○ NonDetect
▼ Detect Limit

Scatterplots and Trend Analysis

D4, Cadmium

Concentration (µg/L)



Stats

N Data: 8

N Detect: 8

% Detect: 100

95% Confidence

MK Trend: NS

MK p-val: 0.664

Shapes

● Detect

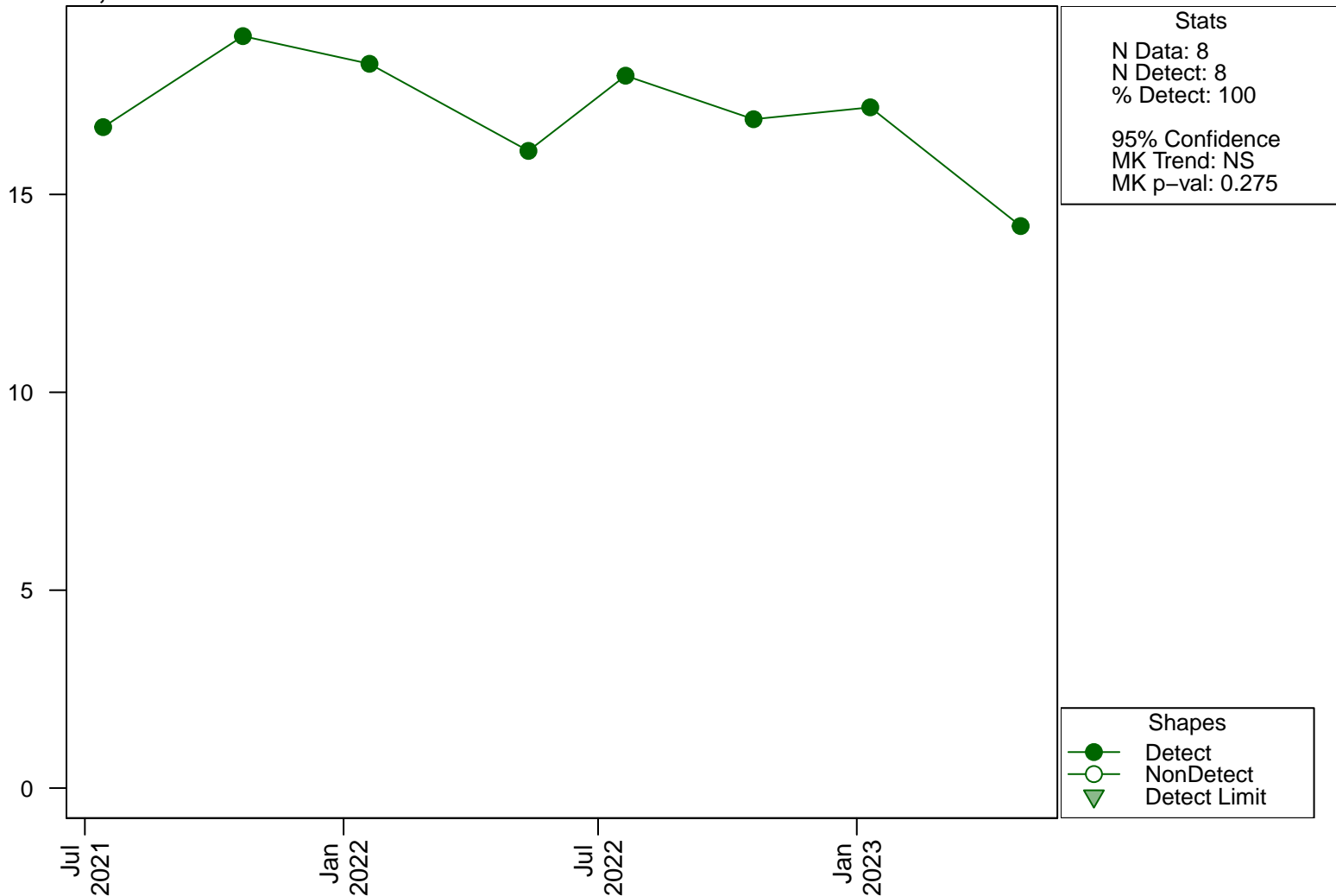
○ NonDetect

▼ Detect Limit

Scatterplots and Trend Analysis

D4, Chloride

Concentration (mg/L)



Scatterplots and Trend Analysis

D4, Chromium

Concentration (µg/L)

2.0
1.5
1.0
0.5
0.0

Jul
2021

Jan
2022

Jul
2022

Jan
2023

Stats

N Data: 8

N Detect: 8

% Detect: 100

95% Confidence

MK Trend: NS

MK p-val: 0.739

Shapes

● Detect

○ NonDetect

▼ Detect Limit

Jul
2021

Jan
2022

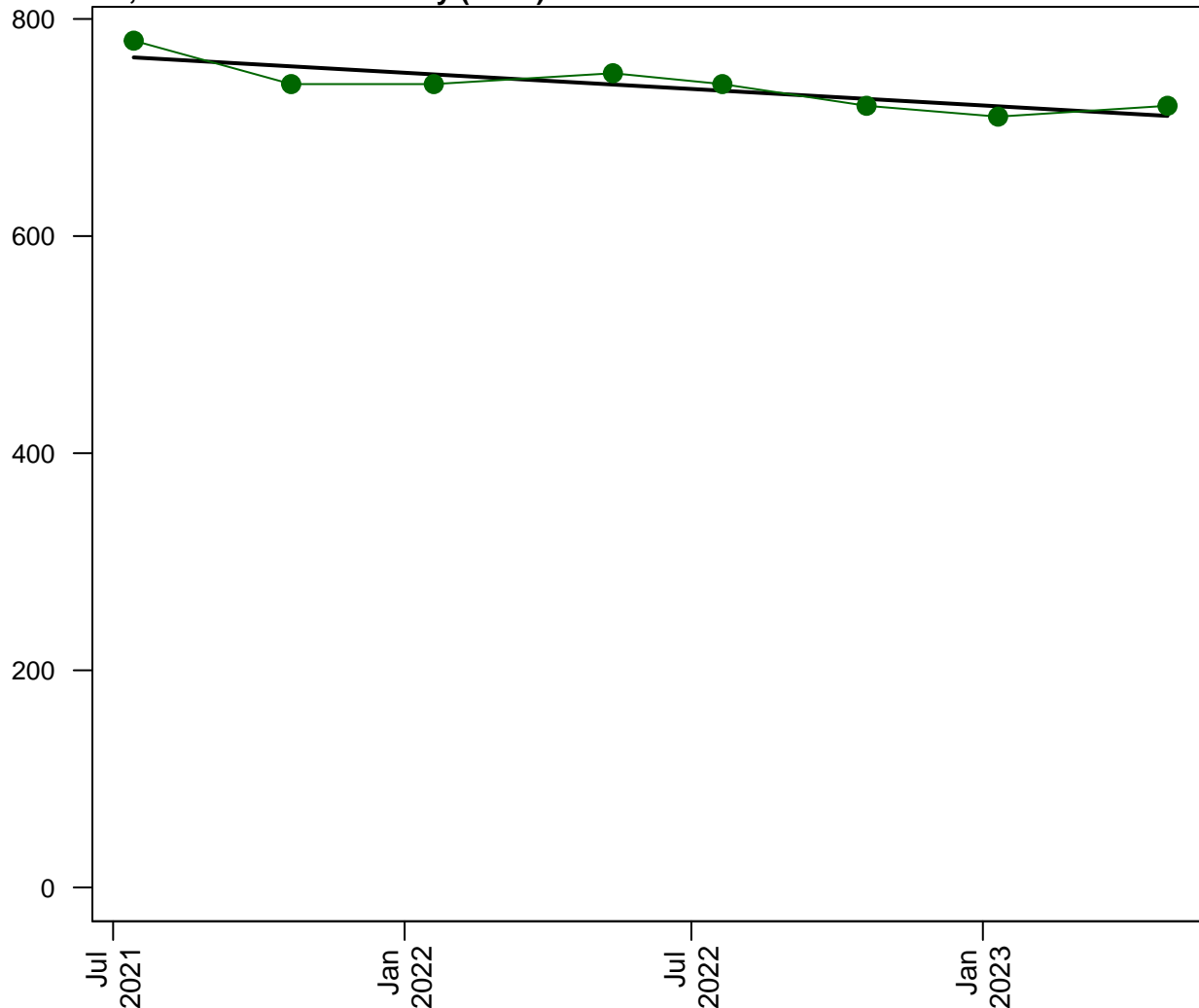
Jul
2022

Jan
2023

Scatterplots and Trend Analysis

D4, Electrical Conductivity (Field)

Concentration (uS/cm)



Stats

N Data: 8

N Detect: 8

% Detect: 100

95% Confidence

MK Trend: Significant

MK p-val: 0.0208

Direction: Decreasing

Lines

Linear Fit

Shapes

● Detect

○ NonDetect

▼ Detect Limit

Scatterplots and Trend Analysis

D4, Fluoride

Concentration (mg/L)

0.10
0.08
0.06
0.04
0.02
0.00

Jul
2021

Jan
2022

Jul
2022

Jan
2023

Stats

N Data: 8

N Detect: 1

% Detect: 12

MK criteria not met

Shapes



Detect



NonDetect



Detect Limit

Jul
2021

Jan
2022

Jul
2022

Jan
2023

Scatterplots and Trend Analysis

D4, Iron

Concentration (µg/L)

70000
60000
50000
40000
30000
20000
10000
0

Jul
2021

Jan
2022

Jul
2022

Jan
2023

Stats

N Data: 16

N Detect: 16

% Detect: 100

95% Confidence

MK Trend: NS

MK p-val: 0.204

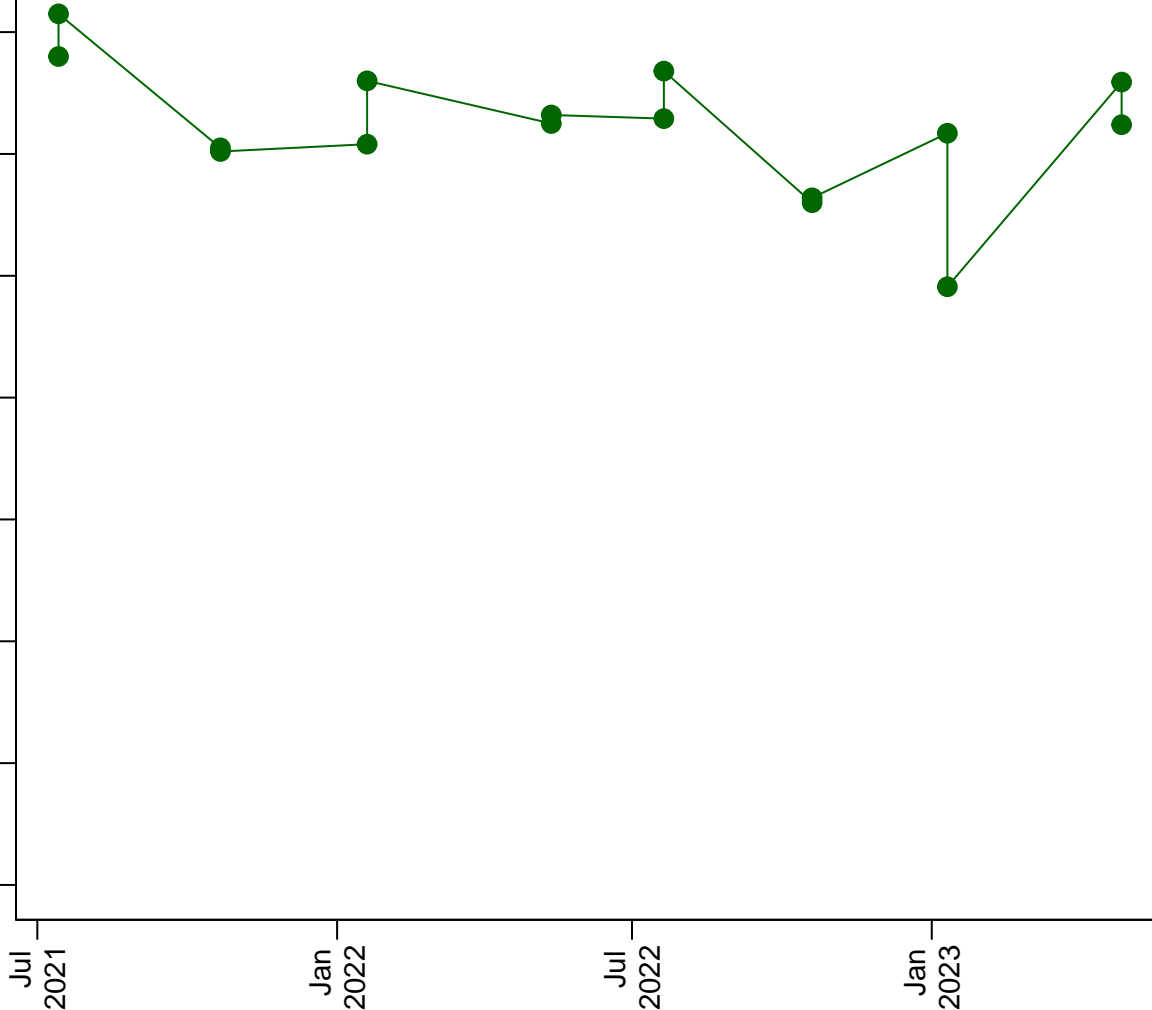
Shapes

● Detect

○ NonDetect

▼ Detect Limit

Detect Limit



Scatterplots and Trend Analysis

D4, Lead

Concentration (µg/L)

20
15
10
5
0

Jul
2021

Jan
2022

Jul
2022

Jan
2023

Stats

N Data: 8

N Detect: 8

% Detect: 100

95% Confidence

MK Trend: Significant

MK p-val: 0.0161

Direction: Decreasing

Lines

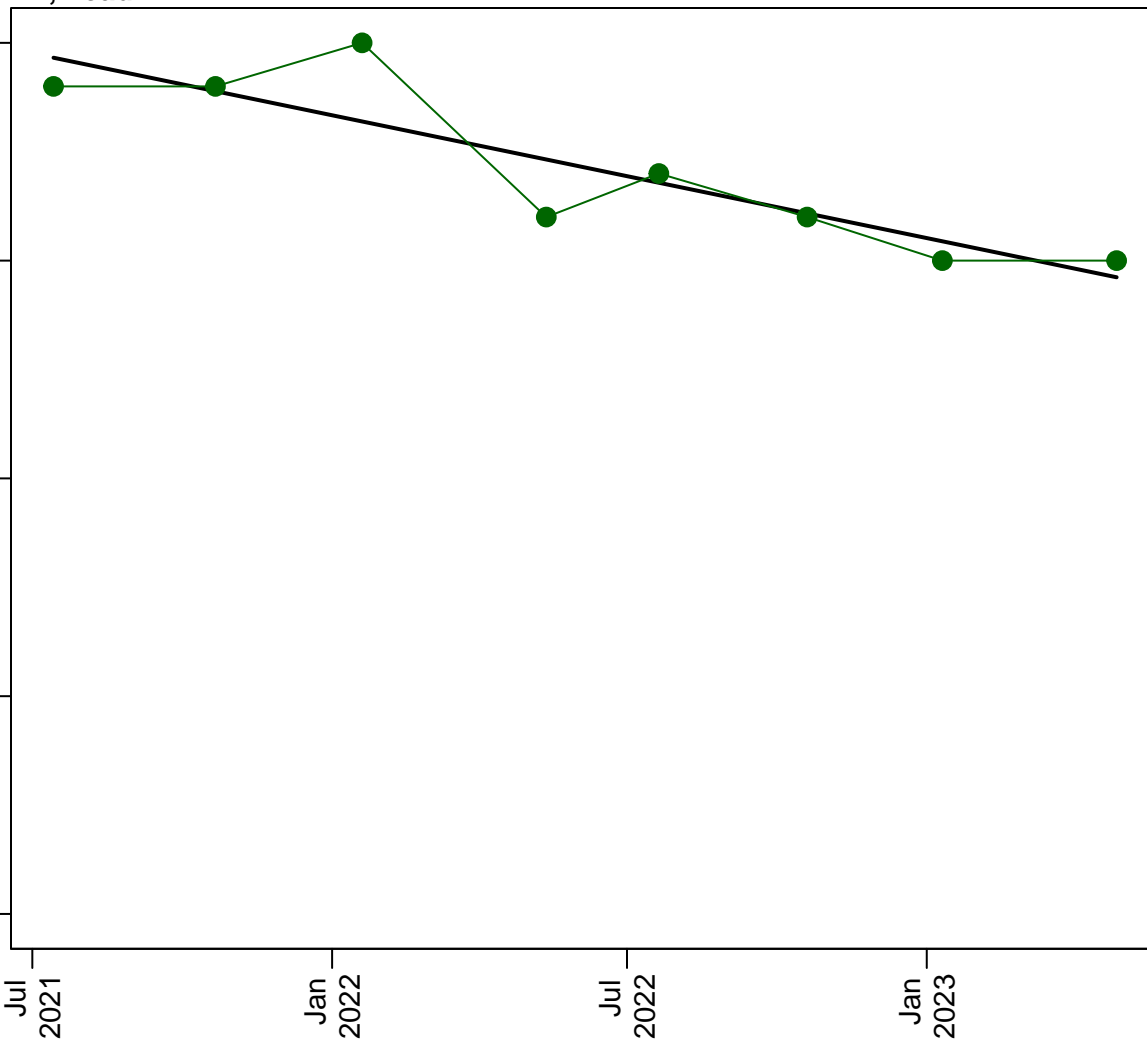
Linear Fit

Shapes

Detect

NonDetect

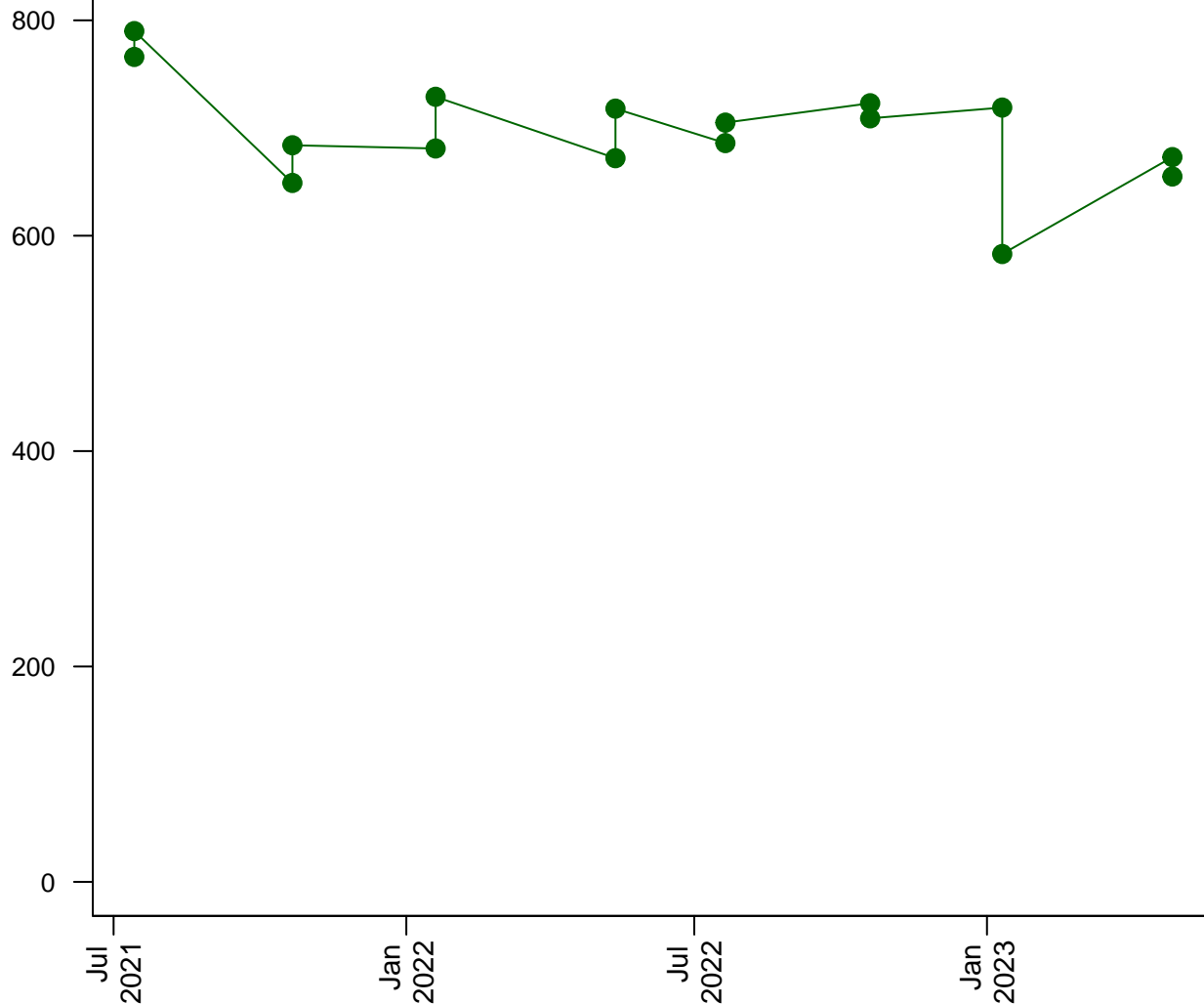
Detect Limit



Scatterplots and Trend Analysis

D4, Manganese

Concentration (µg/L)



Stats
N Data: 16
N Detect: 16
% Detect: 100

95% Confidence
MK Trend: NS
MK p-val: 0.173

Shapes
Detect
NonDetect
Detect Limit

Scatterplots and Trend Analysis

D4, Mercury

Concentration (µg/L)

0.04
0.03
0.02
0.01
0.00

Jul
2021

Jan
2022

Jul
2022

Jan
2023

Stats

N Data: 8
N Detect: 0
% Detect: 0

MK criteria not met

Shapes

● Detect
○ NonDetect
▼ Detect Limit

Jul
2021

Jan
2022

Jul
2022

Jan
2023

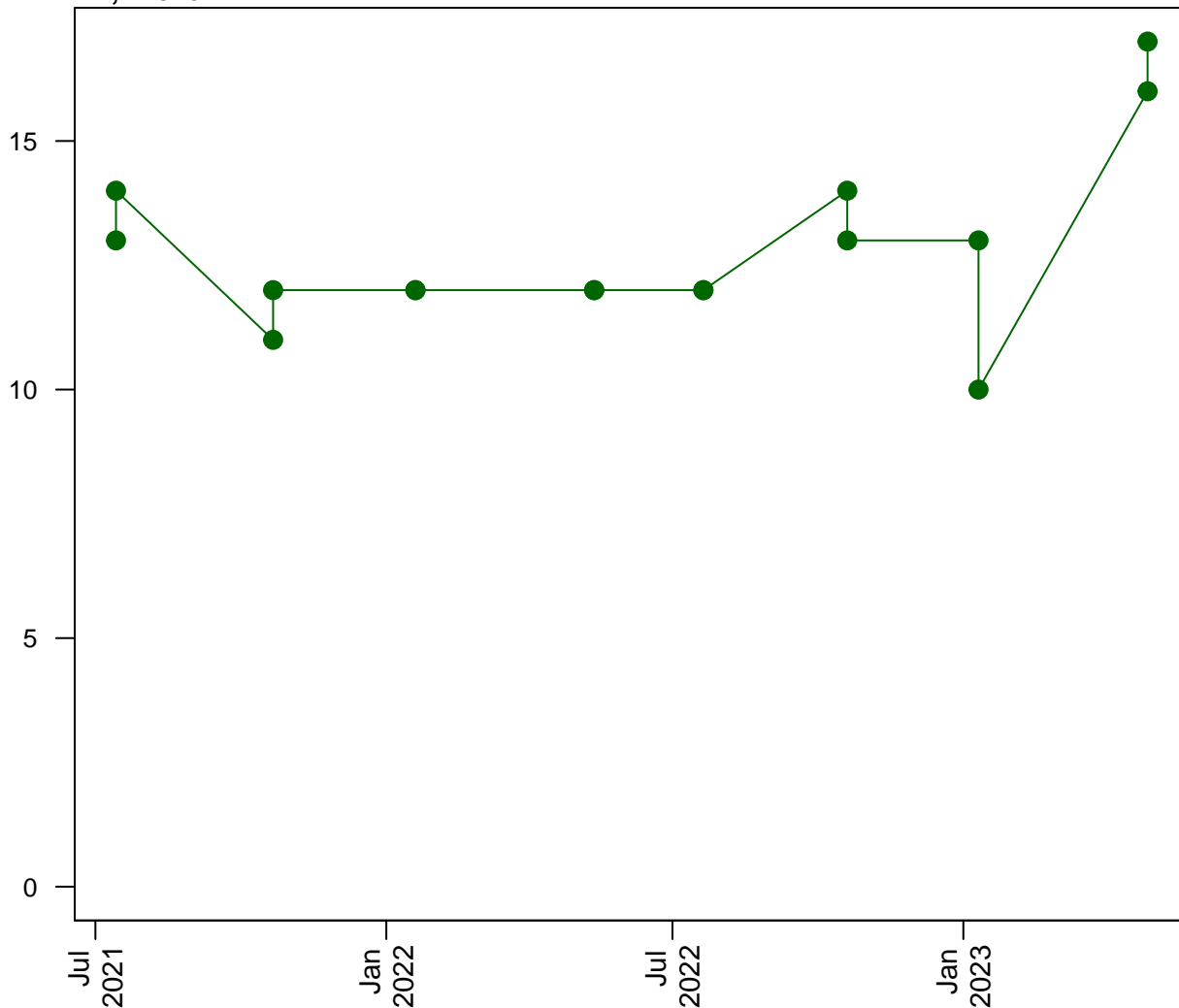
D4, Molybdenum



Scatterplots and Trend Analysis

D4, Nickel

Concentration (µg/L)



Stats

N Data: 16

N Detect: 16

% Detect: 100

95% Confidence

MK Trend: NS

MK p-val: 0.181

Shapes

● Detect

○ NonDetect

▼ Detect Limit

Scatterplots and Trend Analysis

D4, Selenium

Concentration (µg/L)

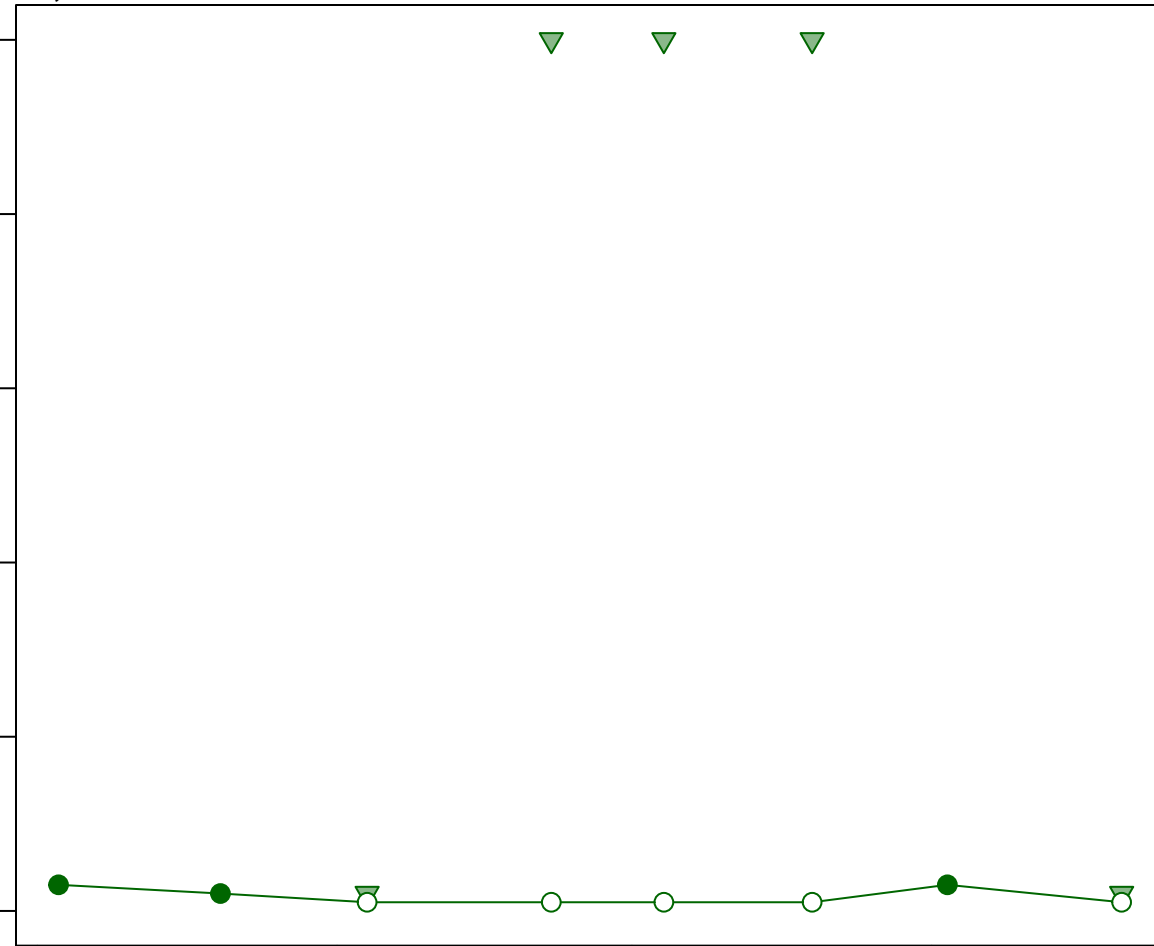
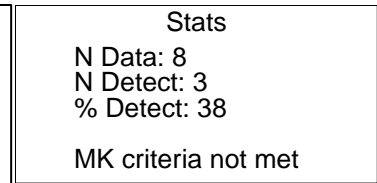
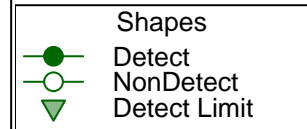
10
8
6
4
2
0

Jul
2021

Jan
2022

Jul
2022

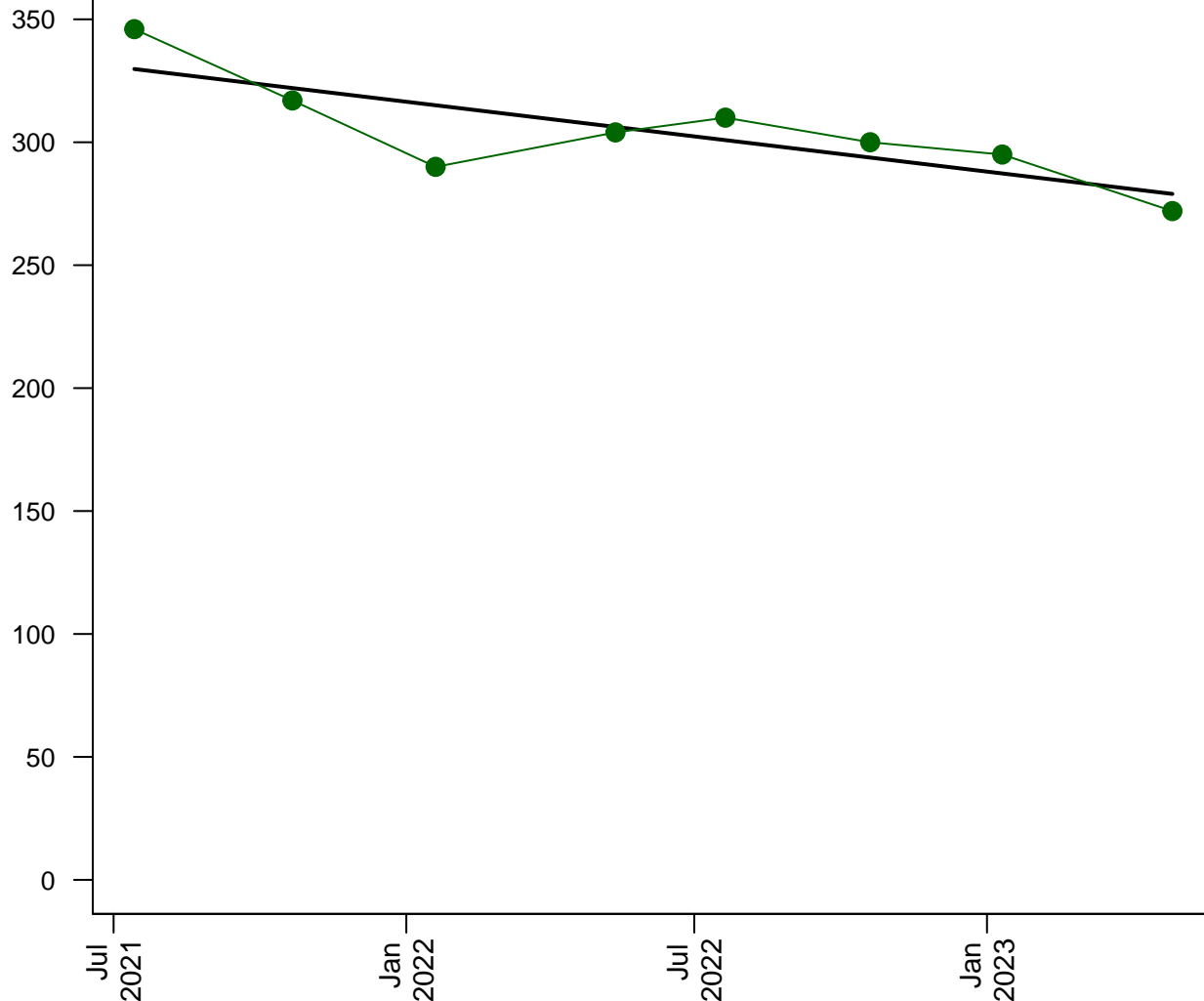
Jan
2023



Scatterplots and Trend Analysis

D4, Sulfate (as SO4)

Concentration (mg/L)



Stats

N Data: 8

N Detect: 8

% Detect: 100

95% Confidence

MK Trend: Significant

MK p-val: 0.0312

Direction: Decreasing

Lines

— Linear Fit

Shapes

● Detect

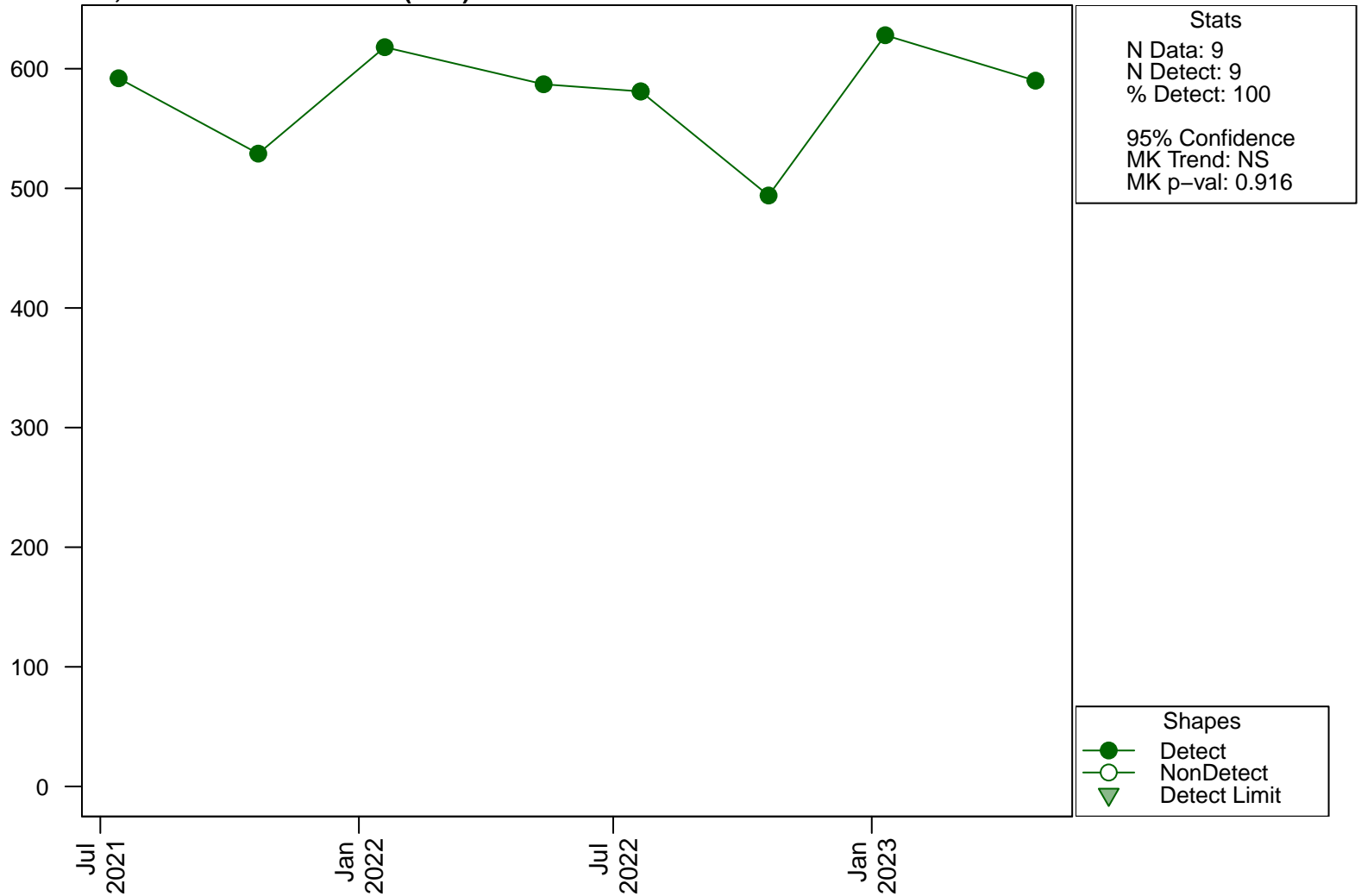
○ NonDetect

▼ Detect Limit

Scatterplots and Trend Analysis

D4, Total Dissolved Solids (TDS)

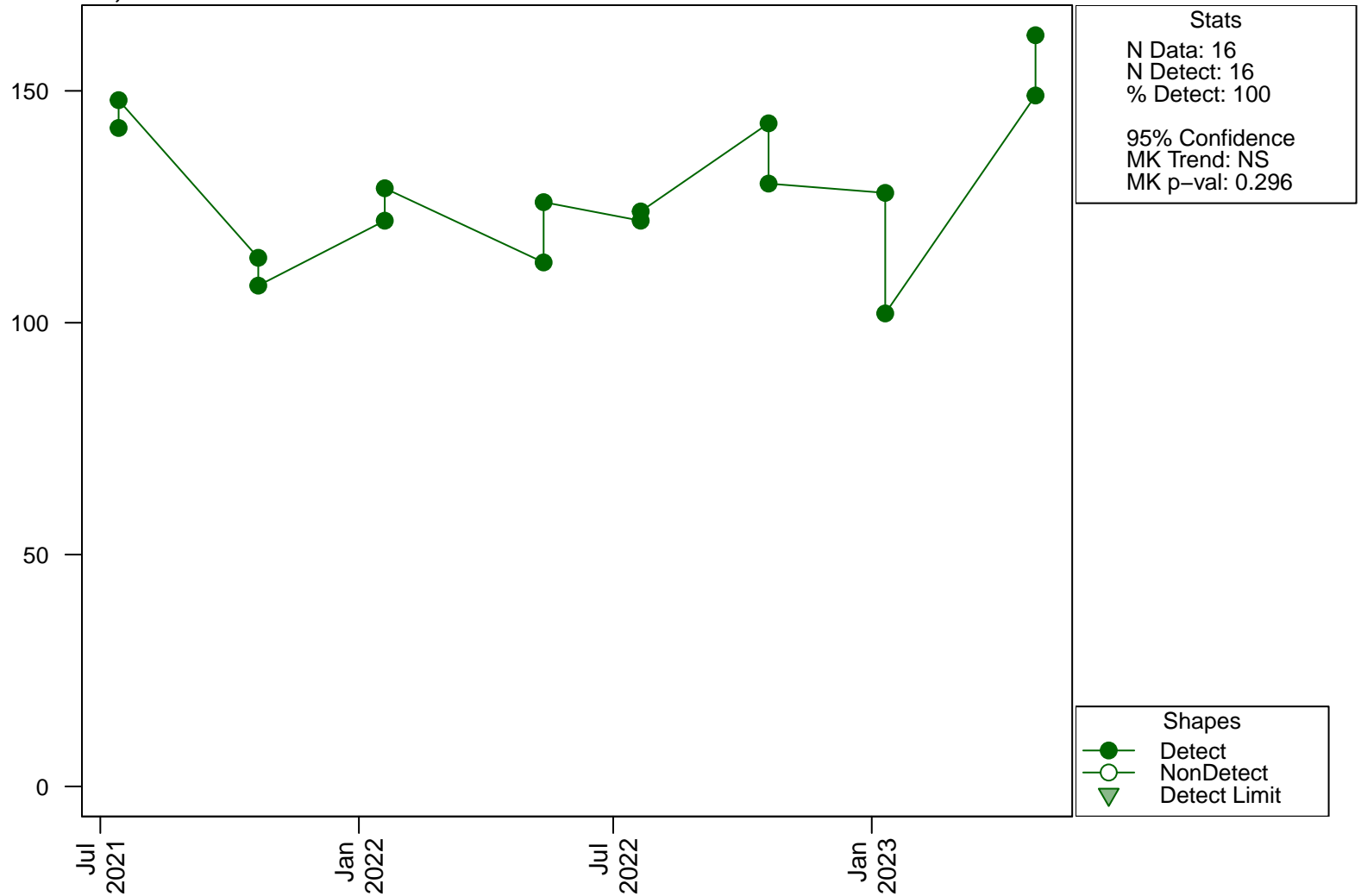
Concentration (mg/L)



Scatterplots and Trend Analysis

D4, Zinc

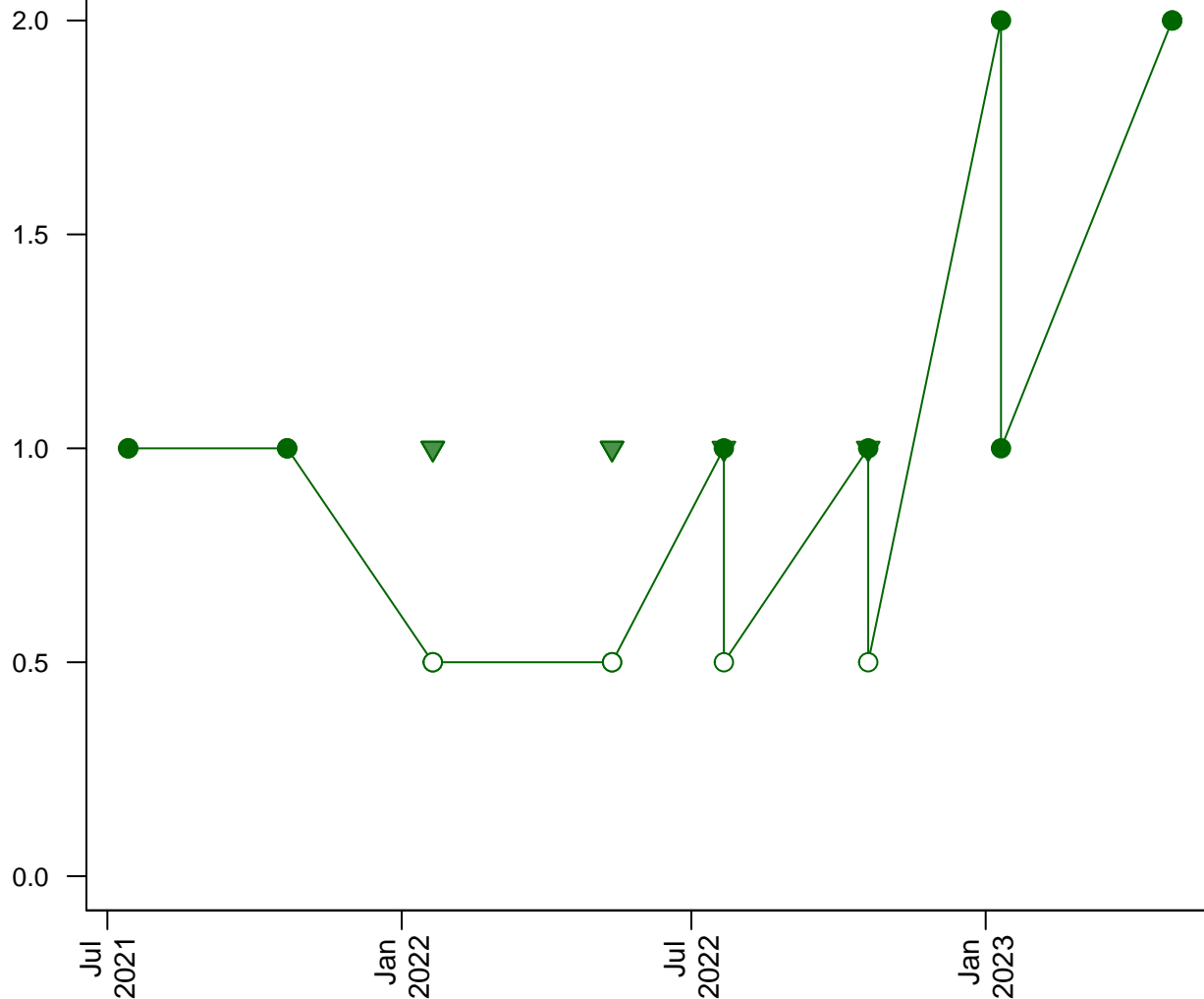
Concentration (µg/L)



Scatterplots and Trend Analysis

D5, Arsenic

Concentration (µg/L)



Stats

N Data: 16
N Detect: 10
% Detect: 62

95% Confidence
MK Trend: NS
MK p-val: 0.168

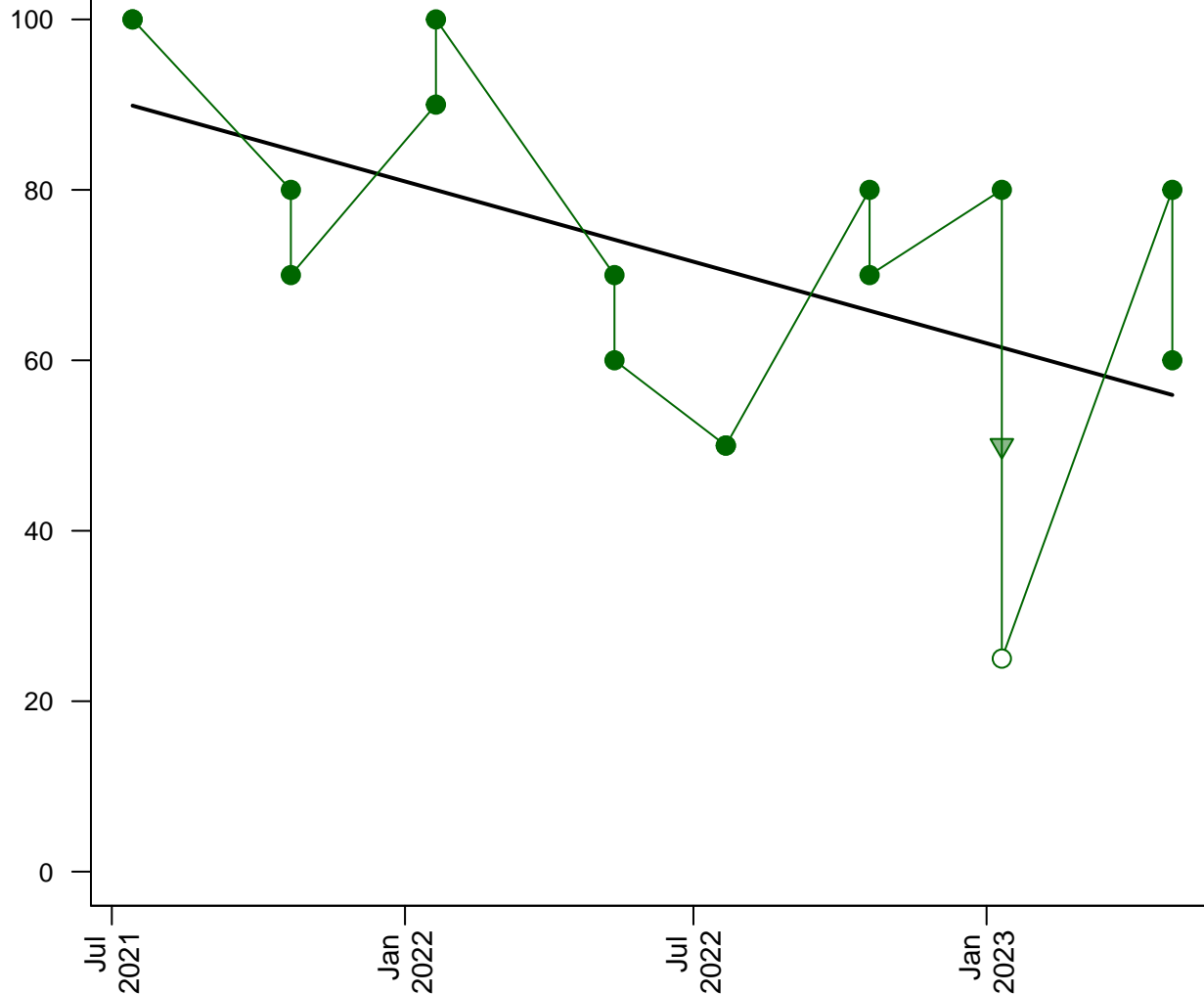
Shapes

● Detect
○ NonDetect
▼ Detect Limit

Scatterplots and Trend Analysis

D5, Boron

Concentration (µg/L)



Stats

N Data: 16
N Detect: 15
% Detect: 94

95% Confidence
MK Trend: Significant
MK p-val: 0.042
Direction: Decreasing

Lines

— Linear Fit

Shapes

● Detect
○ NonDetect
▼ Detect Limit

Scatterplots and Trend Analysis

D5, Cadmium

Concentration (µg/L)

0.10
0.08
0.06
0.04
0.02
0.00

Jul
2021

Jan
2022

Jul
2022

Jan
2023

Stats

N Data: 8
N Detect: 0
% Detect: 0

MK criteria not met

Shapes

● Detect
○ NonDetect
▼ Detect Limit

Jul
2021

Jan
2022

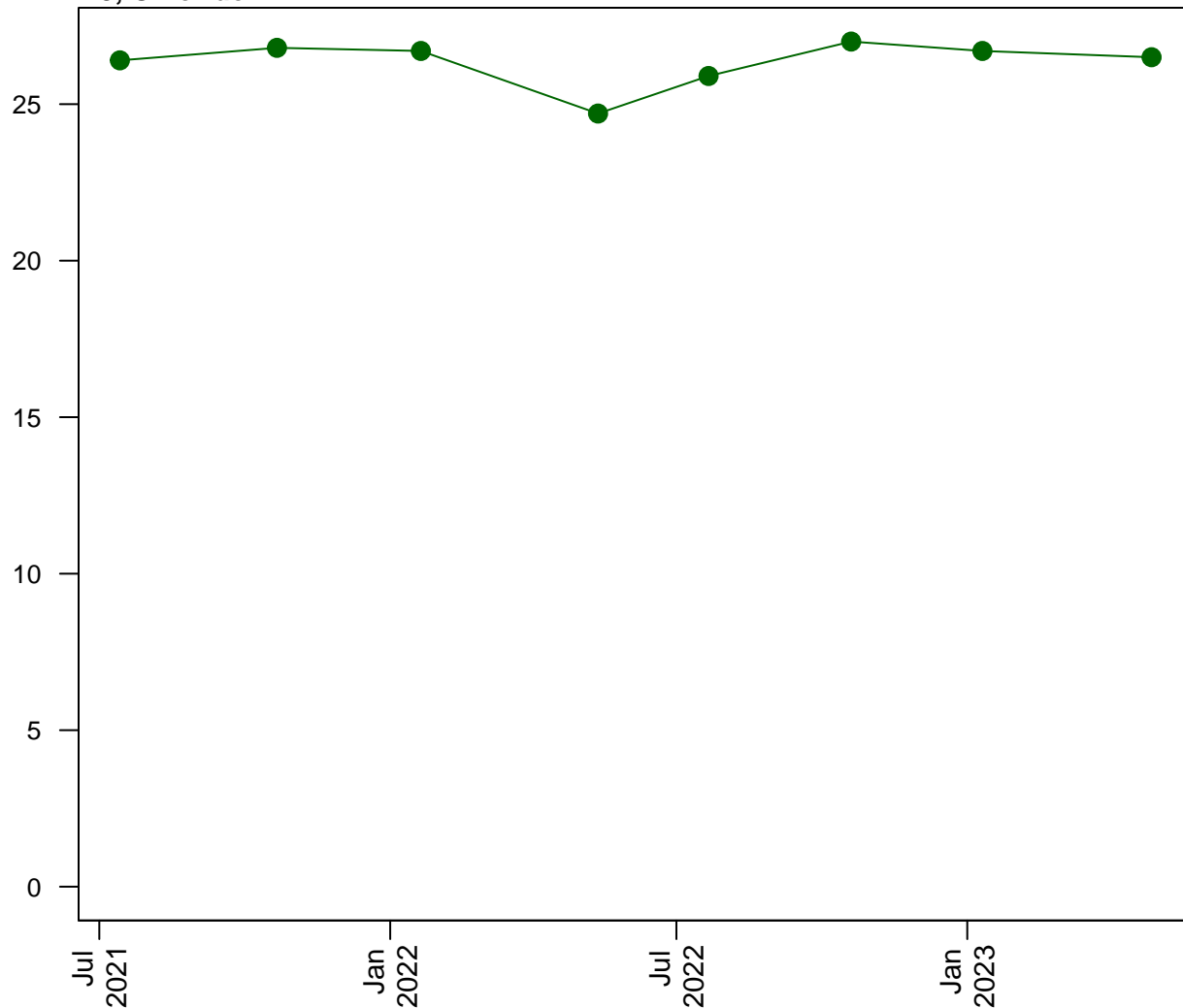
Jul
2022

Jan
2023

Scatterplots and Trend Analysis

D5, Chloride

Concentration (mg/L)



Stats

N Data: 8

N Detect: 8

% Detect: 100

95% Confidence

MK Trend: NS

MK p-val: 0.901

Shapes

● Detect

○ NonDetect

▼ Detect Limit

Scatterplots and Trend Analysis

D5, Chromium

Concentration (µg/L)

1.0
0.8
0.6
0.4
0.2
0.0

Jul
2021

Jan
2022

Jul
2022

Jan
2023

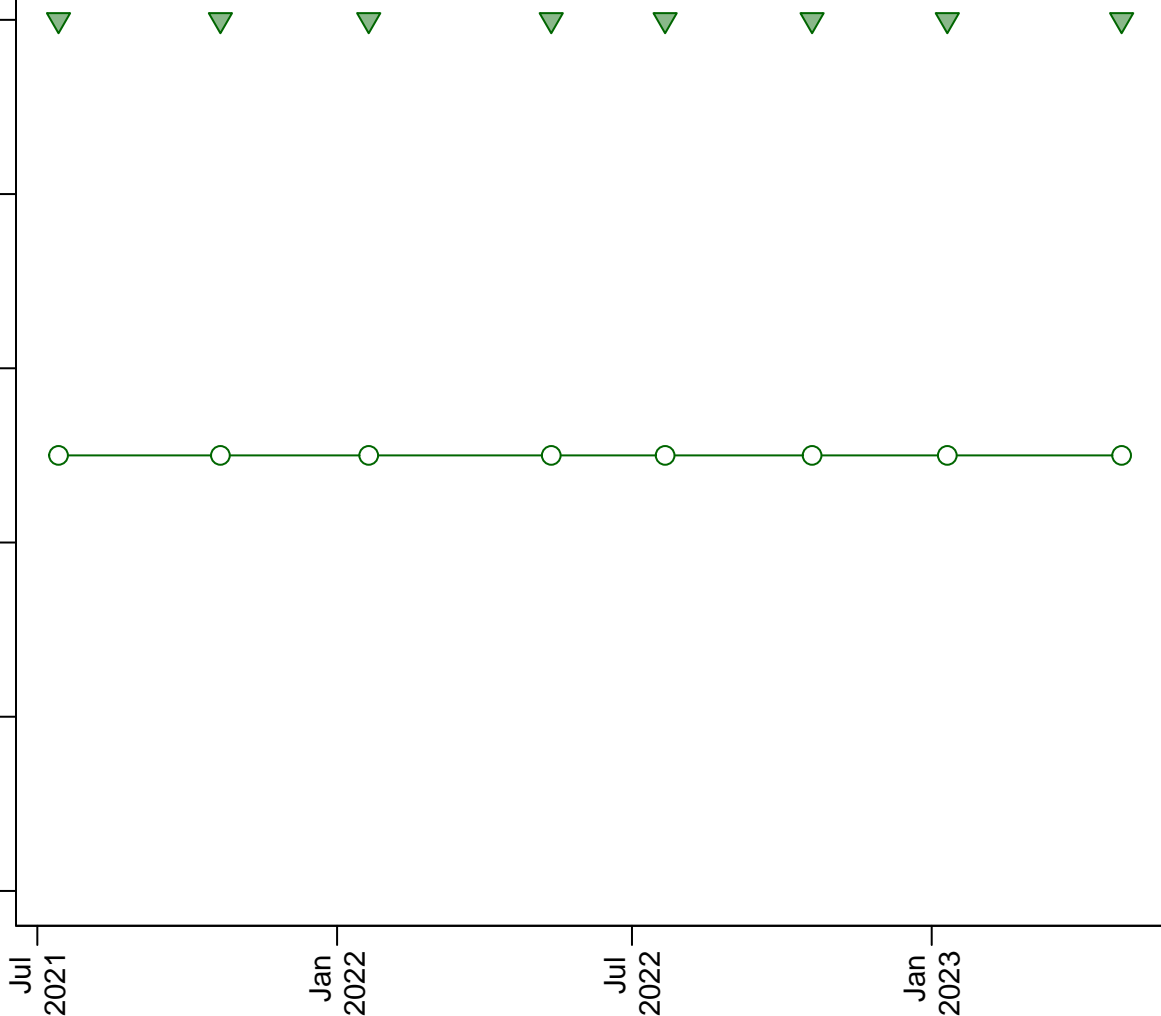
Stats

N Data: 8
N Detect: 0
% Detect: 0

MK criteria not met

Shapes

● Detect
○ NonDetect
▼ Detect Limit



Scatterplots and Trend Analysis

D5, Electrical Conductivity (Field)

Concentration (uS/cm)

1200
1000
800
600
400
200
0

Jul
2021

Jan
2022

Jul
2022

Jan
2023

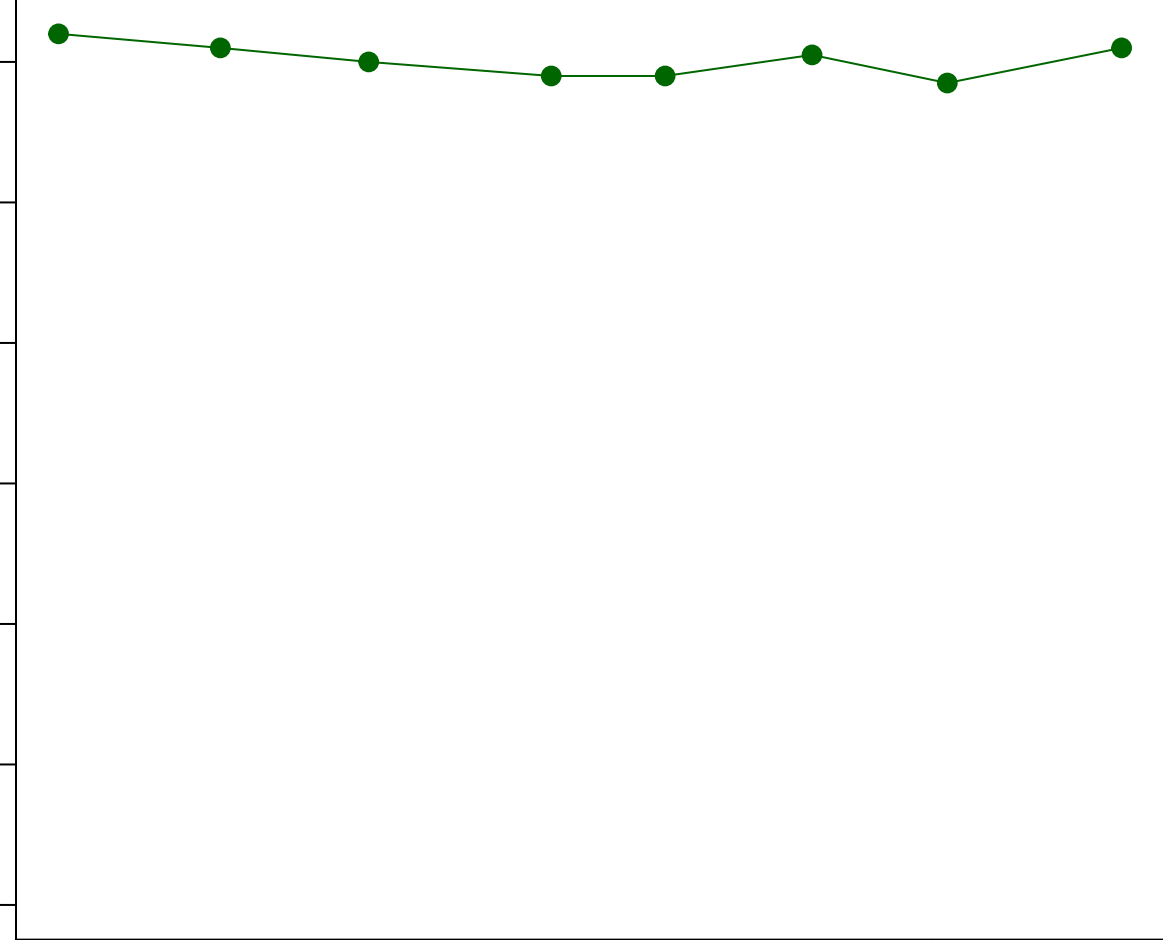
Stats

N Data: 8
N Detect: 8
% Detect: 100

95% Confidence
MK Trend: NS
MK p-val: 0.209

Shapes

● Detect
○ NonDetect
▼ Detect Limit



Scatterplots and Trend Analysis

D5, Fluoride

Concentration (mg/L)

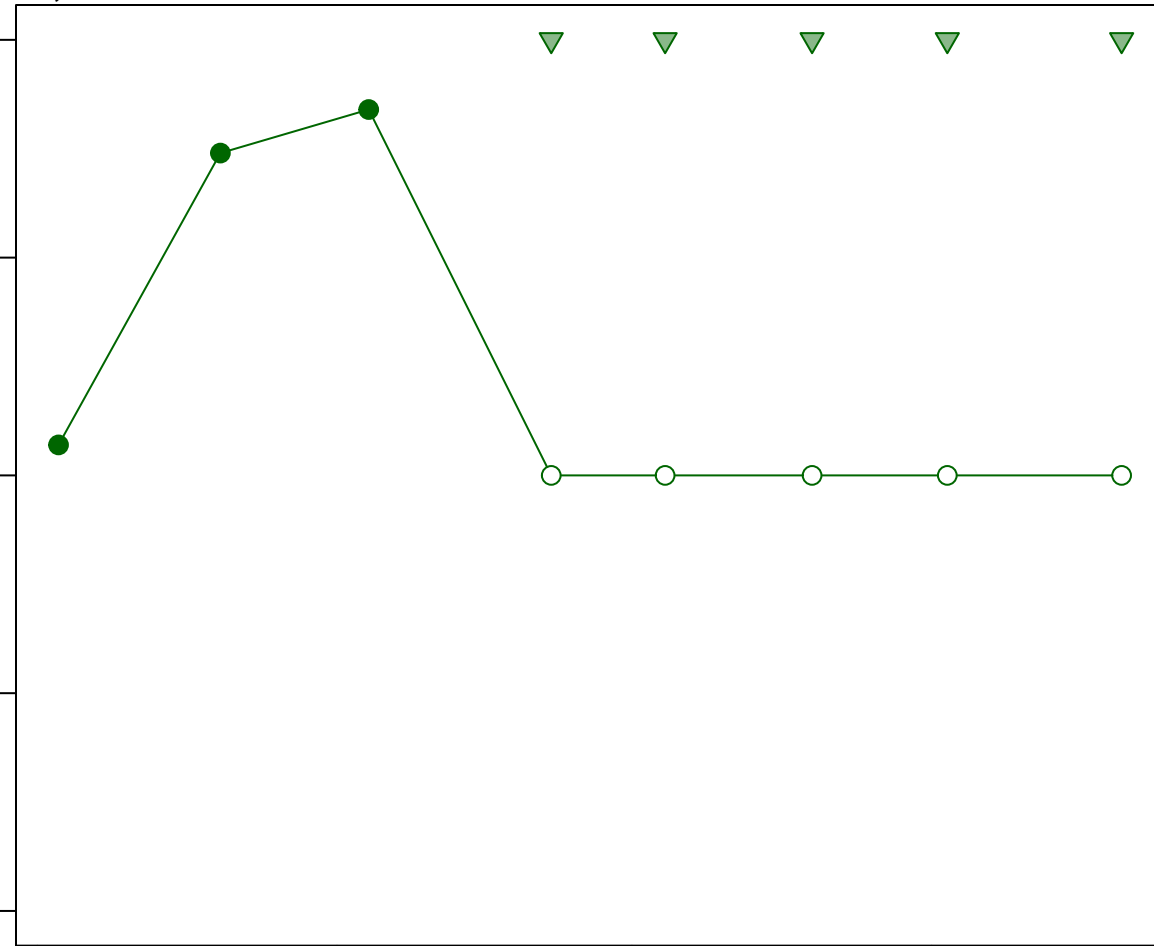
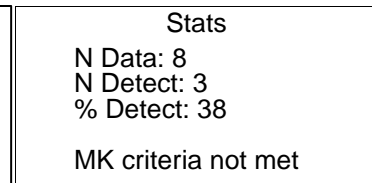
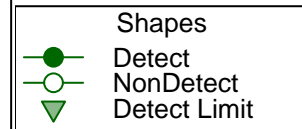
0.20
0.15
0.10
0.05
0.00

Jul
2021

Jan
2022

Jul
2022

Jan
2023



Scatterplots and Trend Analysis

D5, Iron

Concentration (µg/L)

50000
40000
30000
20000
10000
0

Jul
2021

Jan
2022

Jul
2022

Jan
2023

Stats

N Data: 16

N Detect: 16

% Detect: 100

95% Confidence

MK Trend: NS

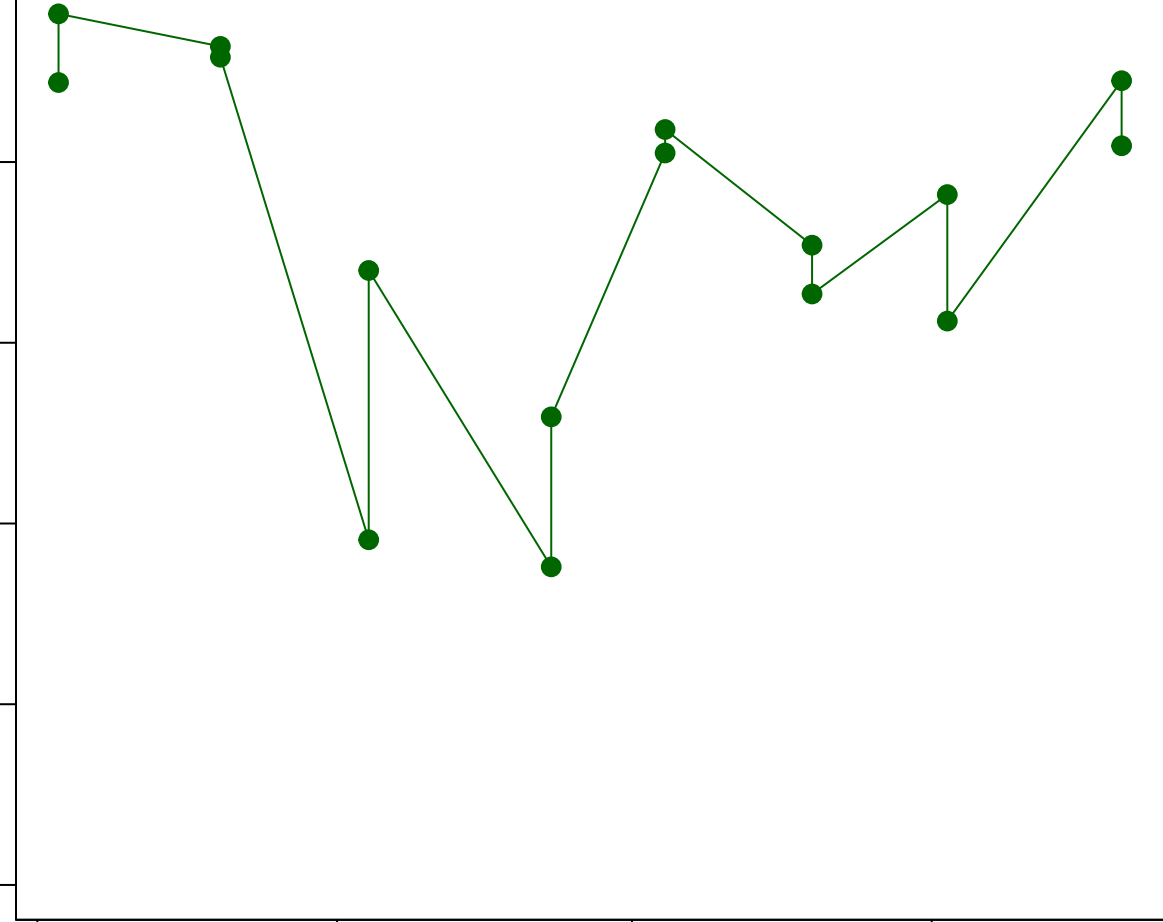
MK p-val: 0.414

Shapes

● Detect

○ NonDetect

▼ Detect Limit



Scatterplots and Trend Analysis

D5, Lead

Concentration (µg/L)

1.0
0.8
0.6
0.4
0.2
0.0

Jul
2021

Jan
2022

Jul
2022

Jan
2023

Stats

N Data: 8

N Detect: 0

% Detect: 0

MK criteria not met

Shapes

●

Detect

○

NonDetect

▼

Detect Limit

Jul
2021

Jan
2022

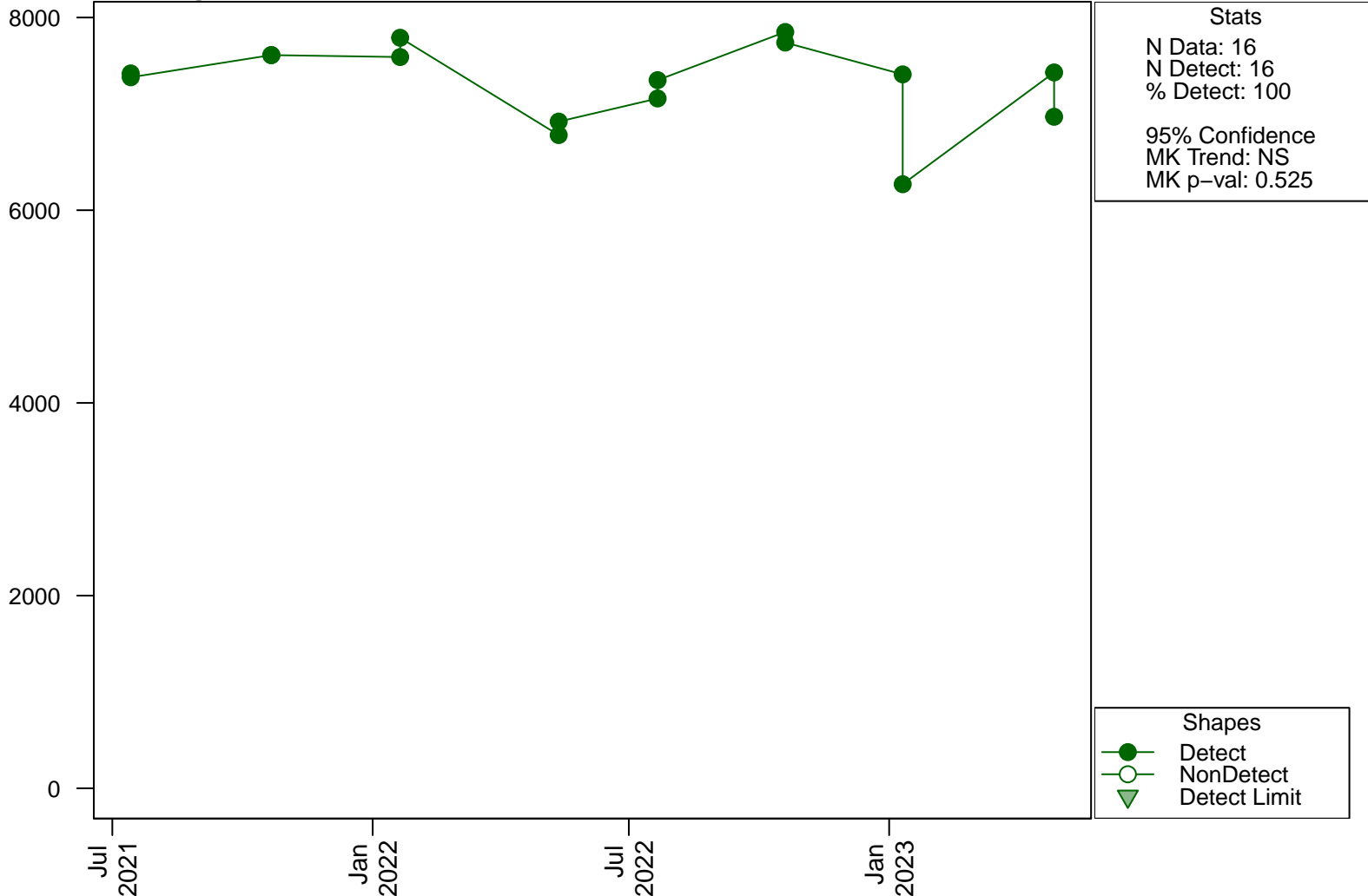
Jul
2022

Jan
2023

Scatterplots and Trend Analysis

D5, Manganese

Concentration (µg/L)



Scatterplots and Trend Analysis

D5, Mercury

Concentration (µg/L)

0.04
0.03
0.02
0.01
0.00

Jul
2021

Jan
2022

Jul
2022

Jan
2023

Stats

N Data: 8
N Detect: 0
% Detect: 0

MK criteria not met

Shapes

● Detect
○ NonDetect
▼ Detect Limit

Jul
2021

Jan
2022

Jul
2022

Jan
2023

Scatterplots and Trend Analysis

D5, Molybdenum

Concentration (µg/L)

1.0
0.8
0.6
0.4
0.2
0.0

Jul
2021

Jan
2022

Jul
2022

Jan
2023

Stats

N Data: 8
N Detect: 0
% Detect: 0

MK criteria not met

Shapes

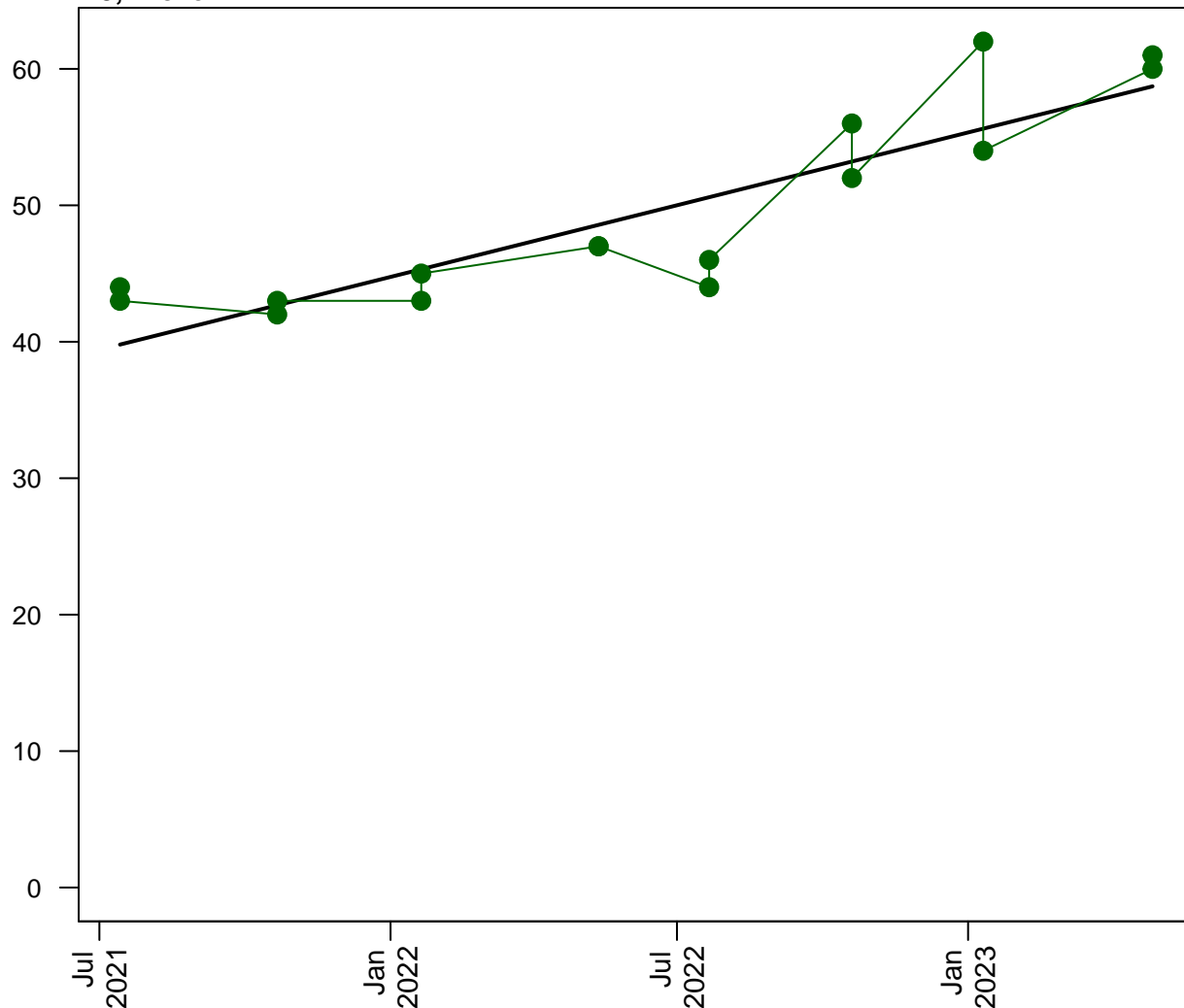
● Detect
○ NonDetect
▼ Detect Limit



Scatterplots and Trend Analysis

D5, Nickel

Concentration (µg/L)



Stats

N Data: 16
N Detect: 16
% Detect: 100

95% Confidence
MK Trend: Significant
MK p-val: <0.001
Direction: Increasing

Lines

— Linear Fit

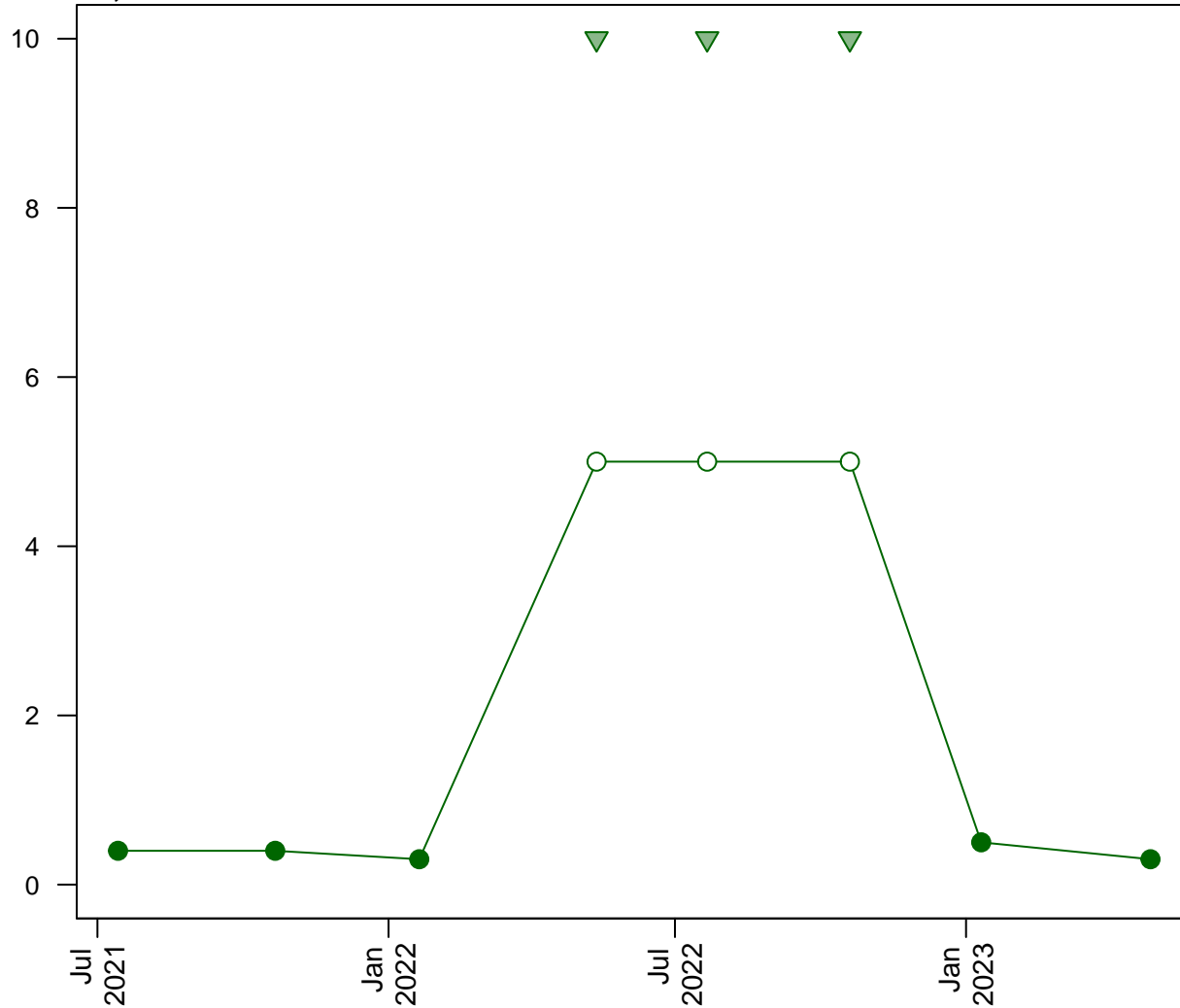
Shapes

● Detect
○ NonDetect
▼ Detect Limit

Scatterplots and Trend Analysis

D5, Selenium

Concentration (µg/L)



Stats

N Data: 8

N Detect: 5

% Detect: 62

95% Confidence

MK Trend: NS

MK p-val: 0.897

Shapes



Detect



NonDetect

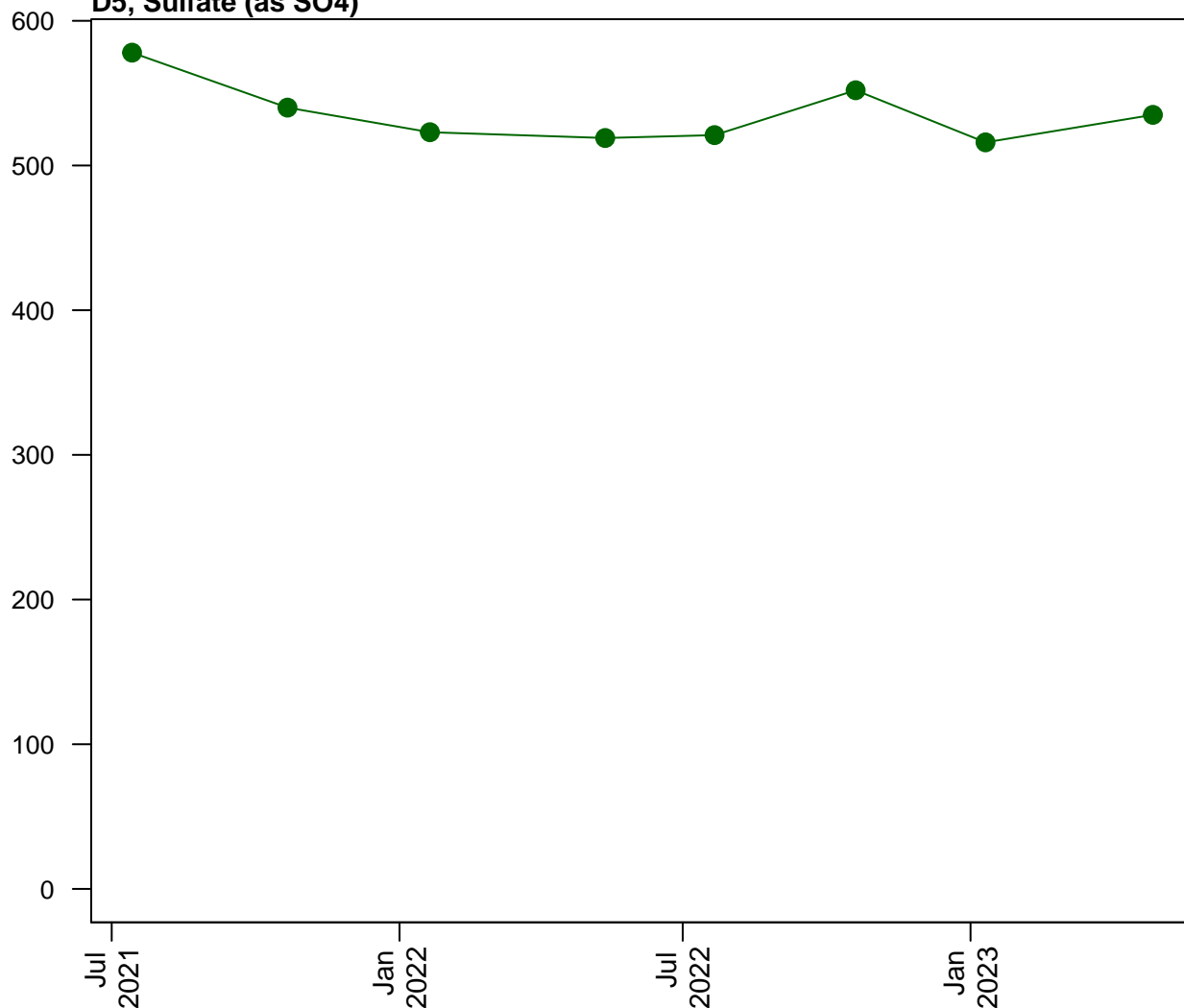


Detect Limit

Scatterplots and Trend Analysis

D5, Sulfate (as SO4)

Concentration (mg/L)



Stats

N Data: 8

N Detect: 8

% Detect: 100

95% Confidence

MK Trend: NS

MK p-val: 0.275

Shapes



Detect



NonDetect

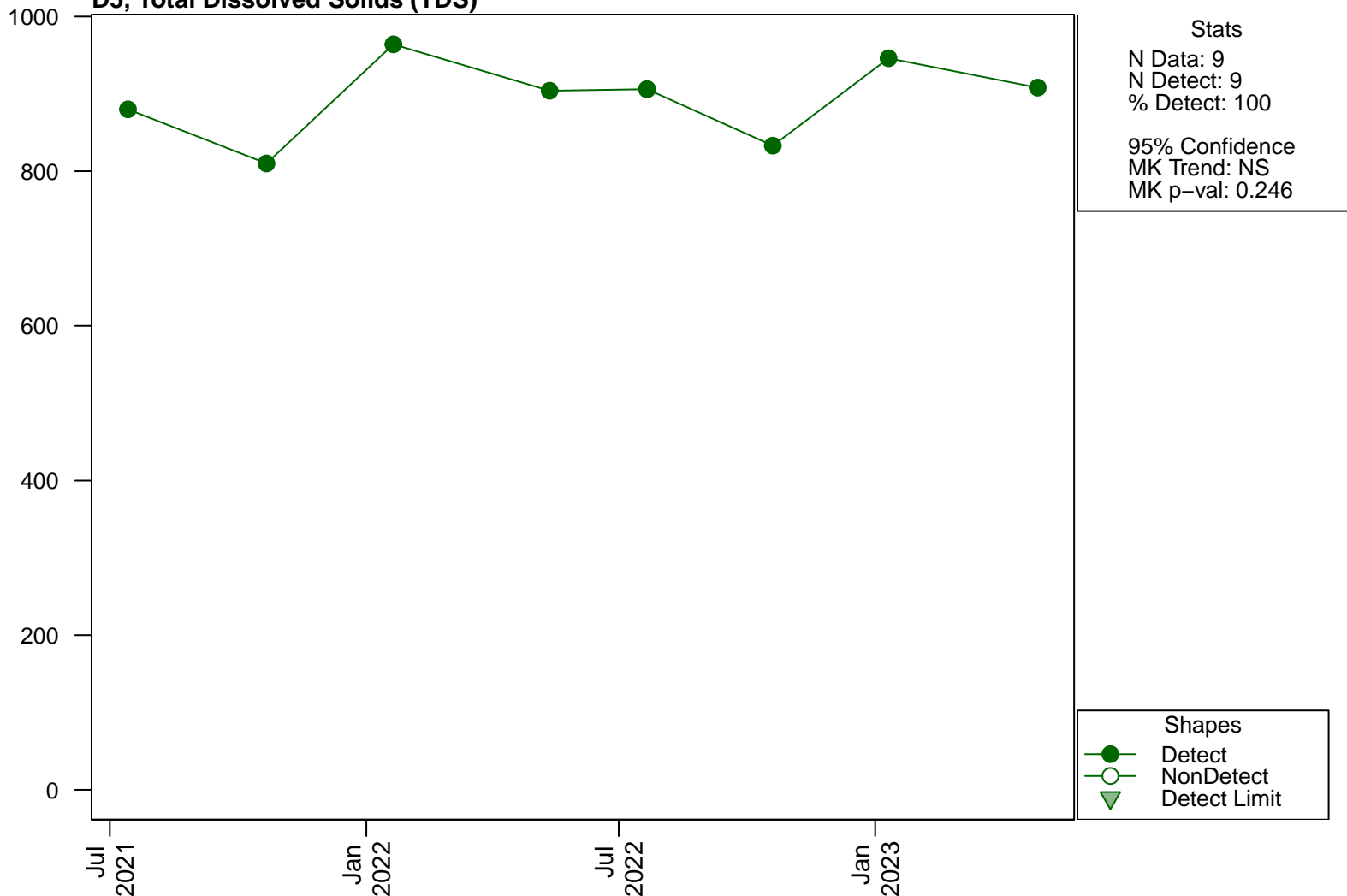


Detect Limit

Scatterplots and Trend Analysis

D5, Total Dissolved Solids (TDS)

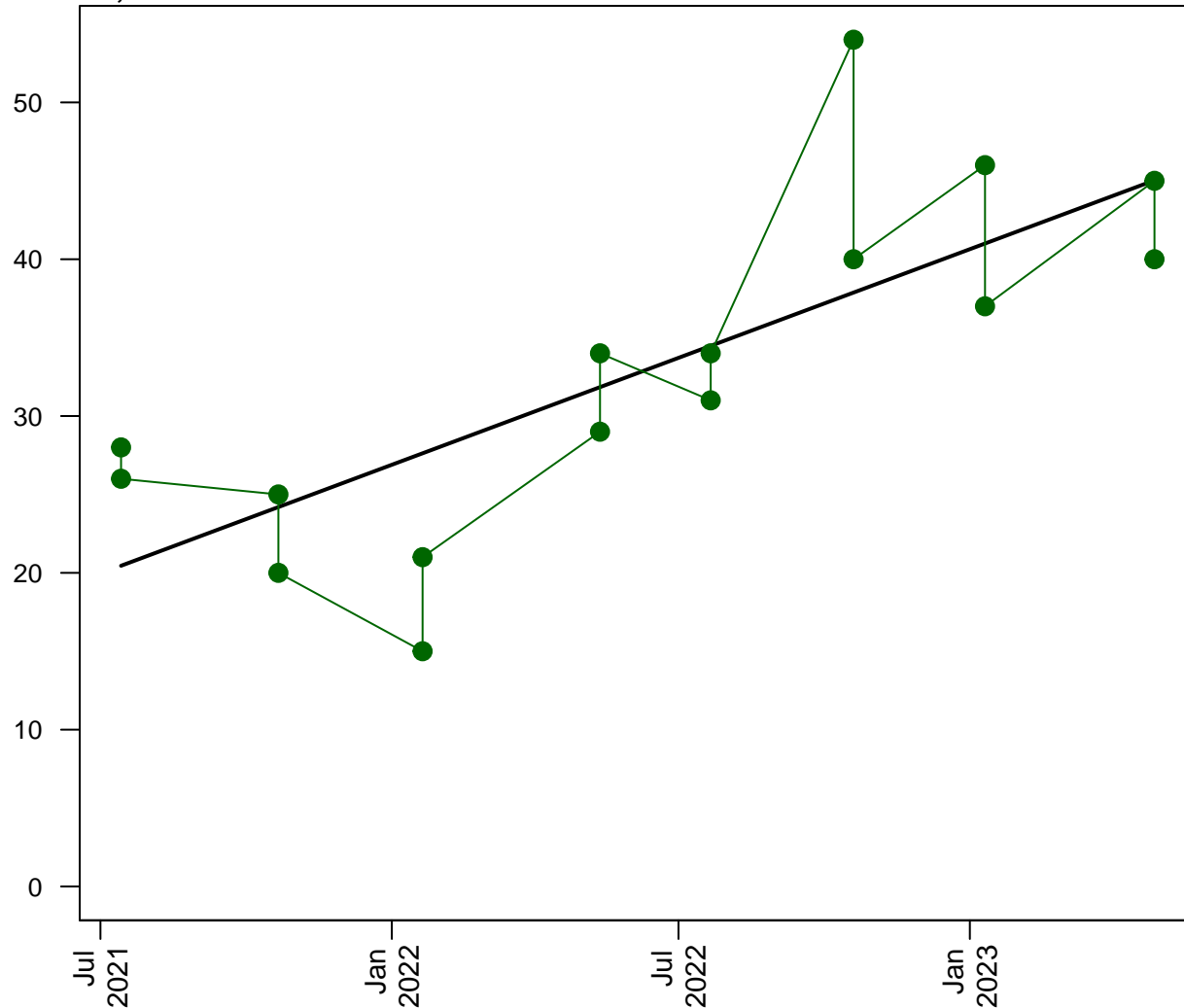
Concentration (mg/L)



Scatterplots and Trend Analysis

D5, Zinc

Concentration (µg/L)



Stats

N Data: 16
N Detect: 16
% Detect: 100

95% Confidence
MK Trend: Significant
MK p-val: 0.00106
Direction: Increasing

Lines

— Linear Fit

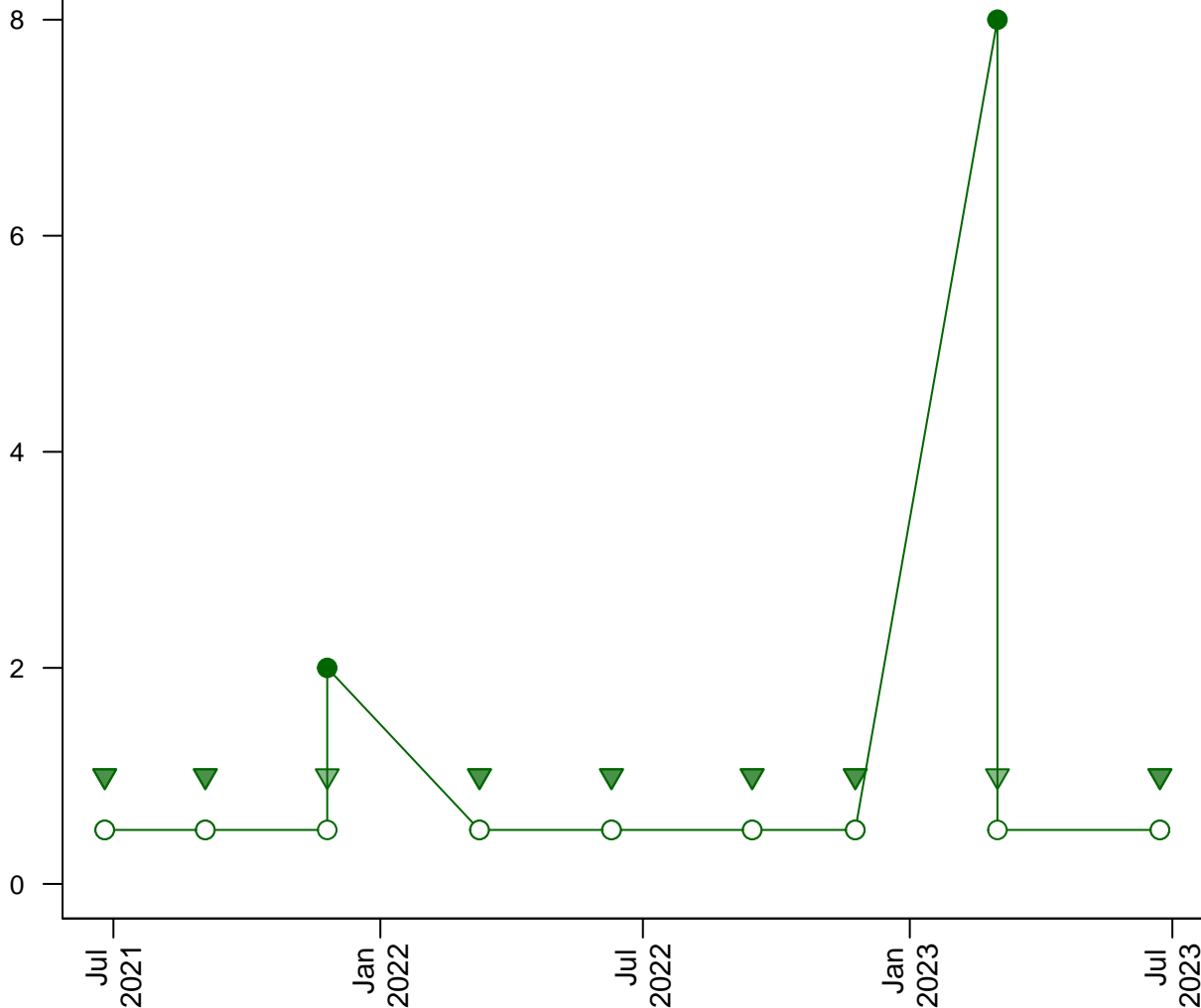
Shapes

● Detect
○ NonDetect
▼ Detect Limit

Scatterplots and Trend Analysis

D8, Arsenic

Concentration (µg/L)



Stats

N Data: 18

N Detect: 2

% Detect: 11

MK criteria not met

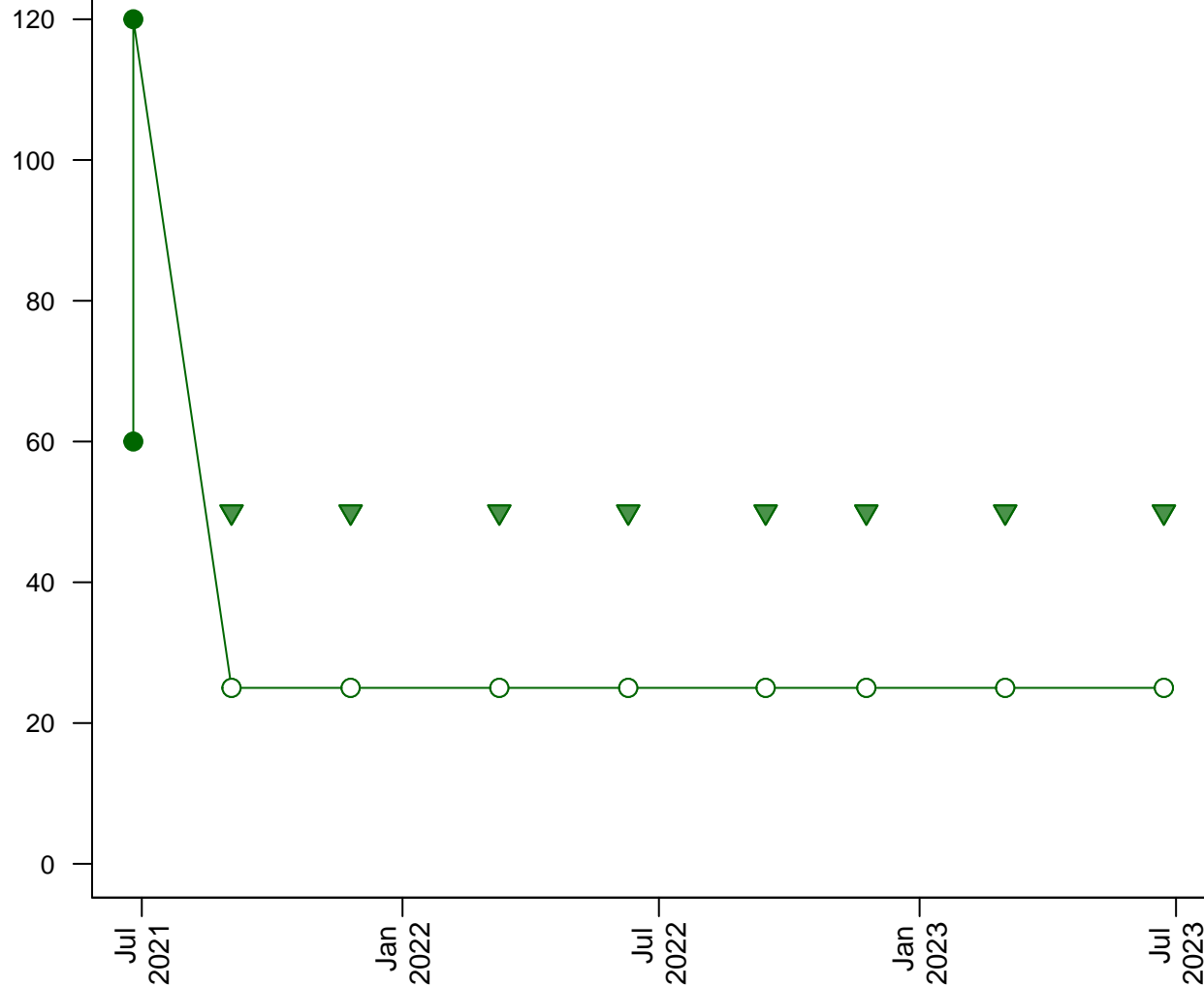
Shapes

- Detect
- NonDetect
- ▼ Detect Limit

Scatterplots and Trend Analysis

D8, Boron

Concentration (µg/L)



Stats

N Data: 18

N Detect: 2

% Detect: 11

MK criteria not met

Shapes

● Detect

○ NonDetect

▼ Detect Limit

Scatterplots and Trend Analysis

D8, Cadmium

Concentration (µg/L)

0.20
0.15
0.10
0.05
0.00

Jul
2021

Jan
2022

Jul
2022

Jan
2023

Jul
2023

Stats

N Data: 9

N Detect: 2

% Detect: 22

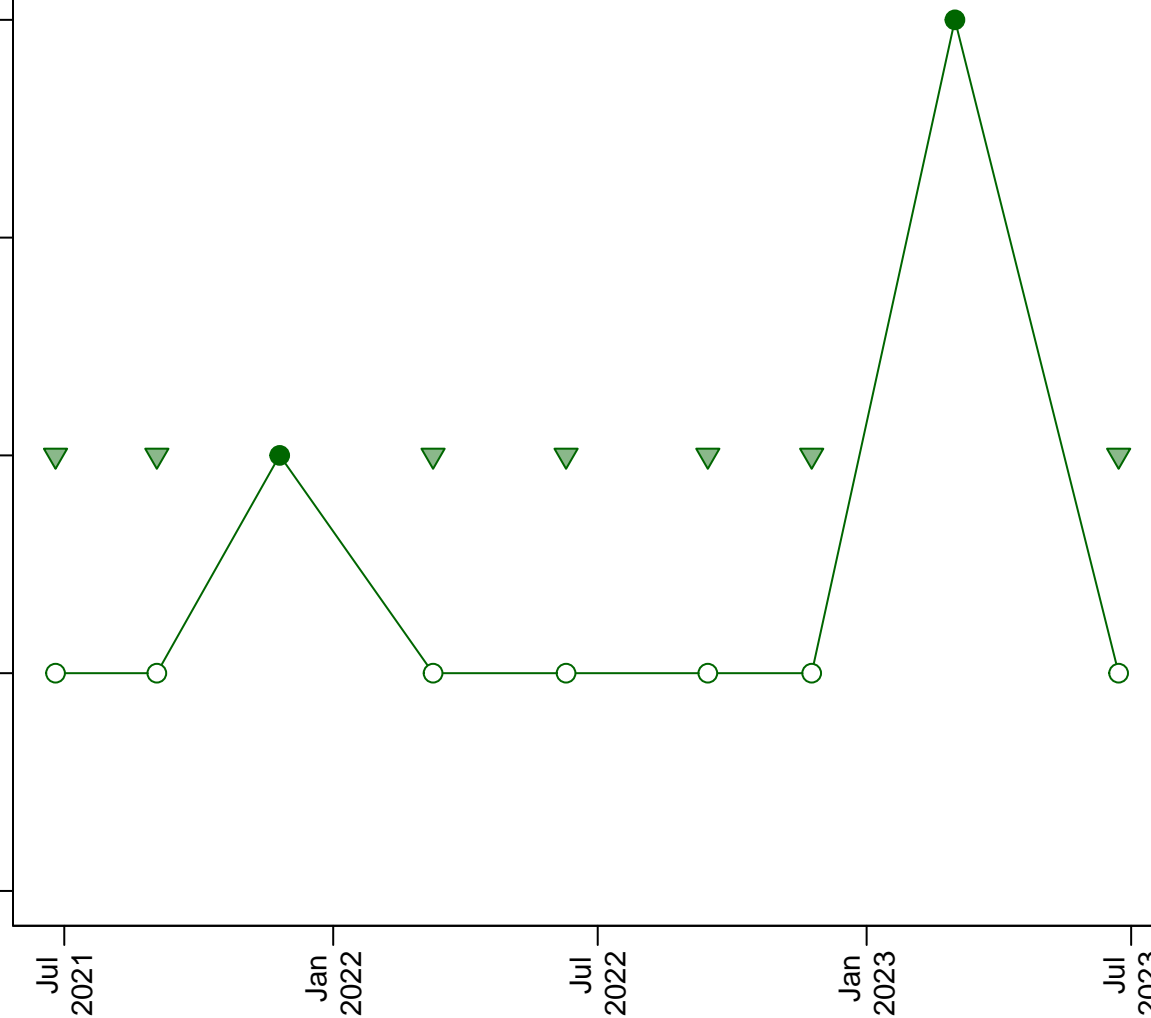
MK criteria not met

Shapes

● Detect

○ NonDetect

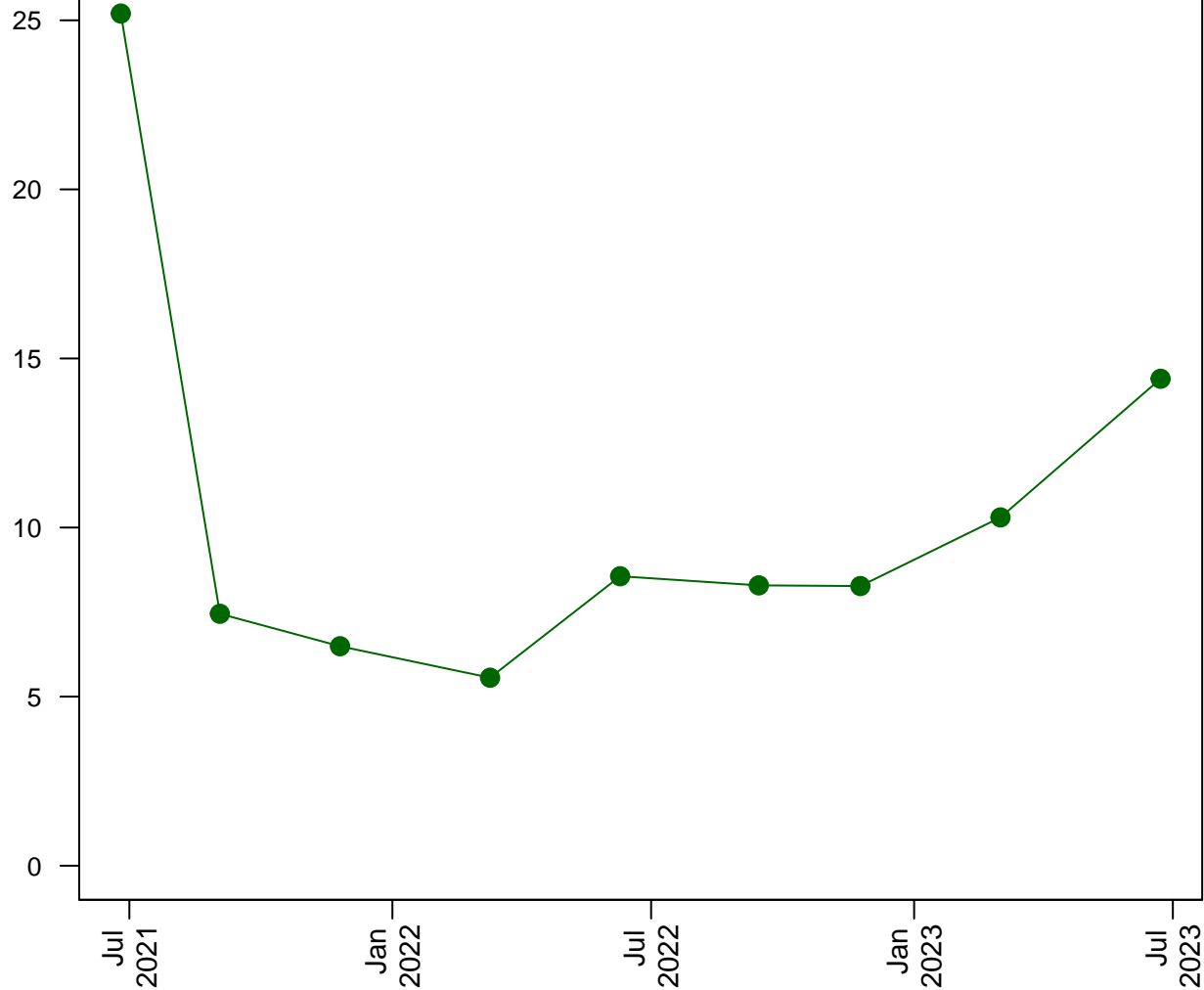
▼ Detect Limit



Scatterplots and Trend Analysis

D8, Chloride

Concentration (mg/L)



Stats

N Data: 9
N Detect: 9
% Detect: 100

95% Confidence
MK Trend: NS
MK p-val: 0.477

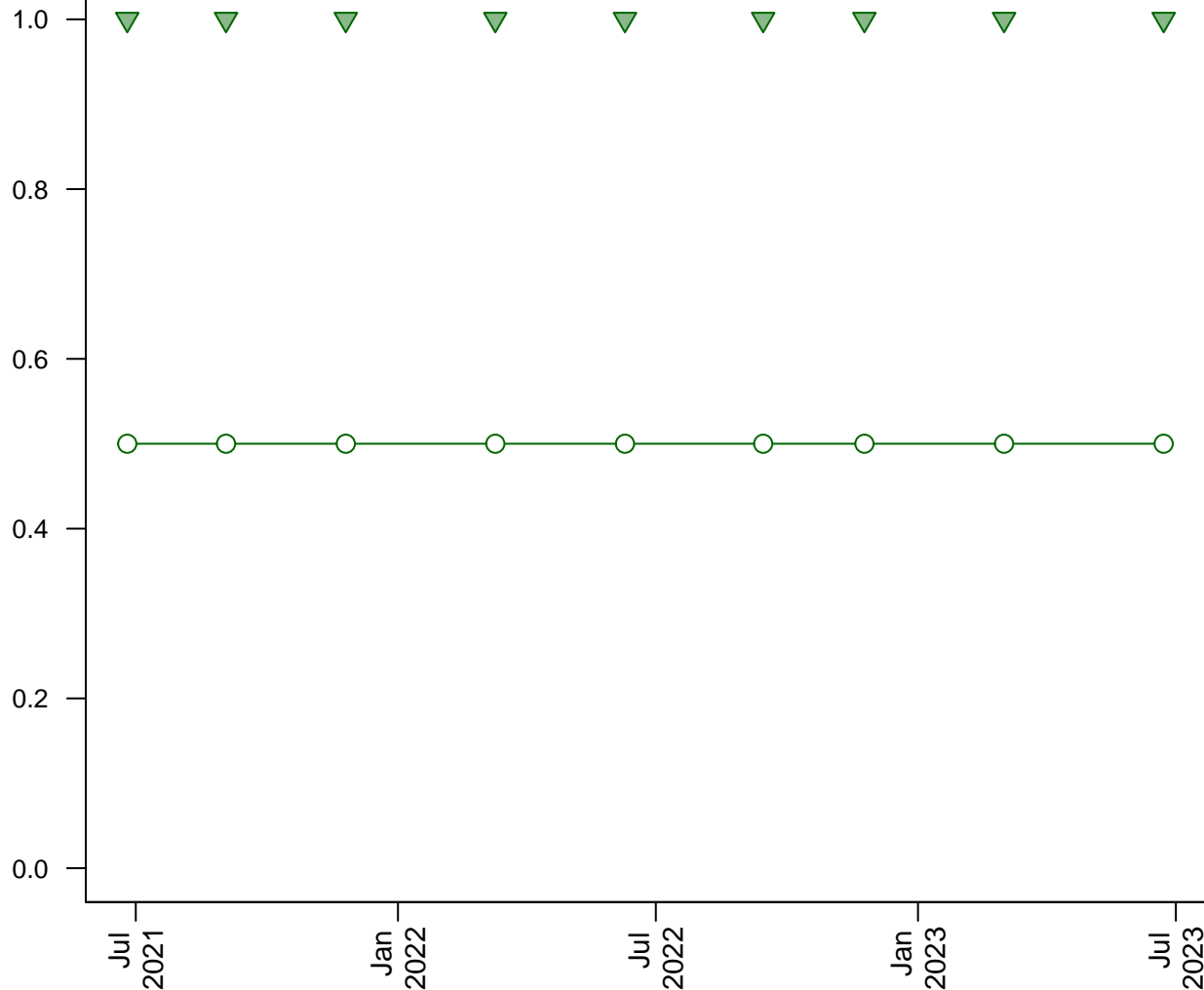
Shapes

● Detect
○ NonDetect
▼ Detect Limit

Scatterplots and Trend Analysis

D8, Chromium

Concentration (µg/L)



Stats

N Data: 9

N Detect: 0

% Detect: 0

MK criteria not met

Shapes



Detect



NonDetect

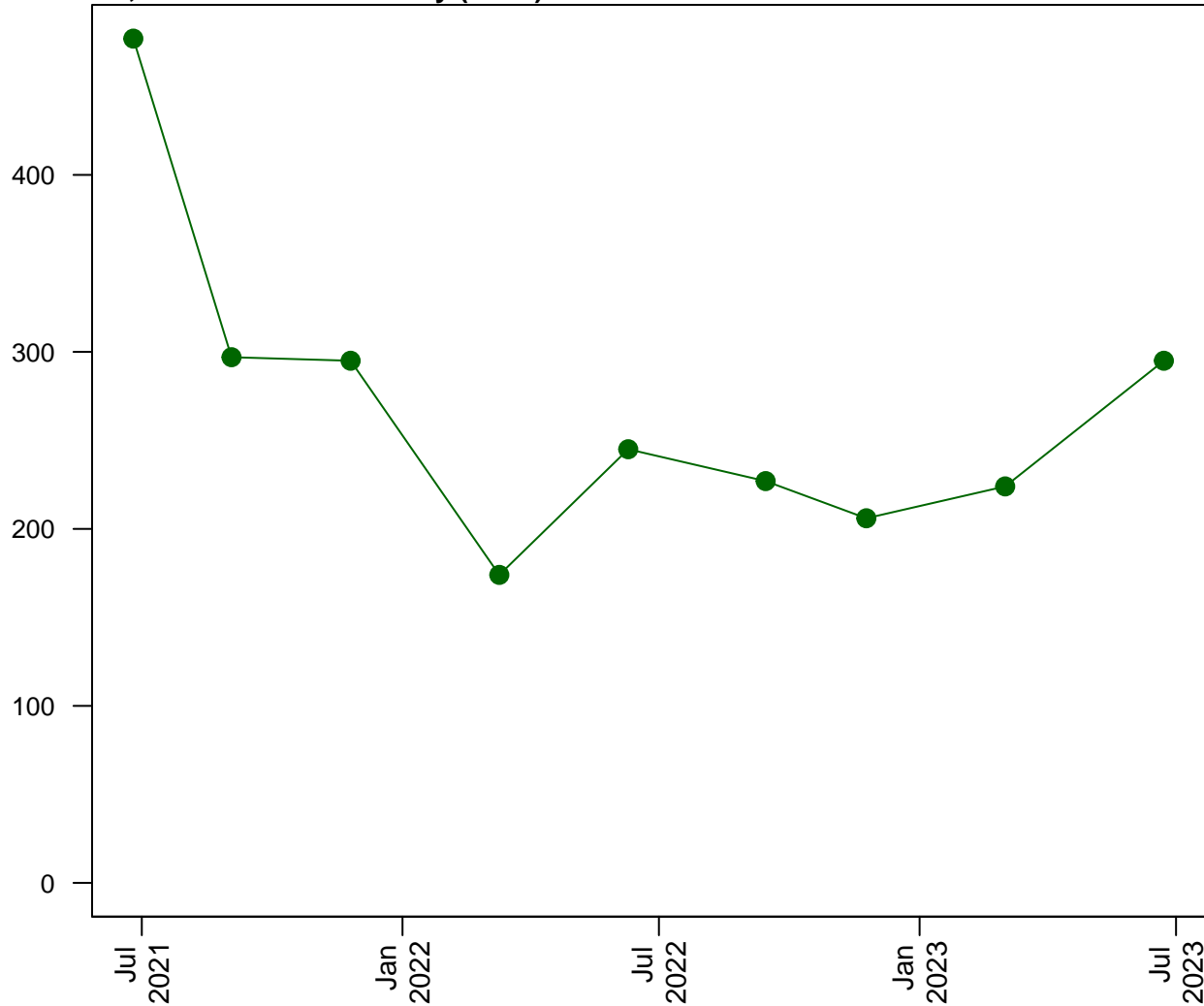


Detect Limit

Scatterplots and Trend Analysis

D8, Electrical Conductivity (Field)

Concentration (uS/cm)



Stats

N Data: 9
N Detect: 9
% Detect: 100

95% Confidence
MK Trend: NS
MK p-val: 0.116

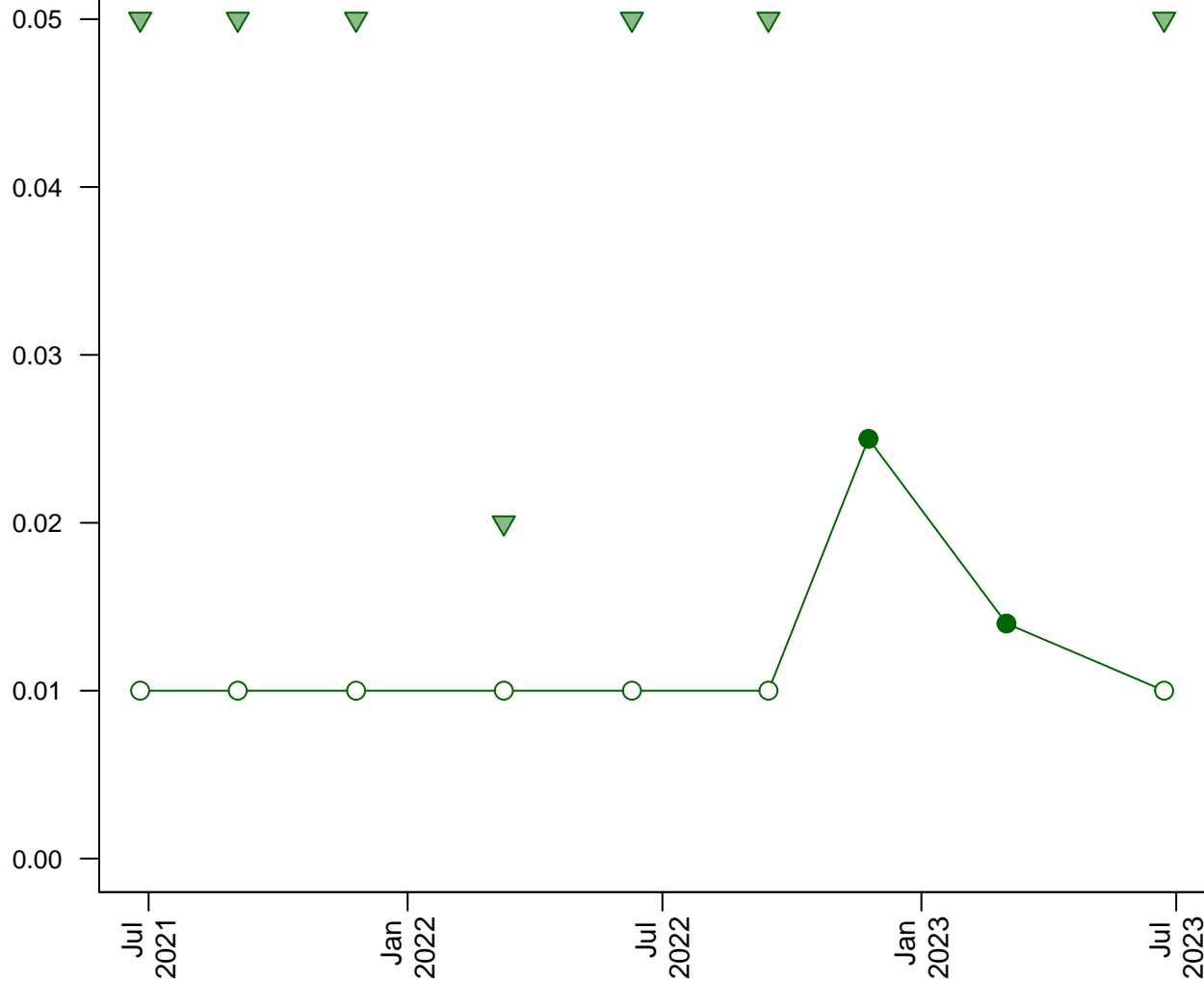
Shapes

● Detect
○ NonDetect
▼ Detect Limit

Scatterplots and Trend Analysis

D8, Fluoride

Concentration (mg/L)



Stats

N Data: 9
N Detect: 2
% Detect: 22

MK criteria not met

Shapes

● Detect
○ NonDetect
▼ Detect Limit

Scatterplots and Trend Analysis

D8, Iron

Concentration (µg/L)

500
400
300
200
100
0

Jul
2021

Jan
2022

Jul
2022

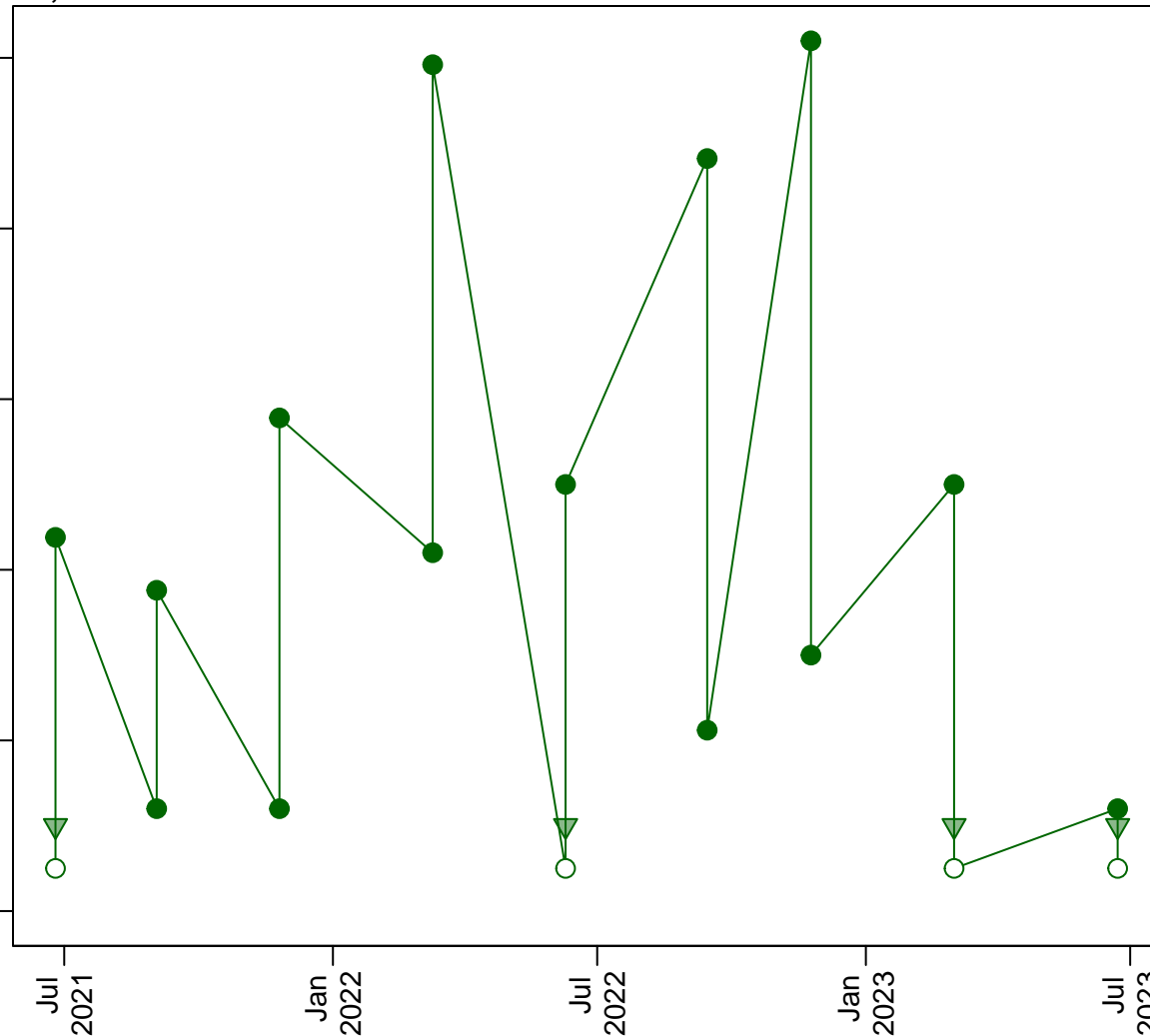
Jan
2023

Jul
2023

Stats
N Data: 18
N Detect: 14
% Detect: 78

95% Confidence
MK Trend: NS
MK p-val: 0.878

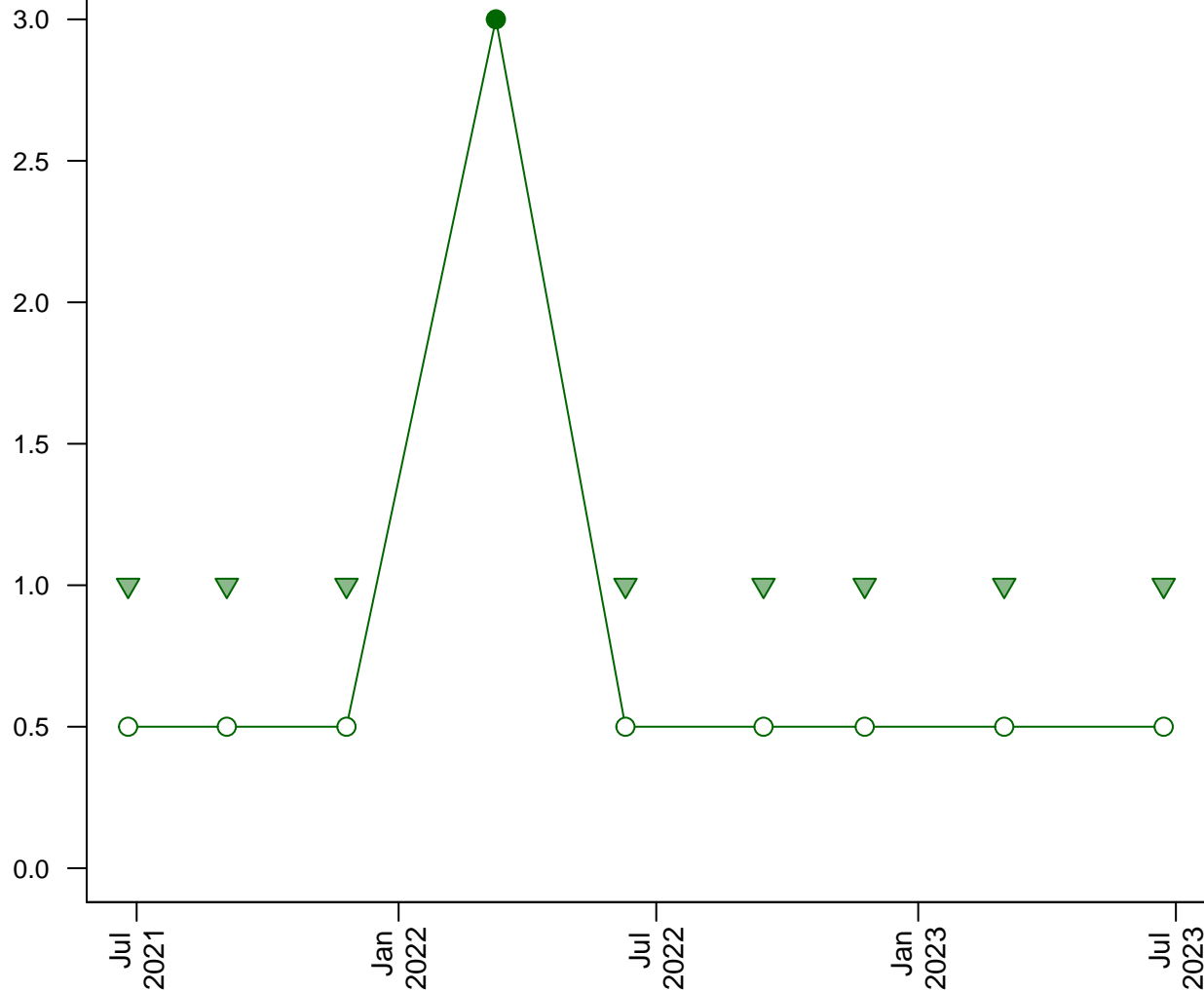
Shapes
Detect
NonDetect
Detect Limit



Scatterplots and Trend Analysis

D8, Lead

Concentration (µg/L)



Stats

N Data: 9

N Detect: 1

% Detect: 11

MK criteria not met

Shapes

● Detect

○ NonDetect

▼ Detect Limit

Scatterplots and Trend Analysis D8, Manganese

Concentration (µg/L)

300
250
200
150
100
50
0

Jul
2021

Jan
2022

Jul
2022

Jan
2023

Jul
2023

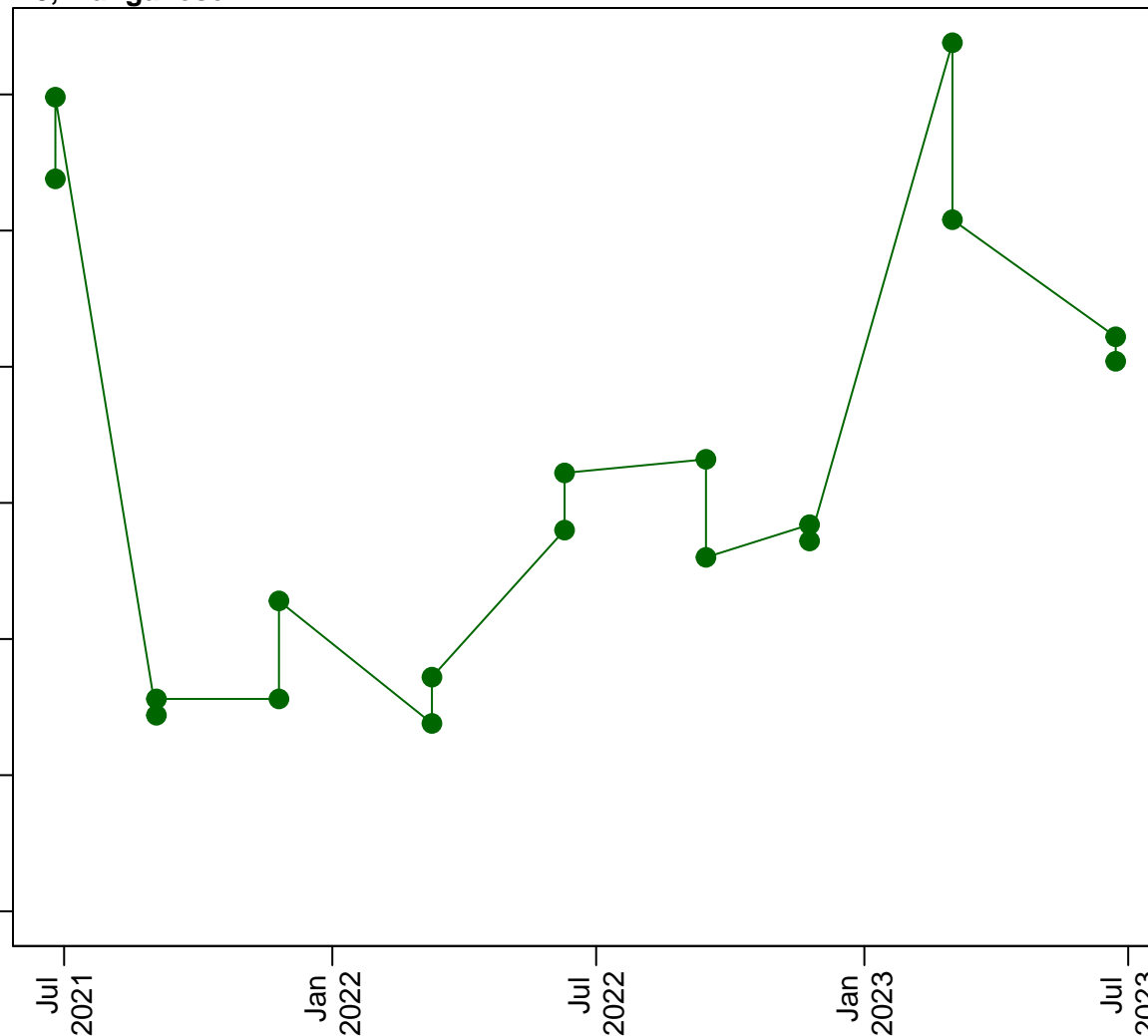
Stats

N Data: 18
N Detect: 18
% Detect: 100

95% Confidence
MK Trend: NS
MK p-val: 0.0517

Shapes

● Detect
○ NonDetect
▼ Detect Limit



Scatterplots and Trend Analysis

D8, Mercury

Concentration ($\mu\text{g/L}$)

0.04
0.03
0.02
0.01
0.00

Jul
2021

Jan
2022

Jul
2022

Jan
2023

Jul
2023

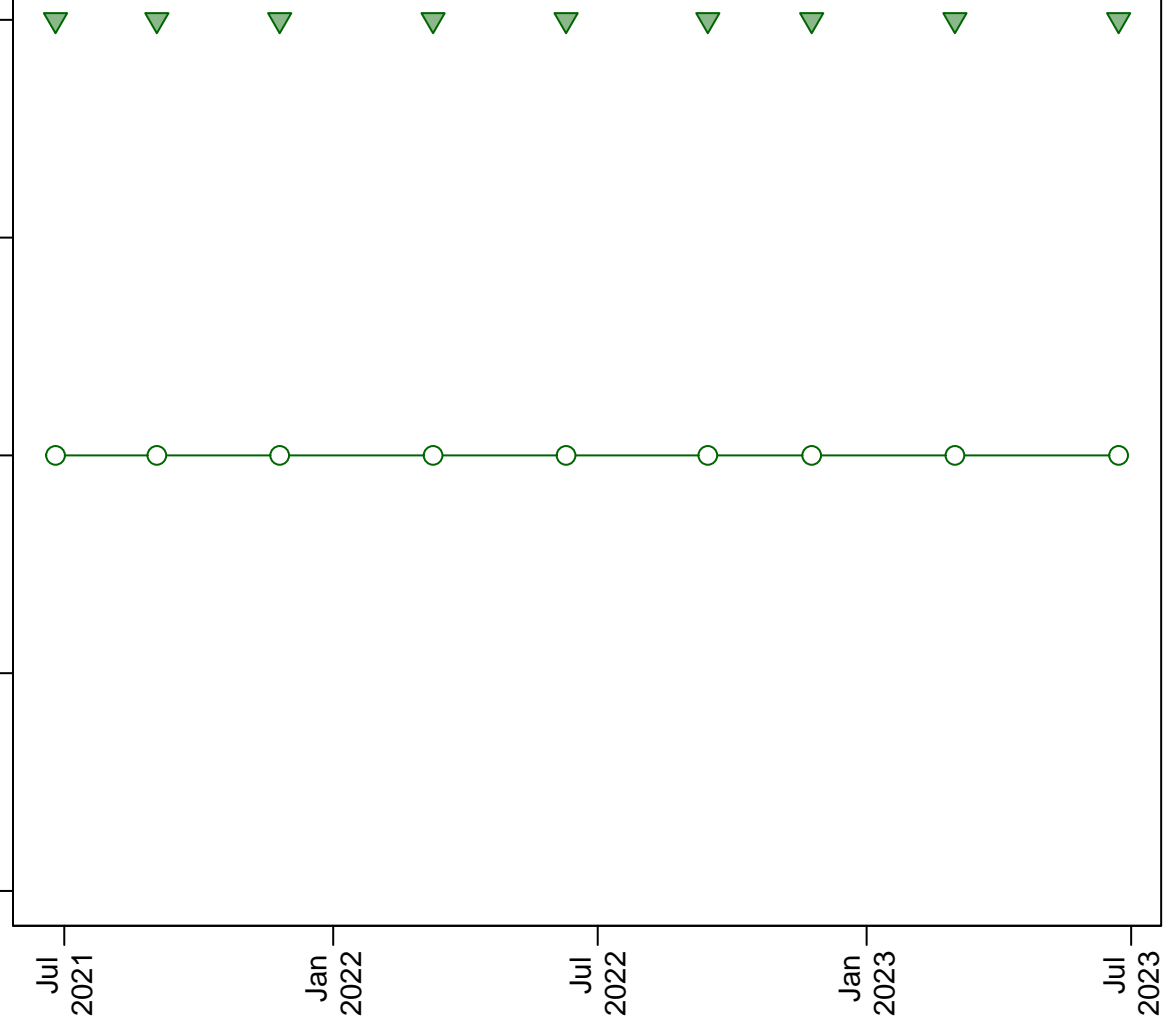
Stats

N Data: 9
N Detect: 0
% Detect: 0

MK criteria not met

Shapes

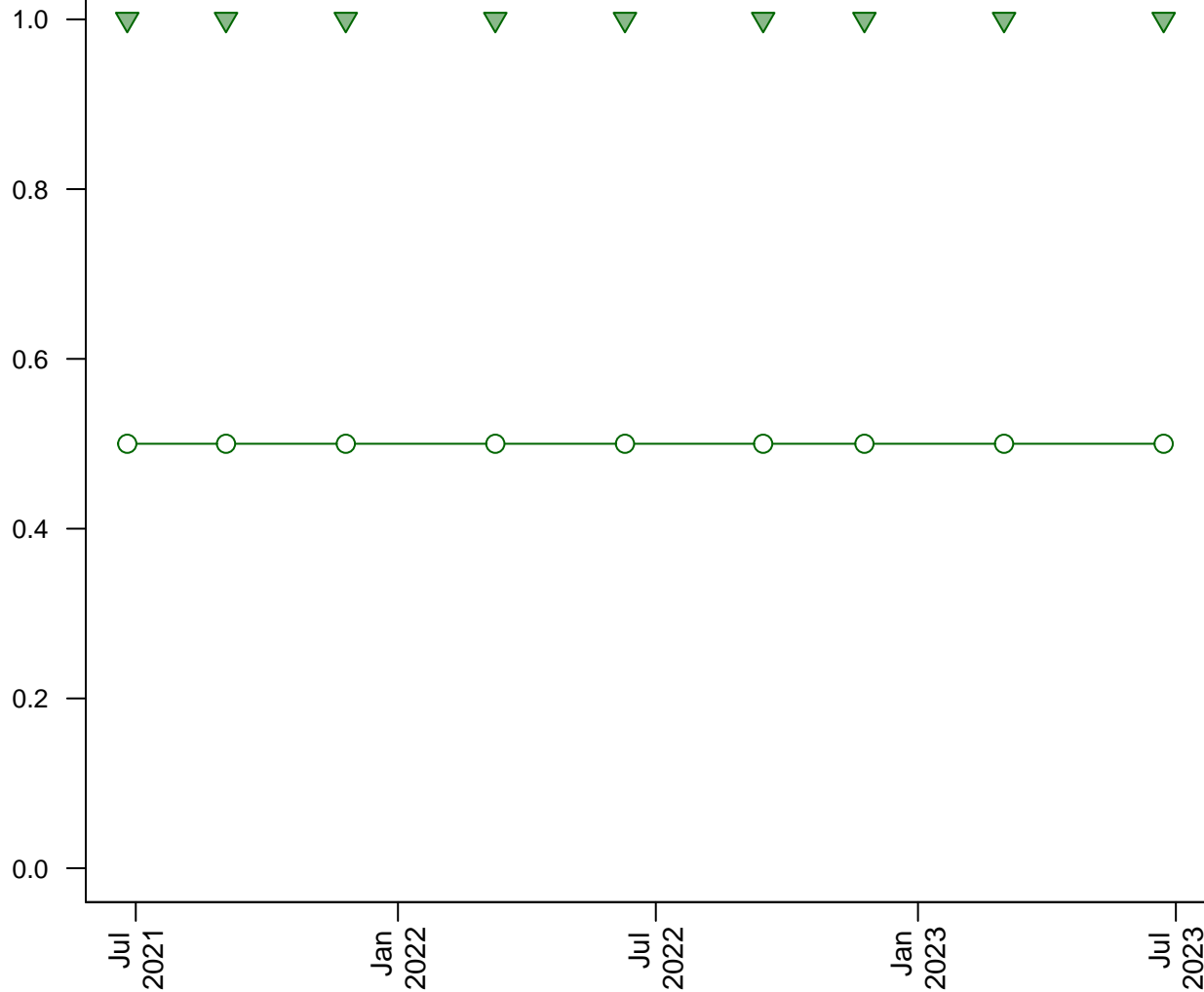
● Detect
○ NonDetect
▼ Detect Limit



Scatterplots and Trend Analysis

D8, Molybdenum

Concentration (µg/L)



Stats

N Data: 9

N Detect: 0

% Detect: 0

MK criteria not met

Shapes



Detect



NonDetect

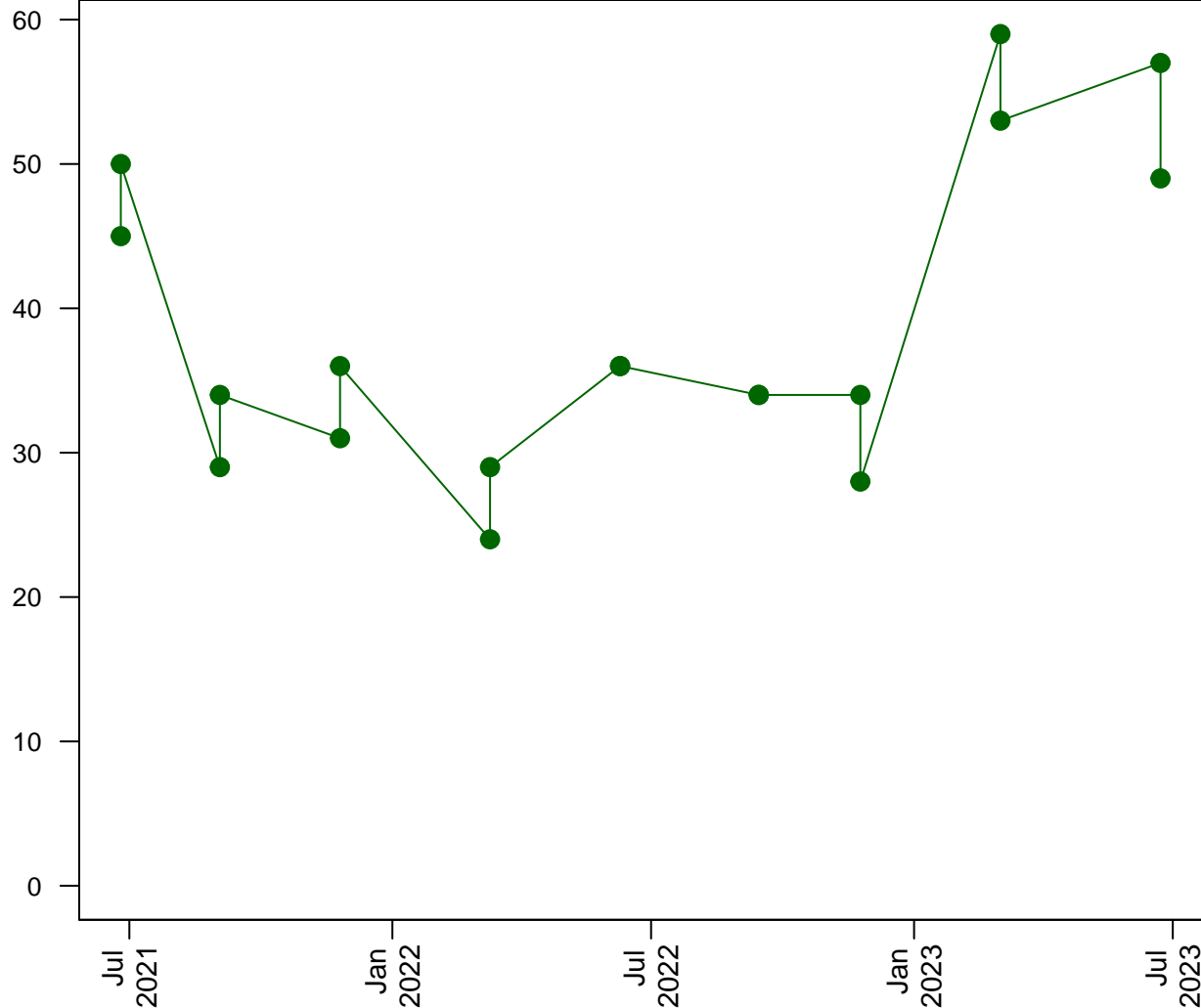


Detect Limit

Scatterplots and Trend Analysis

D8, Nickel

Concentration (µg/L)



Stats
N Data: 18
N Detect: 18
% Detect: 100

95% Confidence
MK Trend: NS
MK p-val: 0.281

Shapes
Detect
NonDetect
Detect Limit

Scatterplots and Trend Analysis

D8, Selenium

Concentration (µg/L)

10
8
6
4
2
0

Jul 2021
Jan 2022
Jul 2022
Jan 2023
Jul 2023

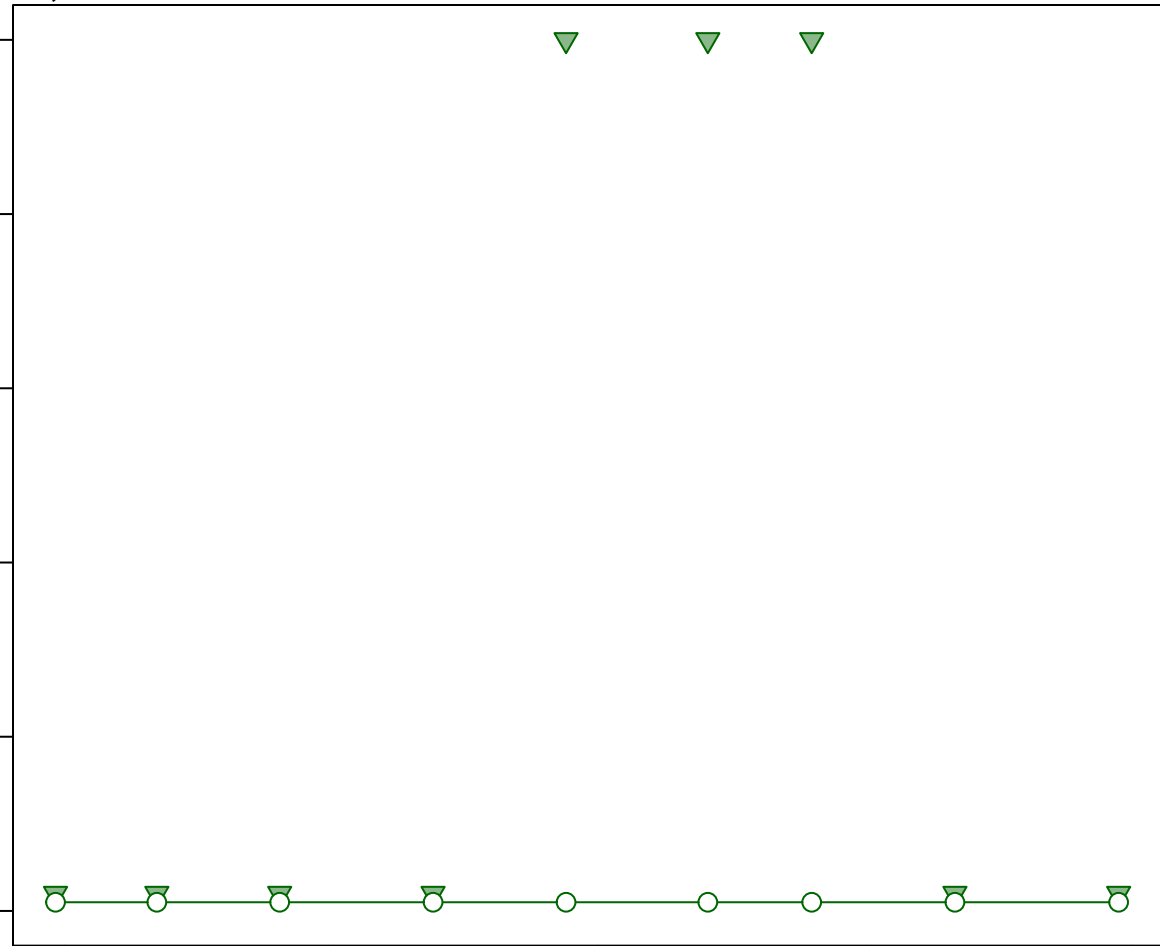
Stats

N Data: 9
N Detect: 0
% Detect: 0

MK criteria not met

Shapes

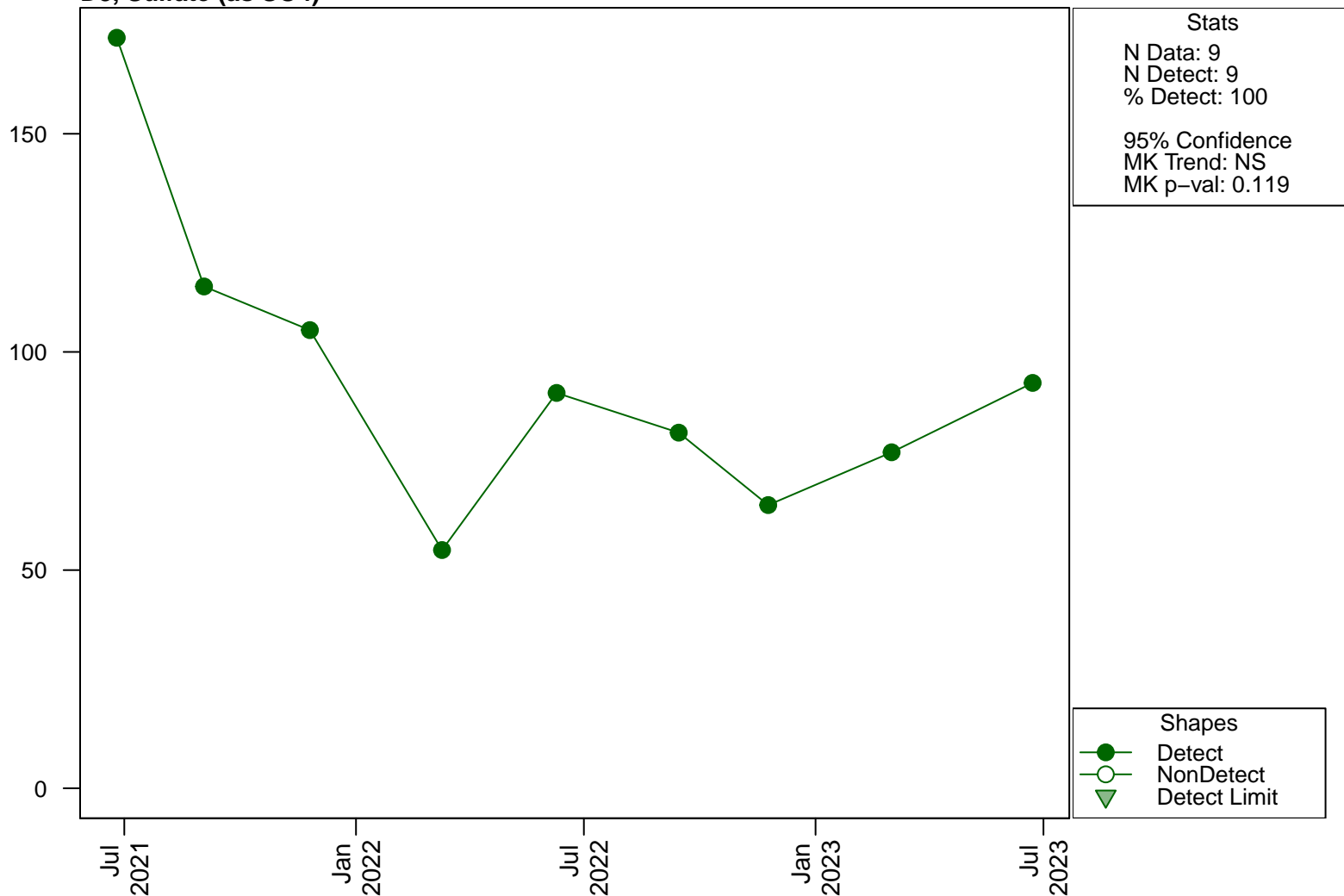
● Detect
○ NonDetect
▼ Detect Limit



Scatterplots and Trend Analysis

D8, Sulfate (as SO4)

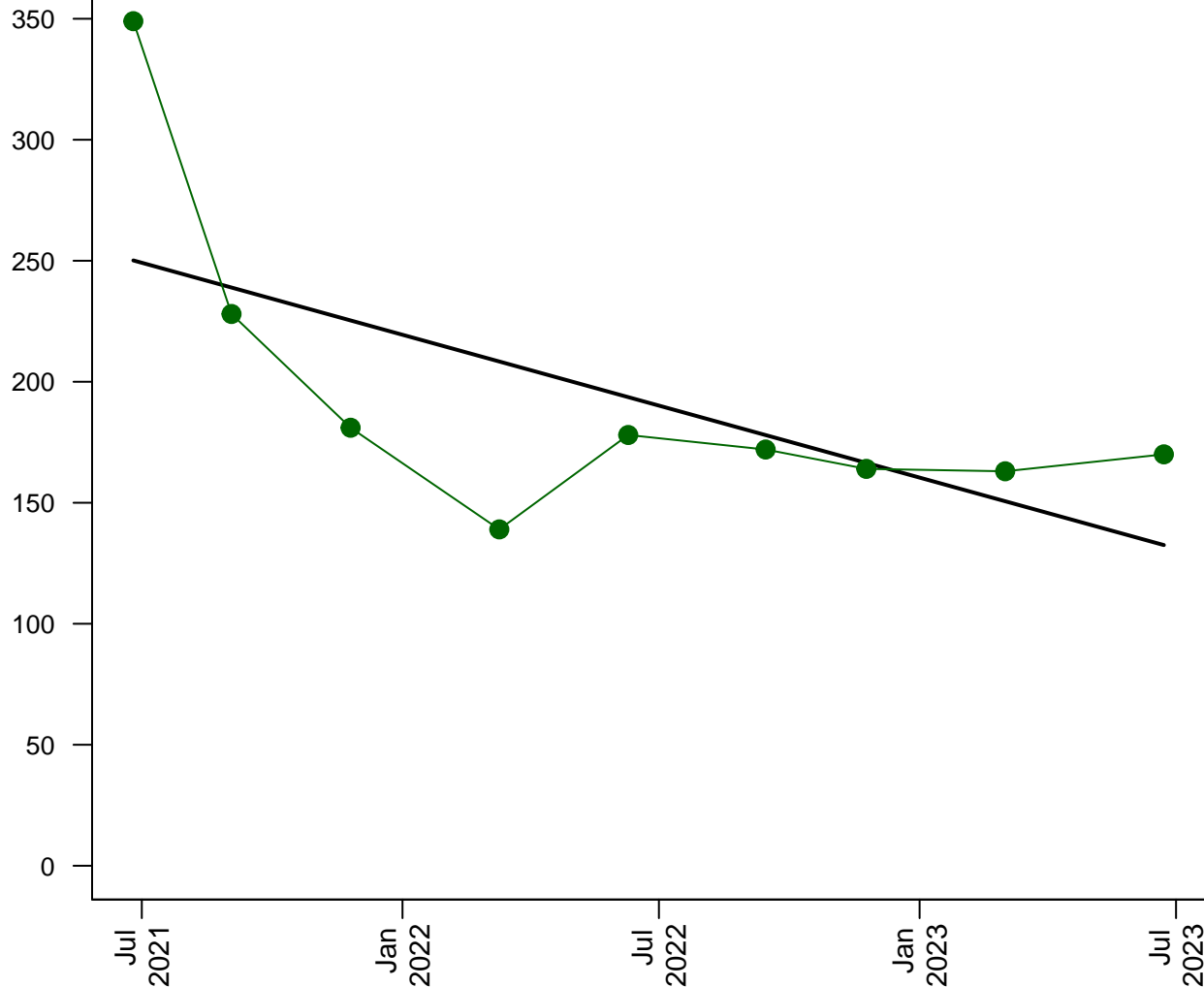
Concentration (mg/L)



Scatterplots and Trend Analysis

D8, Total Dissolved Solids (TDS)

Concentration (mg/L)



Stats

N Data: 9

N Detect: 9

% Detect: 100

95% Confidence

MK Trend: Significant

MK p-val: 0.0247

Direction: Decreasing

Lines

Linear Fit

Shapes

● Detect

○ NonDetect

▼ Detect Limit

Scatterplots and Trend Analysis

D8, Zinc

Concentration (µg/L)

70
60
50
40
30
20
10
0

Jul
2021

Jan
2022

Jul
2022

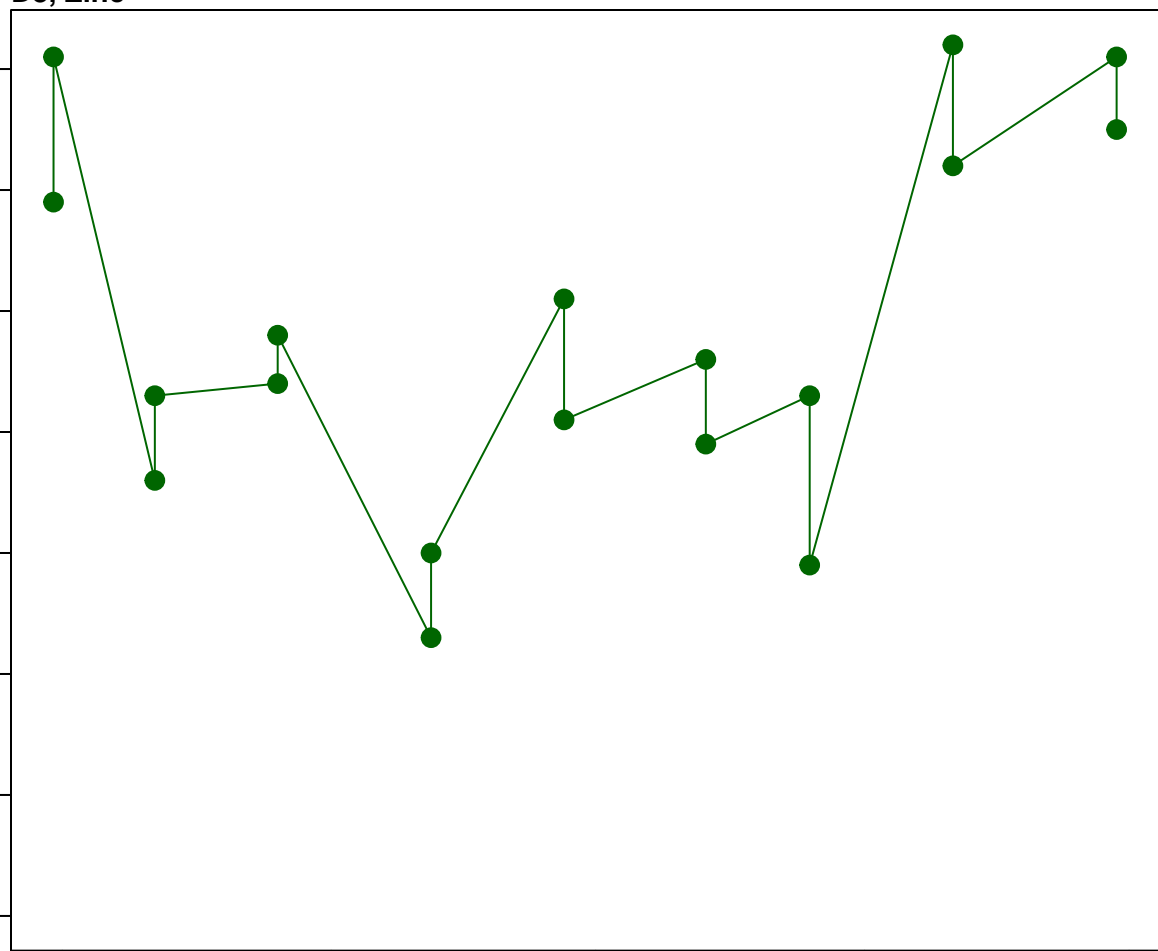
Jan
2023

Jul
2023

Stats
N Data: 18
N Detect: 18
% Detect: 100

95% Confidence
MK Trend: NS
MK p-val: 0.36

Shapes
Detect
NonDetect
Detect Limit



Scatterplots and Trend Analysis

D9, Arsenic

Concentration (µg/L)

12
10
8
6
4
2
0

Jul
2021

Jan
2022

Jul
2022

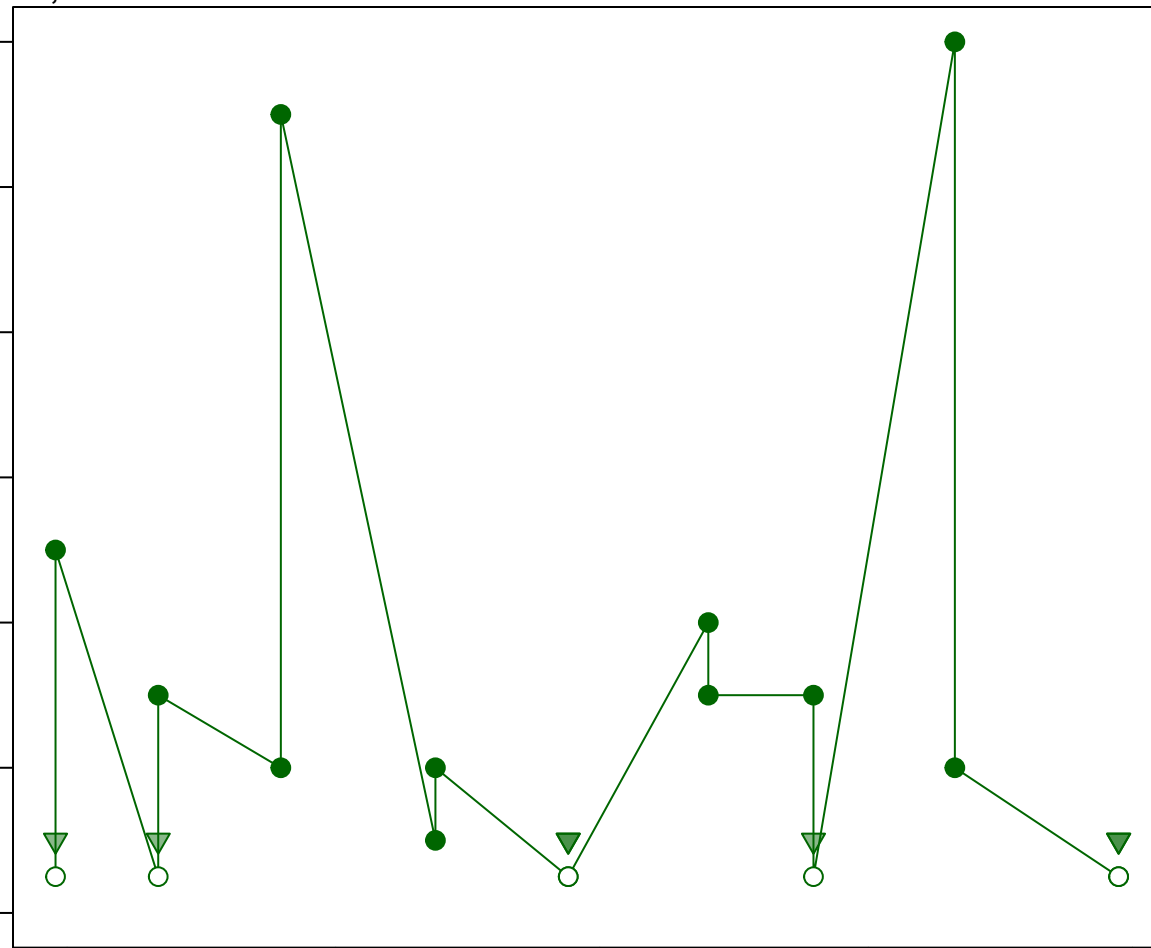
Jan
2023

Jul
2023

Stats
N Data: 18
N Detect: 11
% Detect: 61

95% Confidence
MK Trend: NS
MK p-val: 0.607

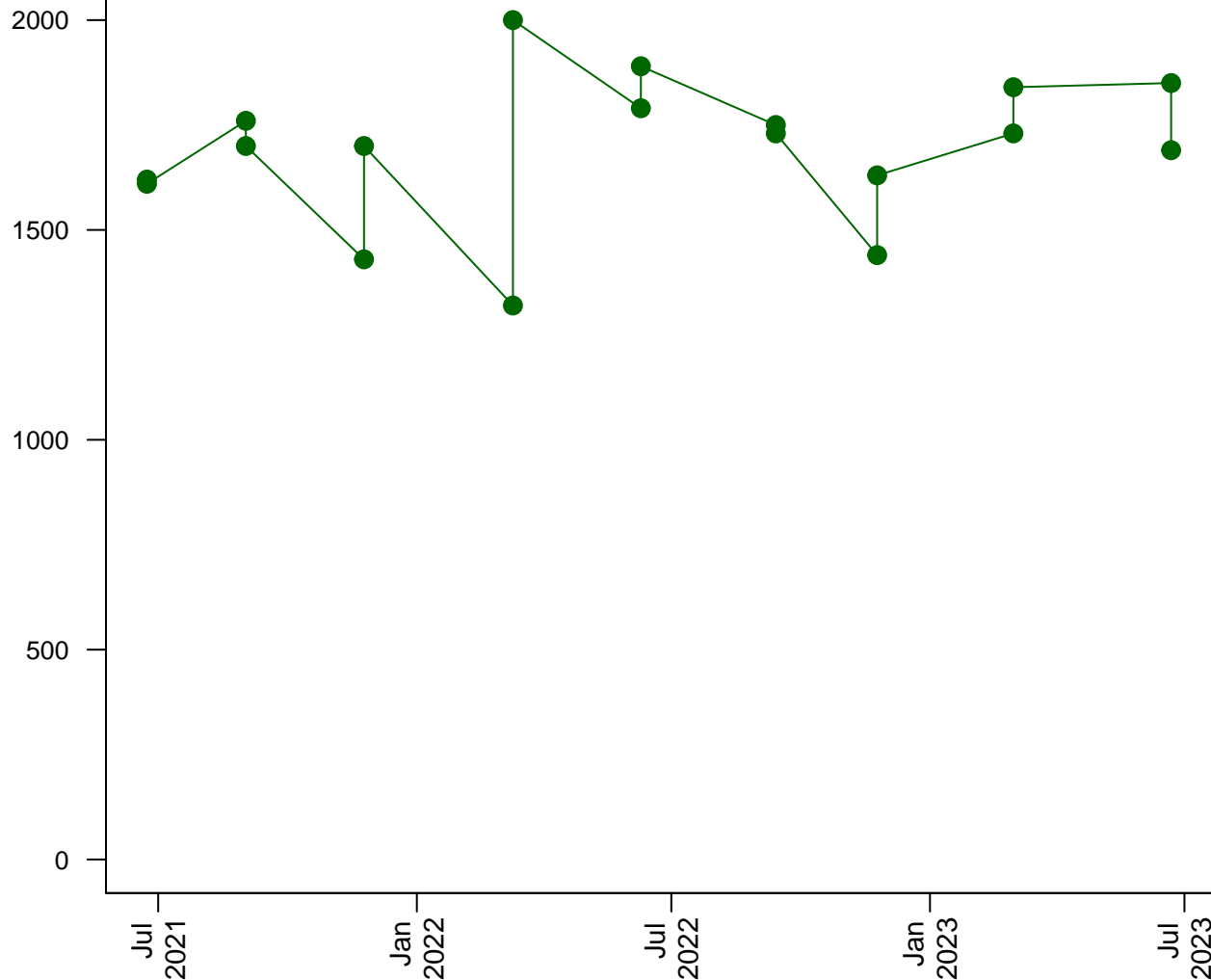
Shapes
● Detect
○ NonDetect
▼ Detect Limit



Scatterplots and Trend Analysis

D9, Boron

Concentration ($\mu\text{g/L}$)



Stats

N Data: 18
N Detect: 18
% Detect: 100

95% Confidence
MK Trend: NS
MK p-val: 0.321

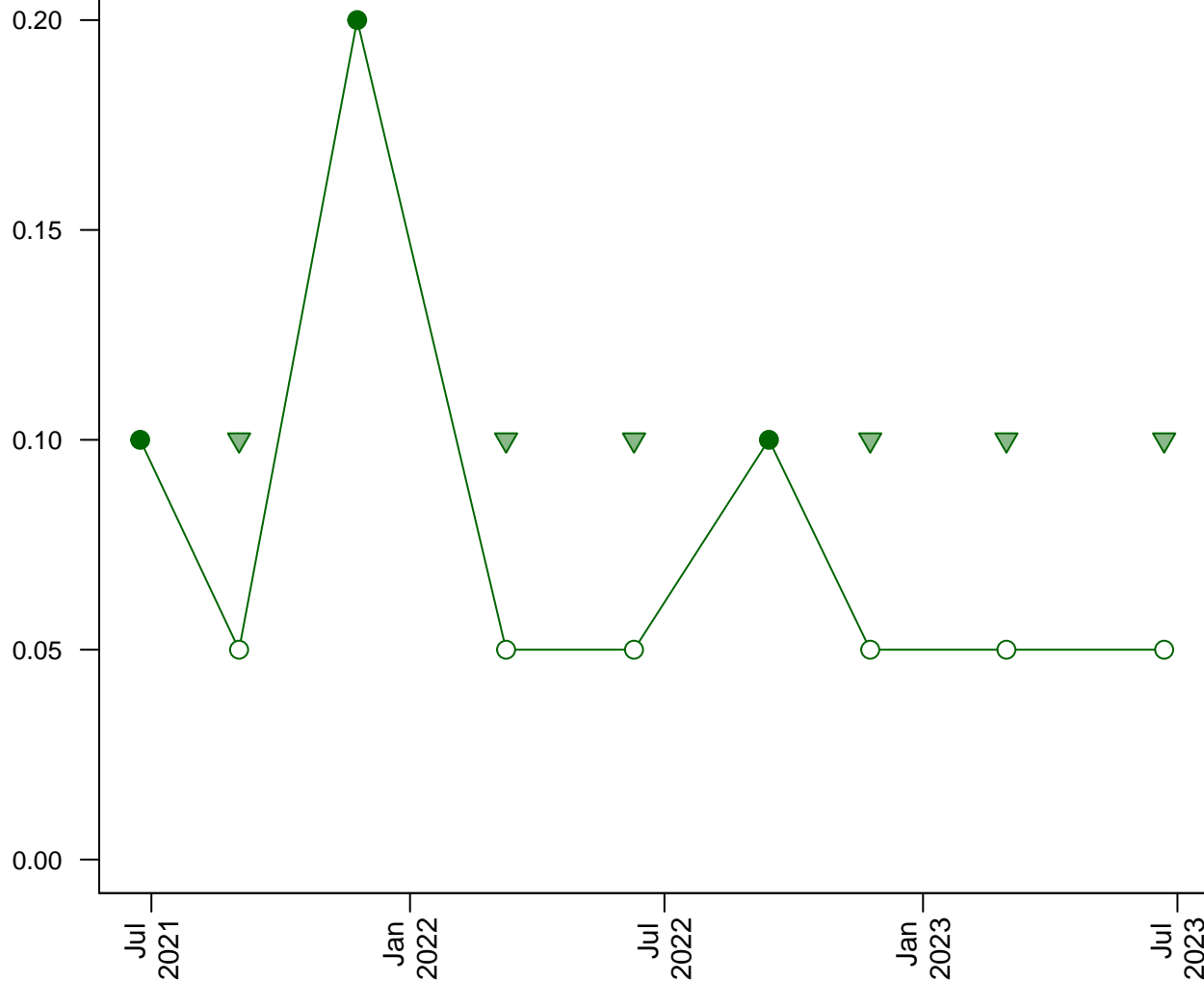
Shapes

● Detect
○ NonDetect
▼ Detect Limit

Scatterplots and Trend Analysis

D9, Cadmium

Concentration (µg/L)



Stats

N Data: 9

N Detect: 3

% Detect: 33

MK criteria not met

Shapes

● Detect

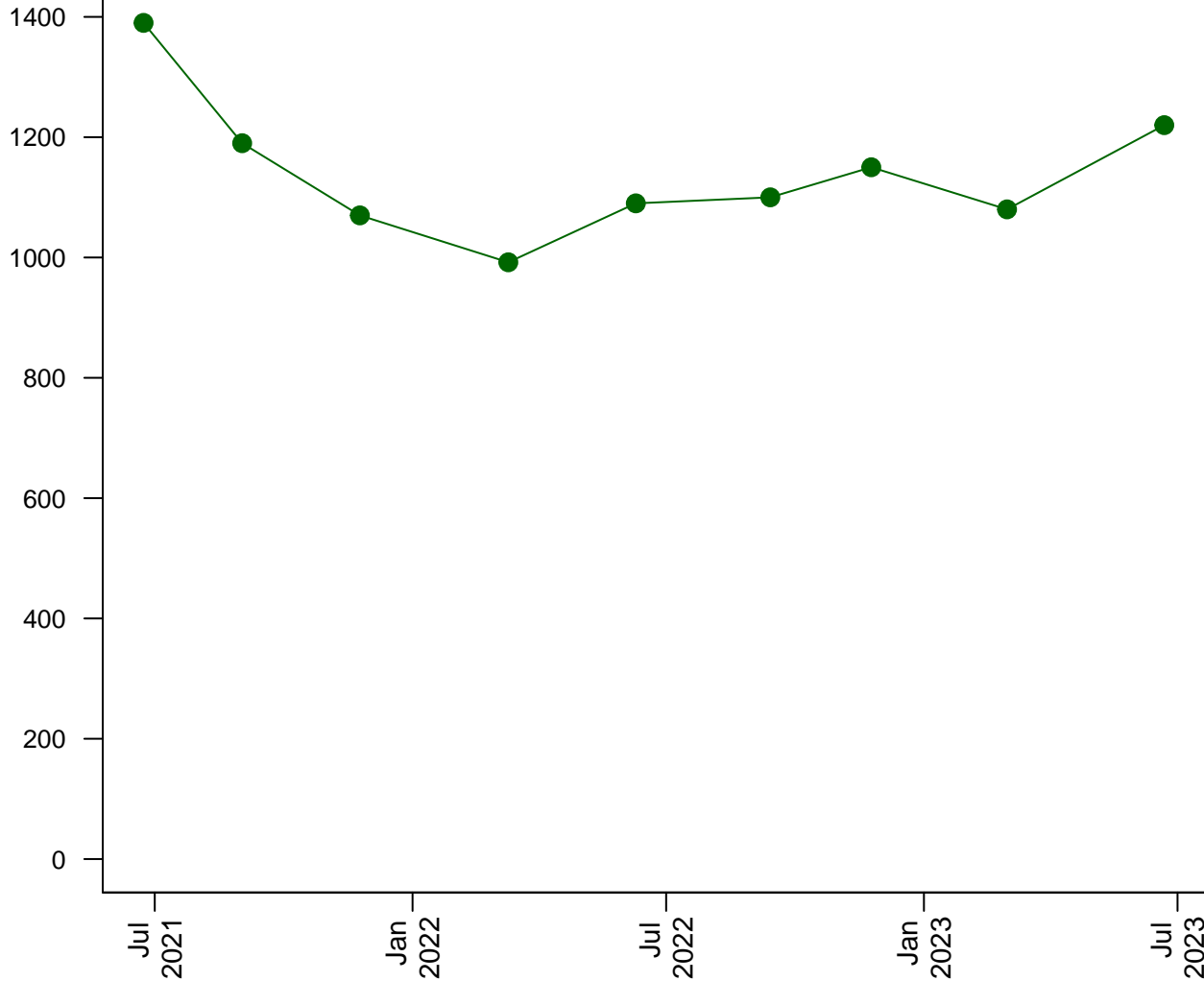
○ NonDetect

▼ Detect Limit

Scatterplots and Trend Analysis

D9, Chloride

Concentration (mg/L)



Stats

N Data: 9

N Detect: 9

% Detect: 100

95% Confidence

MK Trend: NS

MK p-val: 1

Shapes



Detect



NonDetect

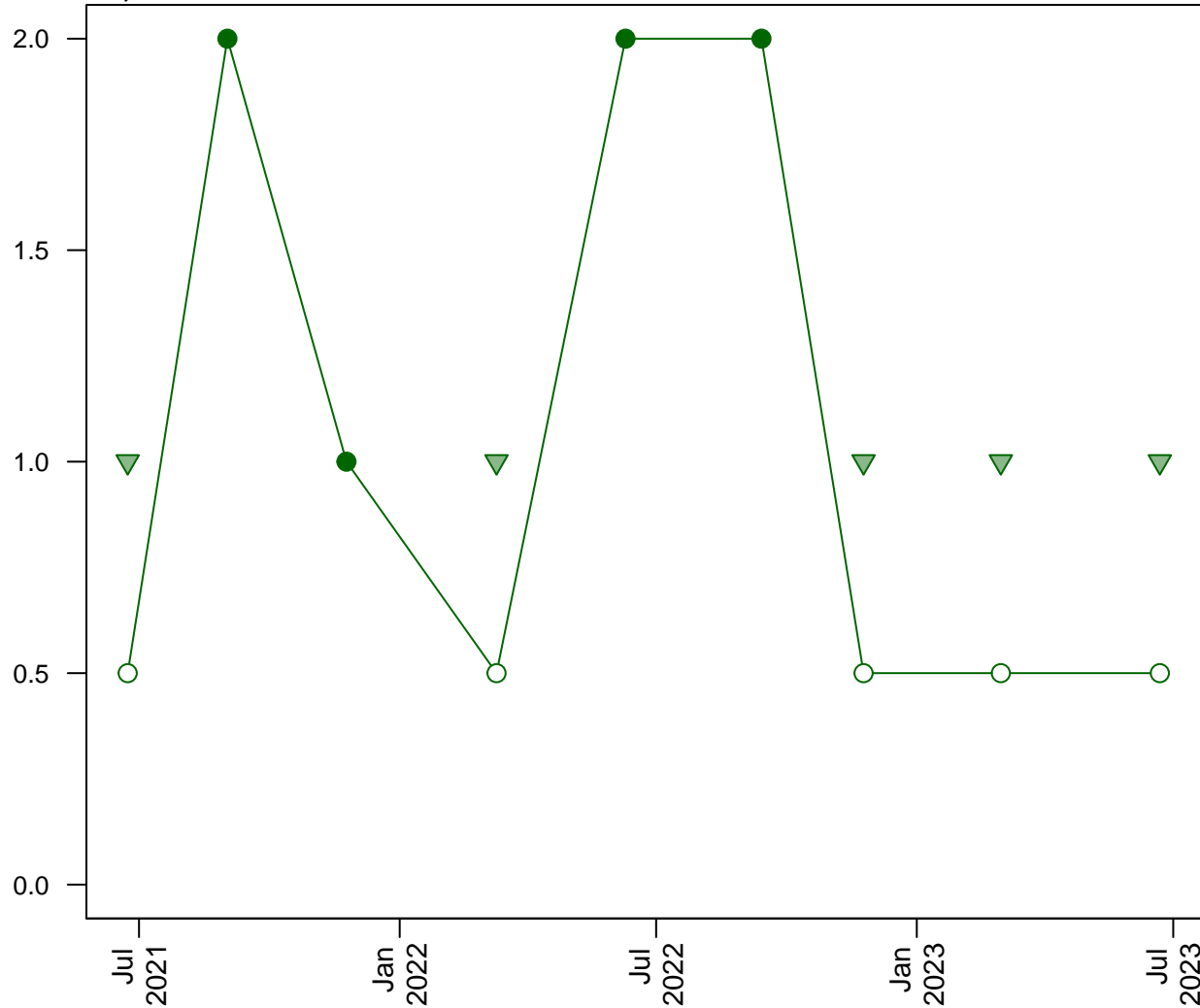


Detect Limit

Scatterplots and Trend Analysis

D9, Chromium

Concentration (µg/L)



Stats

N Data: 9
N Detect: 4
% Detect: 44

MK criteria not met

Shapes

● Detect
○ NonDetect
▼ Detect Limit

Scatterplots and Trend Analysis

D9, Electrical Conductivity (Field)

Concentration (uS/cm)

10000
8000
6000
4000
2000
0

Jul 2021
Jan 2022
Jul 2022
Jan 2023
Jul 2023

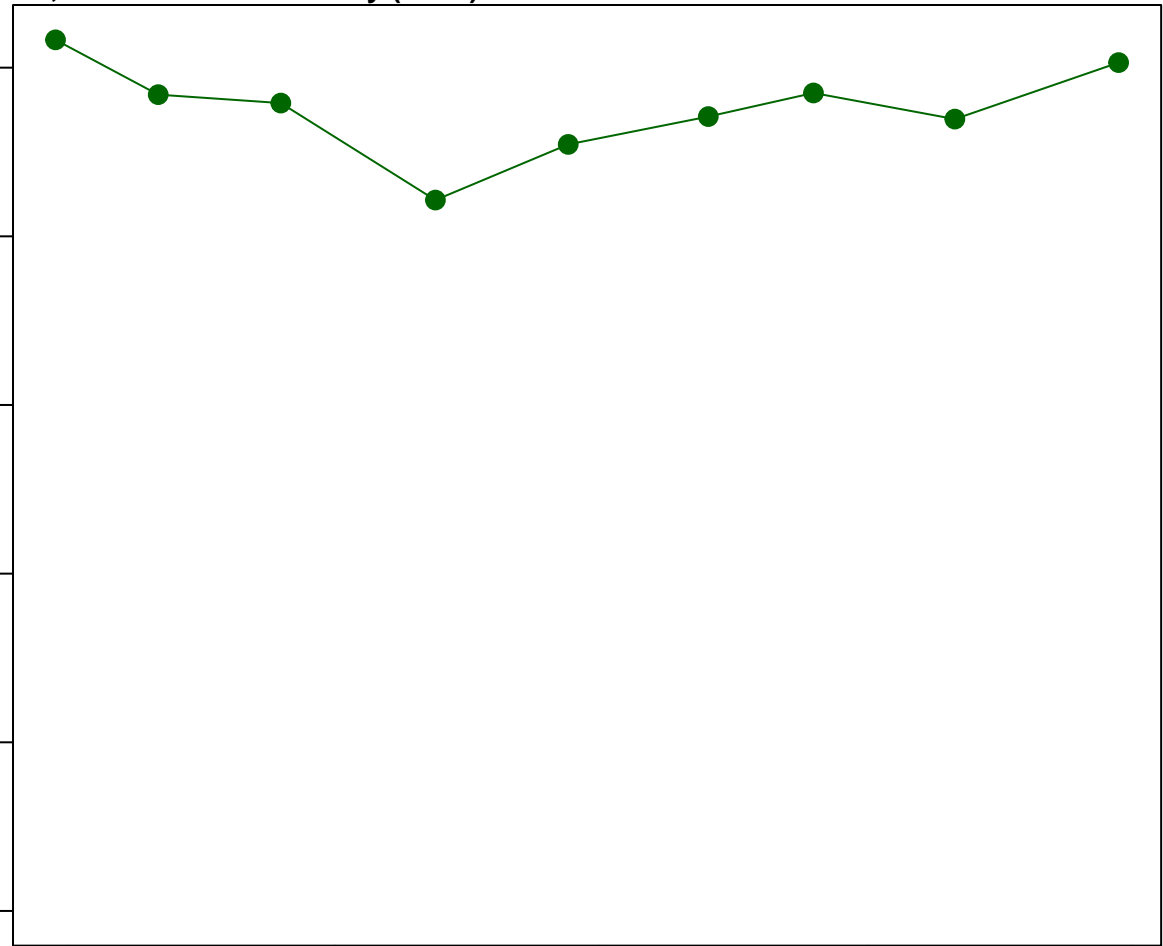
Stats

N Data: 9
N Detect: 9
% Detect: 100

95% Confidence
MK Trend: NS
MK p-val: 0.919

Shapes

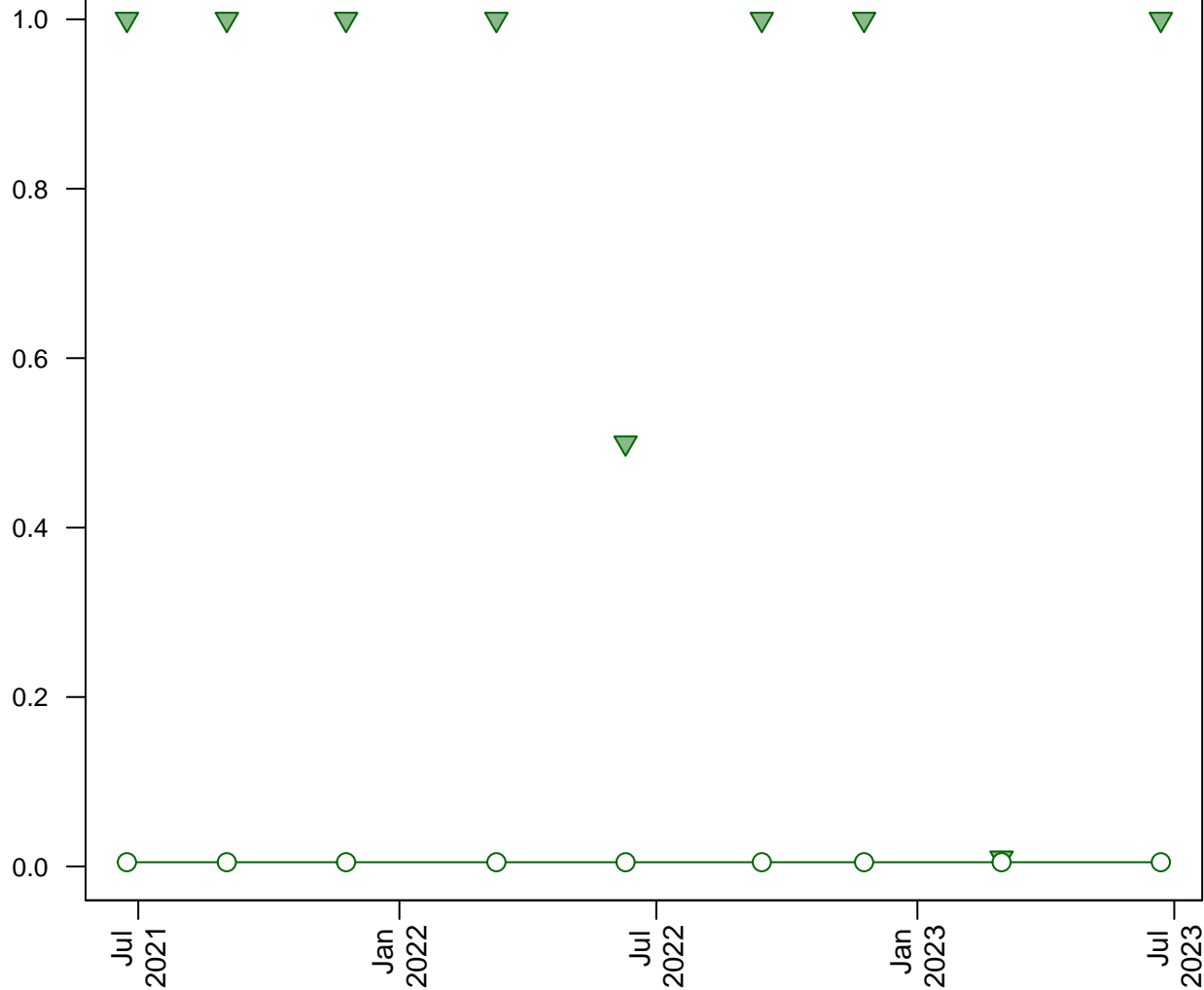
● Detect
○ NonDetect
▼ Detect Limit



Scatterplots and Trend Analysis

D9, Fluoride

Concentration (mg/L)



Stats

N Data: 9
N Detect: 0
% Detect: 0

MK criteria not met

Shapes

● Detect
○ NonDetect
▼ Detect Limit

Scatterplots and Trend Analysis

D9, Iron

Concentration (µg/L)

60000
40000
20000
0

Jul 2021
Jan 2022
Jul 2022
Jan 2023
Jul 2023

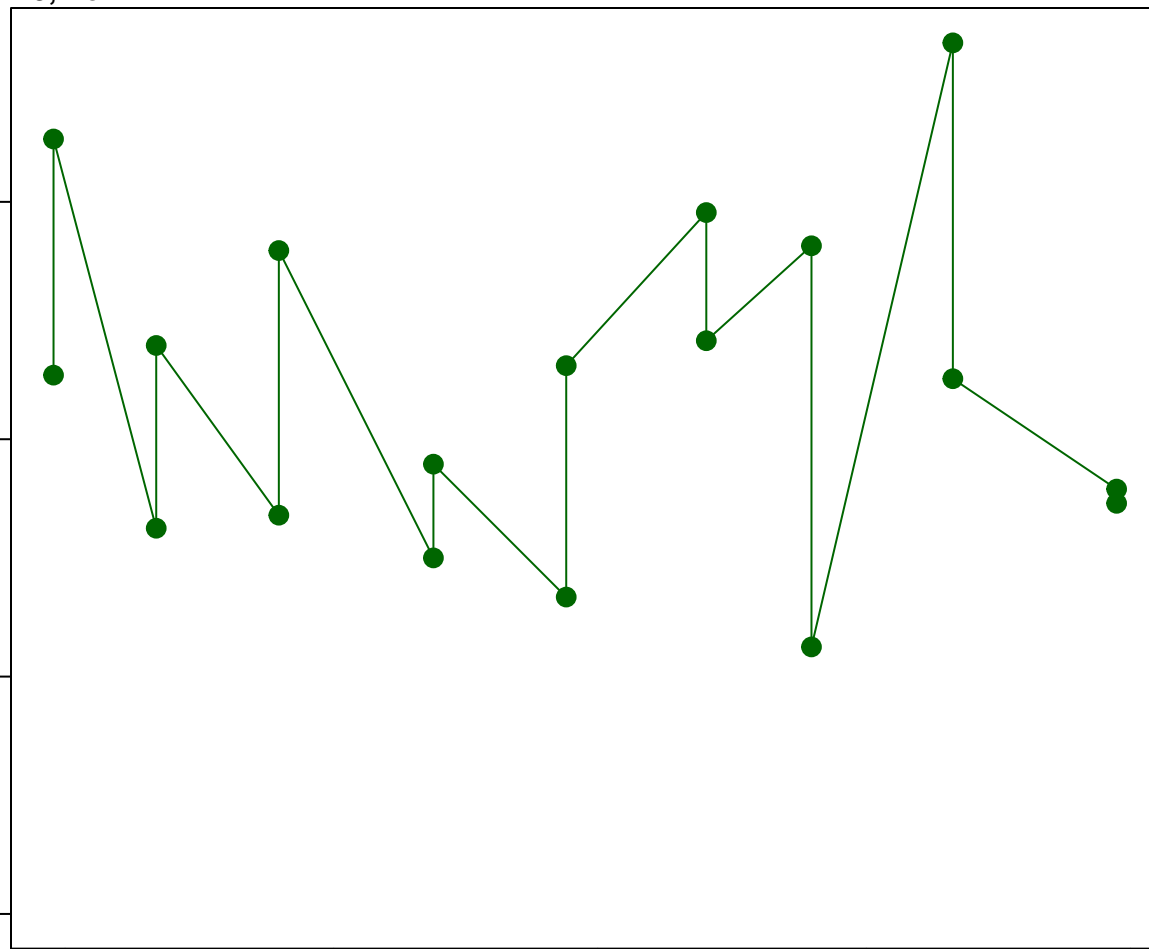
Stats

N Data: 18
N Detect: 18
% Detect: 100

95% Confidence
MK Trend: NS
MK p-val: 0.819

Shapes

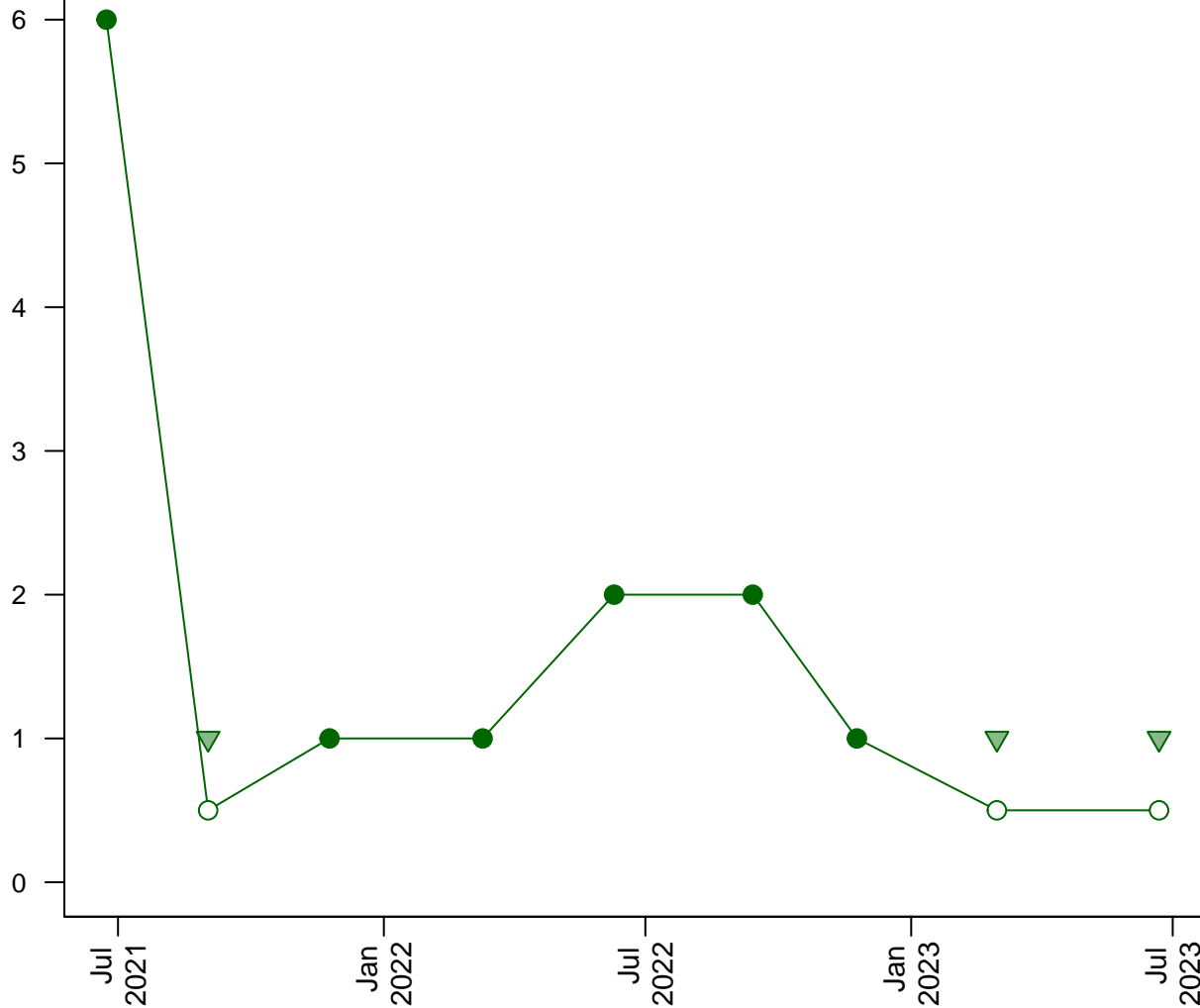
● Detect
○ NonDetect
▼ Detect Limit



Scatterplots and Trend Analysis

D9, Lead

Concentration (µg/L)



Stats

N Data: 9

N Detect: 6

% Detect: 67

95% Confidence

MK Trend: NS

MK p-val: 0.229

Shapes

● Detect

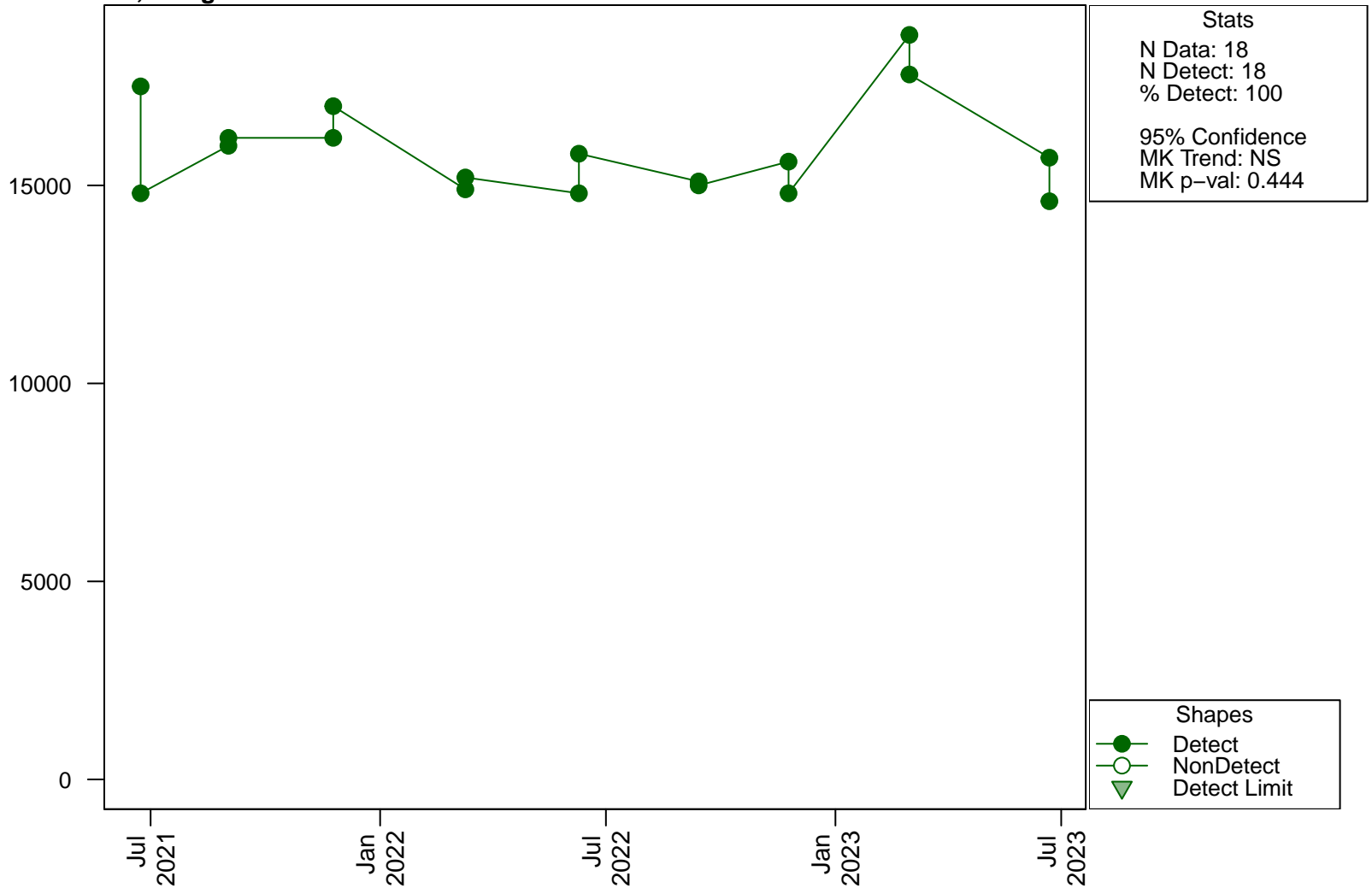
○ NonDetect

▼ Detect Limit

Scatterplots and Trend Analysis

D9, Manganese

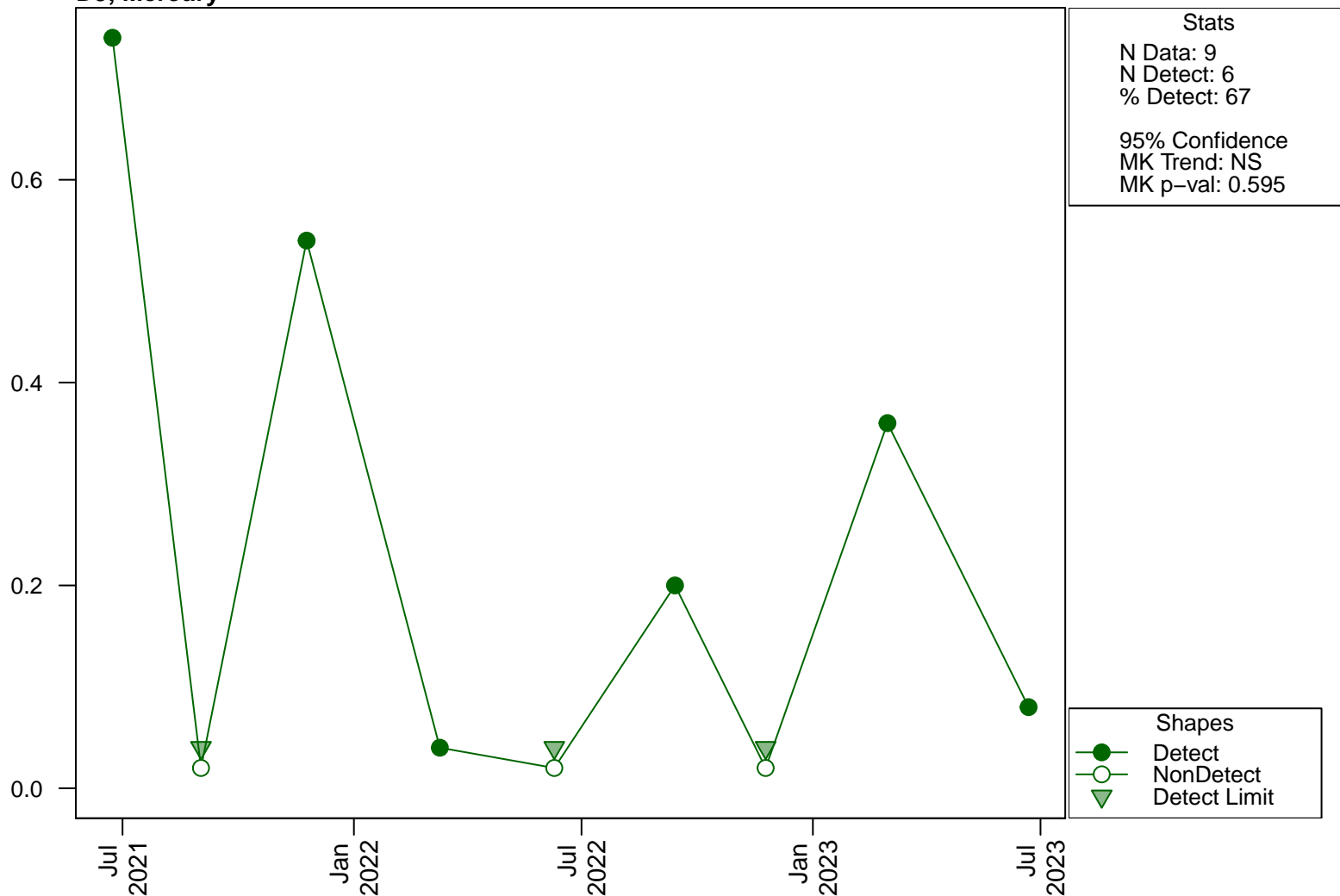
Concentration (µg/L)



Scatterplots and Trend Analysis

D9, Mercury

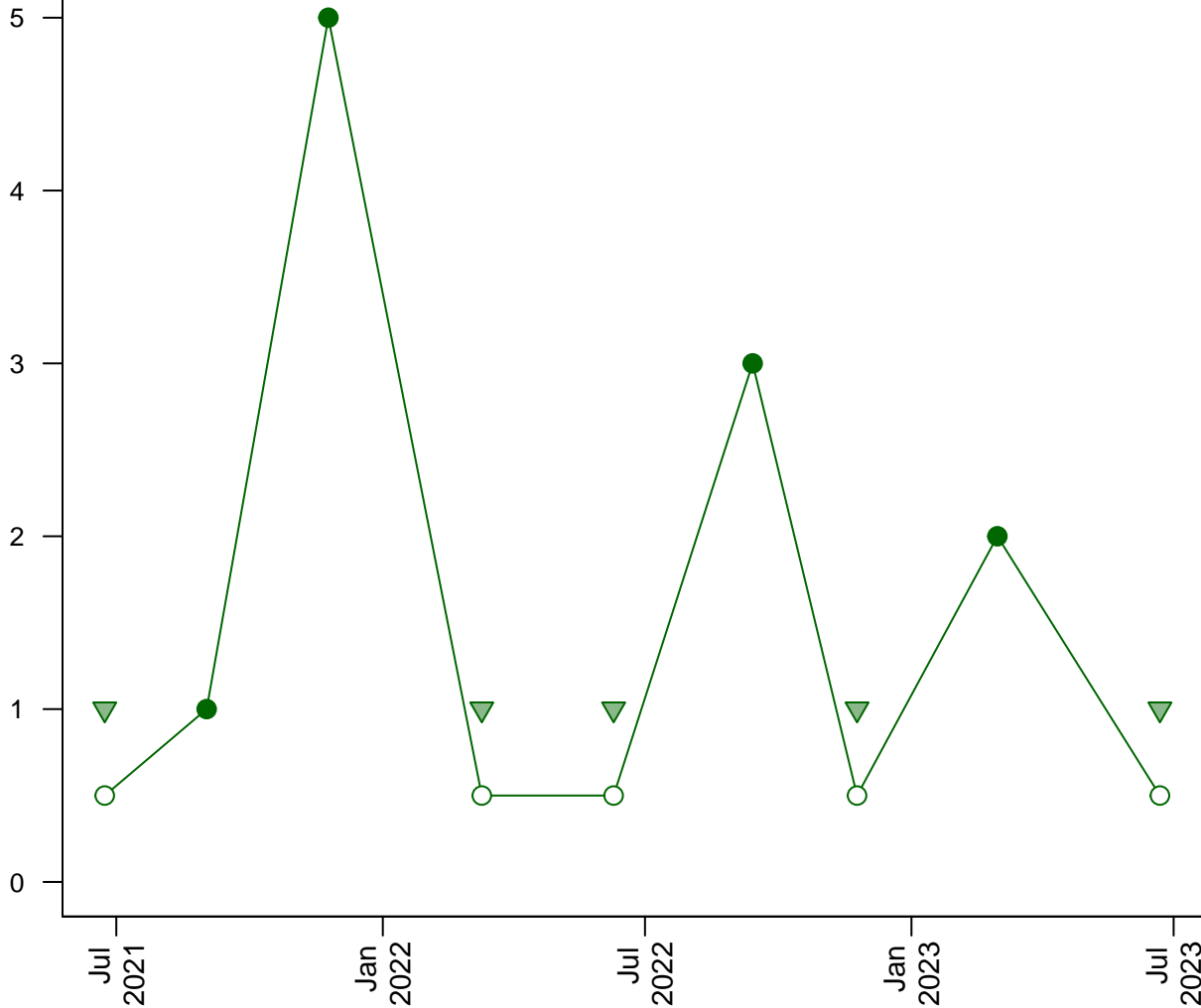
Concentration (µg/L)



Scatterplots and Trend Analysis

D9, Molybdenum

Concentration (µg/L)



Stats

N Data: 9

N Detect: 4

% Detect: 44

MK criteria not met

Shapes

● Detect

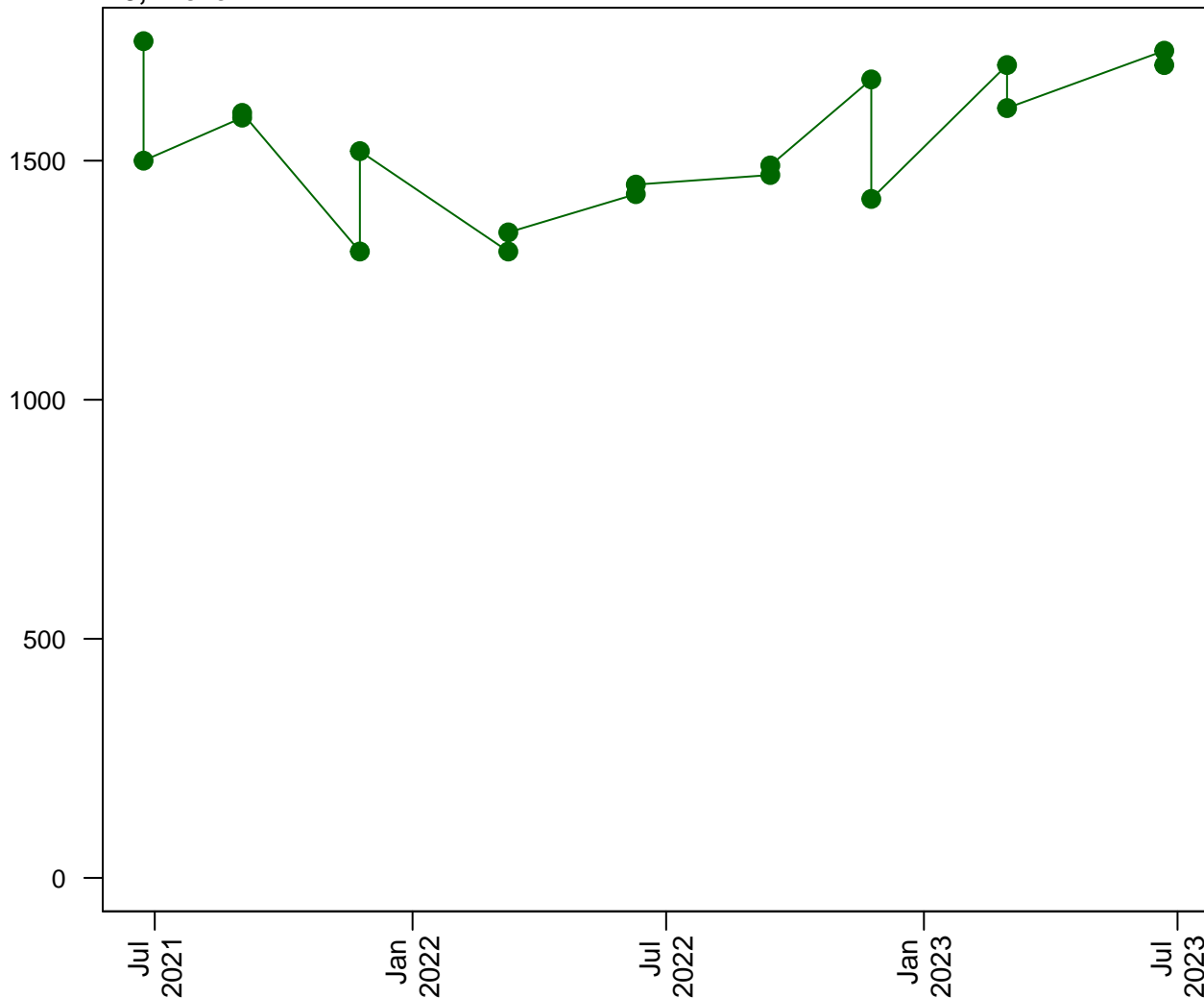
○ NonDetect

▼ Detect Limit

Scatterplots and Trend Analysis

D9, Nickel

Concentration (µg/L)



Stats

N Data: 18

N Detect: 18

% Detect: 100

95% Confidence

MK Trend: NS

MK p-val: 0.194

Shapes

● Detect

○ NonDetect

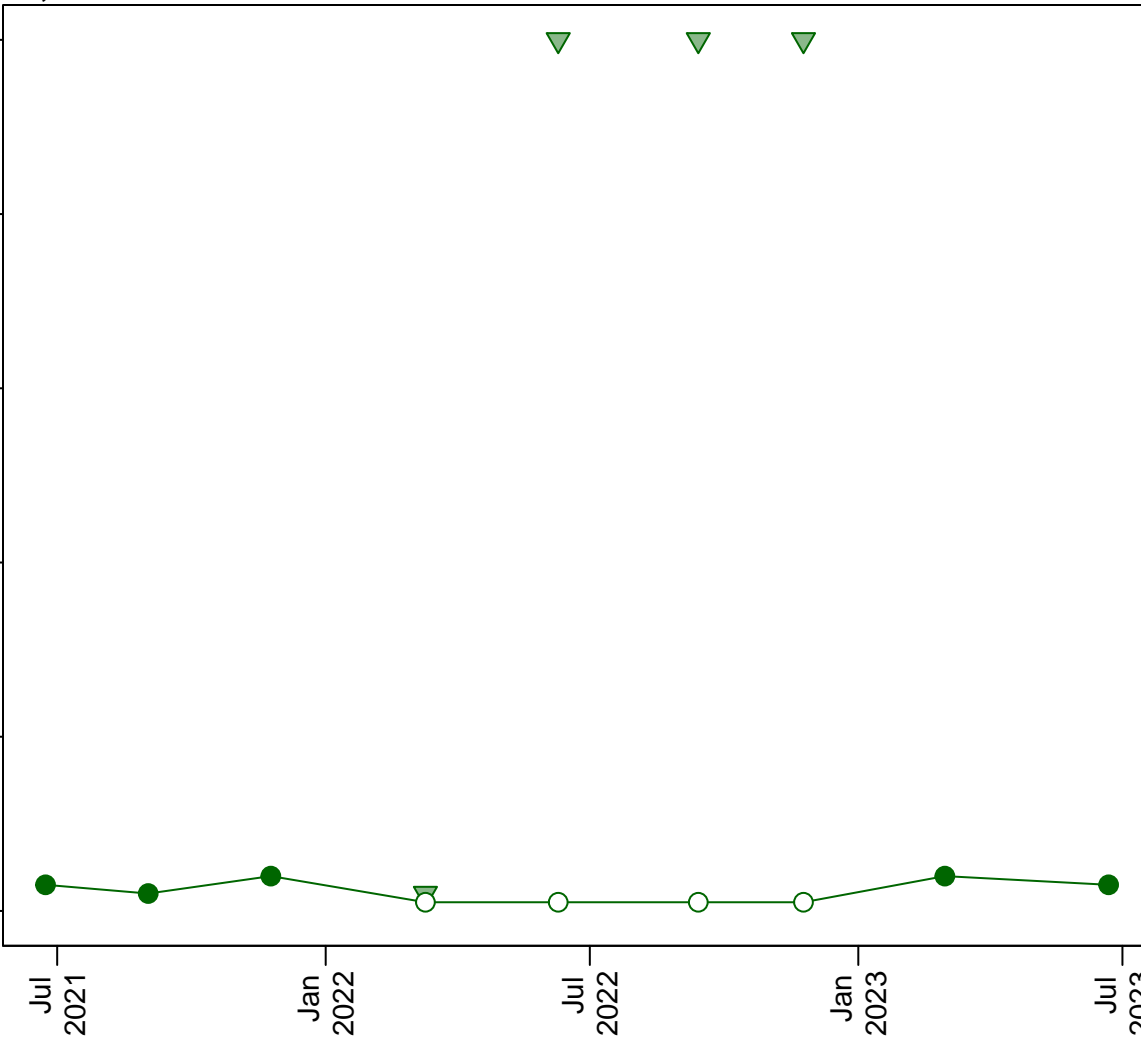
▼ Detect Limit

Scatterplots and Trend Analysis

D9, Selenium

Concentration (µg/L)

10
8
6
4
2
0



Stats
N Data: 9
N Detect: 5
% Detect: 56

95% Confidence
MK Trend: NS
MK p-val: 0.824

Shapes
● Detect
○ NonDetect
▼ Detect Limit

Scatterplots and Trend Analysis

D9, Sulfate (as SO4)

Concentration (mg/L)

5000
4000
3000
2000
1000
0

Jul 2021
Jan 2022
Jul 2022
Jan 2023
Jul 2023

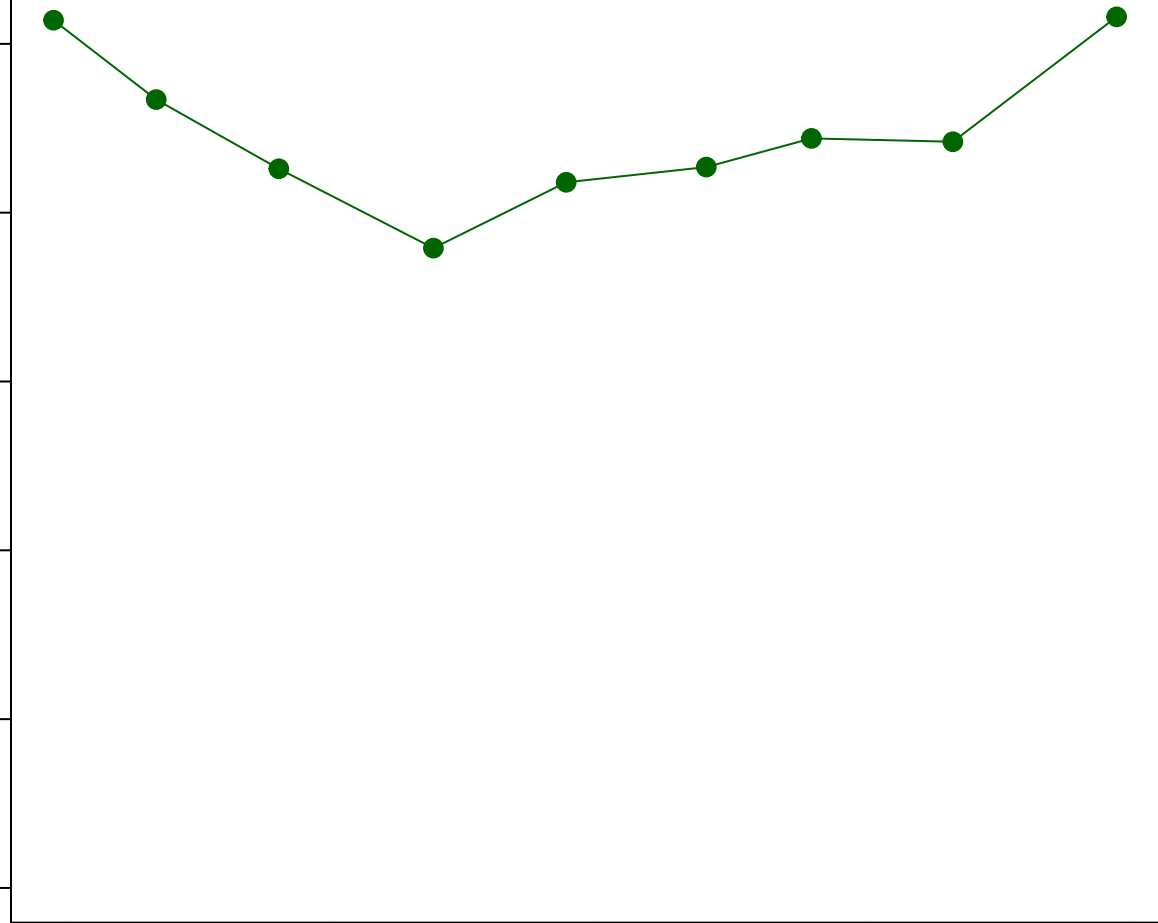
Stats

N Data: 9
N Detect: 9
% Detect: 100

95% Confidence
MK Trend: NS
MK p-val: 0.761

Shapes

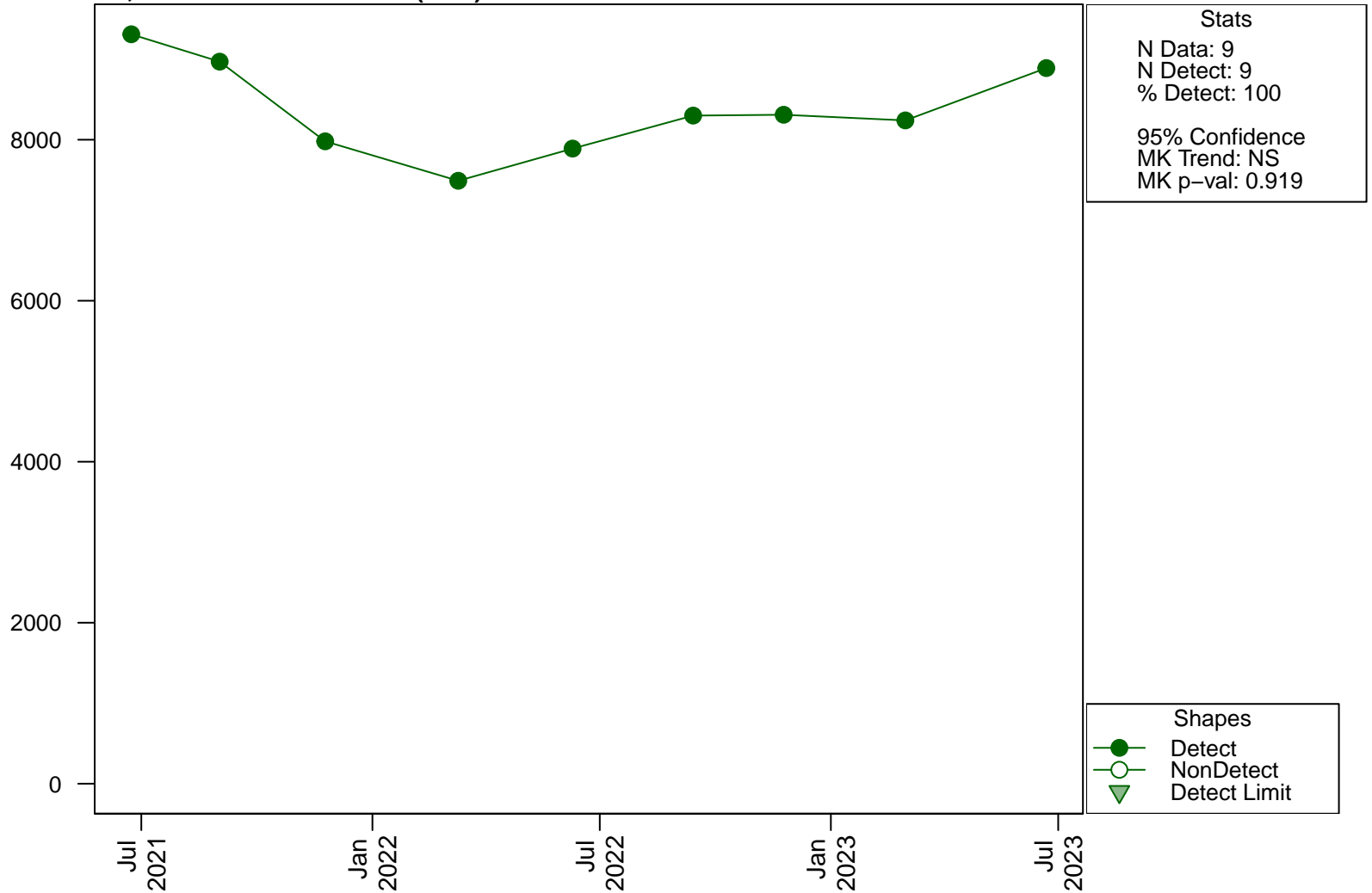
● Detect
○ NonDetect
▼ Detect Limit



Scatterplots and Trend Analysis

D9, Total Dissolved Solids (TDS)

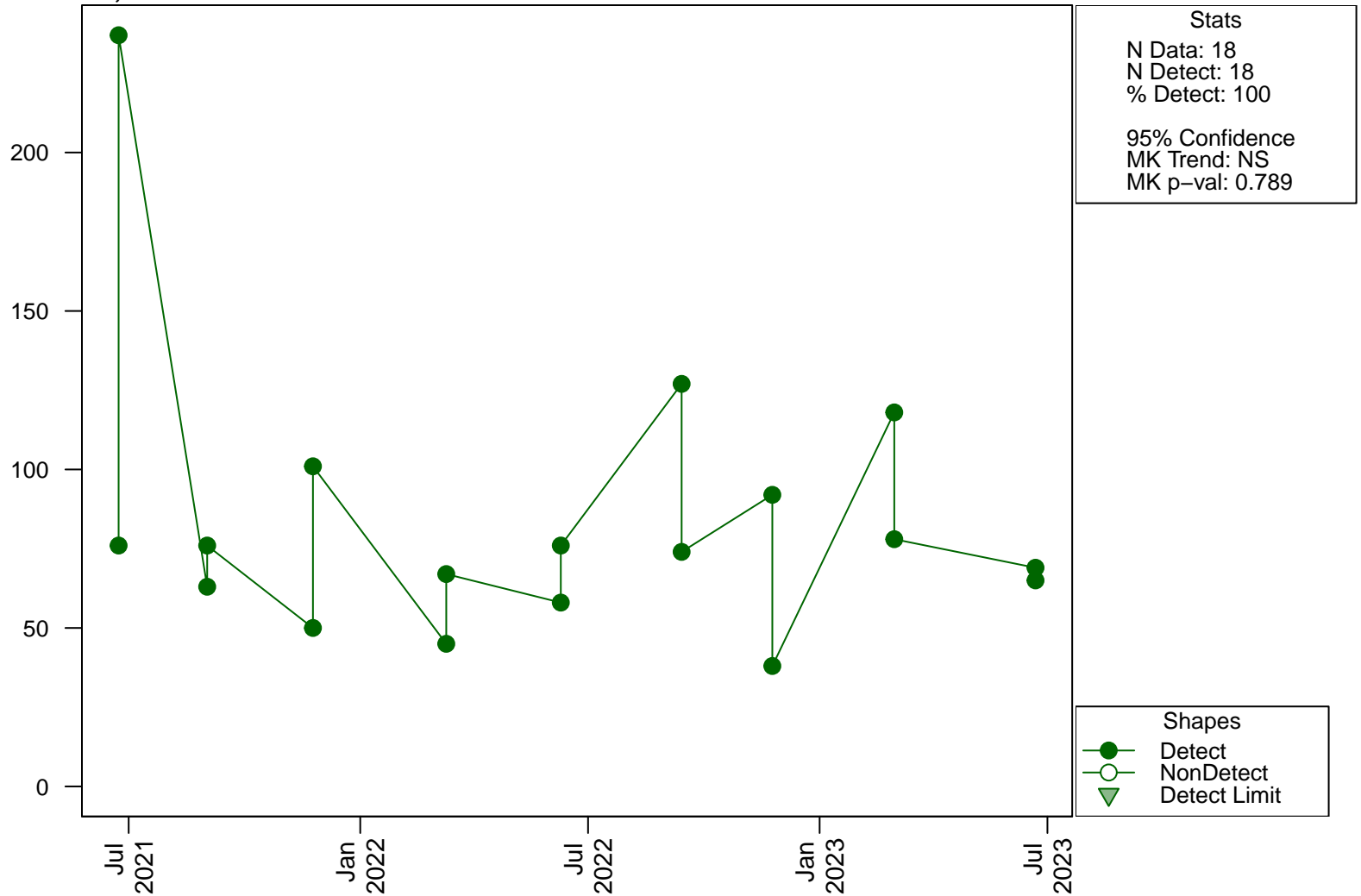
Concentration (mg/L)



Scatterplots and Trend Analysis

D9, Zinc

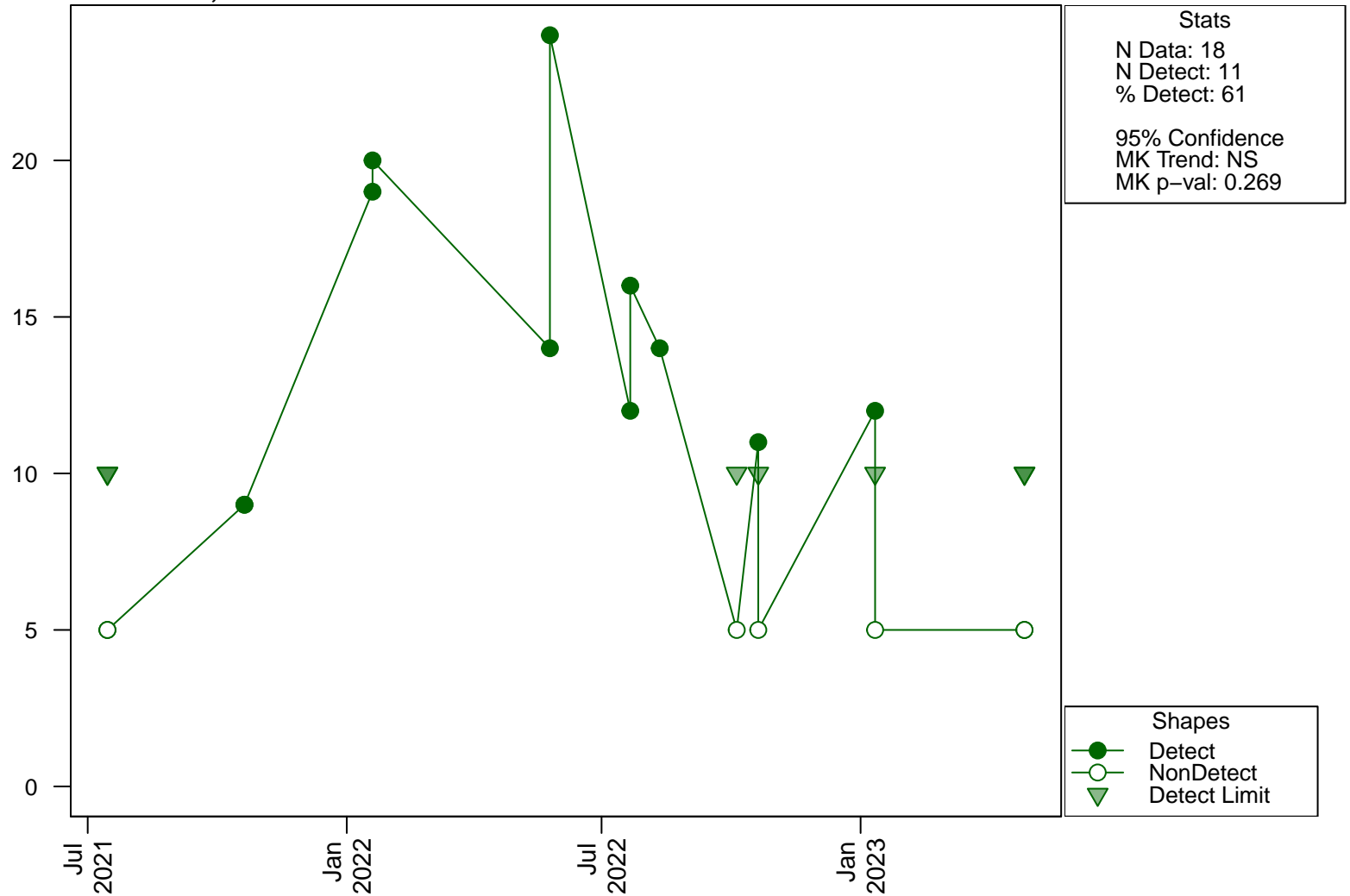
Concentration (µg/L)



Scatterplots and Trend Analysis

MPGM5-D5, Arsenic

Concentration (µg/L)



Scatterplots and Trend Analysis MPGM5-D5, Boron

Concentration (µg/L)

3000

2000

1000

0

Jul
2021

Jan
2022

Jul
2022

Jan
2023

Stats

N Data: 18

N Detect: 18

% Detect: 100

95% Confidence

MK Trend: NS

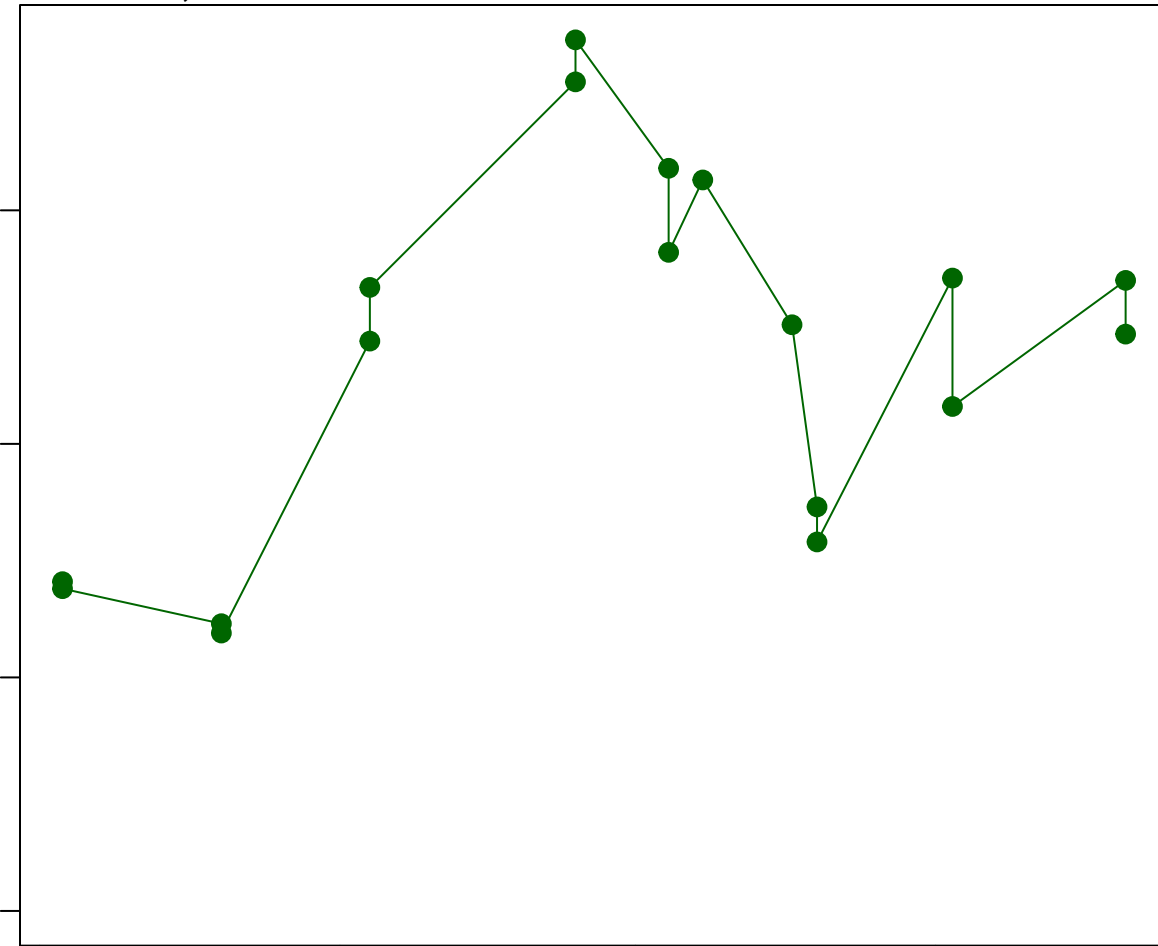
MK p-val: 0.341

Shapes

● Detect

○ NonDetect

▼ Detect Limit



Scatterplots and Trend Analysis

MPGM5-D5, Cadmium

Concentration (µg/L)

40
30
20
10
0

Jul
2021

Jan
2022

Jul
2022

Jan
2023

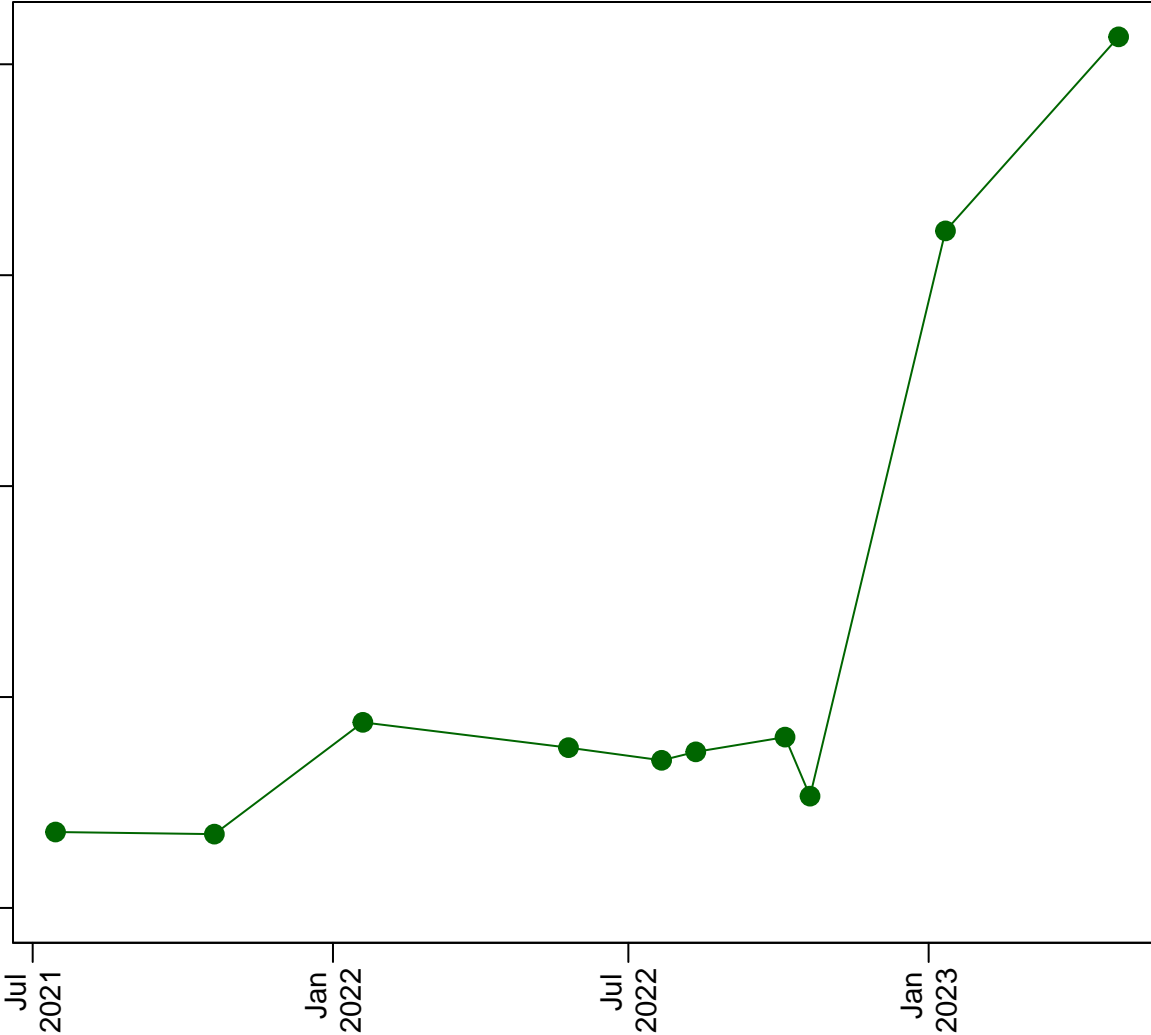
Stats

N Data: 10
N Detect: 10
% Detect: 100

95% Confidence
MK Trend: NS
MK p-val: 0.0726

Shapes

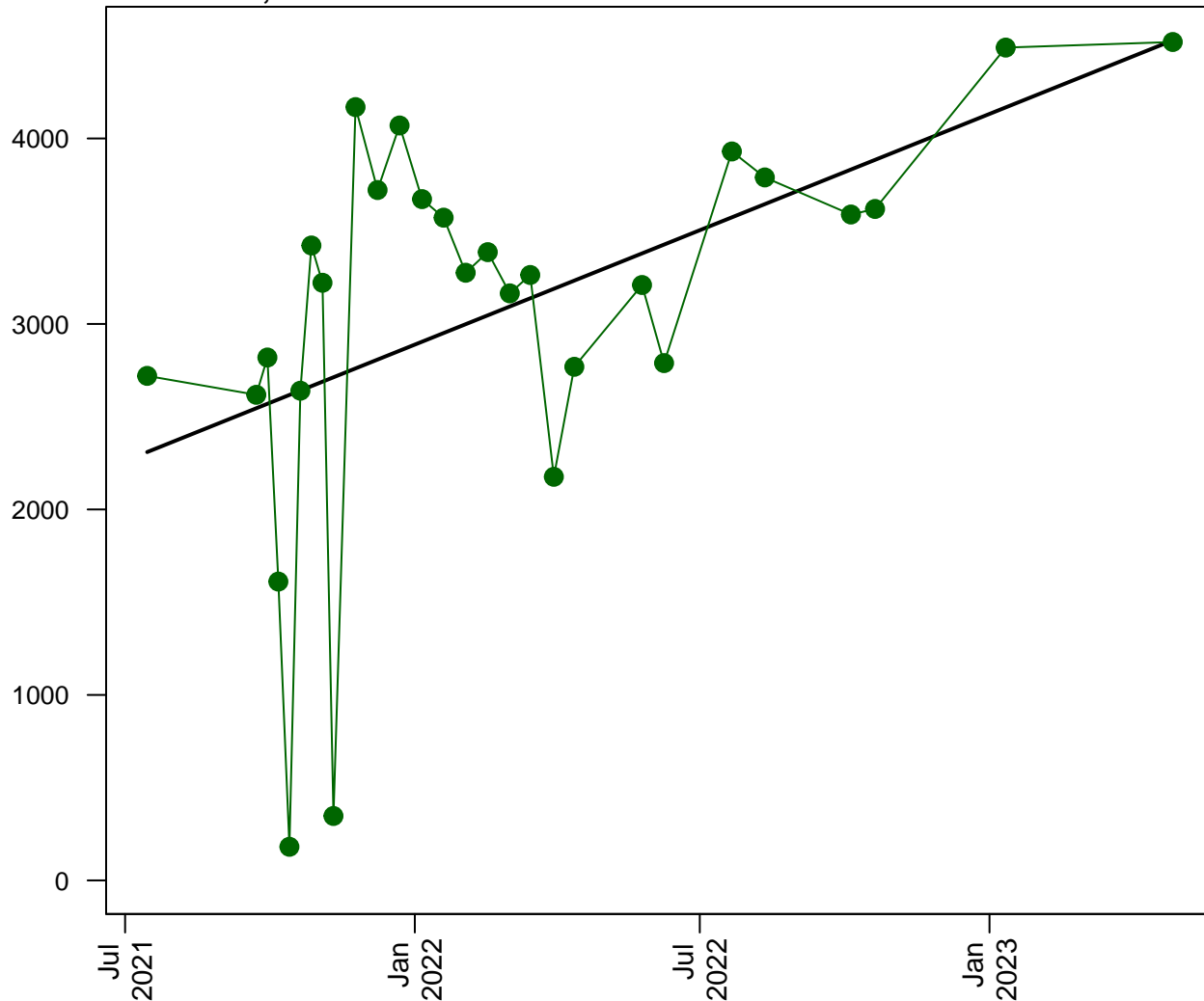
● Detect
○ NonDetect
▼ Detect Limit



Scatterplots and Trend Analysis

MPGM5-D5, Chloride

Concentration (mg/L)



Stats

N Data: 28
N Detect: 28
% Detect: 100

95% Confidence
MK Trend: Significant
MK p-val: 0.00875
Direction: Increasing

Lines

Linear Fit

Shapes

Detect
NonDetect
Detect Limit

Scatterplots and Trend Analysis

MPGM5-D5, Chromium

Concentration (µg/L)

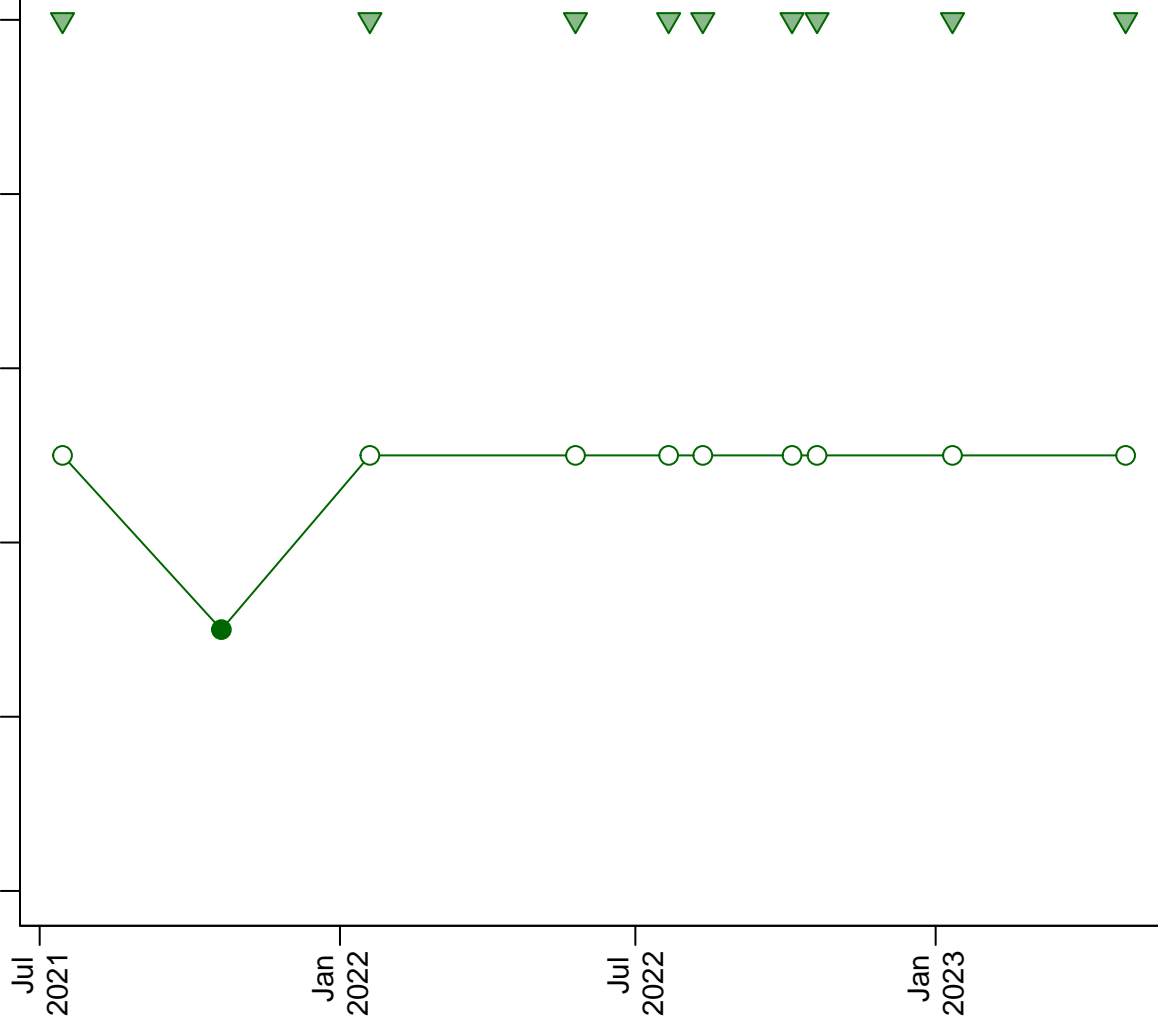
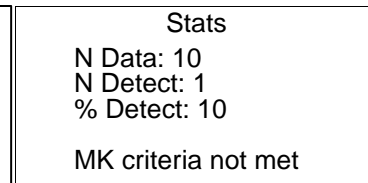
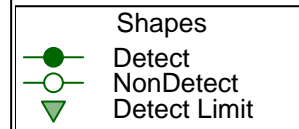
10
8
6
4
2
0

Jul
2021

Jan
2022

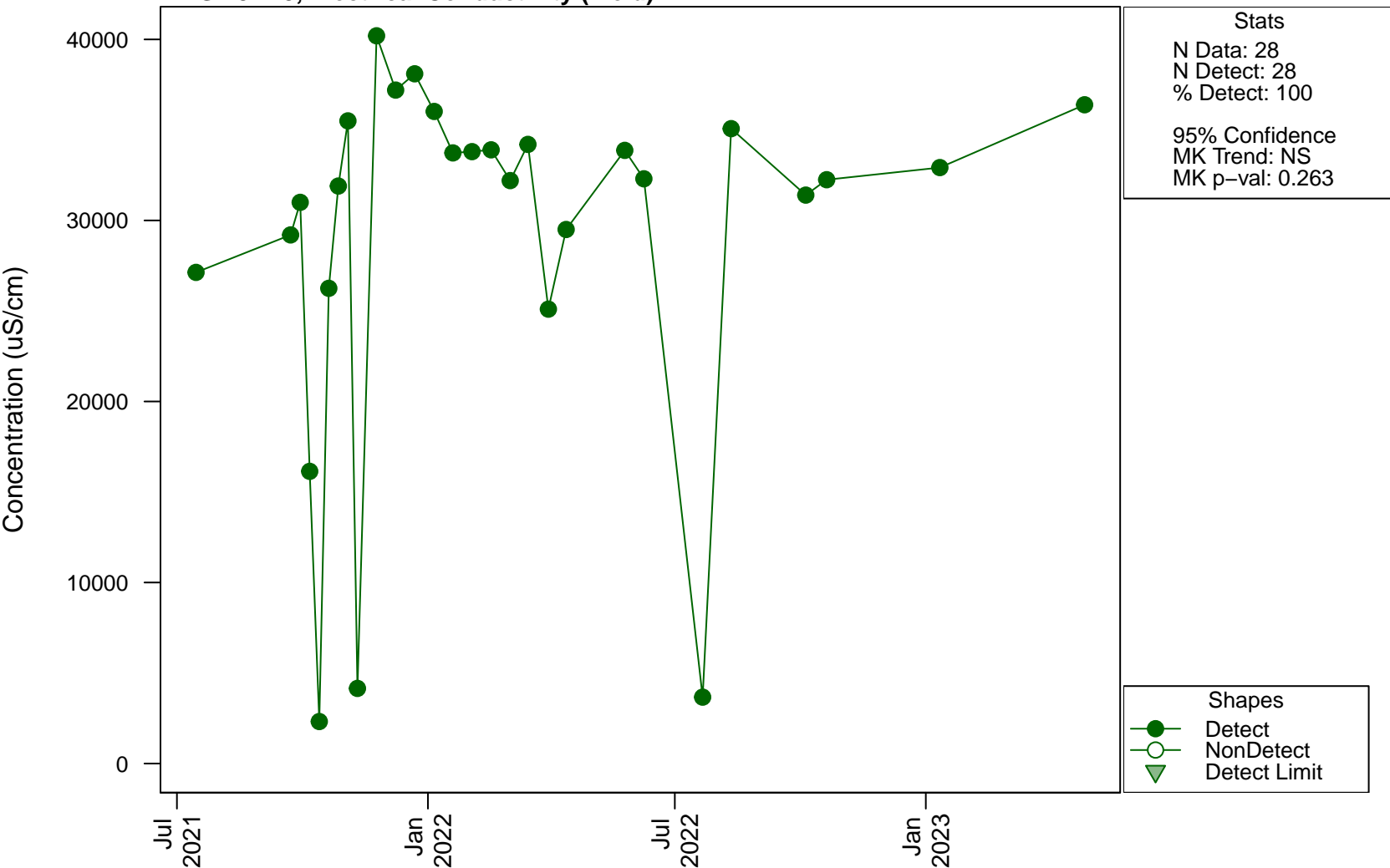
Jul
2022

Jan
2023



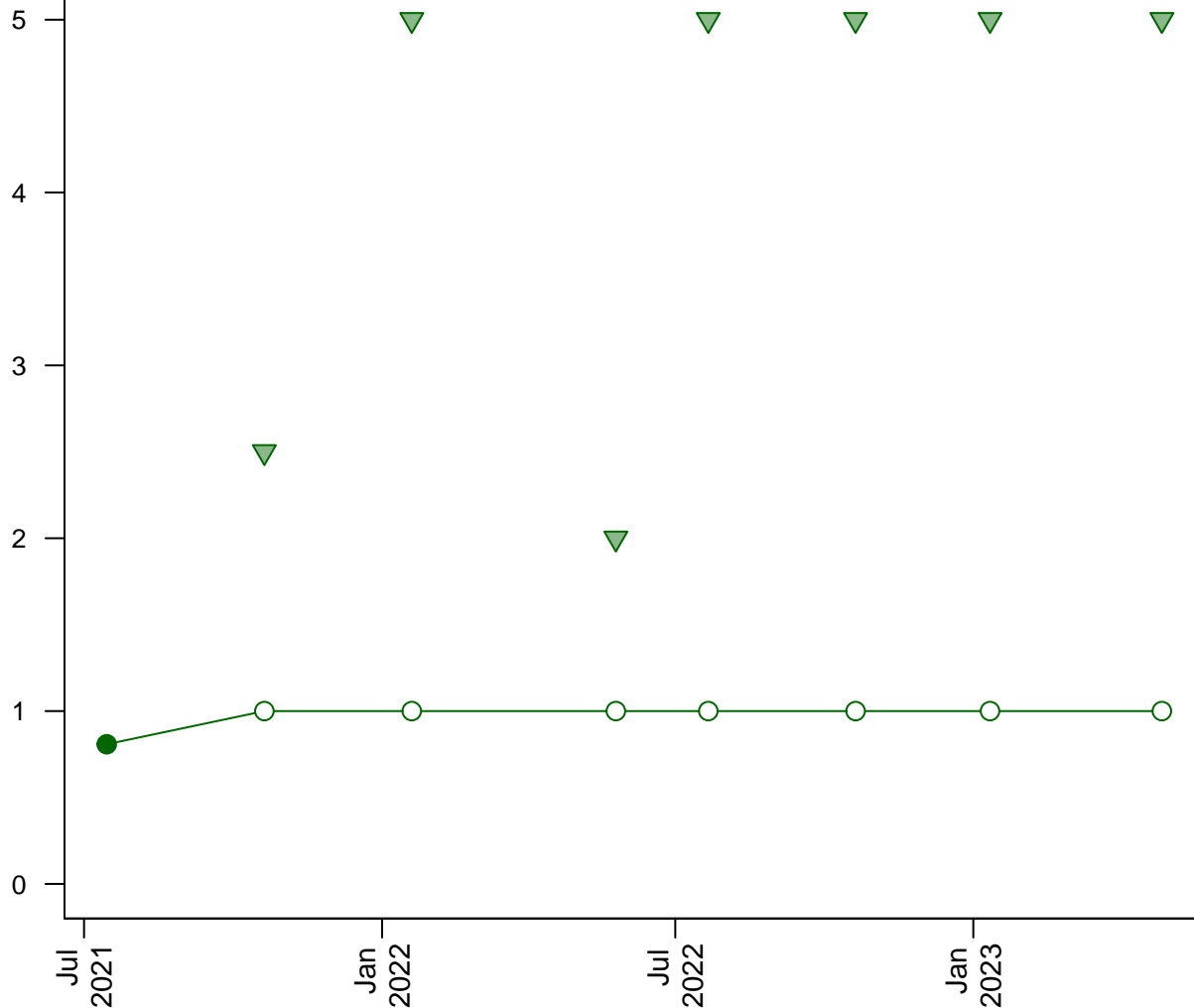
Scatterplots and Trend Analysis

MPGM5-D5, Electrical Conductivity (Field)



Scatterplots and Trend Analysis MPGM5-D5, Fluoride

Concentration (mg/L)



Stats

N Data: 8

N Detect: 1

% Detect: 12

MK criteria not met

Shapes



Detect



NonDetect



Detect Limit

Scatterplots and Trend Analysis

MPGM5-D5, Iron

Concentration (µg/L)

6000
5000
4000
3000
2000
1000
0

Jul
2021

Jan
2022

Jul
2022

Jan
2023

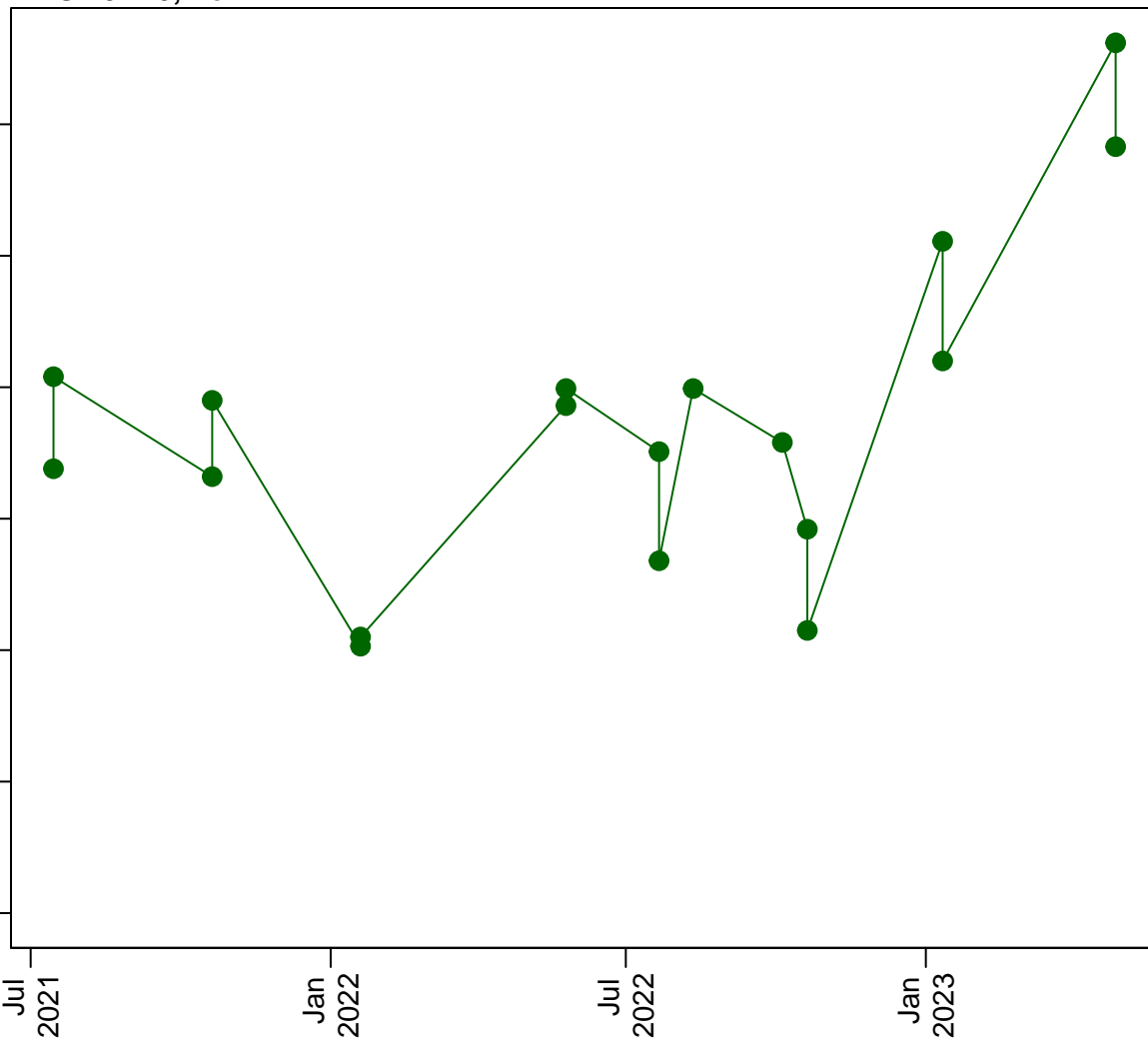
Stats

N Data: 18
N Detect: 18
% Detect: 100

95% Confidence
MK Trend: NS
MK p-val: 0.0795

Shapes

● Detect
○ NonDetect
▼ Detect Limit



Scatterplots and Trend Analysis

MPGM5-D5, Lead

Concentration (µg/L)

140
120
100
80
60
40
20
0

Jul
2021

Jan
2022

Jul
2022

Jan
2023

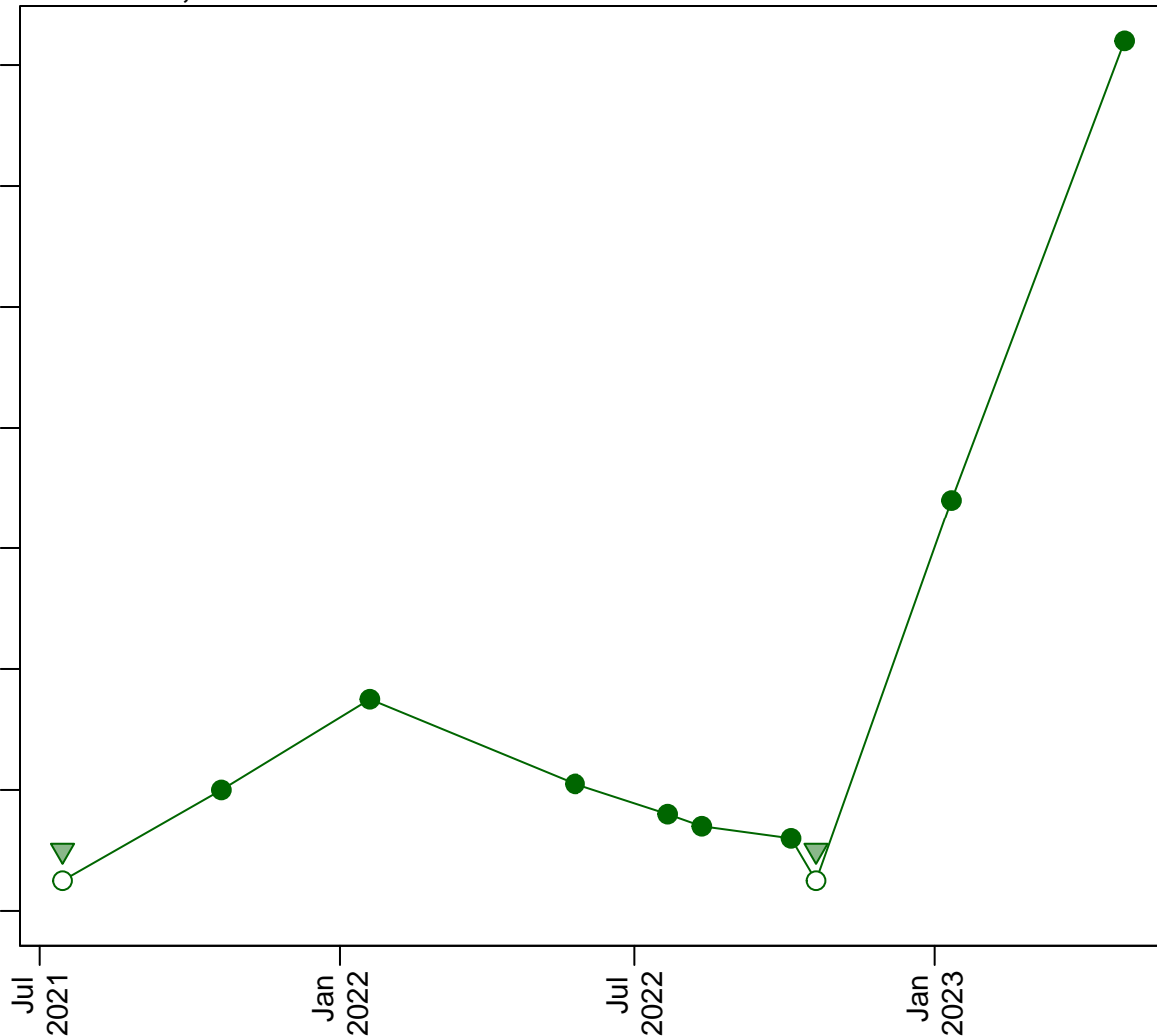
Stats

N Data: 10
N Detect: 8
% Detect: 80

95% Confidence
MK Trend: NS
MK p-val: 0.59

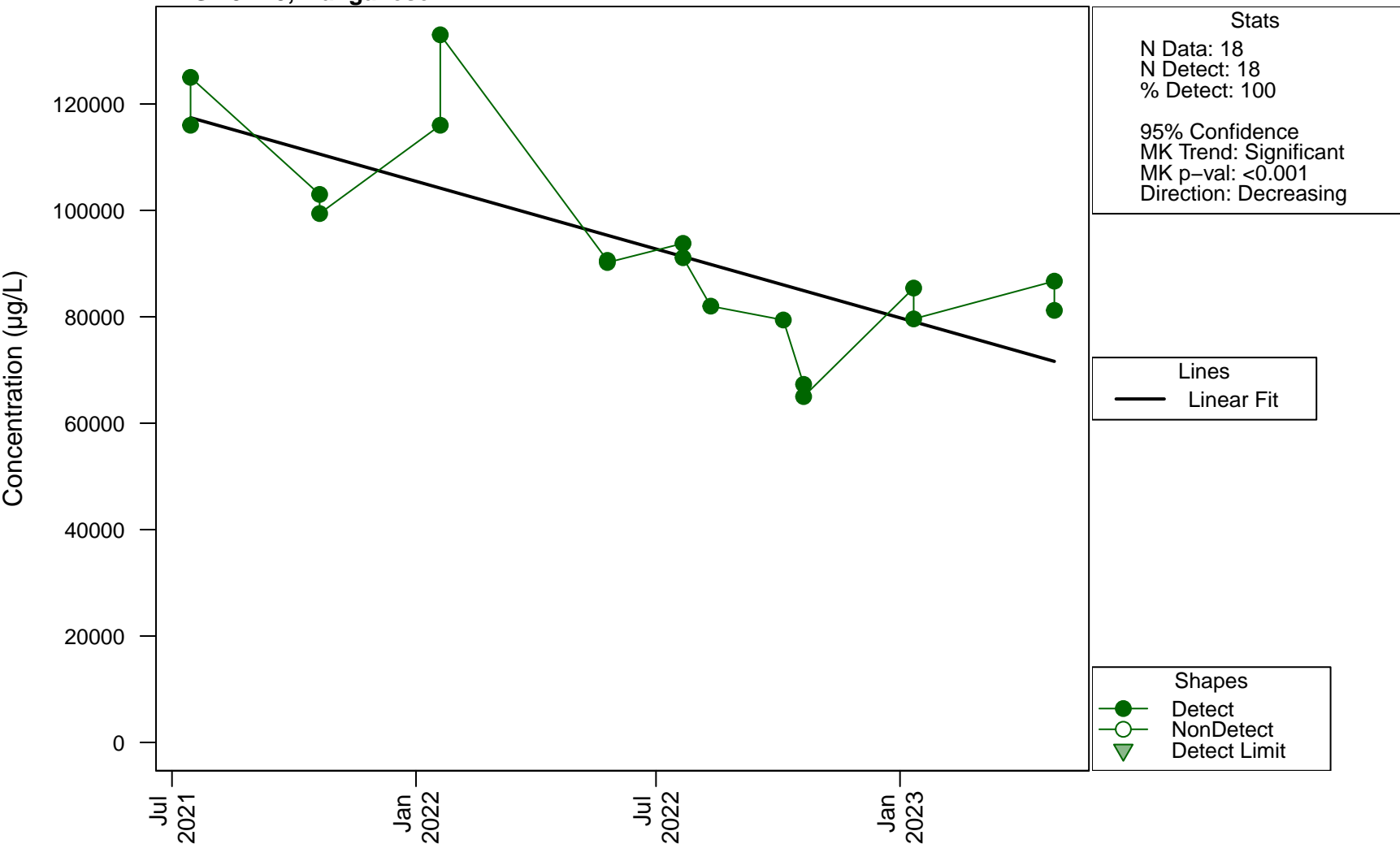
Shapes

● Detect
○ NonDetect
▼ Detect Limit



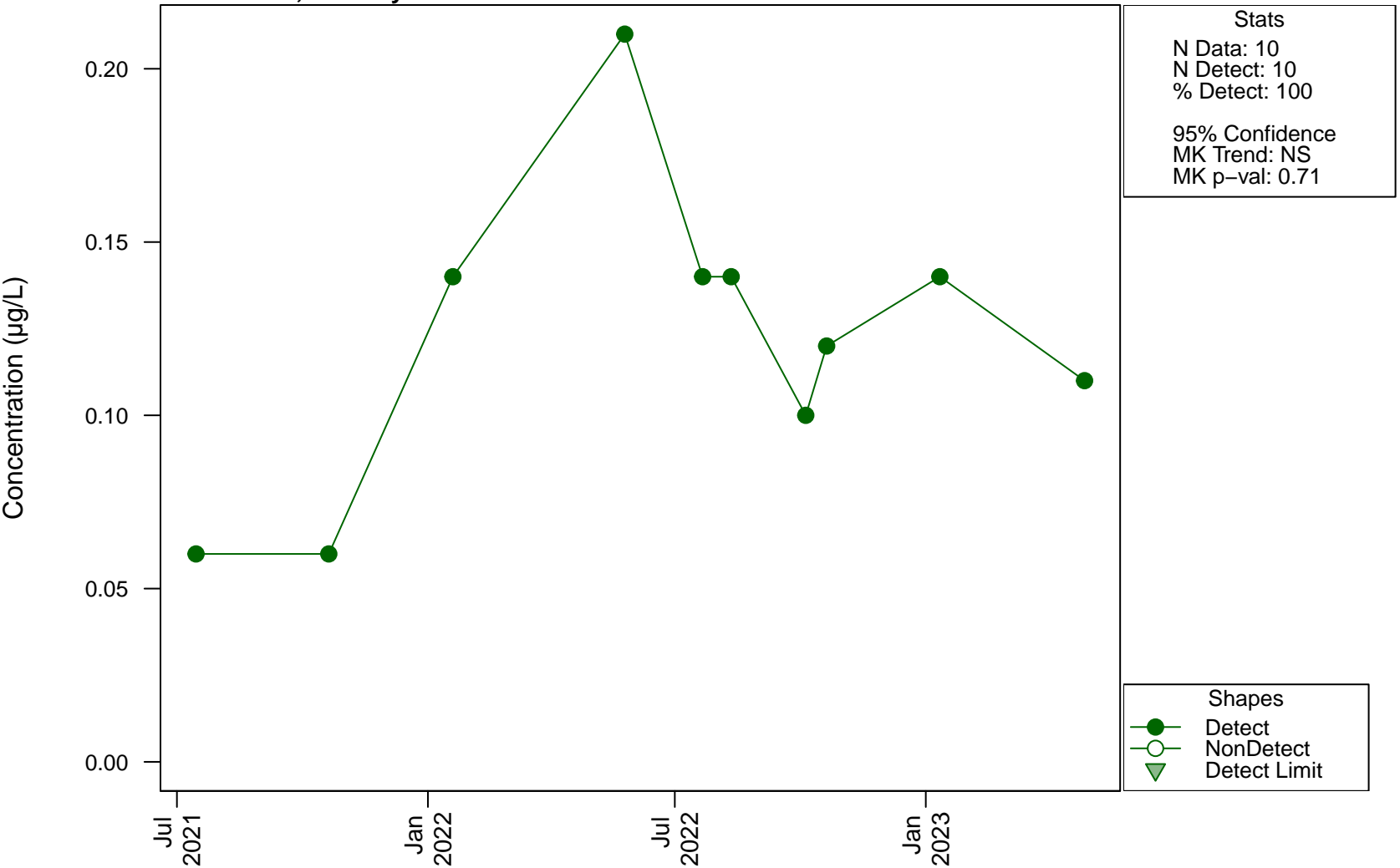
Scatterplots and Trend Analysis

MPGM5-D5, Manganese



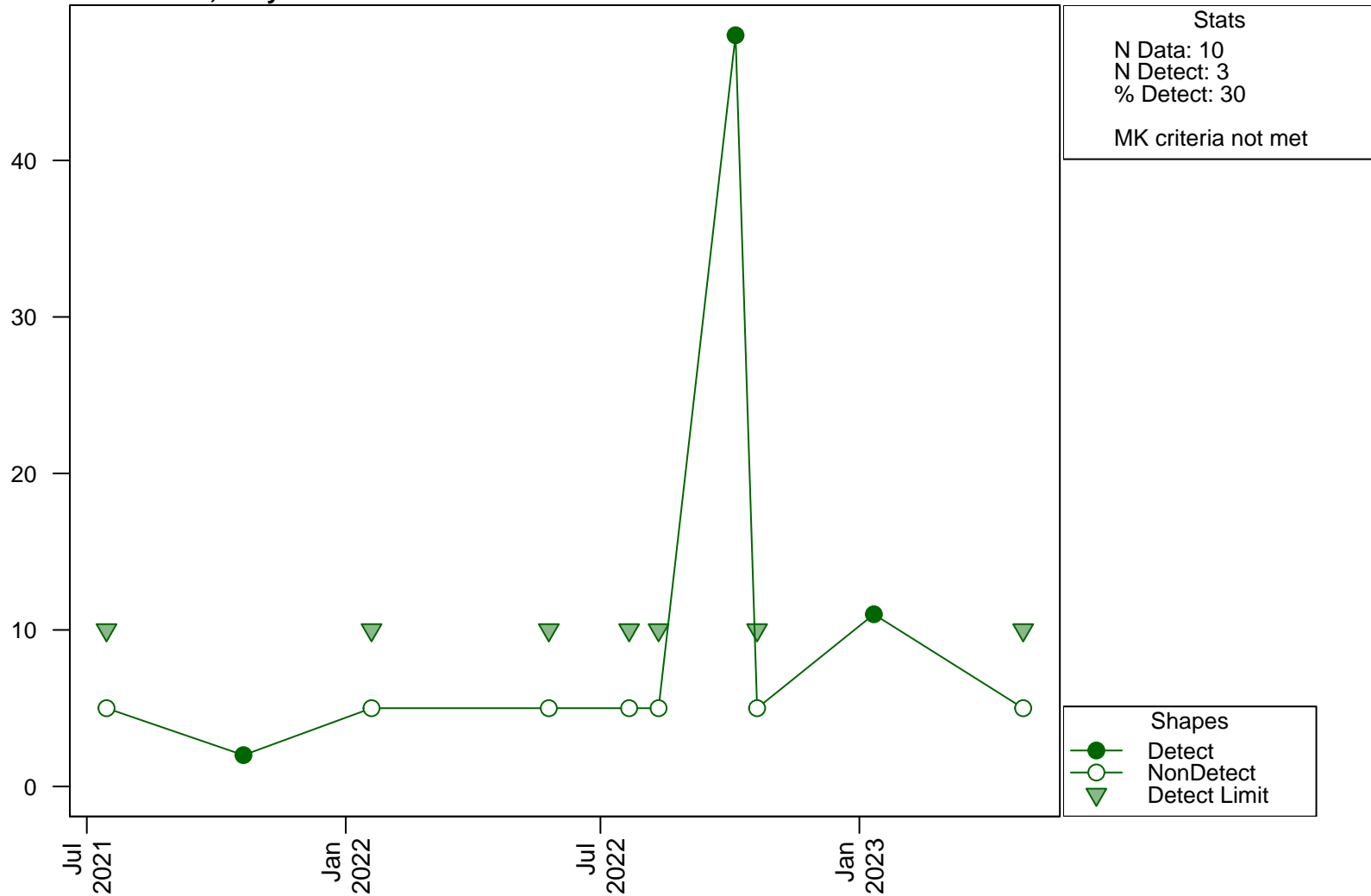
Scatterplots and Trend Analysis

MPGM5-D5, Mercury



Scatterplots and Trend Analysis MPGM5-D5, Molybdenum

Concentration (µg/L)



Scatterplots and Trend Analysis

MPGM5-D5, Nickel

Concentration (µg/L)

8000
6000
4000
2000
0

Jul
2021

Jan
2022

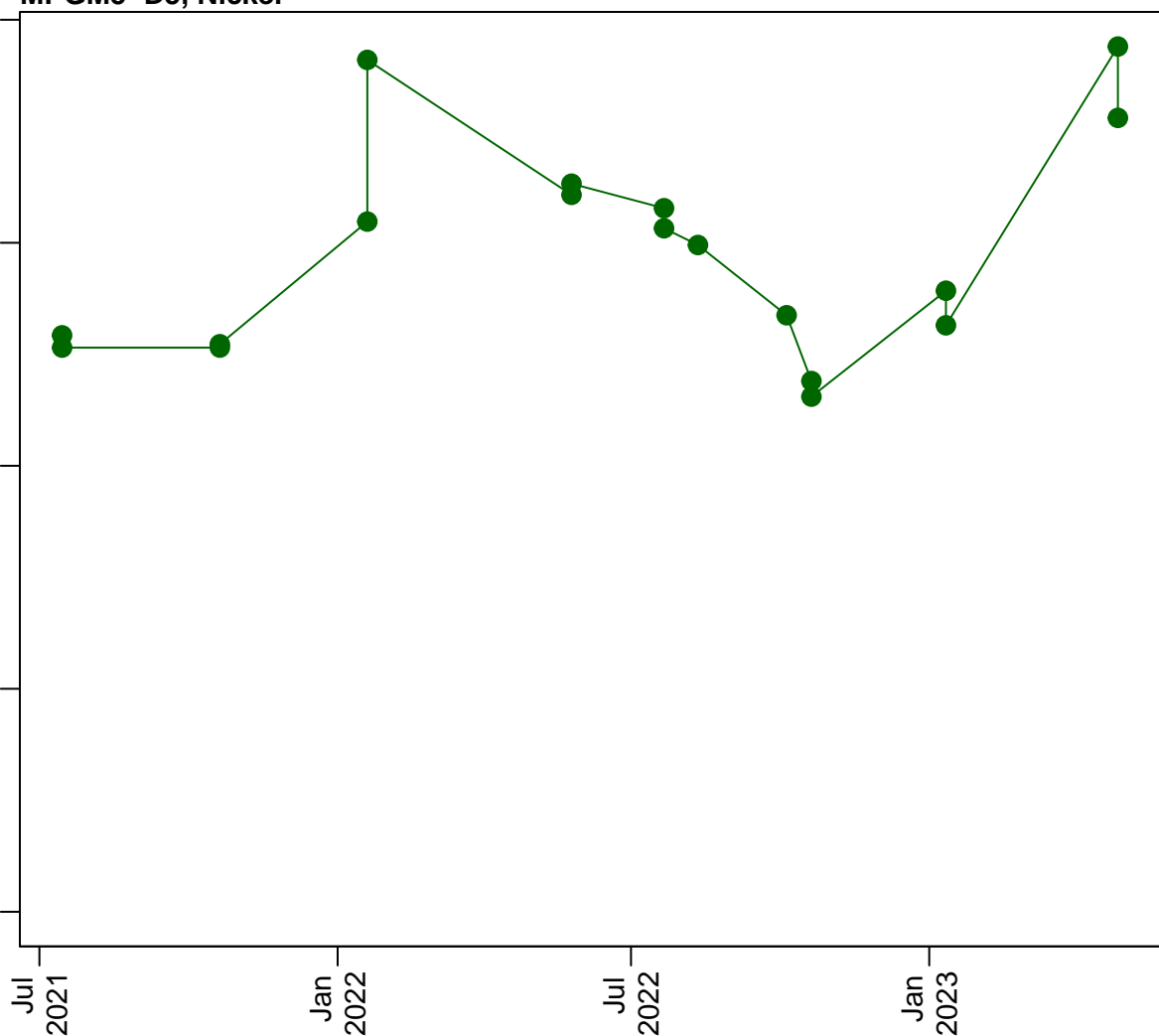
Jul
2022

Jan
2023

Stats
N Data: 18
N Detect: 18
% Detect: 100

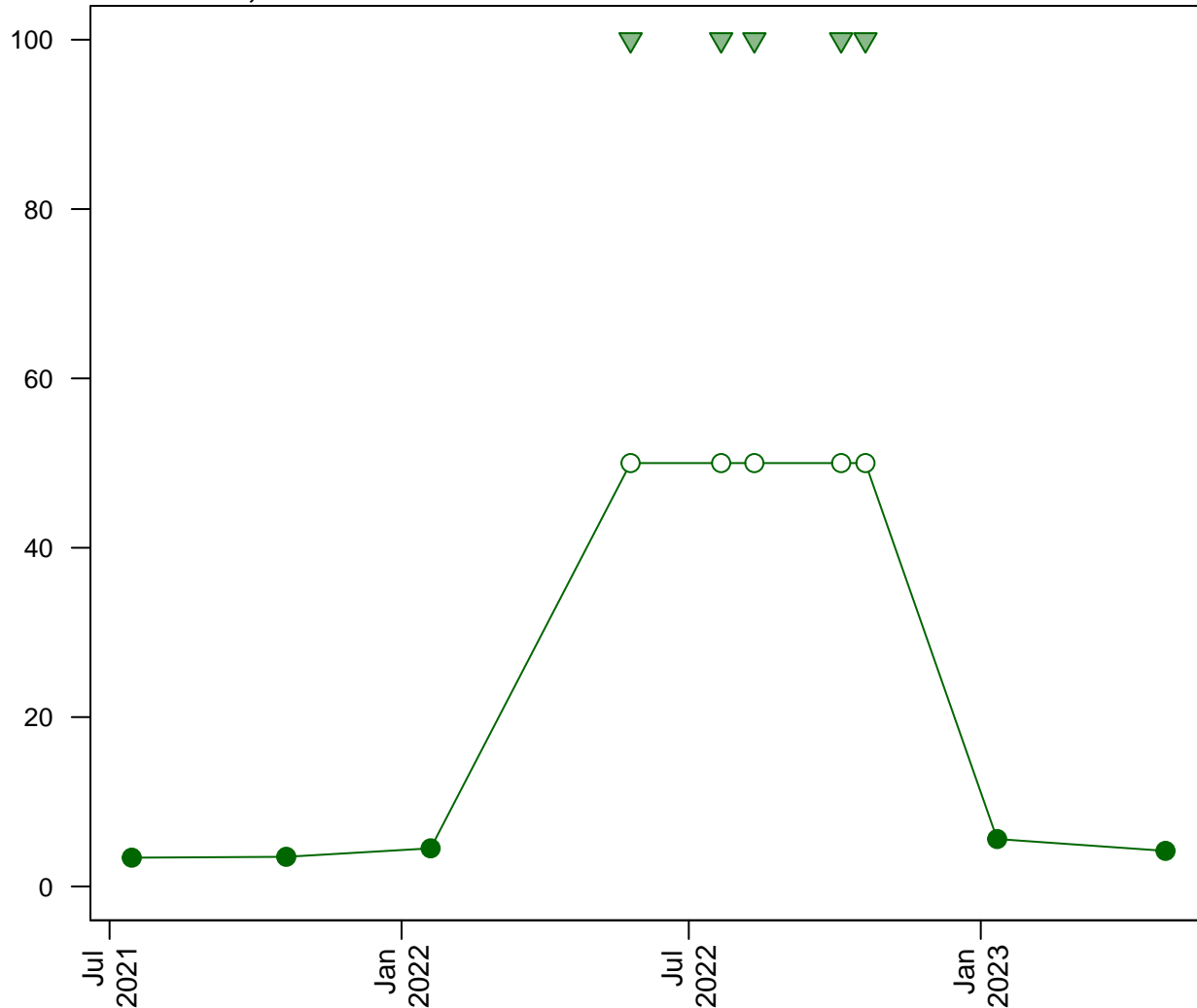
95% Confidence
MK Trend: NS
MK p-val: 0.542

Shapes
● Detect
○ NonDetect
▼ Detect Limit



Scatterplots and Trend Analysis MPGM5-D5, Selenium

Concentration (µg/L)



Stats

N Data: 10
N Detect: 5
% Detect: 50

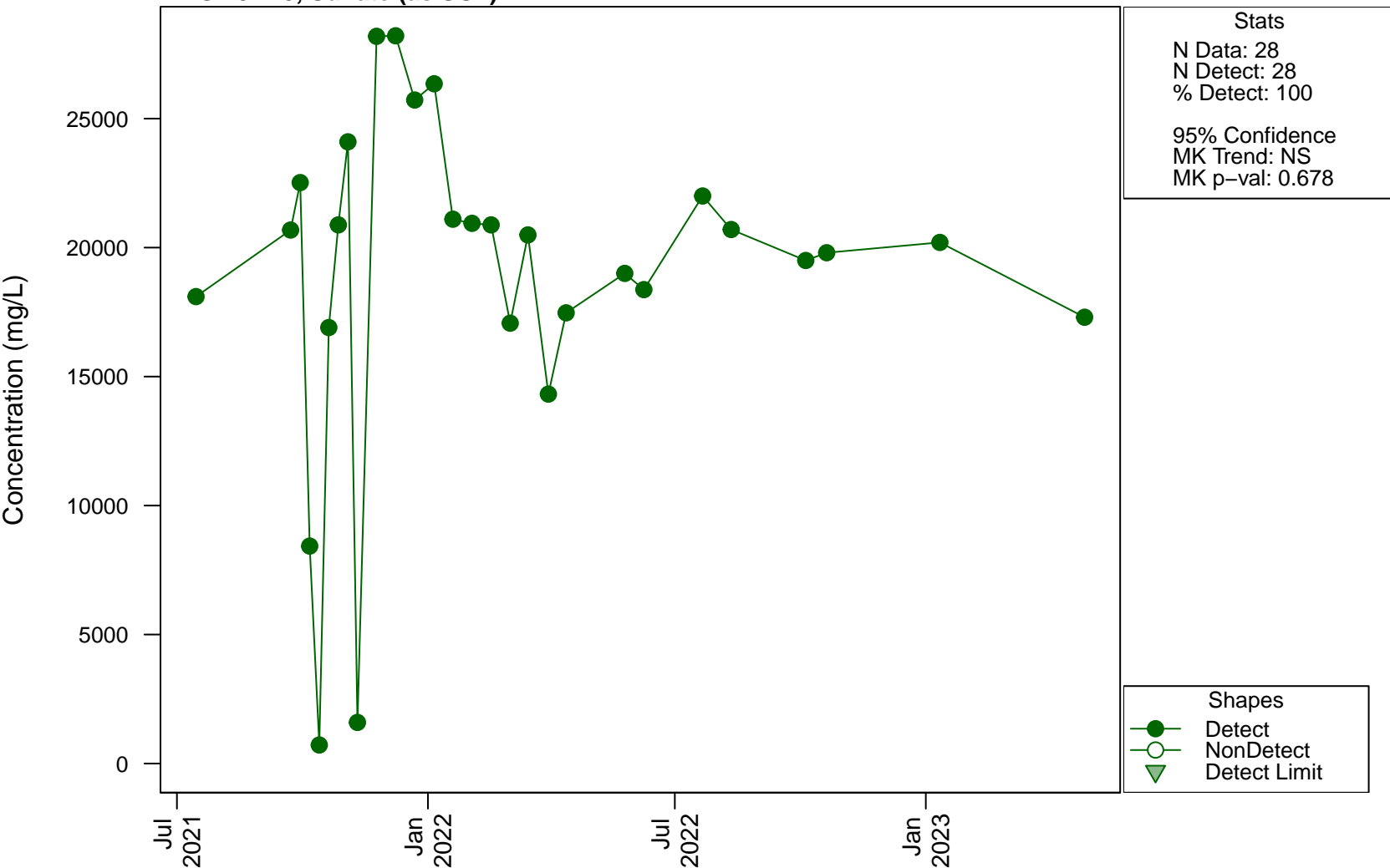
95% Confidence
MK Trend: NS
MK p-val: 0.291

Shapes

● Detect
○ NonDetect
▼ Detect Limit

Scatterplots and Trend Analysis

MPGM5-D5, Sulfate (as SO4)



Scatterplots and Trend Analysis

MPGM5-D5, Total Dissolved Solids (TDS)

Concentration (mg/L)

40000
30000
20000
10000
0

Jul
2021

Jan
2022

Jul
2022

Jan
2023

Stats

N Data: 8

N Detect: 8

% Detect: 100

95% Confidence

MK Trend: NS

MK p-val: 0.399

Shapes



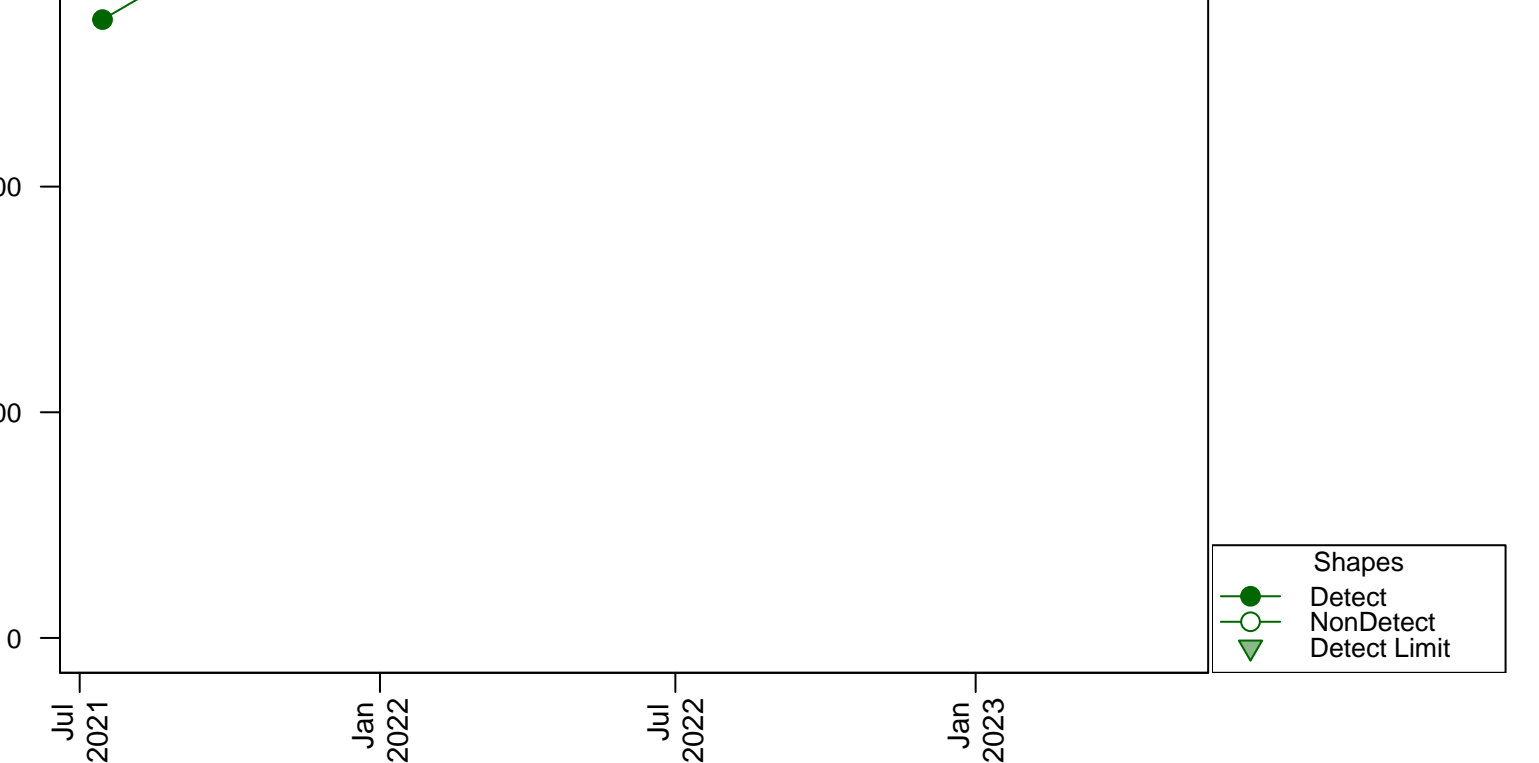
Detect



NonDetect



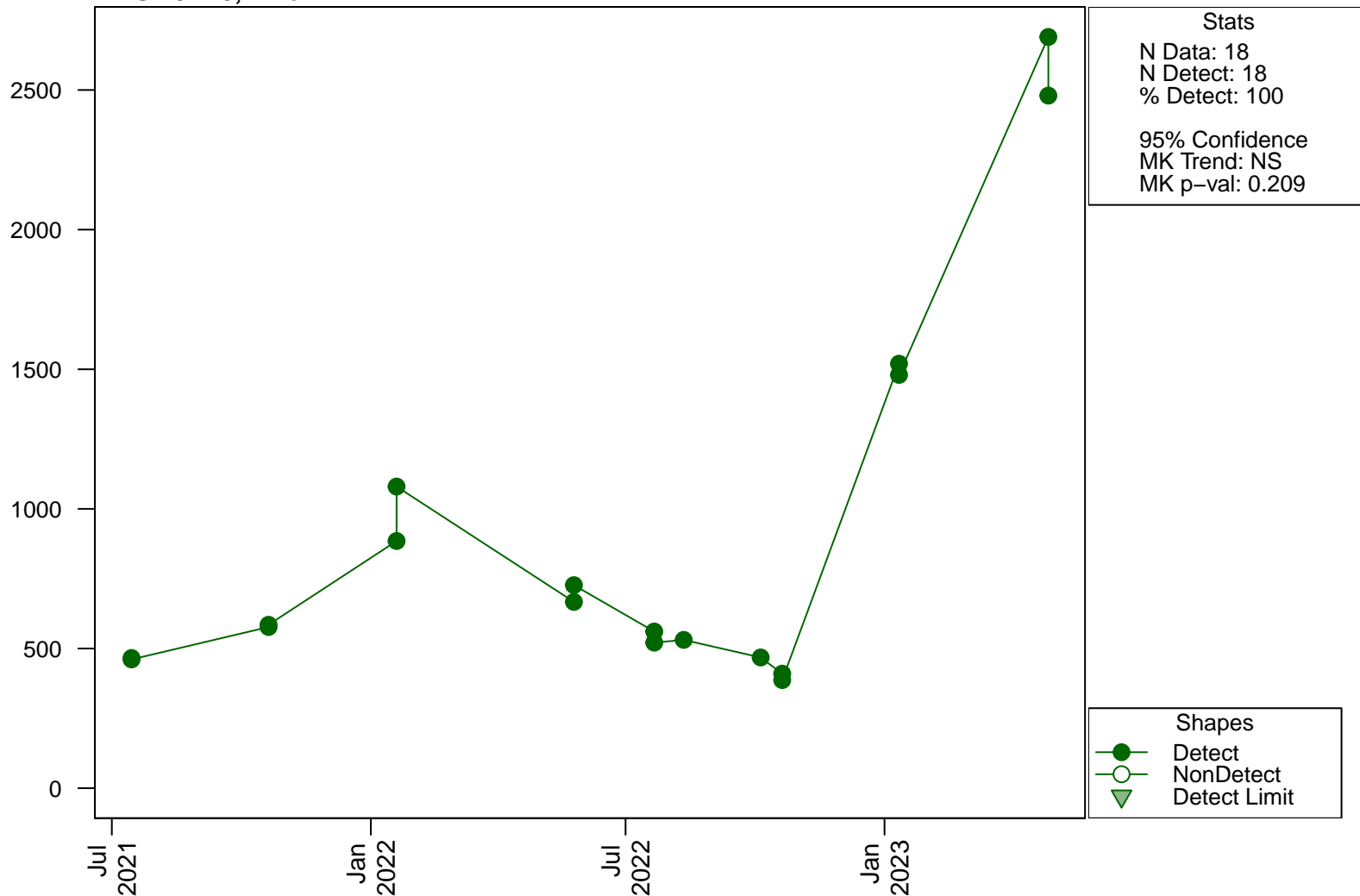
Detect Limit



Scatterplots and Trend Analysis

MPGM5-D5, Zinc

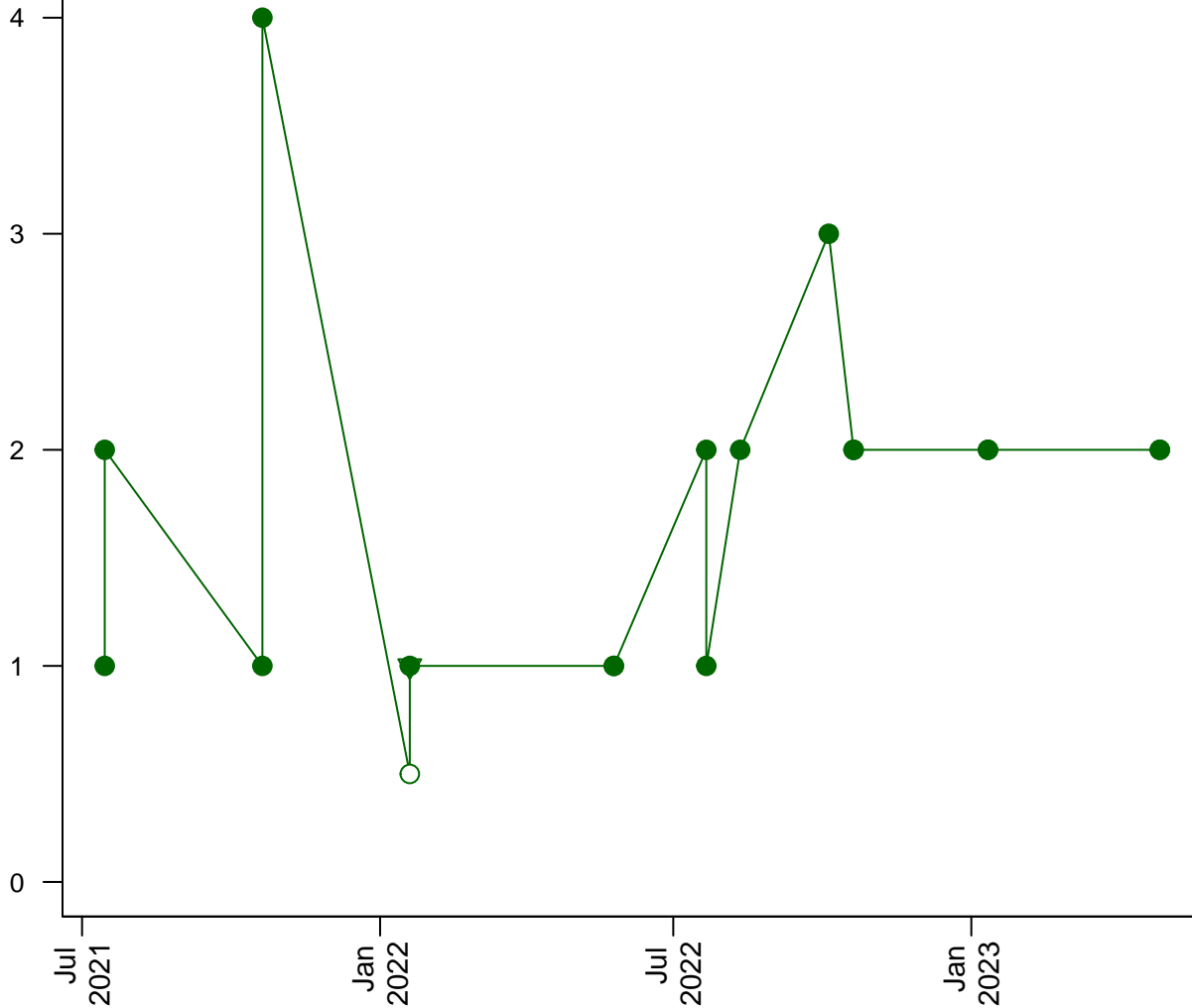
Concentration (µg/L)



Scatterplots and Trend Analysis

MPGM5-D6, Arsenic

Concentration (µg/L)



Stats

N Data: 18
N Detect: 17
% Detect: 94

95% Confidence
MK Trend: NS
MK p-val: 0.0789

Shapes

● Detect
○ NonDetect
▼ Detect Limit

Scatterplots and Trend Analysis MPGM5-D6, Boron

Concentration (µg/L)

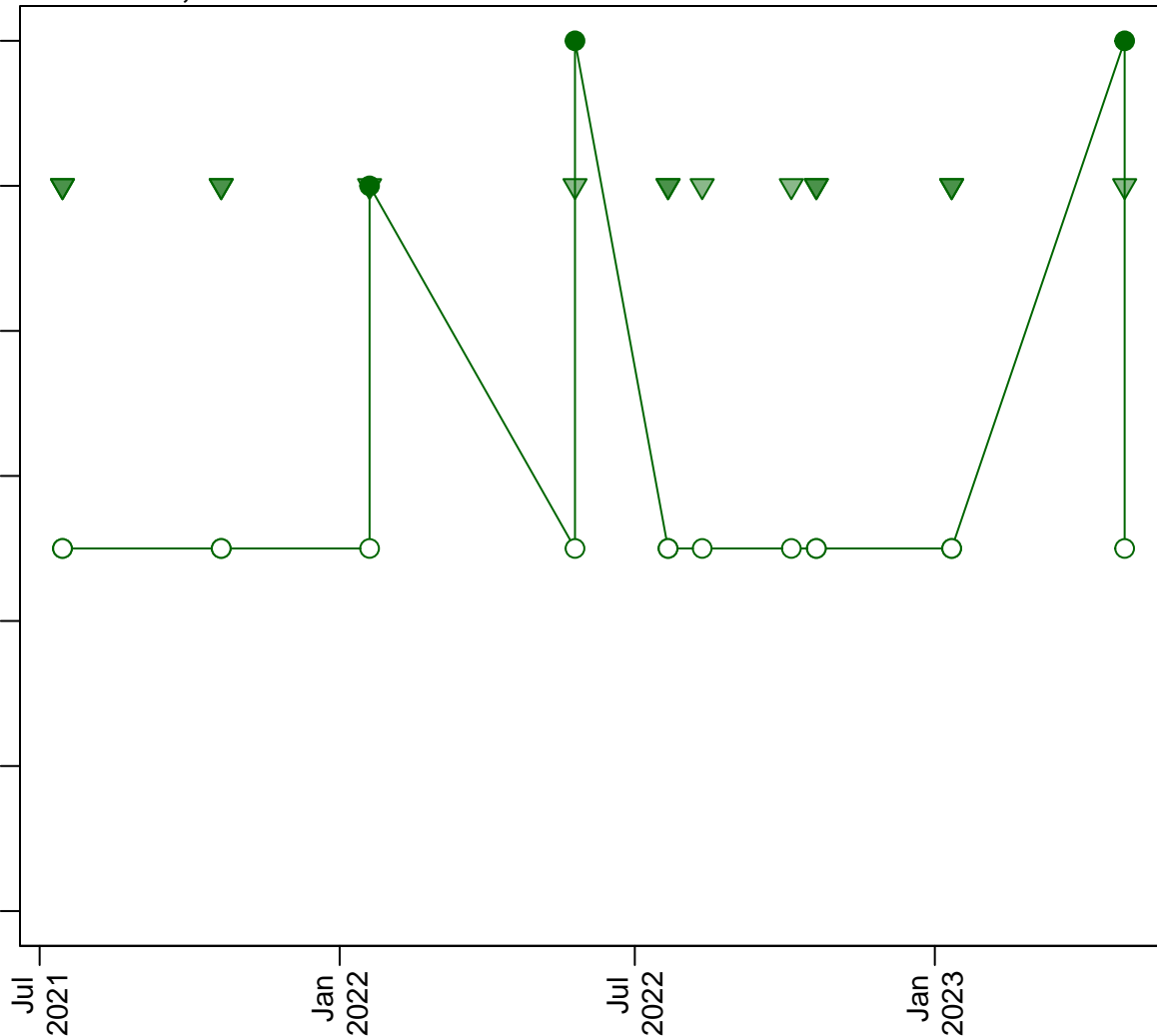
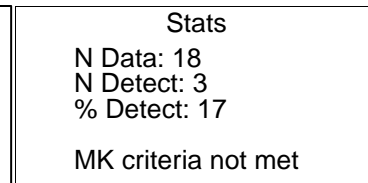
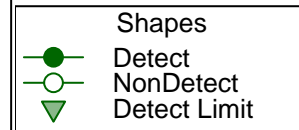
60
50
40
30
20
10
0

Jul
2021

Jan
2022

Jul
2022

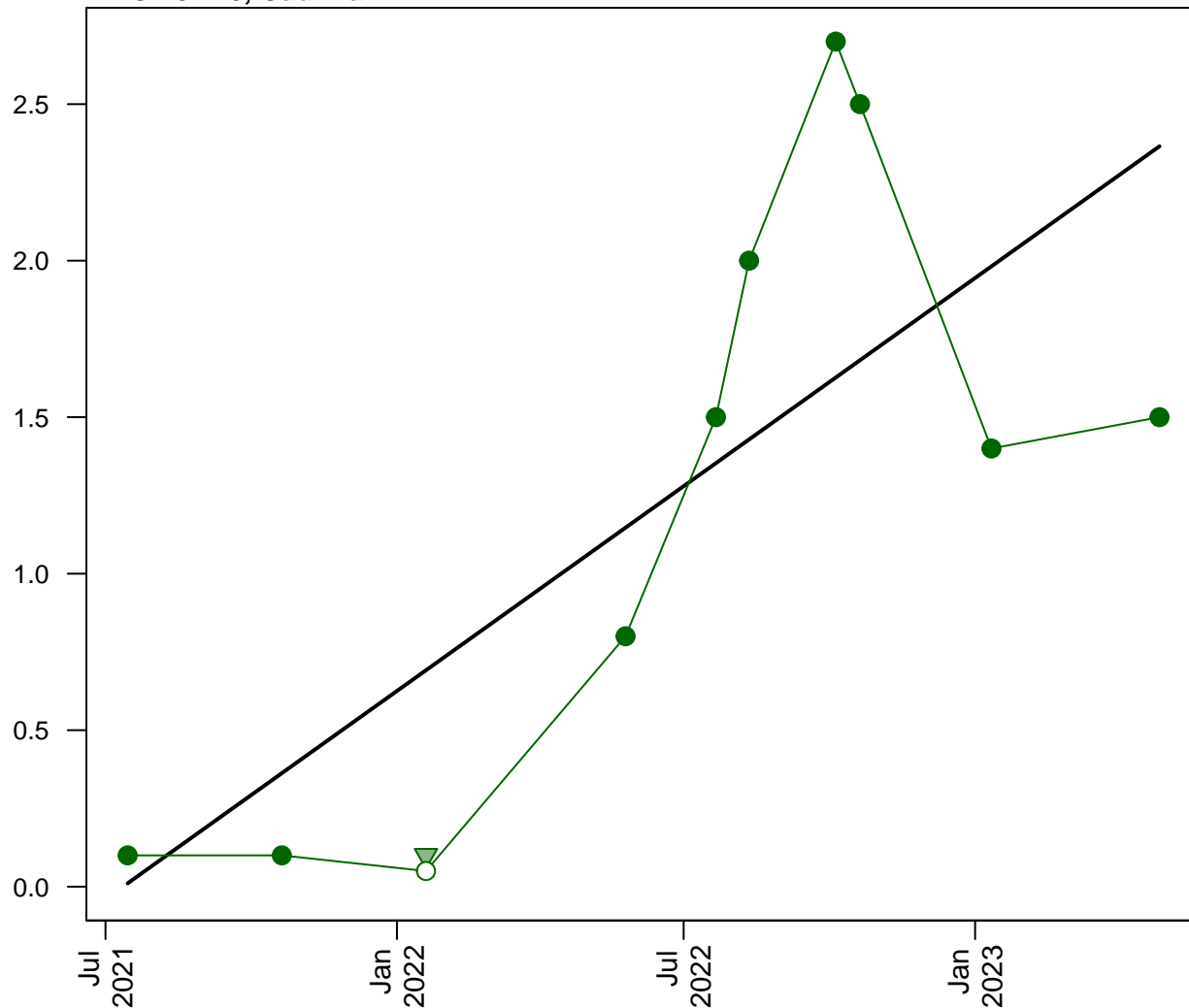
Jan
2023



Scatterplots and Trend Analysis

MPGM5-D6, Cadmium

Concentration (µg/L)



Stats

N Data: 10
N Detect: 9
% Detect: 90

95% Confidence
MK Trend: Significant
MK p-val: 0.0381
Direction: Increasing

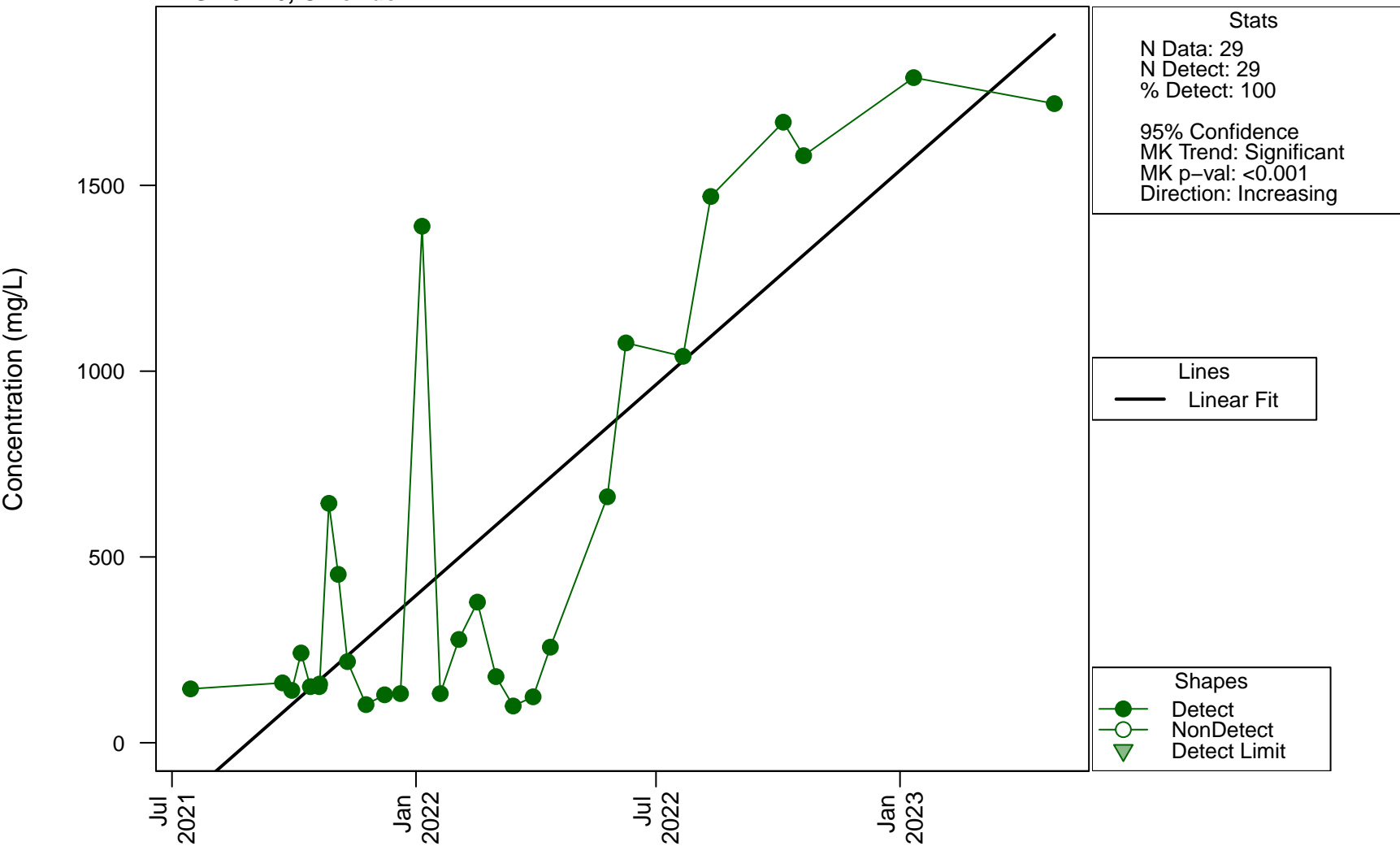
Lines

— Linear Fit

Shapes

● Detect
○ NonDetect
▼ Detect Limit

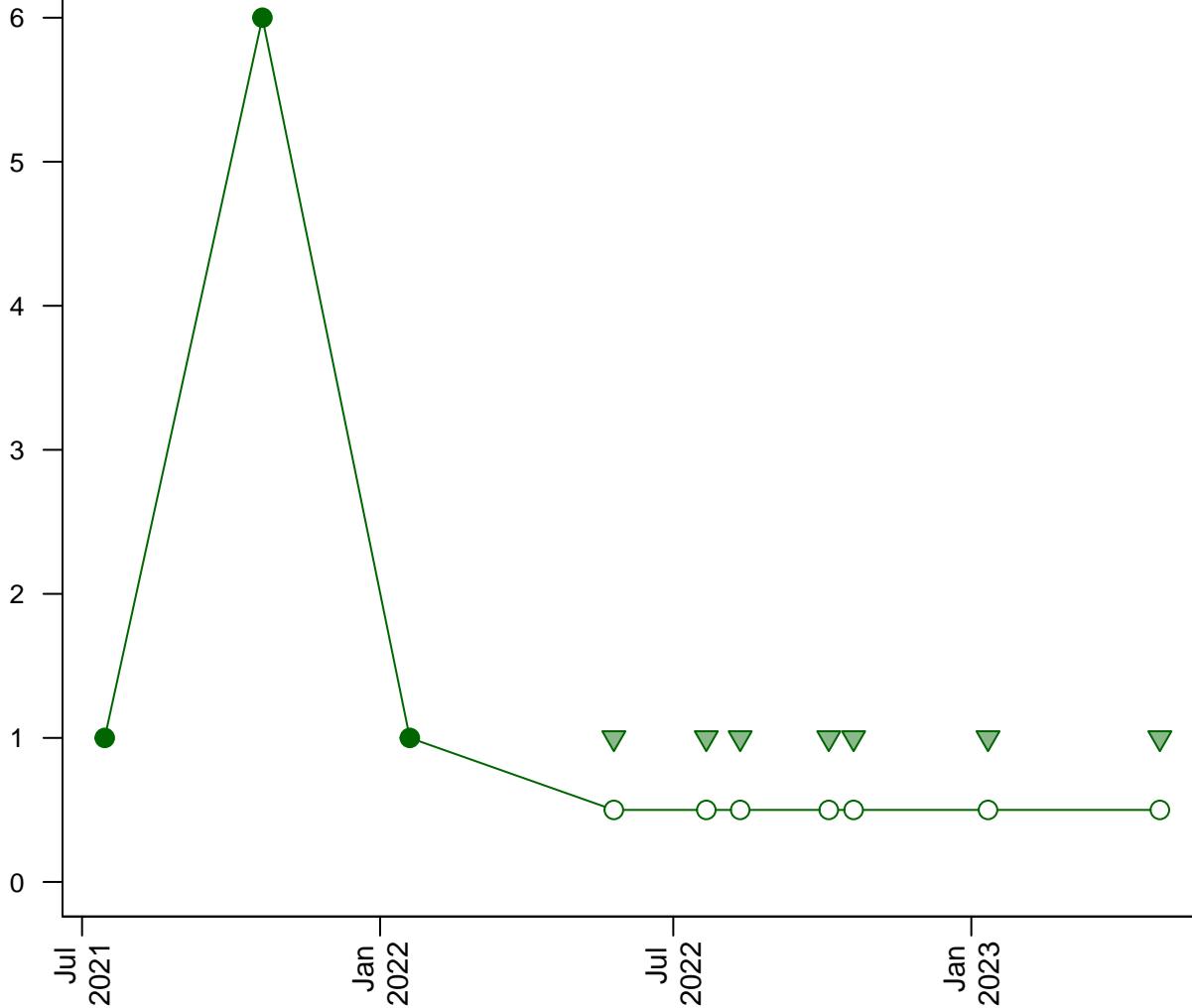
Scatterplots and Trend Analysis MPGM5-D6, Chloride



Scatterplots and Trend Analysis

MPGM5-D6, Chromium

Concentration (µg/L)



Stats

N Data: 10

N Detect: 3

% Detect: 30

MK criteria not met

Shapes

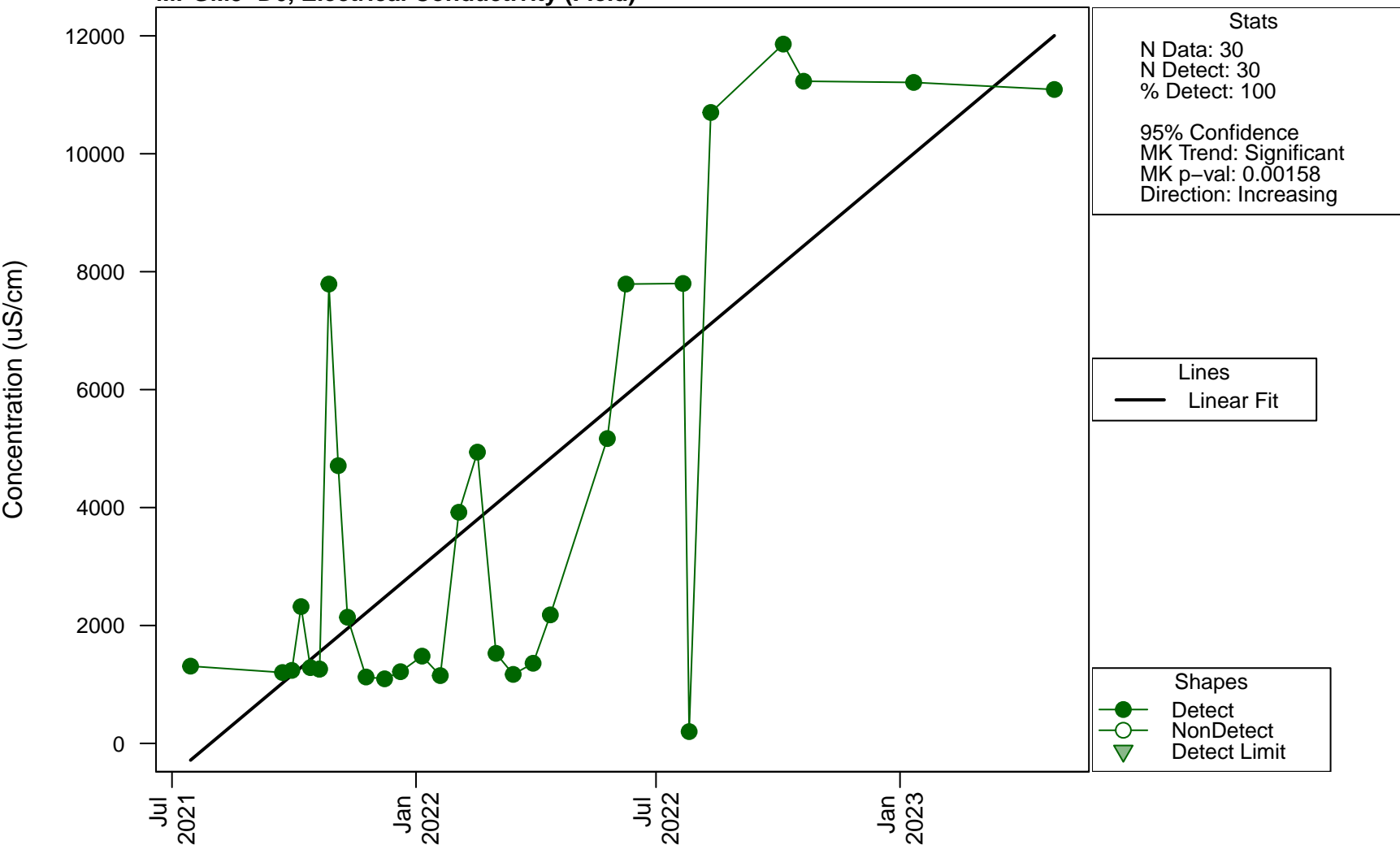
● Detect

○ NonDetect

▼ Detect Limit

Scatterplots and Trend Analysis

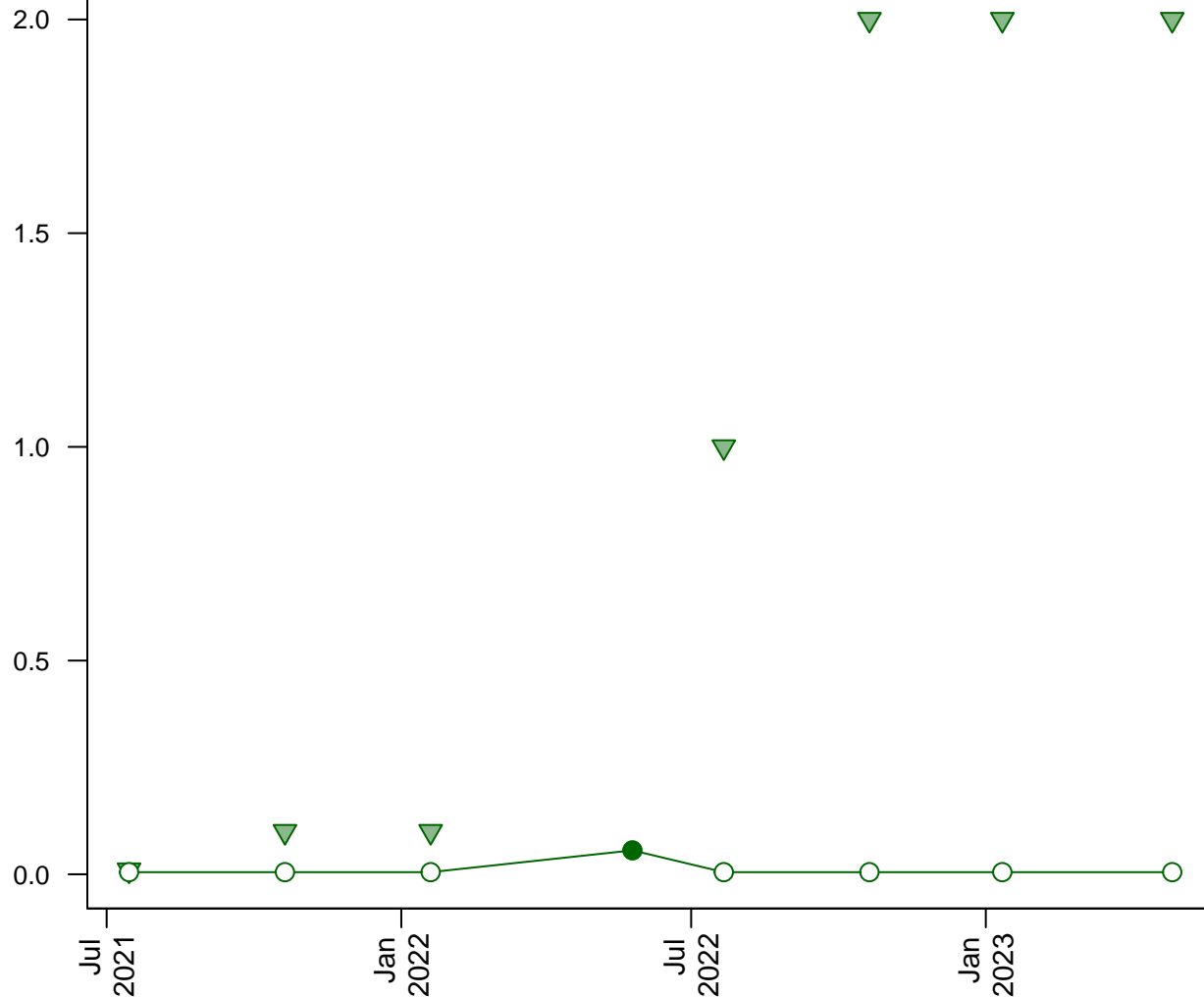
MPGM5-D6, Electrical Conductivity (Field)



Scatterplots and Trend Analysis

MPGM5-D6, Fluoride

Concentration (mg/L)



Stats

N Data: 8

N Detect: 1

% Detect: 12

MK criteria not met

Shapes

● Detect

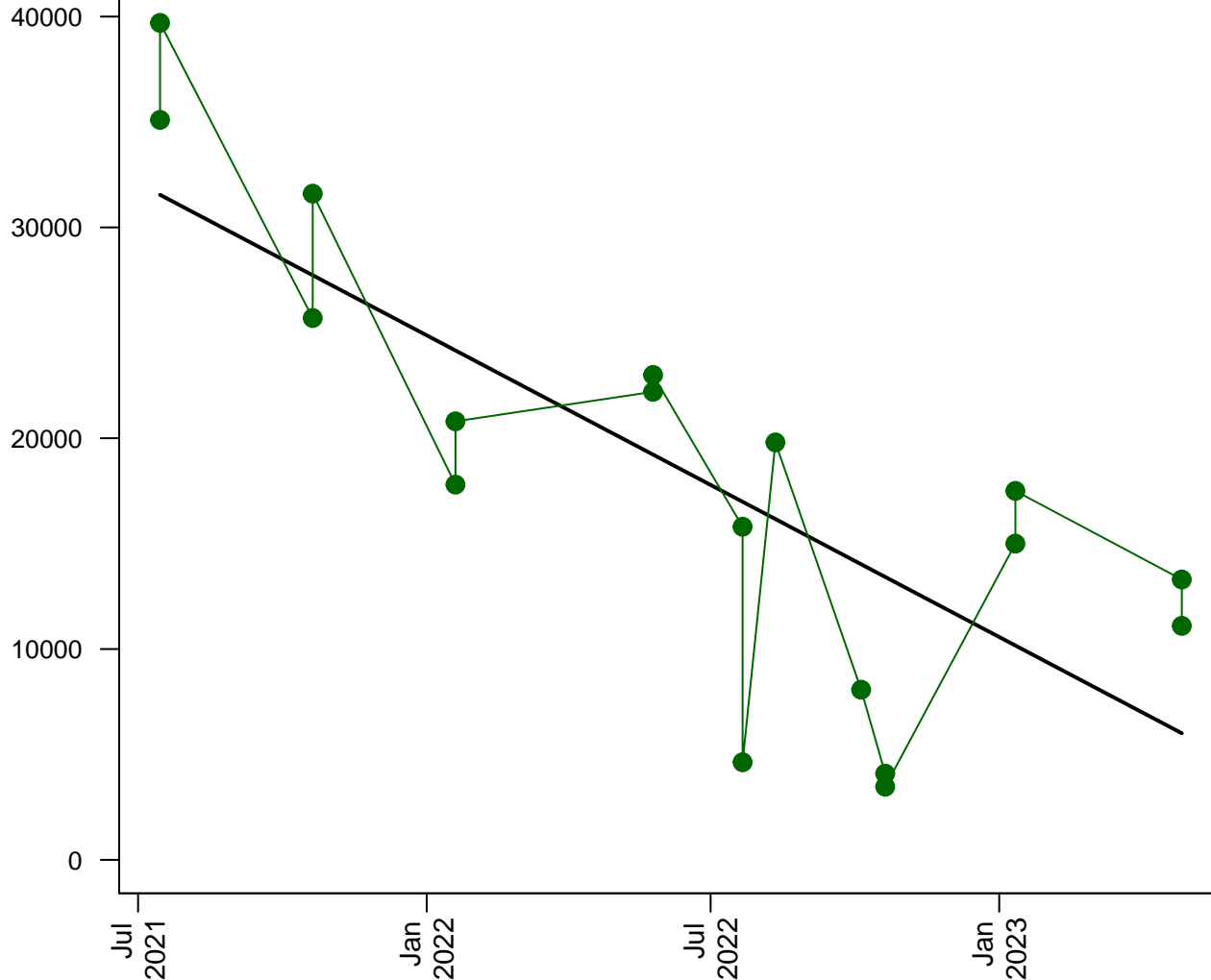
○ NonDetect

▼ Detect Limit

Scatterplots and Trend Analysis

MPGM5-D6, Iron

Concentration (µg/L)



Stats

N Data: 18
N Detect: 18
% Detect: 100

95% Confidence
MK Trend: Significant
MK p-val: <0.001
Direction: Decreasing

Lines

— Linear Fit

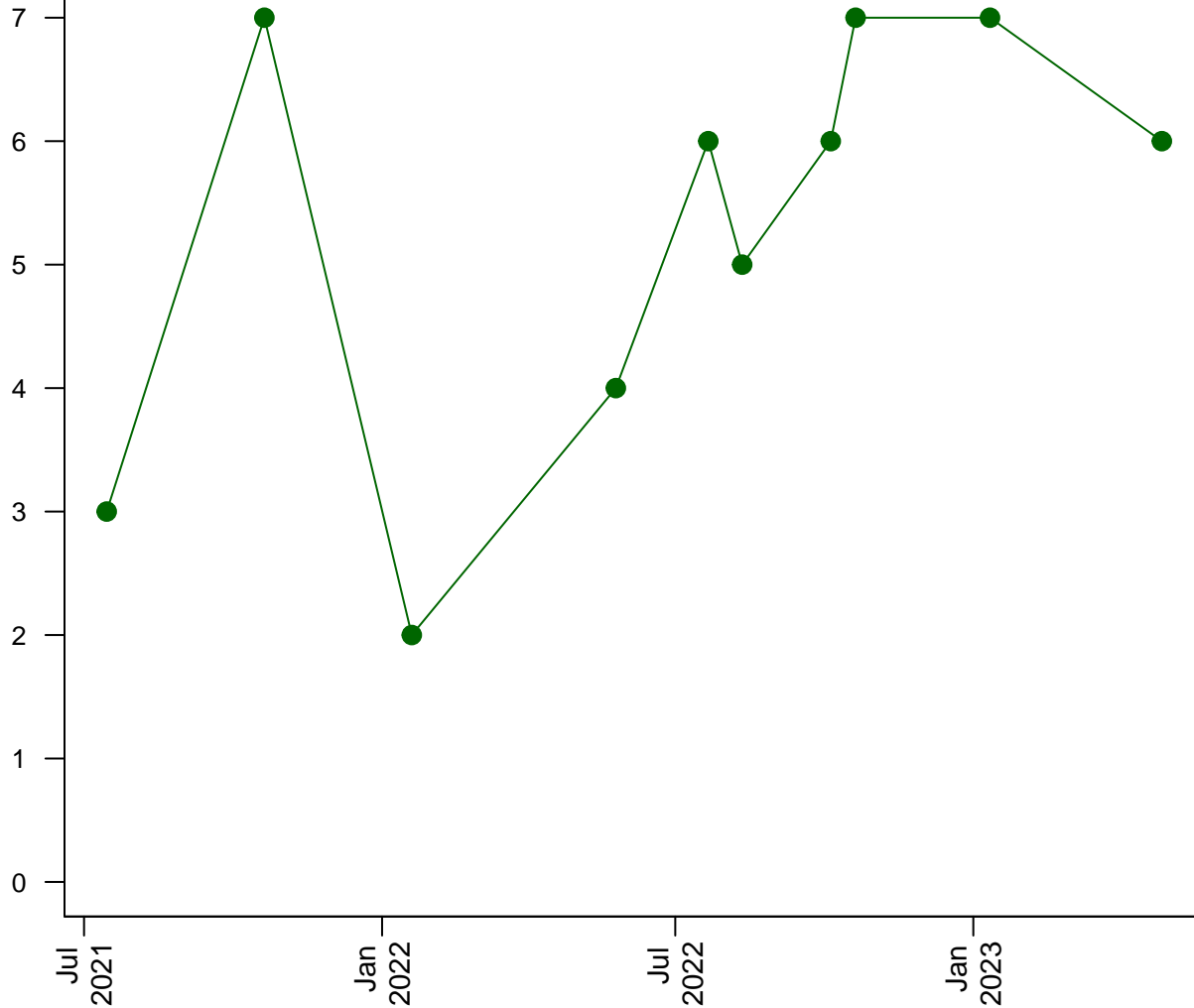
Shapes

● Detect
○ NonDetect
▼ Detect Limit

Scatterplots and Trend Analysis

MPGM5-D6, Lead

Concentration (µg/L)



Stats

N Data: 10
N Detect: 10
% Detect: 100

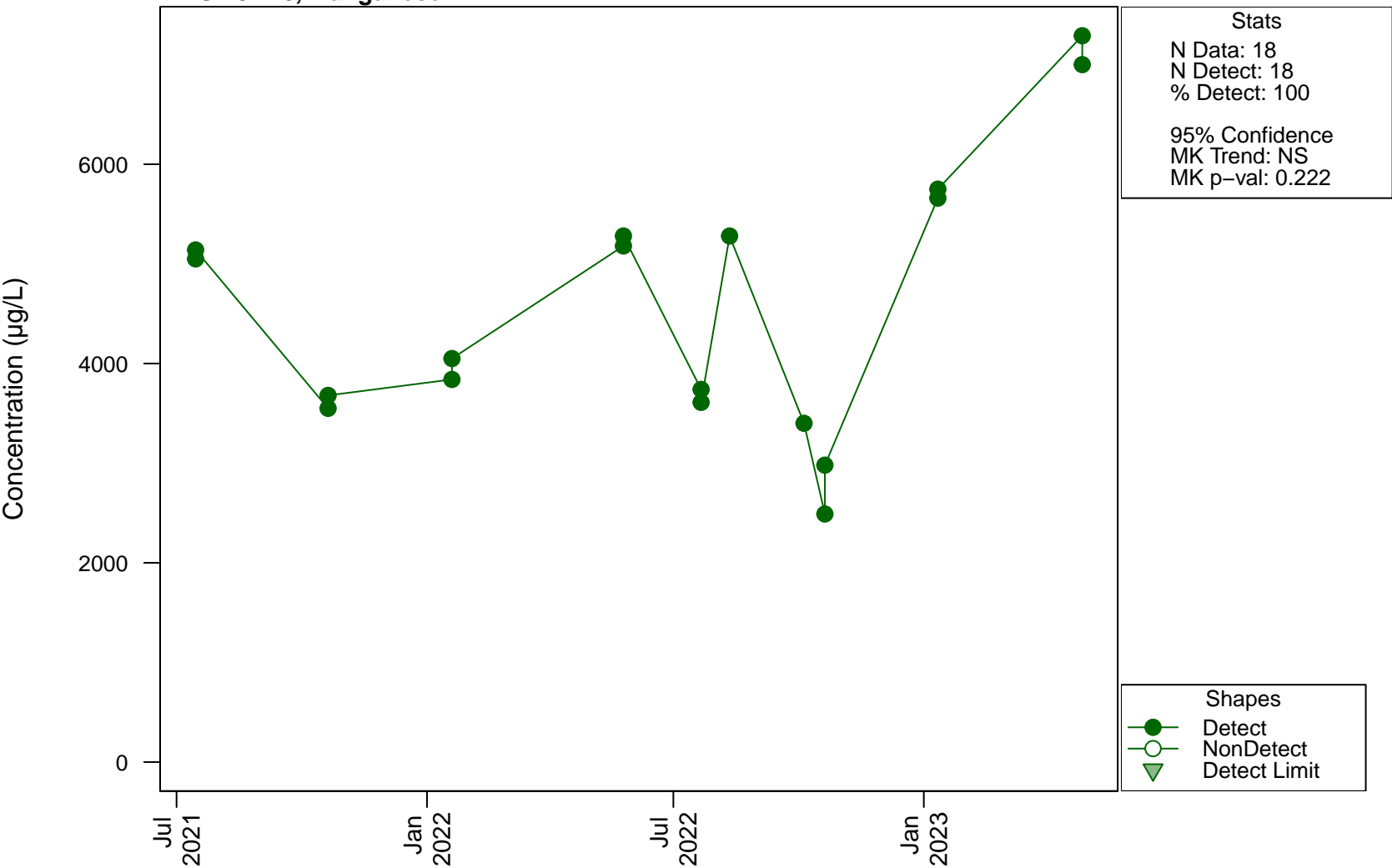
95% Confidence
MK Trend: NS
MK p-val: 0.0798

Shapes

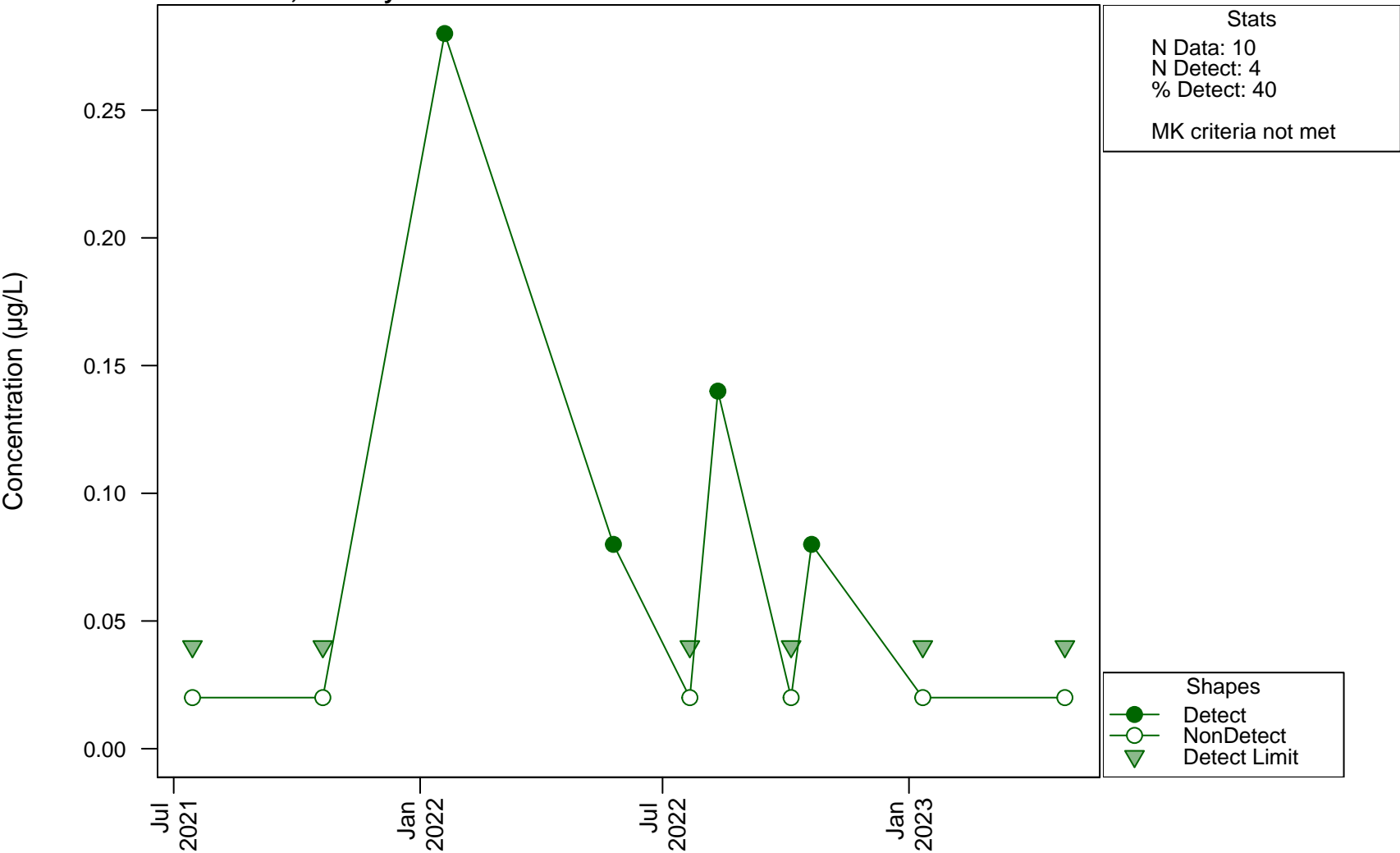
● Detect
○ NonDetect
▼ Detect Limit

Scatterplots and Trend Analysis

MPGM5-D6, Manganese



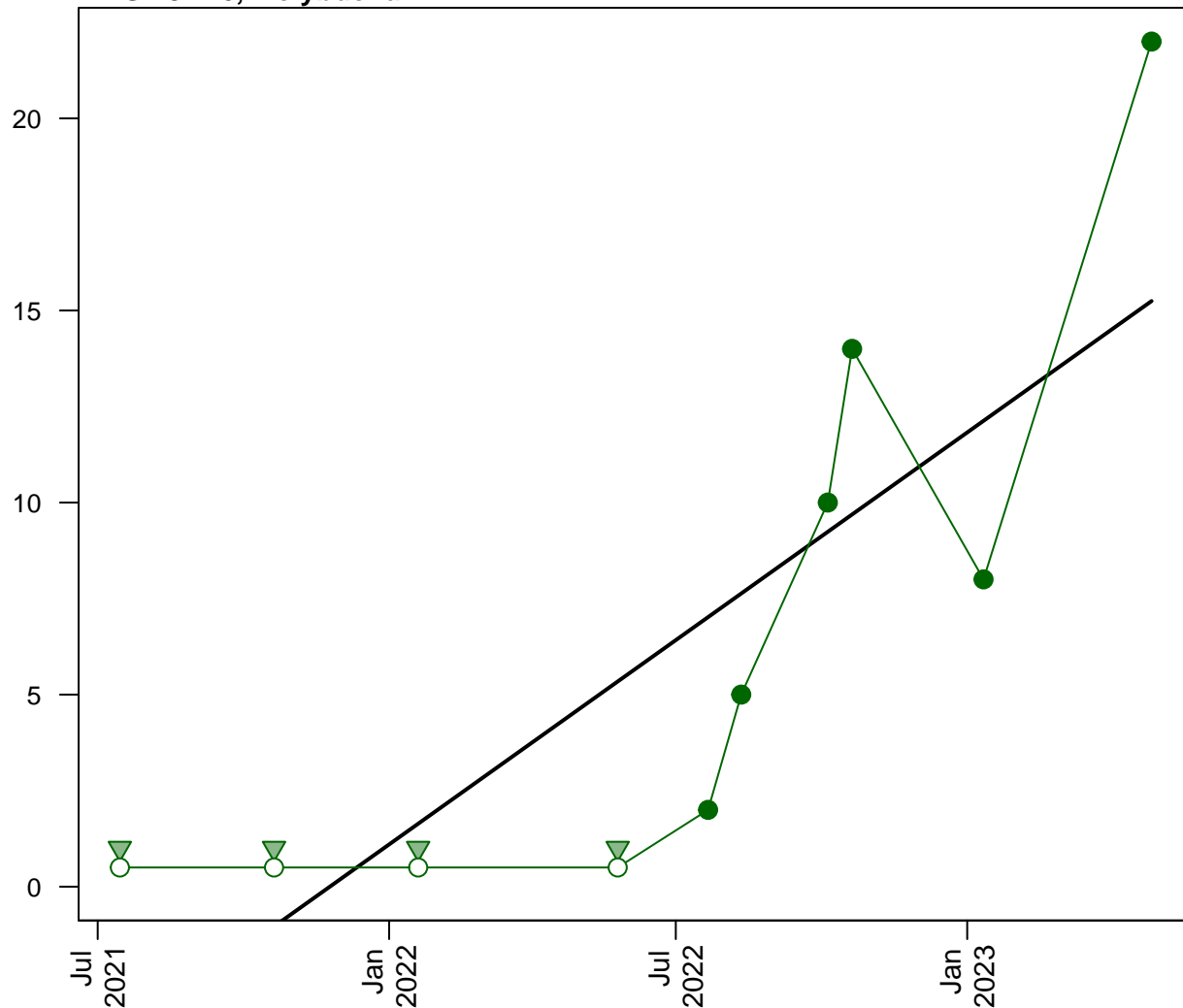
Scatterplots and Trend Analysis MPGM5-D6, Mercury



Scatterplots and Trend Analysis

MPGM5-D6, Molybdenum

Concentration (µg/L)



Stats

N Data: 10

N Detect: 6

% Detect: 60

95% Confidence

MK Trend: Significant

MK p-val: 0.00117

Direction: Increasing

Lines

Linear Fit

Shapes



Detect



NonDetect



Detect Limit

Scatterplots and Trend Analysis

MPGM5-D6, Nickel

Concentration (µg/L)

1200
1000
800
600
400
200
0

Jul
2021

Jan
2022

Jul
2022

Jan
2023

Stats

N Data: 18

N Detect: 18

% Detect: 100

95% Confidence

MK Trend: Significant

MK p-val: <0.001

Direction: Increasing

Lines

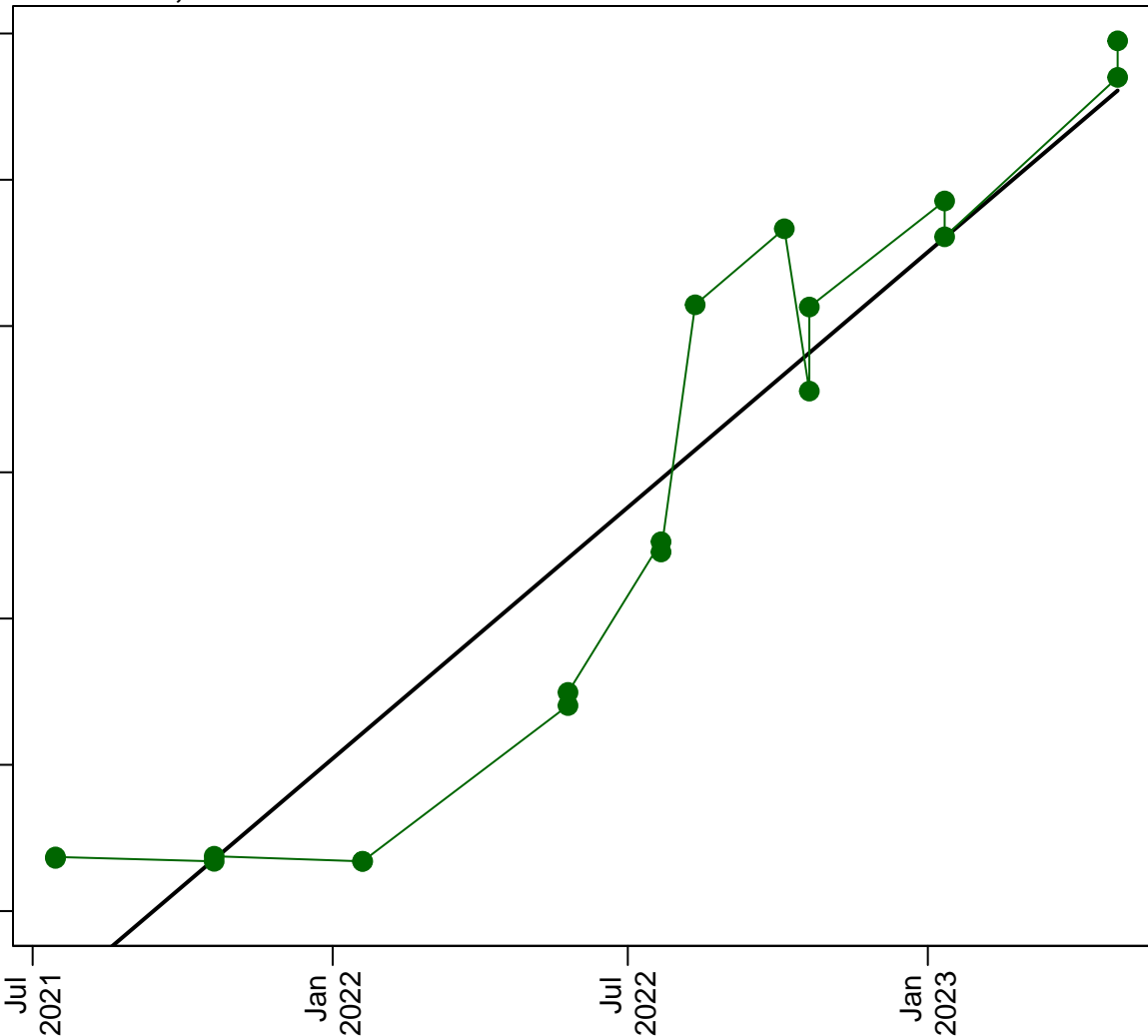
Linear Fit

Shapes

Detect

NonDetect

Detect Limit



Scatterplots and Trend Analysis MPGM5-D6, Selenium

Concentration (µg/L)

10
8
6
4
2
0

Jul
2021

Jan
2022

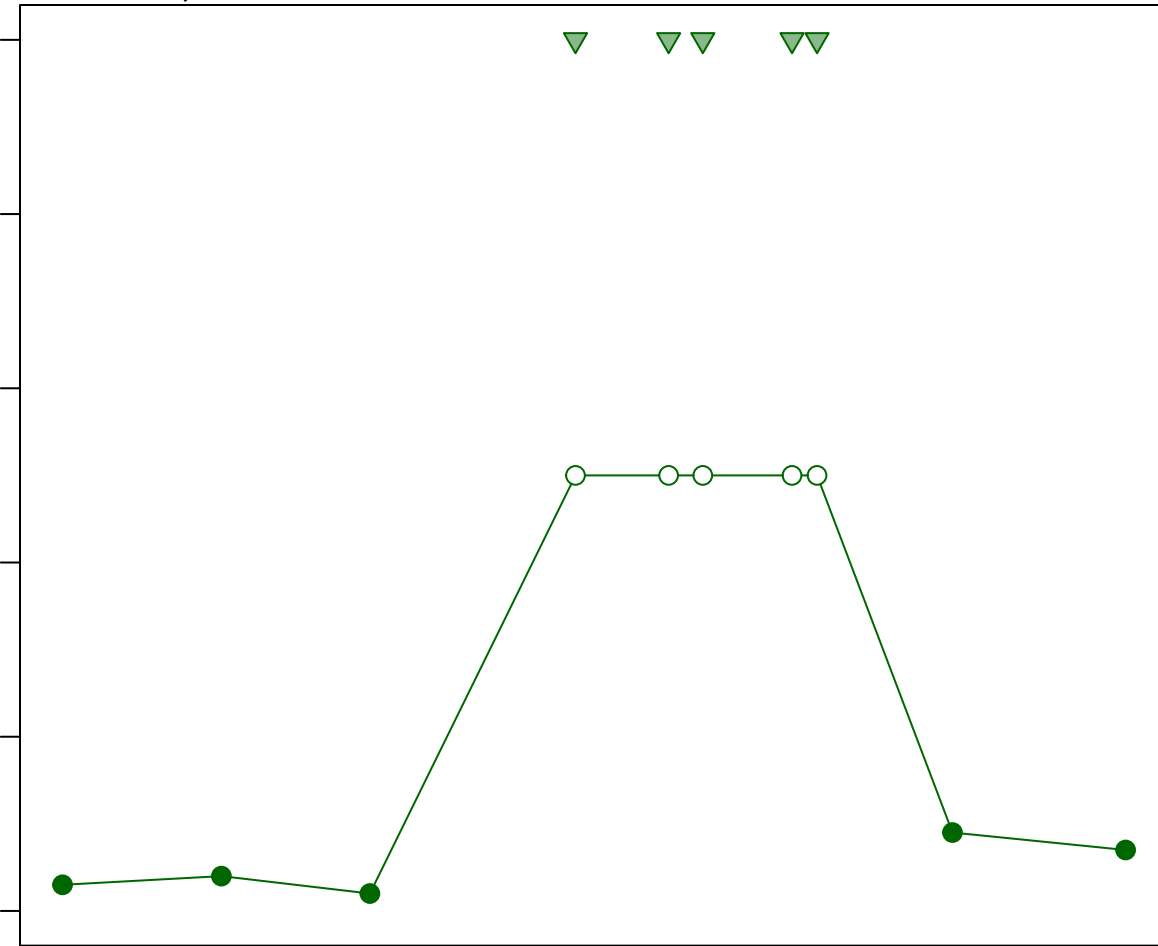
Jul
2022

Jan
2023

Stats
N Data: 10
N Detect: 5
% Detect: 50

95% Confidence
MK Trend: NS
MK p-val: 0.387

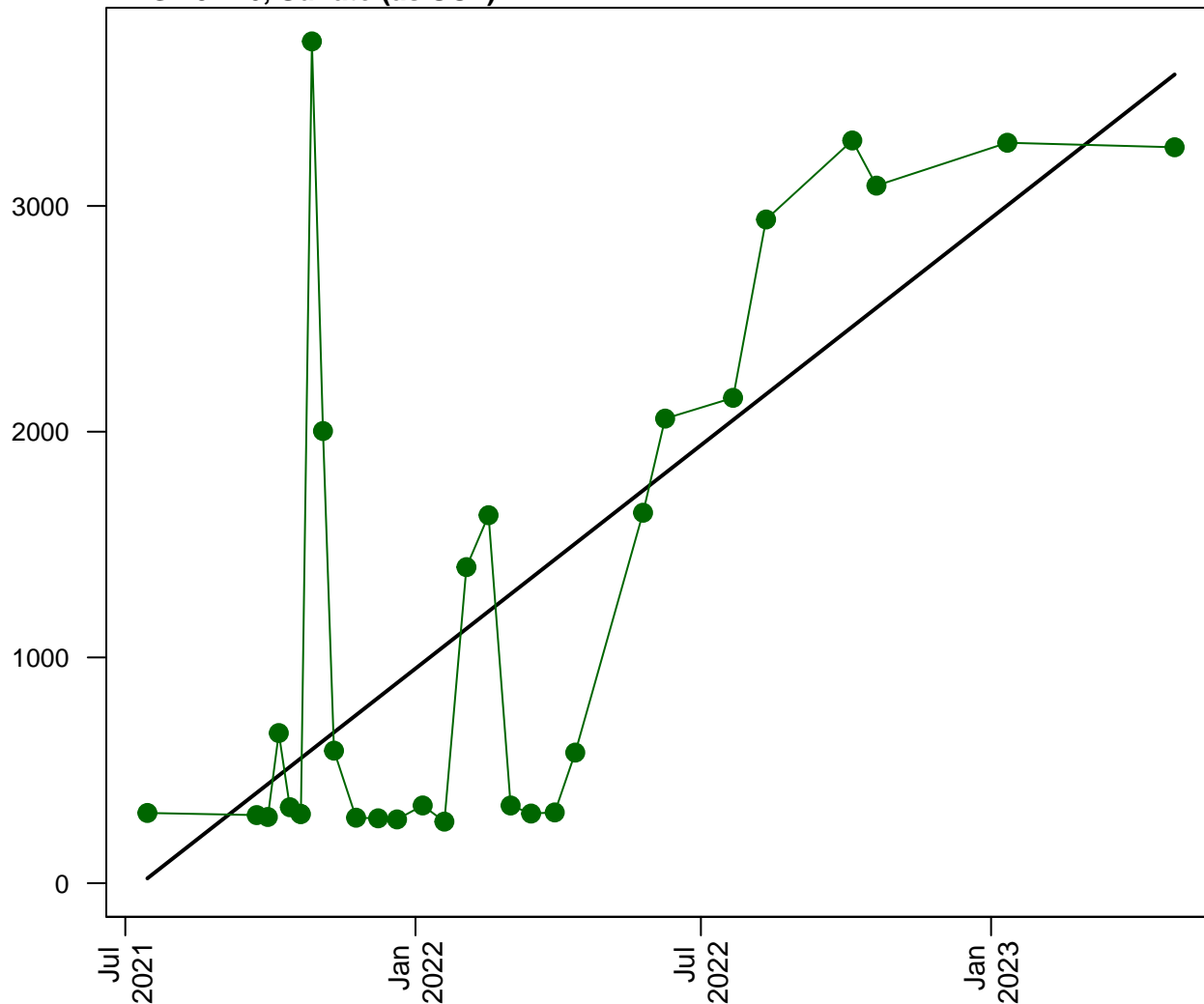
Shapes
● Detect
○ NonDetect
▼ Detect Limit



Scatterplots and Trend Analysis

MPGM5-D6, Sulfate (as SO4)

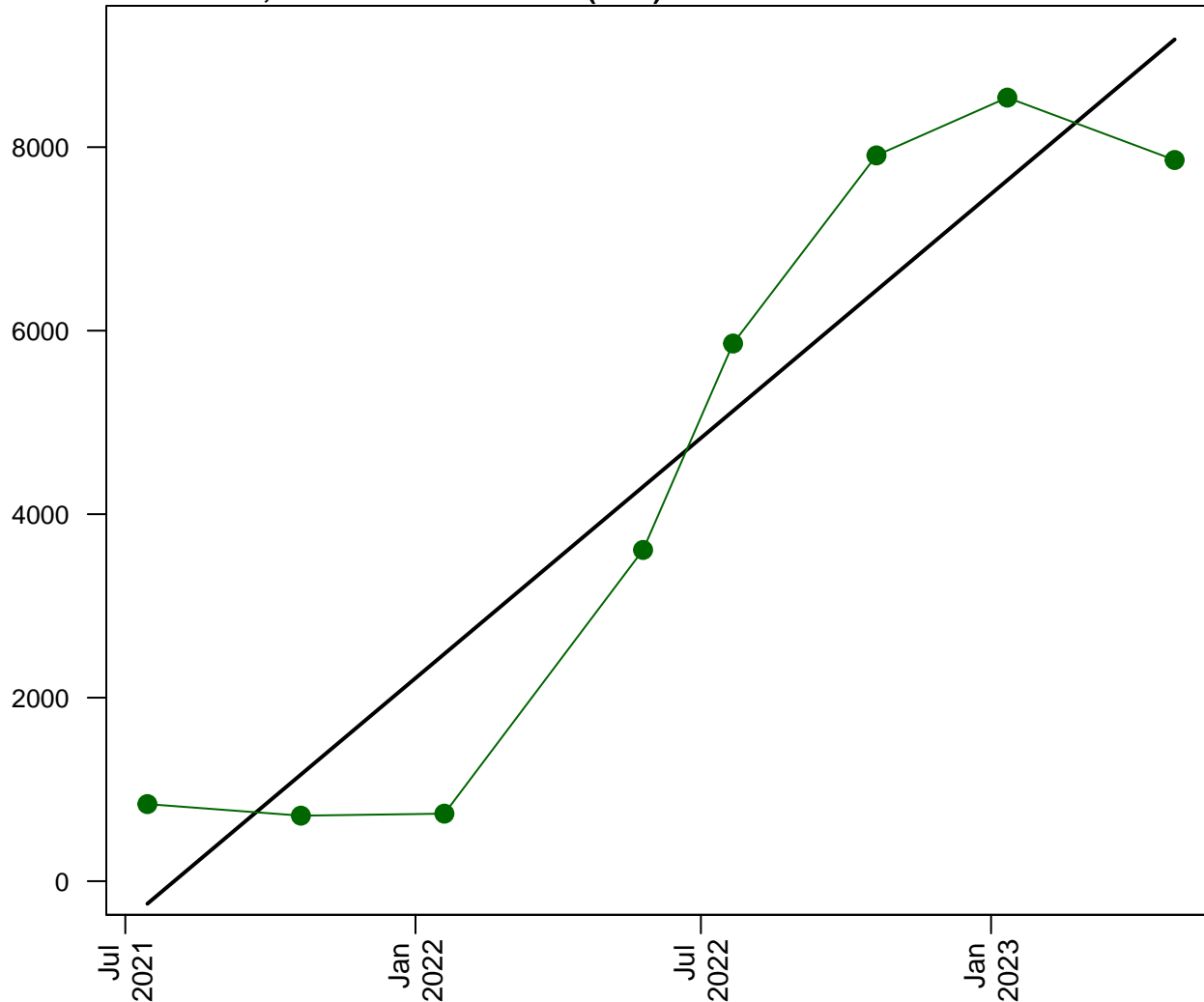
Concentration (mg/L)



Scatterplots and Trend Analysis

MPGM5-D6, Total Dissolved Solids (TDS)

Concentration (mg/L)



Stats

N Data: 8

N Detect: 8

% Detect: 100

95% Confidence

MK Trend: Significant

MK p-val: 0.0141

Direction: Increasing

Lines

Linear Fit

Shapes

● Detect

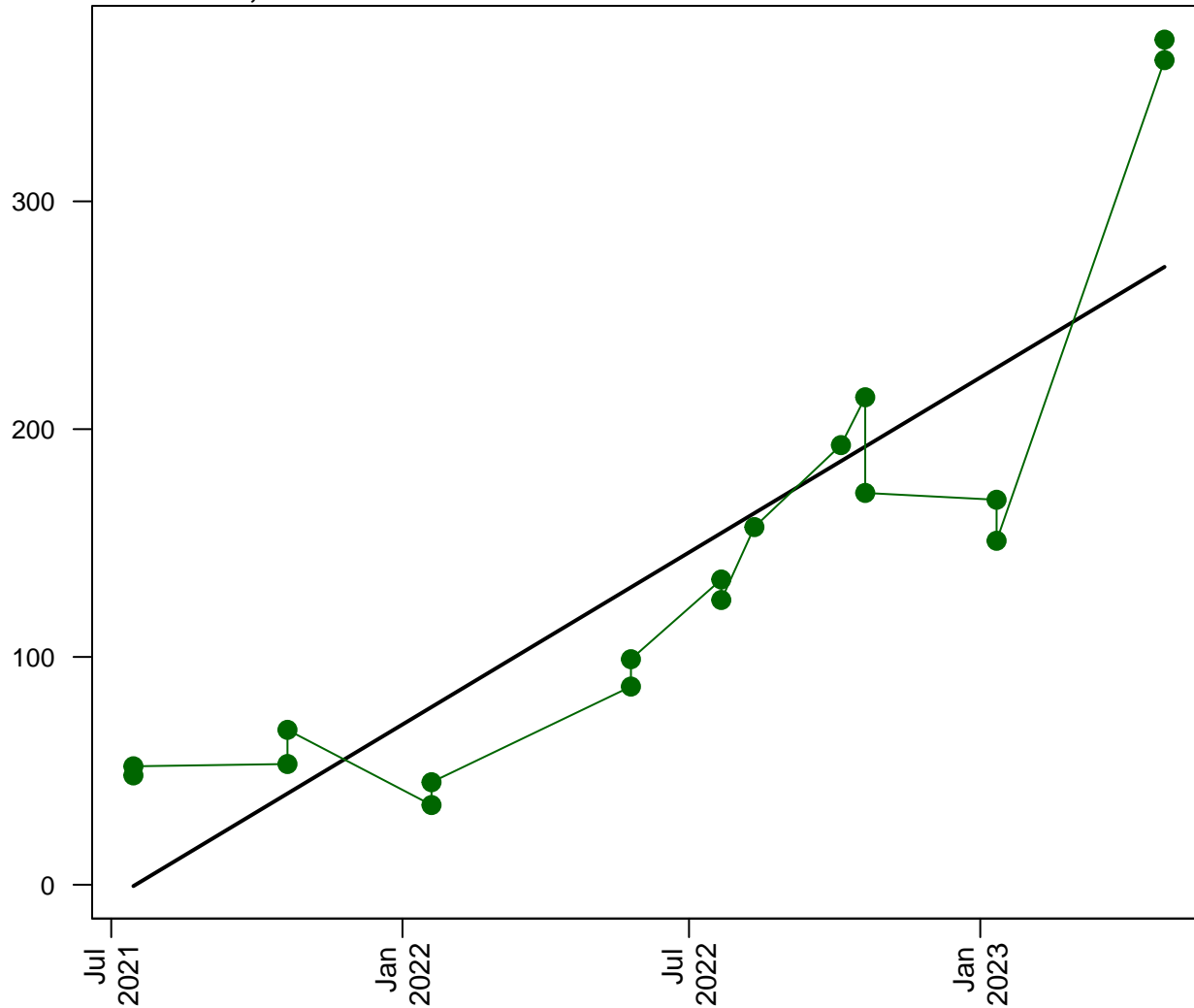
○ NonDetect

▼ Detect Limit

Scatterplots and Trend Analysis

MPGM5-D6, Zinc

Concentration (µg/L)



Stats

N Data: 18
N Detect: 18
% Detect: 100

95% Confidence
MK Trend: Significant
MK p-val: <0.001
Direction: Increasing

Lines

— Linear Fit

Shapes

● Detect
○ NonDetect
▼ Detect Limit

APPENDIX N MANN-KENDALL METHODOLOGY

Trend Analysis Report

September 05, 2023

1. USER WARNINGS

Mann Kendall analysis is a commonly used statistical tool for assessing changes in concentration over time. Like most statistical analyses, Mann Kendall makes some assumptions about the data being analyzed. If these assumptions are not met, the results of the Mann Kendall may be wrong or misleading. The final section of this memo discusses scenarios that will likely require the input of a qualified statistician to ensure that the results of the trend test are appropriate for your data. A careful review of the results tables and figures can help identify any anomalies in the data that merit further assessment.

Selection of an appropriate α : Statistical convention typically uses an α equal to 0.05 which sets the probability of drawing a false positive conclusion (saying there is a trend when one does not exist) in the statistical analysis at 5 percent. α can be adjusted up or down to meet specific programmatic needs or to meet data quality objectives, but changes in α should be made a priori and should not be changed in an attempt to obtain a more 'favorable' result. Often decreasing α will result in a reduction in the probability of finding a false negative result (saying there is no trend when one actually exists).

2. INTRODUCTION

This report covers the Mt Piper data quality, descriptive statistics, and trend analysis.

- The data file used in this report (MK_Input_010823.xlsx) consists of samples from June 2021 to June 2023.
- The analysis includes 23 unique wells and 17 analytes.
- Descriptive statistics and trend analysis are run for every unique combination of: sys_loc_code, chemical_name (referred to as *Group* from hereon). There are 391 unique Groups.
- Trends were conducted at 95% confidence with minimum data requirements of at least 4 detected values and 50% detection frequency for each Group.

3. DATA HANDLING

This section describes the data included in this evaluation, the handling of field duplicates, data qualifiers, censored values, and handling of anomalous data points.

3.1 Field Duplicates

Only one set of primary and field duplicate measurements were retained for statistical evaluation. While field duplicates can provide useful information on the sampling methodology, the duplicates are almost always statistically dependant on the parent sample (USEPA 2009, Page 6-27). Although complicated methods can be used to allow the inclusion of both values in statistical tests, simpler strategies involve keeping the maximum value between the two samples, randomly selecting one of the two samples, or removing the duplicates altogether (USEPA 2009, Page 6-28). Unless otherwise noted, field duplicates were removed prior to all analysis.

3.2 Data Qualifiers

Data was qualified by a data validator to ensure the quality of the reported results. Consistent with lab conventions, J-flagged values were estimated quantities. Guidance allows for J-flagged values to be used with reported concentrations but cautions against making regulatory decision based on these values (USEPA 2014).

Measurements that have an R-flag had their concentration rejected; the result is rejected due to serious deficiencies in meeting quality control criteria and the analyte may or may not be present in the sample (USEPA 2014). The data quality review found the results to be valid, reliable and useable for decision making purposes with the listed qualifiers. No analytical results were rejected.

3.3 Non-Detects

Non-detects (NDs) commonly reported in water monitoring are statistically known as “left censored” measurements because the concentration of any ND can only be estimated. NDs are assumed to fall between zero and the reporting limit (USEPA 2009). USEPA (2015) offers a number of options for handling non-detected values, including Kaplan-Meier estimators, Regression on Order Statistics, and replacement with surrogate values. The appropriate handling of NDs depends on the statistical test being used and will be discussed in the following sections as appropriate.

Multiple reporting limits were found for several Groups. Of the 391 unique Groups, 32 of them had different reporting limits.

Maximum reporting limits were found to be greater than detected values for 34 of the Groups.

4. DESCRIPTIVE STATISTICS

Descriptive statistics were calculated for all Groups and can be found in Table 1. Non-detects were substituted with a value of half the reporting limit for calculations. The descriptive statistics highlight a number of relevant characteristics about the datasets, including:

- There are a total of 391 Groups.
- 267 Groups have detection rates greater than or equal to 50 percent.
- 50 Groups have 100 percent non-detects.
- 211 Groups have 100 percent detects.
- 151 Groups follow a normal distribution (using Shapiro-Wilks Normality Test) and 29 Groups follow a log-normal distribution. The remaining 211 Groups have no discernible distribution.

5. TESTING FOR TRENDS

Trend tests are a commonly used tool to assess the effectiveness of remediation efforts. By examining whether concentrations are increasing, decreasing, or not significant, trend tests provide one line of evidence about the directional change in concentrations over time.

5.1 Trend Testing Approach

A Mann Kendall test was used to detect changes in concentrations over time. The Mann Kendall Test is a non-parametric method that tests the following null hypothesis (USEPA 2009):

- Null Hypothesis (Ho): No monotonic trend exists.

- Alternative Hypothesis (Ha): A monotonic trend exists.

A monotonic upward (downward) trend means that the variable consistently increases (decreases) through time, but the trend may or may not be linear. The Mann-Kendall test is based on the premise that the lack of monotonic trend should correspond to a time series plot fluctuating randomly about a constant median with no visually apparent upward or downward pattern (Helsel and Hirsch 2002). Significantly increasing or decreasing trends (τ) are identified at a significant level (α) of less than or equal to 0.05. τ^2 can be used like an R^2 value to estimate how much variance in y is explained by x (i.e., what proportion of the variability in concentration is explained by time). USEPA 2009 guidance and/or Helsel and Hirsch (2002) may be consulted for further details for the Mann-Kendall test. With the specified 95% confidence, significantly increasing or decreasing trends are identified with p-values as follows:

| Tau | p-value | Conclusion | Trend |
|----------------------|---------------|-------------|-----------------|
| Positive | $p \leq 0.05$ | Ho Rejected | Increasing |
| Negative | $p \leq 0.05$ | Ho Rejected | Decreasing |
| Positive or Negative | $p > 0.05$ | Ho Accepted | Not Significant |

5.2 Data Constraints

Guidance recommends that trend tests be performed with at least eight detected data points to ensure a reasonable amount of confidence in results (USEPA 2009, p. 17-24). However, it is mathematically possible to carry out the test with five detected samples. The consequences of using the minimum sample size is that there is a greater chance of concluding that there is no trend when, in fact there is a trend (USEPA 2009). If a dataset is comprised of more than 50 percent ND values, the loss of information is considered too great to support a reliable analysis of trends, so no Mann Kendall test was formed.

Consistent with guidance, in cases where FOD was greater than 50 percent, NDs were substituted with a constant that is below the lowest detected value (Helsel and Hirsch 2002). This ensures that all NDs are “tied” in the Mann Kendall and that changing reporting limits have limited influence on whether trends are detected (USEPA 2009, Helsel and Hirsch 2002). NDs were chosen to be substituted with the half reporting limit for the trend analysis. As mentioned previously, multiple reporting limits were found for several Groups. For any of these Groups, the largest value of half the reporting limit was substituted for all other ND values, to ensure that all NDs are tied during the trend test.

5.3 Results

Trend tests were calculated with 95% confidence for all Groups that met the minimum data requirements of at least 4 detected values and 50% detection frequency. A full report of the Mann Kendall trend test results and timeseries plots can be found in Table 2. The following summarize the results of the trend analysis:

- There are a total of 391 Groups in the dataset.
- 259 Groups meet the data requirements of the trend test. Of those:
- 21 Groups had a significant increasing trend,
- 54 Groups had a significant decreasing trend,
- 184 Groups had no significant trend.

Time series scatterplots are provided in Figure 1 for each Group. Detection limits for each sample are also plotted for an easy visual assessment of changing detection limits over time. For Groups with significant trend, a visual of the linear fit is provided on the graph. The Mann Kendall is a correlation test

and does not provide an estimate of the slope and y-intercept. A parametric test was used to provide a visual guide only.

6. SPECIAL CONSIDERATIONS

Like most statistical analyses, Mann Kendall makes some assumptions about the data being analyzed including:

- Observations or data obtained over time are independent.
- The observations obtained over time are representative of the true conditions at sampling times.
- The sample collection, handling, and measurement methods provide unbiased and representative observations of the underlying populations over time.

There is no requirement that the measurements be normally distributed. The Mann Kendall test can be computed if there are missing values and varying detection limits, but the performance of the test will be adversely affected by such events. The assumption of independence requires that the time between samples be sufficiently large so that there is no correlation between measurements collected at different times.

The Mann Kendall test does not assume that the underlying relationship is linear. However, in cases where the data are clearly curvilinear, it may be more appropriate to consult with a statistician to employ different statistical techniques that more accurately characterize the changes in concentration over time.

Special consideration should be given to dataset with clear seasonality and/or NDs. These are considered in the following sections.

6.1 Seasonality

Seasonal changes in precipitation and temperature can cause cyclical fluctuations in groundwater concentrations. These seasonal fluctuations functionally add 'noise' to the data. This type of noise is called serial dependence and can make it difficult to determine trends in the data because of a long-term persistent pattern (like seasonality) or whether it represents a true, underlying change. USEPA Guidance (2009) strongly recommends accounting for seasonality when performing linear trends in hydrologic data. Seasonality has not been explicitly handled in the data described herein.

6.2 Non-Detects and Detection Limits

Non-detects (NDs) commonly reported in water monitoring are statistically known as "left censored" measurements because the concentration of any non-detect either cannot be estimated or is not reported directly. Rather, it is known or assumed only to fall within a certain range of concentration values (USEPA 2009 p. 15-1). With higher detection limits, that uncertainty is greater because the true value lies somewhere in a larger range of possible values.

USEPA (2006) notes that no general procedures exist for the statistical analyses of censored datasets. If a dataset is comprised of more than 50 percent non-detected (ND) values, guidance cautions the user when interpreting the results of statistical tests, especially for relatively small datasets (USEPA 2009). In the context of Mann Kendall, there is general agreement that substituting a constant below the lowest detected value is the best solution for handling non-detected values.

When detection rates are below 85 percent, however, this simple substitution method may lead to bias in the correlation estimates. Visually reviewing the data is a key step in interpreting the appropriateness of the statistical results. The time series plots have been generated using the detection limit for non-detects so that detection rates and multiple detection limits can be visualized. Additional statistical testing may be needed to address datasets with low detection rates or elevated detection limits.

7. REFERENCES

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