National Wastewater Surveillance Programme - COVID-19

Weeks 1 & 2 (Weeks Ending 8 January & 15 January 2023)

Report prepared on 19 January 2023

100%

sites tested in week 2 had SARS-CoV-2 detected (75/75 sites)

70%

NZ population covered by wastewater testing

Omicron CH.1.1 (55%)

Most prevalent variant detected

Nationally, SARS-CoV-2 levels in wastewater are declining. Variant analysis suggests that XBB.1.5 has not yet spread widely in the community.

- Compared to a month ago (week 50 of 2022, week ending 18 December 2022), 84% sites showed a decrease in SARS-CoV-2, with only 4% of sites showing an increase in SARS-CoV-2 levels.
- The main variants detected in wastewater in week 2 of 2023, were CH.1.1 (~55%), BA.2.75* (~22%) and BQ.1.1 (~10%). Detections of XBB (includes XBB.1.5, ~3%) and XBC (~7%) were steady. BA.4/BA.5 down to ~2%.

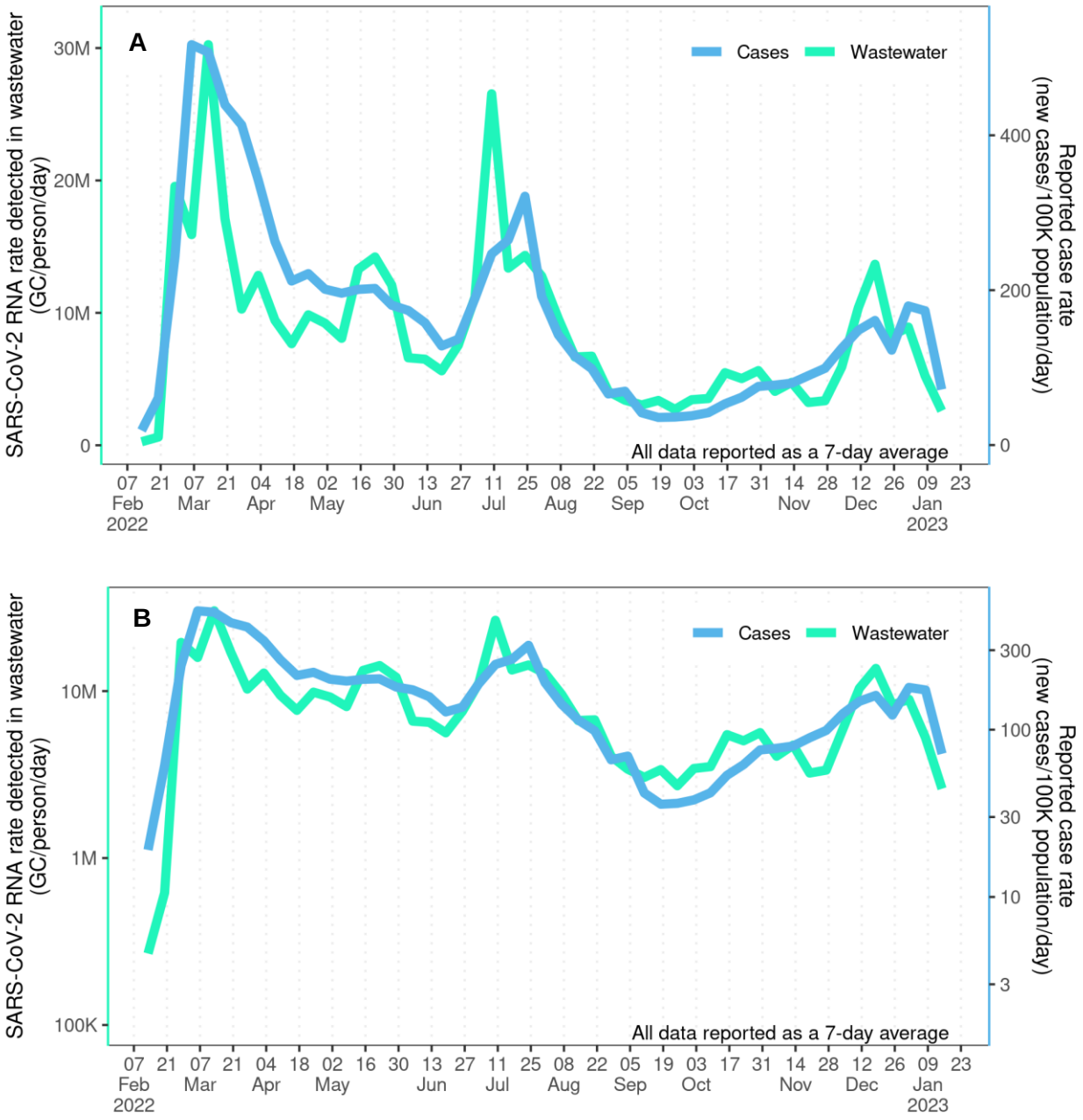


Figure 1. National timeseries of estimated SARS-CoV-2 genome copies (GC) in wastewater rate (GC/person/day, green line) and reported case rate (new cases/100,000 population/day, blue line). Numbers in the points are the week of the year. **A**. Linear scale. **B**. Log_{10} scale. Data reported as 7-day average. The usual data collection covers more than 80 sites. However, from the 25 December 2022 to the 8 January 2023, only five sites were sampled (in Auckland and Christchurch). Therefore, caution should be exercised when interpreting results from this two-week period (week 52 of 2022 and week 1 of 2023).

Results for Week 2 (Week ending 15 January 23)

As described in the report prepared on 12 January 2023, a very limited sampling schedule was maintained over the holiday break. Samples were only tested from Auckland metro sites (4 sites) and Christchurch. In week 52 of 2022 and week 1 of 2023, 5 and 12 samples were tested respectively.

Normal sampling schedules recommenced week beginning 9 January 2023 (week 2, 2023).

In the week ending 15 January 2023 (week 2), 112 samples were collected from 75 locations across New Zealand. SARS CoV-2 RNA was **detected** in 111/112 (99%) of tested samples from 75/75 (100%) of sites (Figure 2, Table 2).

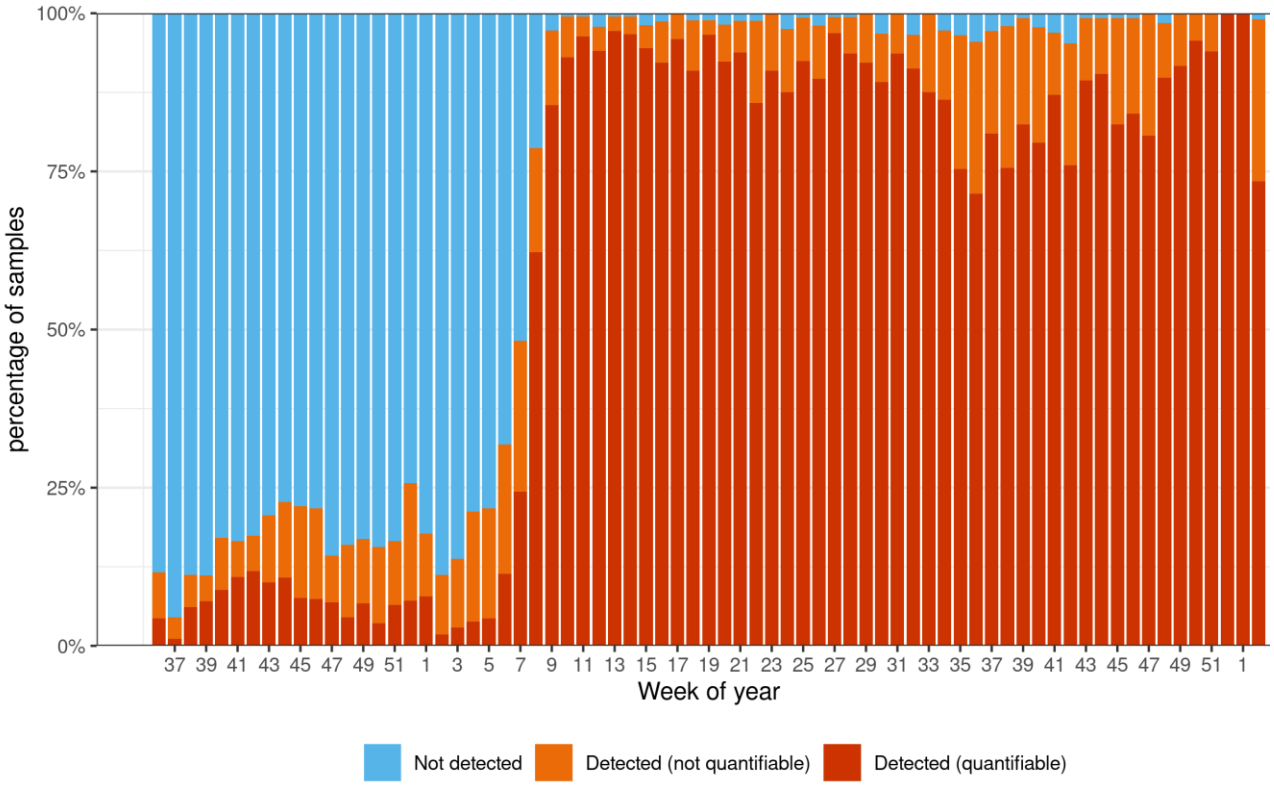


Figure 2. Results for SARS-CoV-2 RNA in wastewater collected across New Zealand.

Regional Trends

Regional summaries (Figure 3) of the wastewater data indicates generally declining viral levels across all regions. Note that regional trend analysis for week 52 (2022) and week 1 (2023) was only possible for Auckland Metro, as there were limited samples collected during the holiday period. Viral quantitation for the other regions were therefore not available during this period (denoted by dashed line).

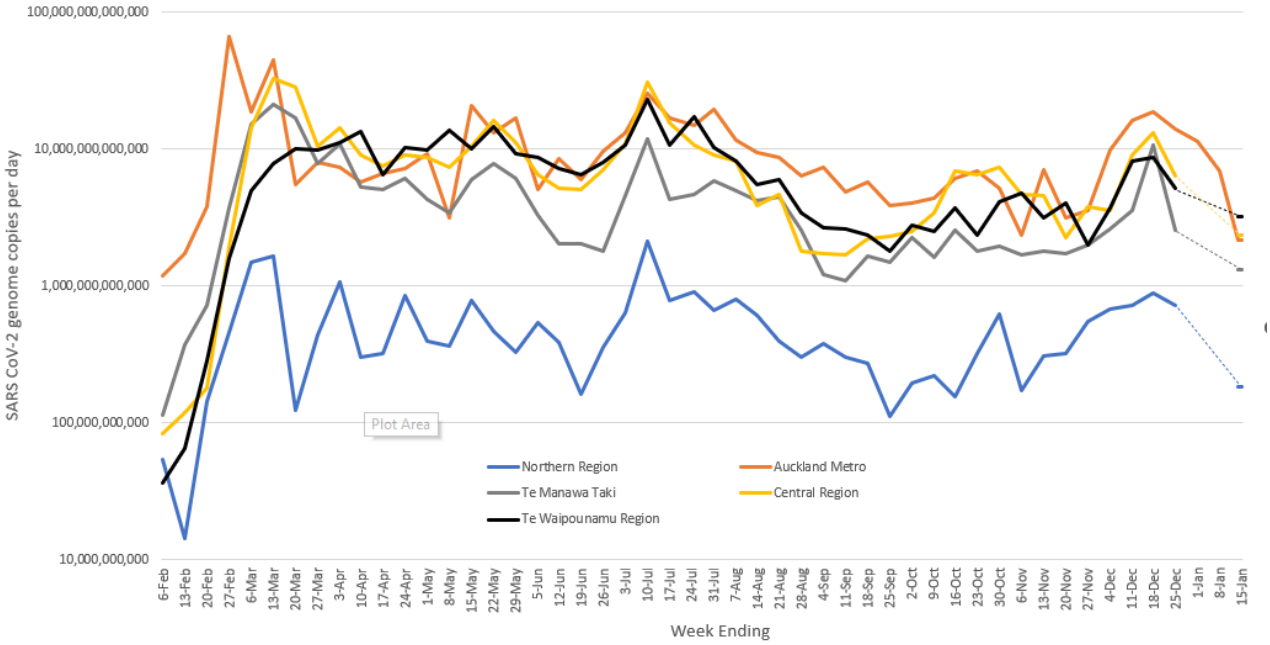


Figure 3. Total SARS-CoV-2 genome copies detected per day in the five Ministry of Health regions.

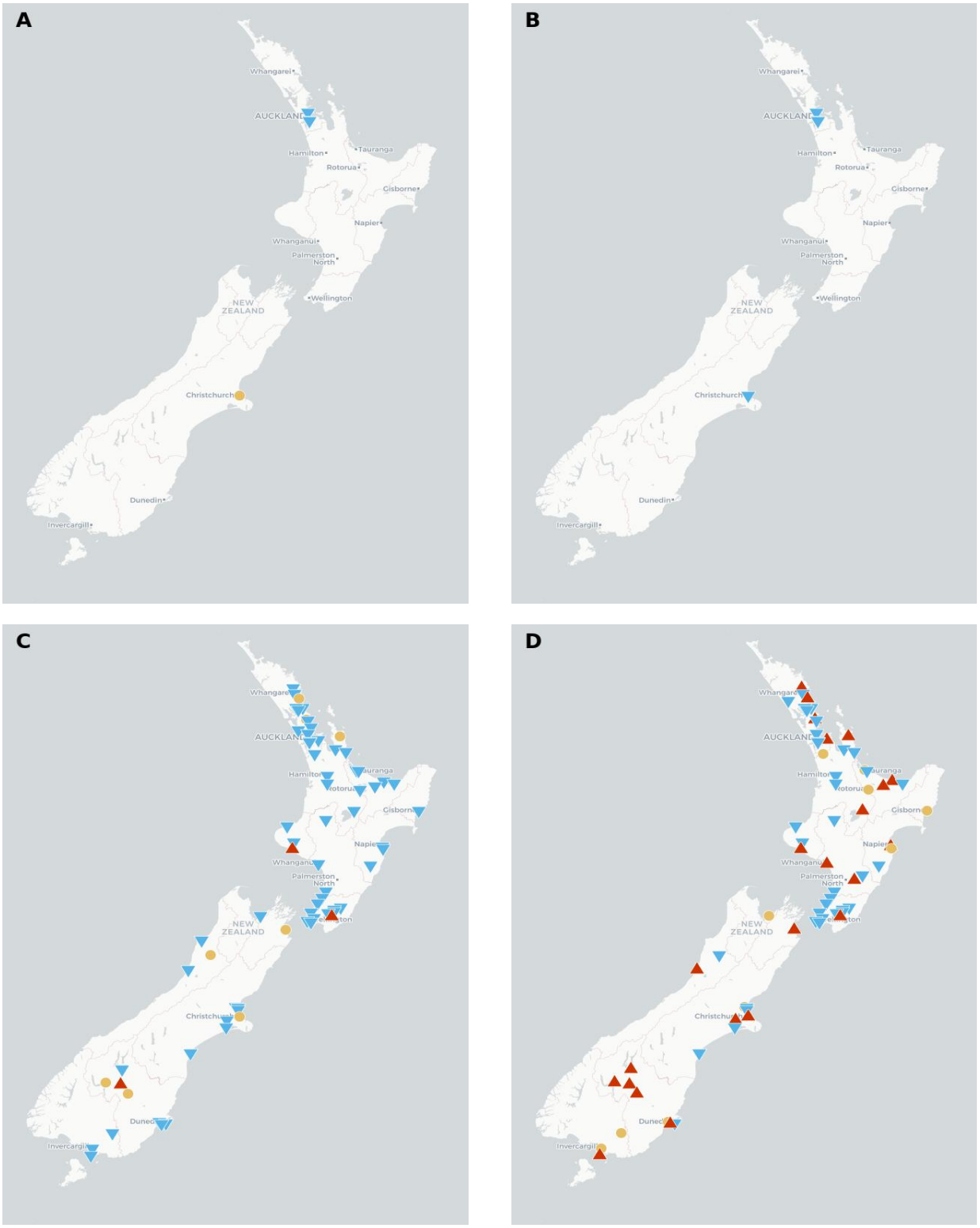


Figure 4. Comparison of SARS-CoV-2 levels for the week ending 15 January 2023, compared to levels measured: A) 1 week ago; B) 2 weeks ago; C) 4 weeks ago; D) 12 weeks ago. Only sites with results for both time points are included. When the viral quantity is 30% or more higher this is labelled as increased (red up arrow on map). When the viral quantity is 30% or more lower, this is labelled as decreased (blue down arrow on map). If viral levels have changed less than this in the compared weeks, this is labelled as no change (yellow circle on map). Interactive map of weekly results available publicly at https://www.poops.nz/

Note that due to limited sampling over holiday period, only Auckland metro and Christchurch sites have data plotted in A) and B).

Wastewater Variant Analysis

In collaboration with Wilderlab, ESR generated the variant analysis results from a variety of sentinel sites in week 51 (ending 25 December 2022), week 52 (ending 1 January 2023), week 1 (ending 8 January 2023) and week 2 (ending the 15 January 2023). Results for the full set of sentinel sites is only available in week 51 and week 2. For other weeks, a small set of sites (Auckland metro and Christchurch) were monitored.

Wastewater variant analysis is based on sequencing a short fragment of the spike gene and therefore provides less resolution than WGS from clinical cases. As such, some specific lineages cannot be distinguished from each other, and are reported as variant groups. The following variants/groups are reported: BA.4/BA.5, BA2.75* (includes BA.2.75/XBF/BR.2 subvariants), CH.1.1, BQ.1.1, XBB (includes XBB.1.5) and XBC.

Consistent with the WGS of clinical cases, the **CH.1.1 subvariant** will now be reported separately from other BA.2.75* subvariants.

CH.1.1 was the most widespread and common variant in wastewater in week 2, being detected at 16/19 sites and comprising ~55% of sequencing reads nationally (~30% in week 51). Other subvariants in the BA.2.75* group (includes BM.4, BR.2, XBF and BA.2.75) accounted for another ~22% of reads nationally in week 2 (~52% in week 51), being detected at 11/19 sites (19/19 sites in week 51). Thus, as a whole, the BA.2.75* constellation represented 78% of reads in week 2, and ~82% of reads in week 51.

The BA.4/BA.5 variant group (includes **BF.7**) continued to show a rapid decline, accounting for only 2% of reads nationally in week 2 (4/19 sites). It was found in 11/19 sites and ~6% of all reads in week 51.

After observing increases in the level of BQ.1.1 in wastewater at the end of 2022 (up to ~22% in week 49), this variant declined to ~6% of reads in week 51 (12/19 sites) and ~10% of reads in week 2 (11/19 sites).

The XBB variant (includes XBB.1.5) was detected in five sites in week 2 (compared to two sites in week 51) and accounted for ~3% of reads nationally (~0.2% of reads in week 51). The wastewater assay cannot currently distinguish XBB.1.5 from other XBB variants. The fact that wastewater XBB detections remain at low levels suggests that **XBB.1.5 has not yet spread widely in the community**. Following its first detection in wastewater in week 46, the XBC variant remains relatively steady. In week 51 it was detected at 12/19 sites and accounted for ~6% of reads nationally. In week 2, it was detected in 9/19 sites and accounted for ~7% of reads.

Due to the increasing complexity of variants in the population, each at relatively low levels, the current approach for sequencing wastewater samples needs to be more precise to report percentages for each variant at the sentinel site level. Instead, the presence of each lineage will currently be reported. ESR is actively testing and developing methods to address the current uncertainty and increase the resolution to identify variants in wastewater.

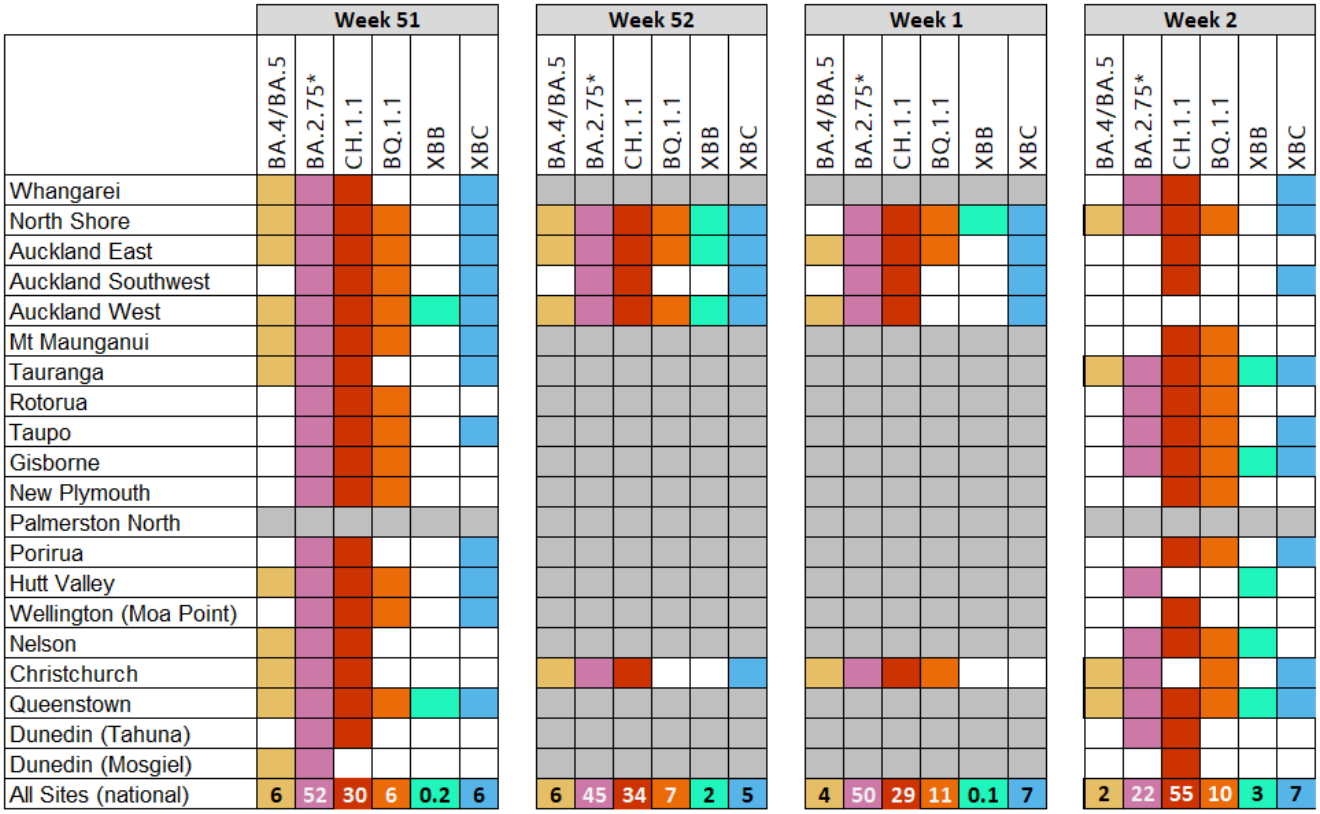
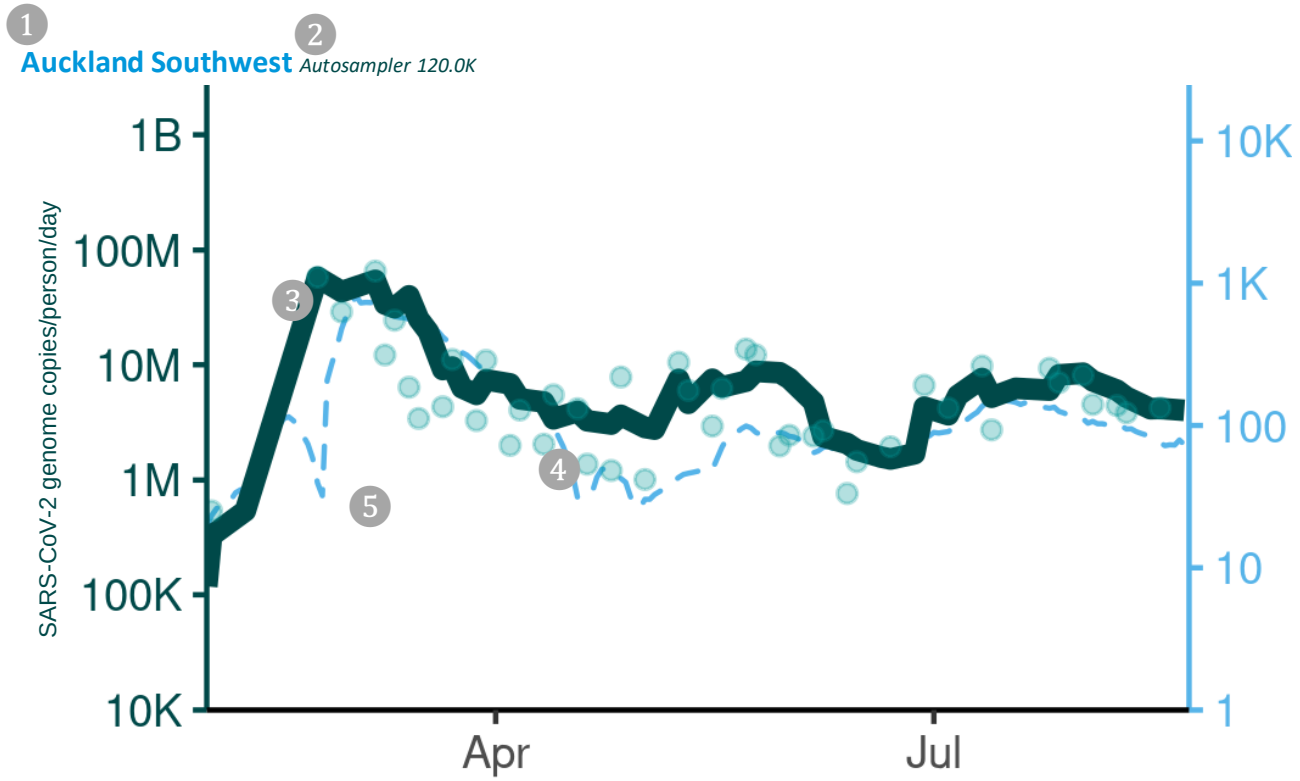


Table 1. Data from up to 19 wastewater sentinel sites sampled in week 51 (ending 25 December 2022), week 52 (ending 1 January 2023), week 1 (ending 8 January 2023) and week 2 (ending 15 January 2023) using a S-gene (spike) barcoding assay able to 'call' the BA.4/BA.5, the BA2.75* constellation (includes BA.2.75/XBF/BR.2 subvariants), CH.1.1, BQ.1.1, XBB (includes XBB.1.5) and XBC (sub)variants. Coloured box denotes that the variant was detected at that site that week, and white box denotes that the variant was not detected, grey box denotes site was not sequenced/no sample. Numbers in the bottom row denote the estimated percentage of each variant at the national scale. Note that for week 52 and week 1, this is based on 5 sites only, due to limited sampled over the holiday period. No sequence reads mapped to variants for Auckland West in week 2.

Interpreting Sites Graphs

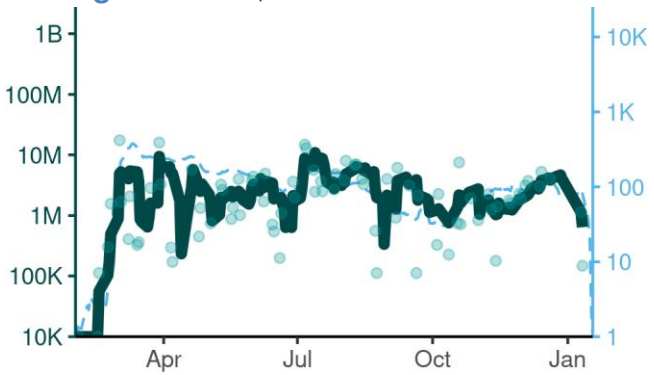


1. Site Name
2. Sample collection method and population. Results based on autosampler may be more representative than grab sample-based results.
3. Wastewater results shown as solid line | 14-day average of genome copies/person/day on a $\log_{10}$ scale.
4. Individual results samples shown as circles | Rolling 14-day average of genome copies/person/day on a $\log_{10}$ scale.
5. Rolling 7-day average of new cases shown as dashed line | New cases reported in a catchment based on reported date of illness on a $\log_{10}$ scale. This data is not available for all sites and subject to change.

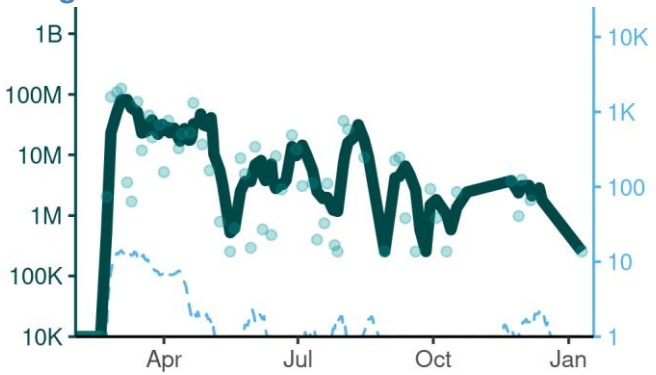
Note: Wastewater and cases data are on a $\log_{10}$ scale. Scales on all graphs have been normalized to cover the same scale on every graph. Care should be taken when interpreting the data.

Northland

Whangarei *Autosampler 65.0K*

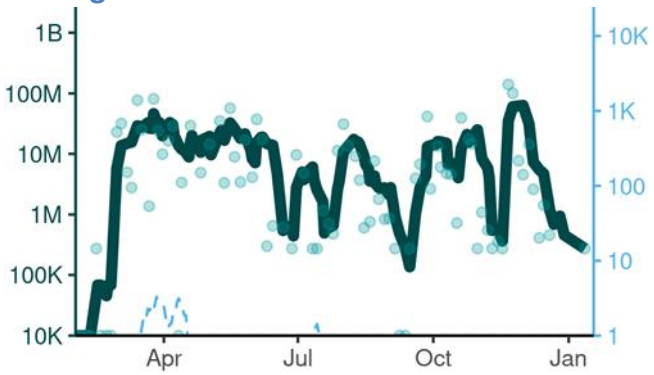


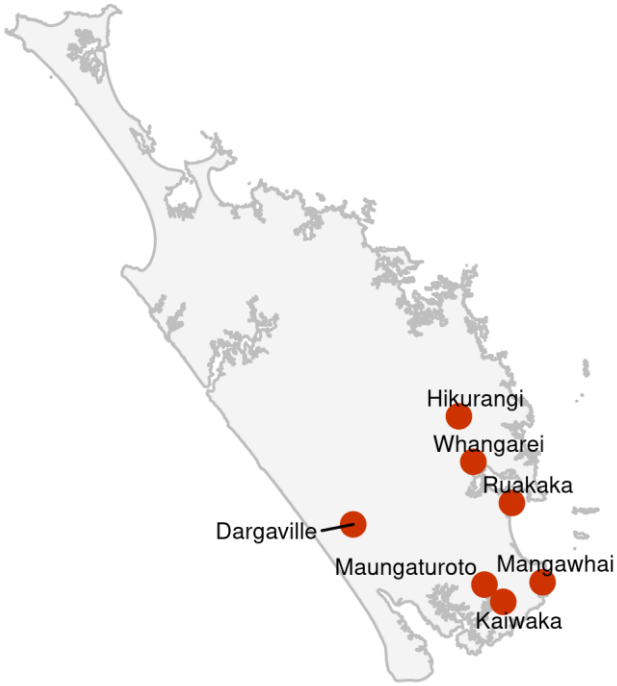
Dargaville *Grab 5.0K*



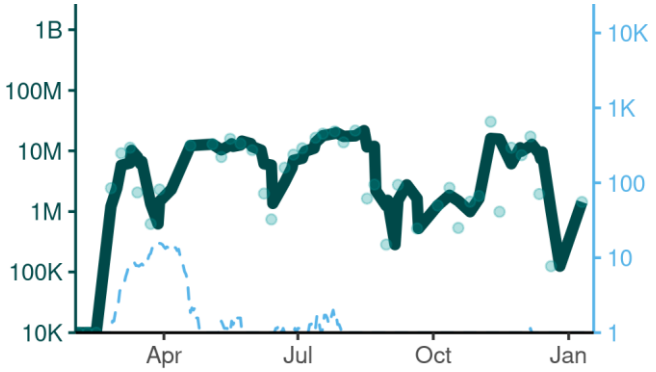
SARS-CoV-2 genome copies / day / person

Maungaturoto *Grab 1.3K*

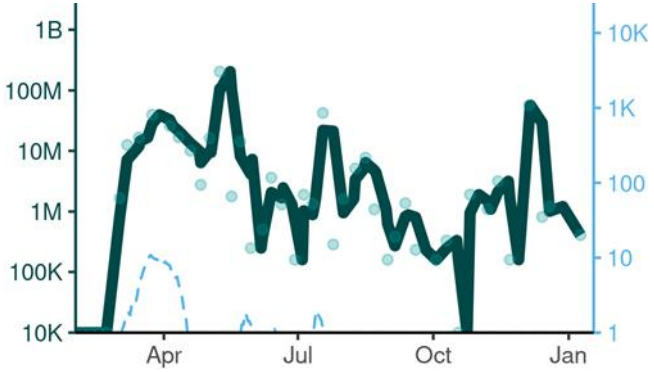




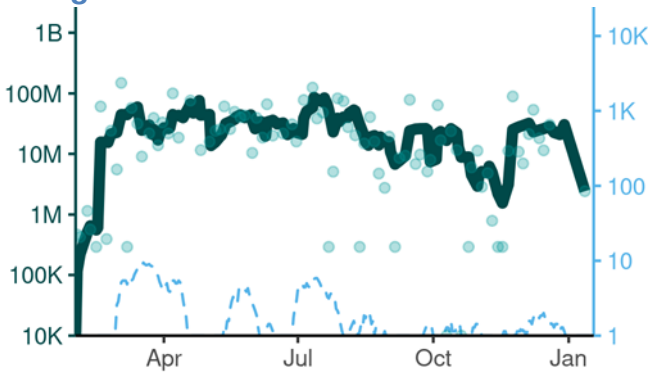
Ruakaka *Grab 4.5K*



Hikurangi *Grab 1.7K*

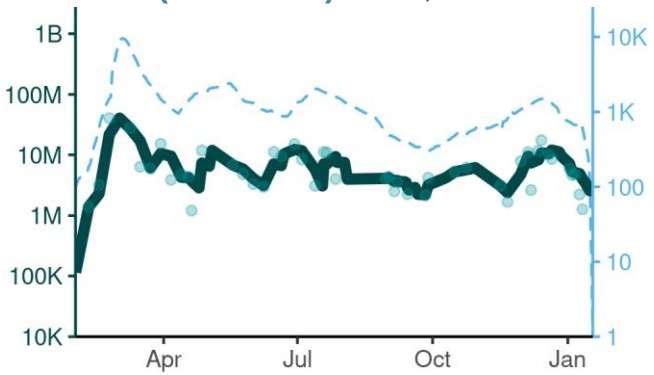


Mangawhai *Grab 1.1K*

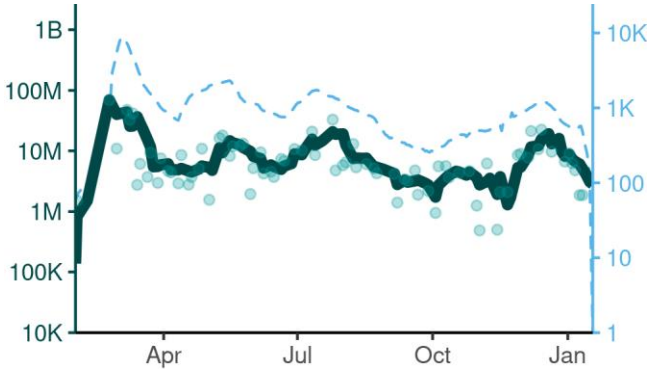


Auckland

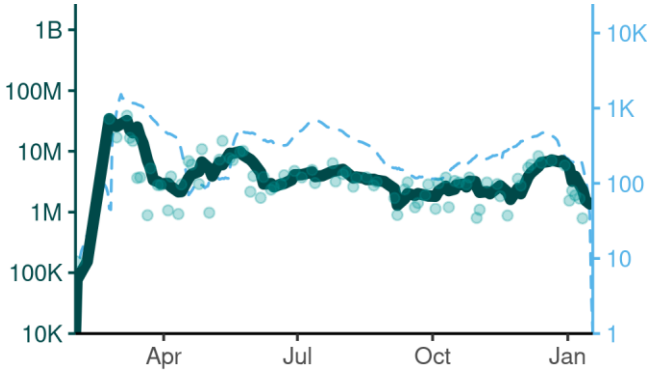
Auckland (Combined) *Autosampler 1.1M*



Auckland East *Autosampler 680.0K*

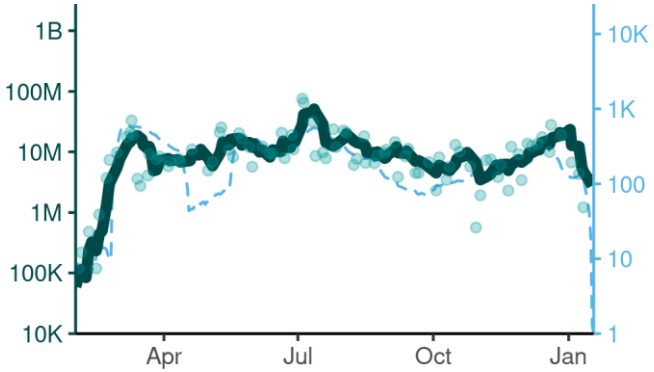


Auckland West *Autosampler 315.0K*

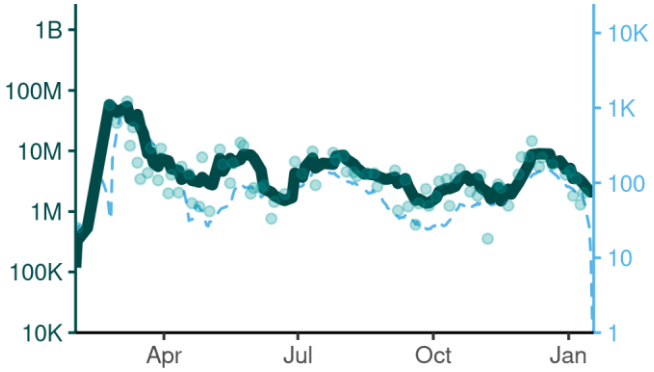


SARS-CoV-2 genome copies / day / person

North Shore *Autosampler 240.0K*

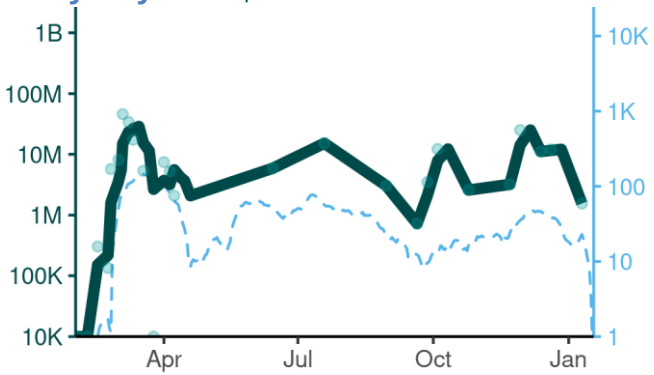


Auckland Southwest *Autosampler 120.0K*



Cases - 7 day rolling average

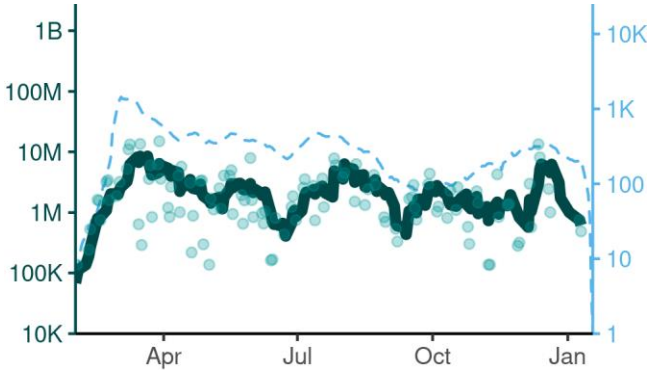
Army Bay *Autosampler 42.0K*



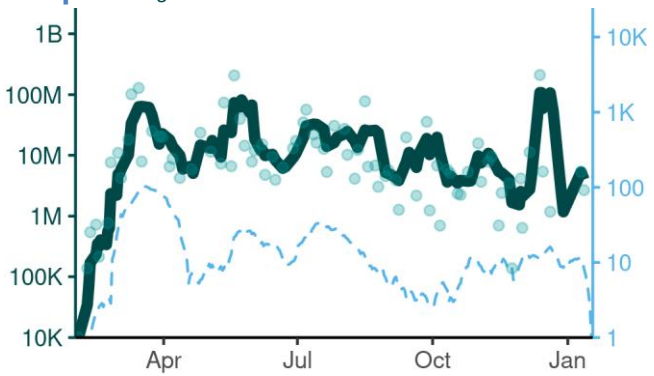

Pukekohe Autosampler 20.9K
Snells/Algies Autosampler 4.0K
Beachlands Grab 6.8K
Helensville Autosampler 3.8K
Warkworth Autosampler 3.5K
SARS-CoV-2 genome copies / day / person
Cases - 7 day rolling average
1B
100M
10M
1M
100K
10K
1K
100
10
1
Apr
Jul
Oct
Jan

Waikato

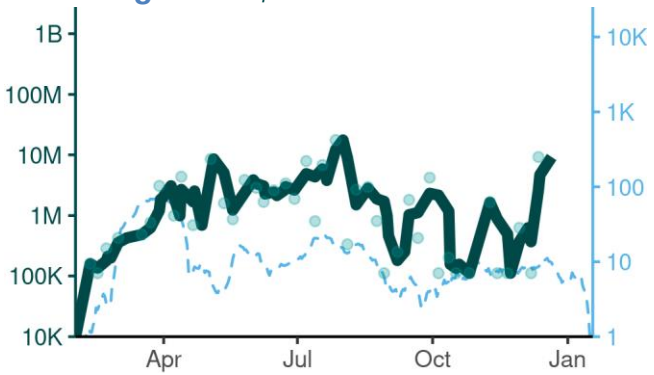
Hamilton *Autosampler 169.0K*



Taupo *Auto/grab 23.0K*

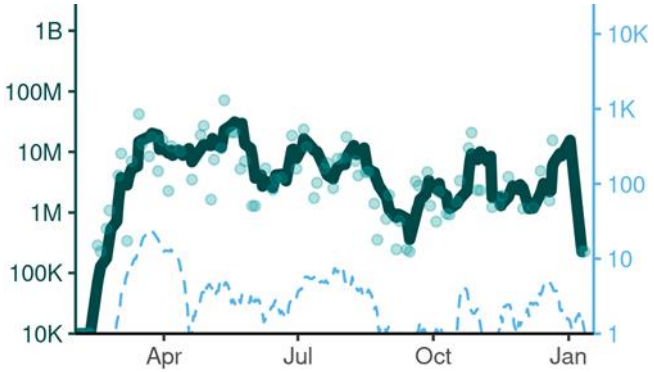


Cambridge *Autosampler 20.1K*

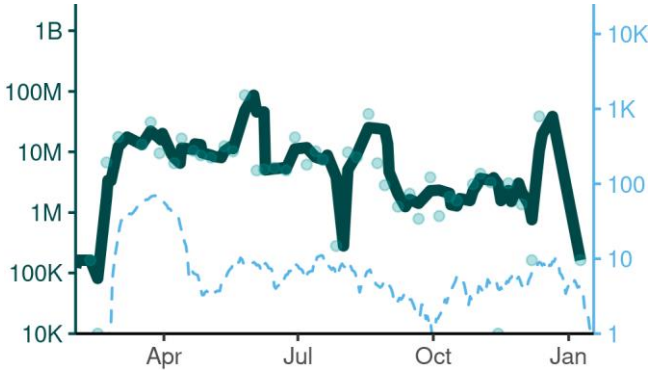


SARS-CoV-2 genome copies / day / person

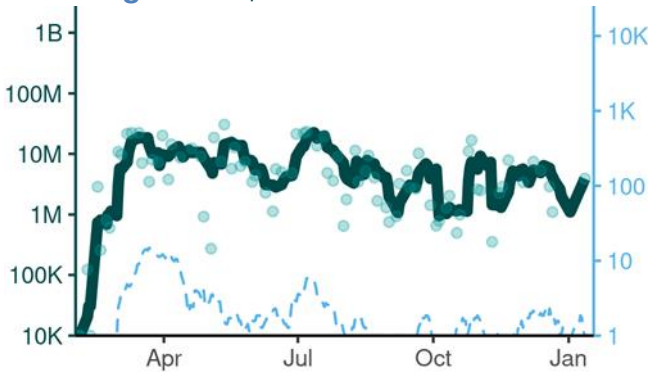
Thames *Autosampler 7.5K*



Te Awamutu *Autosampler 13.1K*

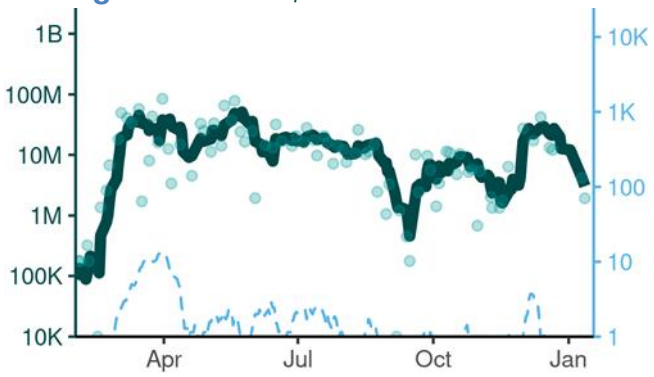


Whitianga *Autosampler 6.6K*



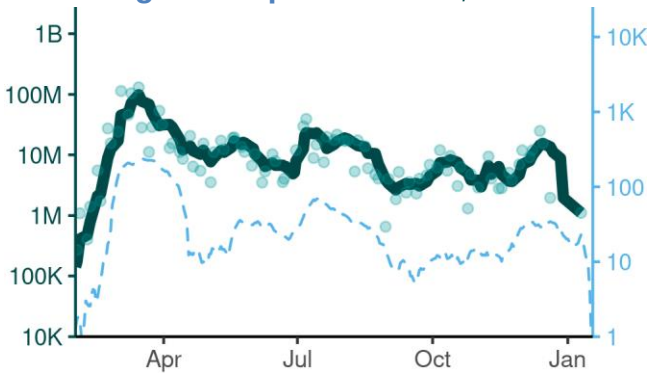
Cases - 7 day rolling average

Whangamata *Autosampler 4.0K*

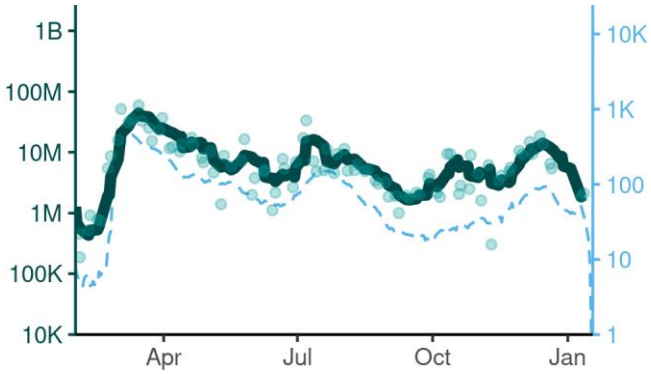


Bay of Plenty and Gisborne

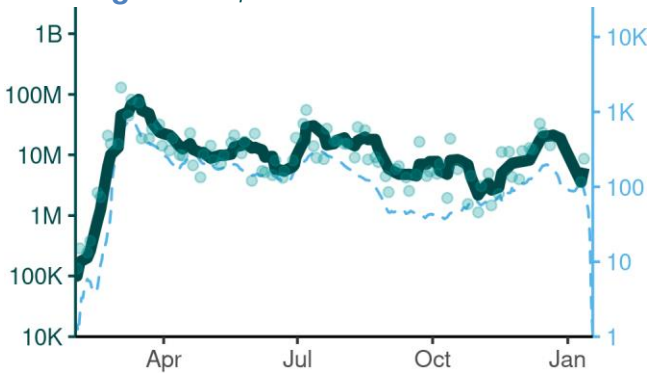
Mt Maunganui/Papamoa *Autosampler 65.0K*



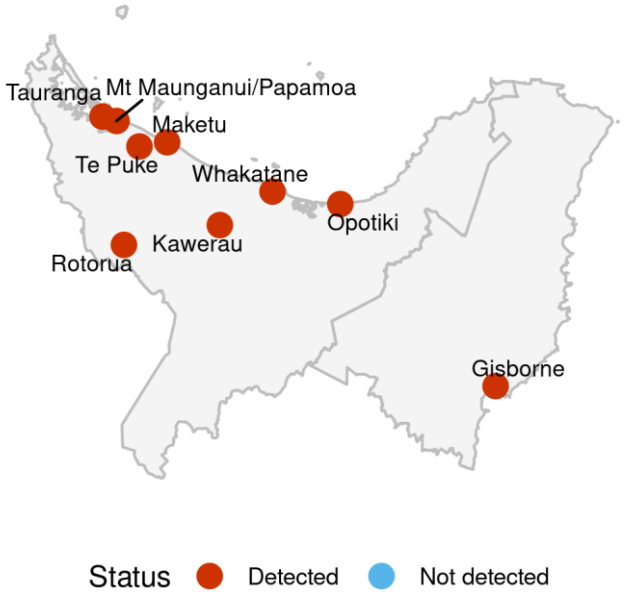
Rotorua *Autosampler 59.0K*



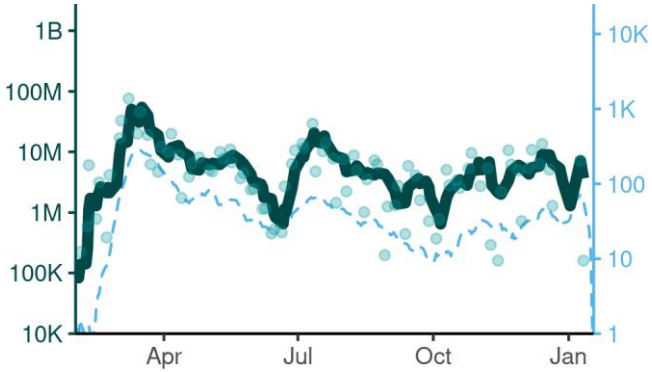
Tauranga *Autosampler 50.0K*



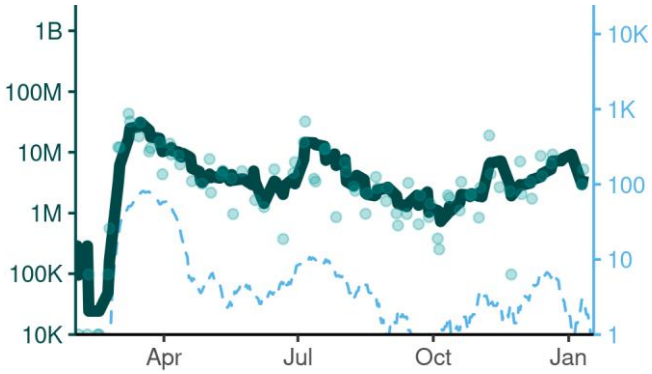
SARS-CoV-2 genome copies / day / person



Gisborne *Autosampler 37.0K*

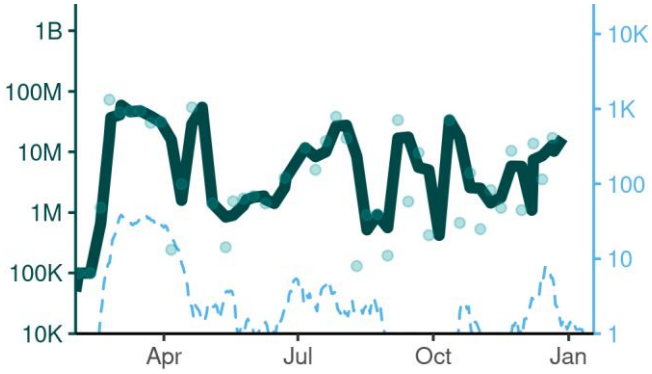


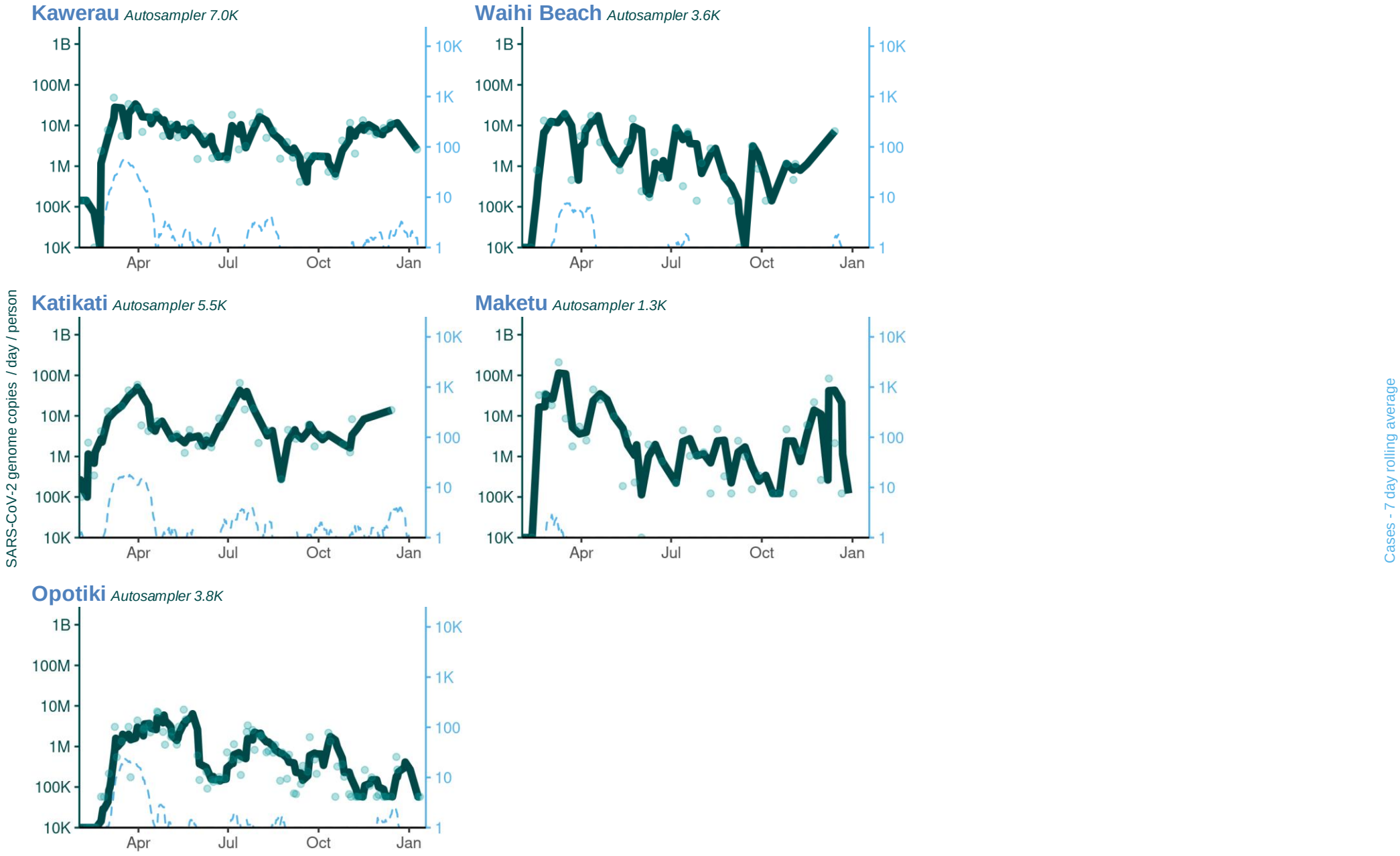
Whakatane *Autosampler 21.0K*



Cases - 7 day rolling average

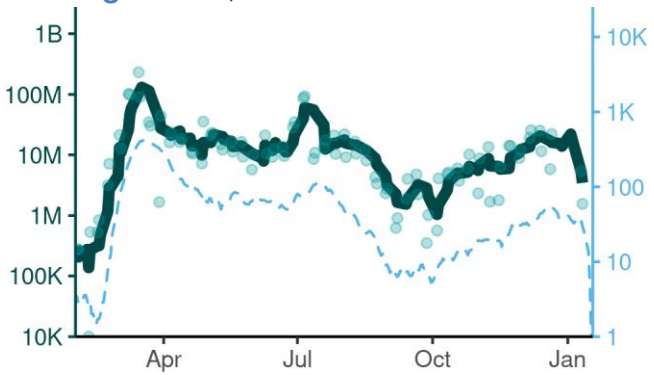
Te Puke *Autosampler 9.7K*



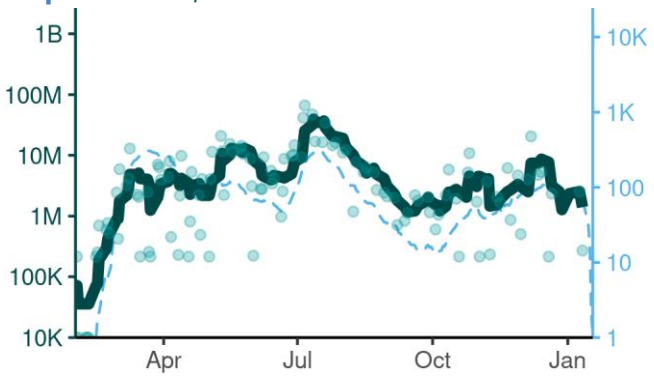

Kawerau Autosampler 7.0K
Waihi Beach Autosampler 3.6K
Katikati Autosampler 5.5K
Maketu Autosampler 1.3K
Opotiki Autosampler 3.8K
SARS-CoV-2 genome copies / day / person
Cases - 7 day rolling average
1B
100M
10M
1M
100K
10K
10K
1K
100
10
1
Apr
Jul
Oct
Jan

Hawke's Bay

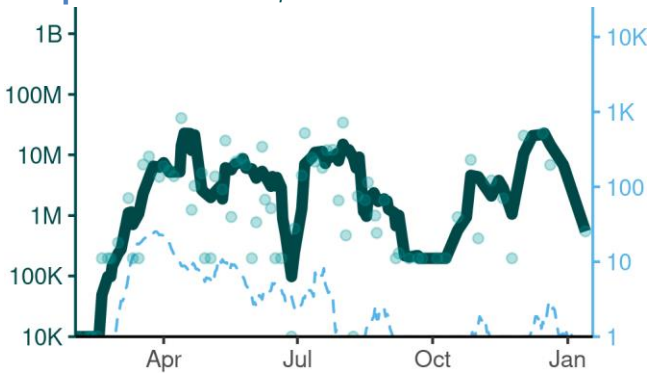
Hastings *Autosampler 80.0K*



Napier *Autosampler 55.0K*

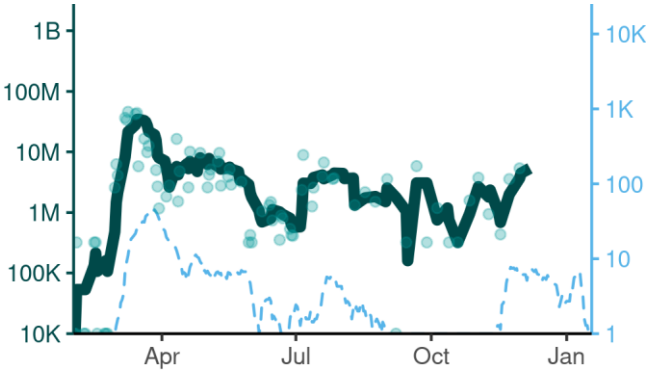


Waipukurau *Autosampler 4.6K*



SARS-CoV-2 genome copies / day / person

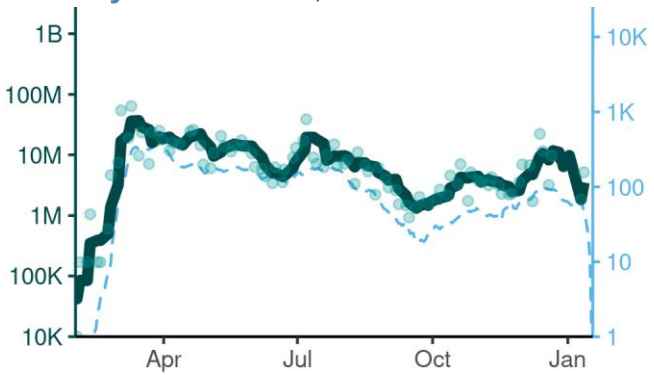
Wairoa *Grab 4.4K*



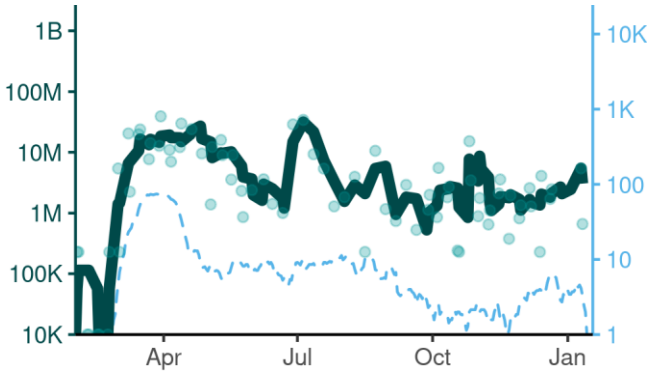
Cases - 7 day rolling average

Taranaki

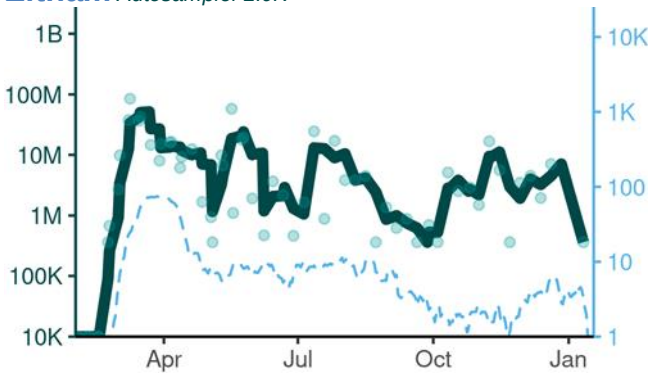
New Plymouth *Autosampler 88.0K*



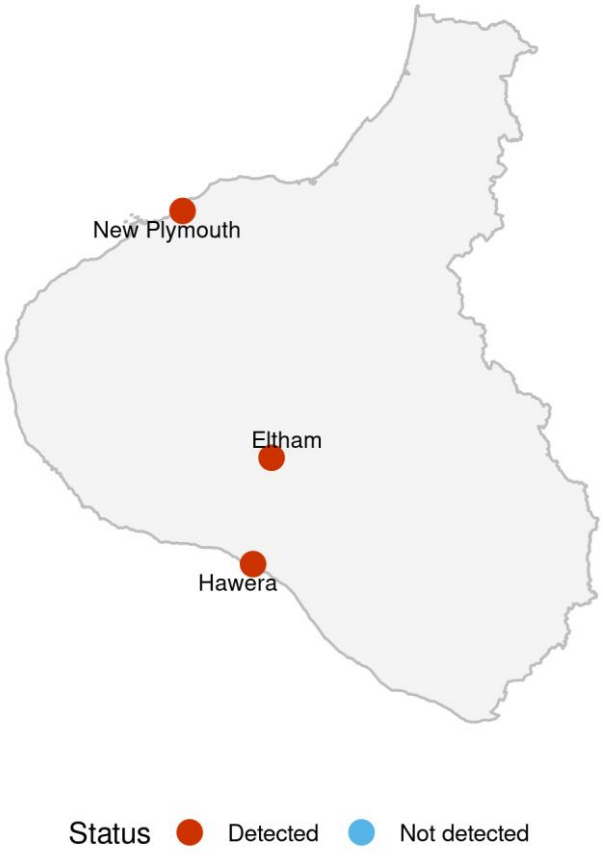
Hawera *Autosampler 12.0K*



Eltham *Autosampler 2.0K*



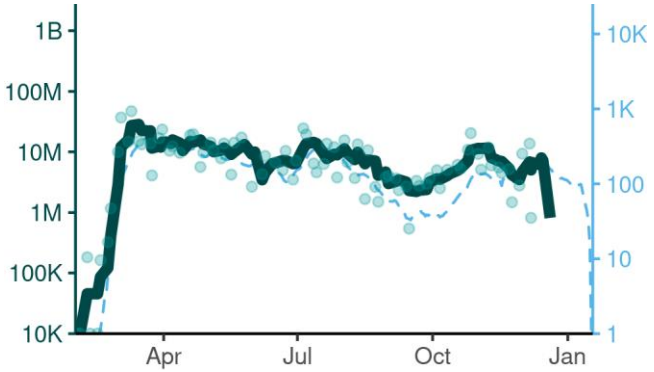
SARS-CoV-2 genome copies / day / person



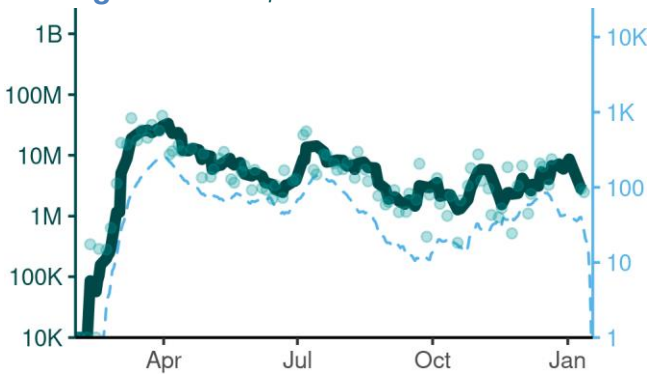
Cases - 7 day rolling average

Manawatu-Whanganui

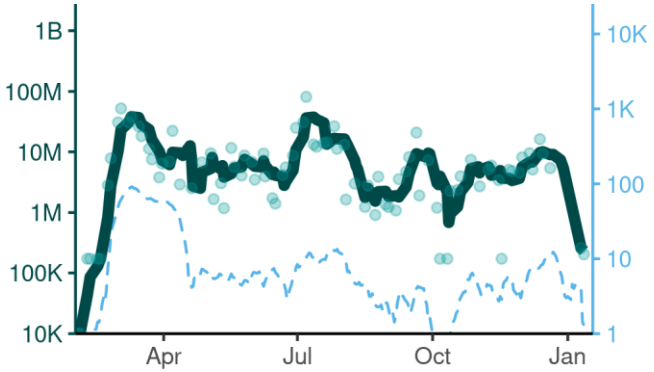
Palmerston North *Autosampler 90.0K*



Whanganui *Autosampler 44.5K*

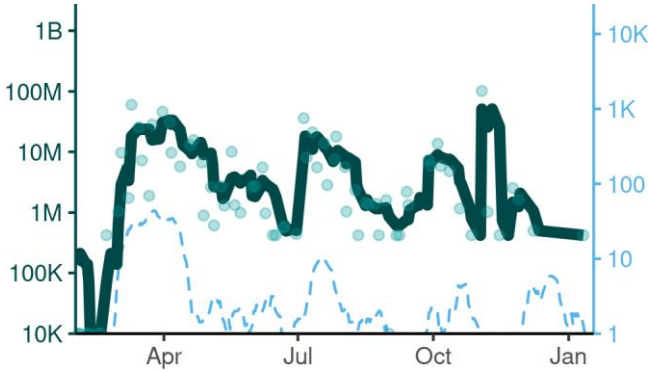


Levin *Autosampler 21.2K*

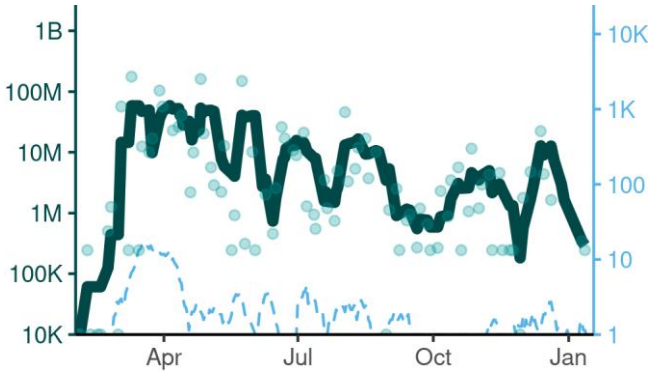


SARS-CoV-2 genome copies / day / person

Dannevirke *Grab 5.7K*

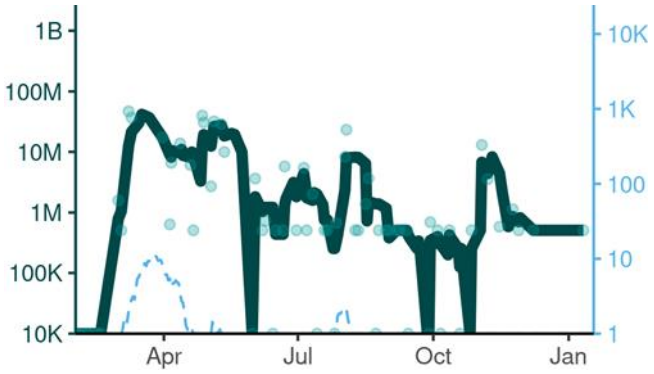


Taumarunui *Grab 4.0K*



Cases - 7 day rolling average

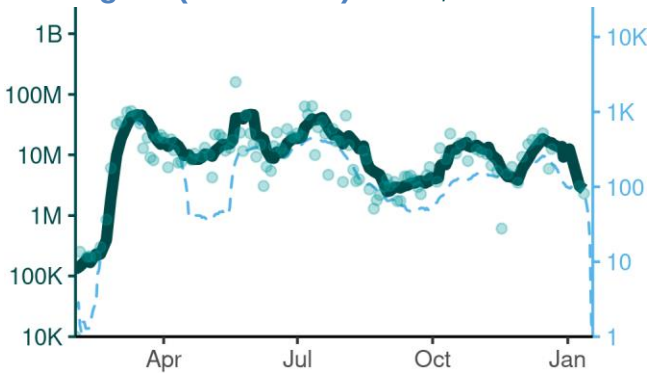
Woodville *Grab 1.7K*



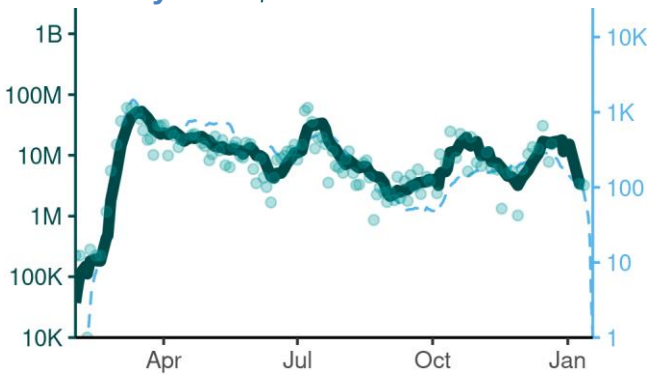
SARS-CoV-2 genome copies / day / person

Wellington

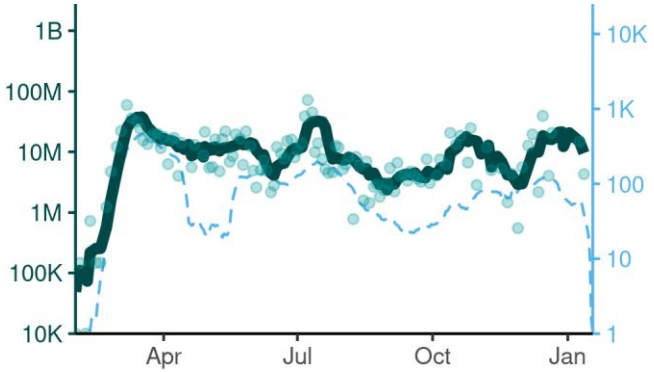
Wellington (Moa Point) *Autosampler 168.0K*



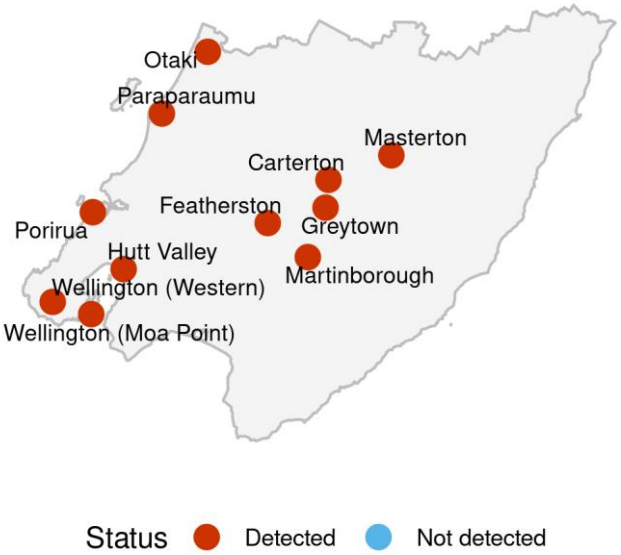
Hutt Valley *Autosampler 133.0K*



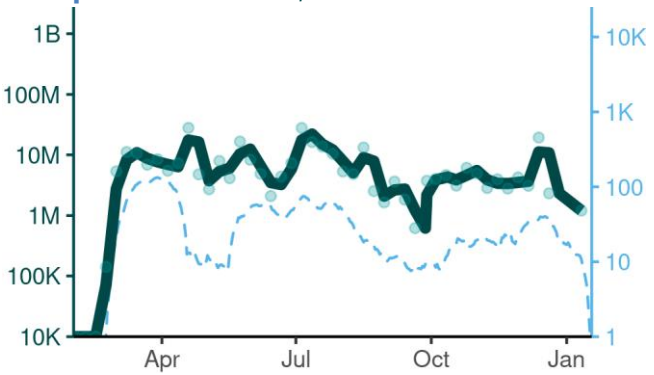
Porirua *Autosampler 85.0K*



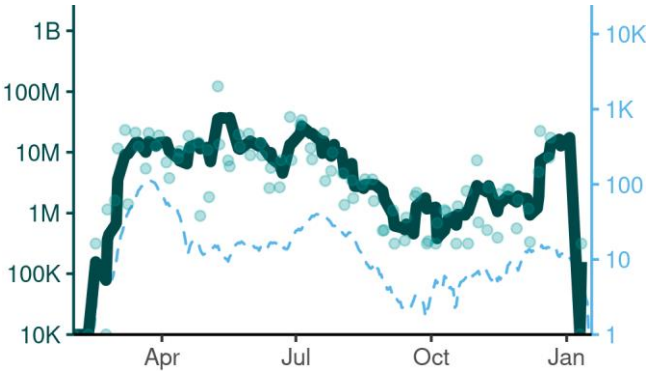
SARS-CoV-2 genome copies / day / person



Paraparaumu *Autosampler 49.0K*

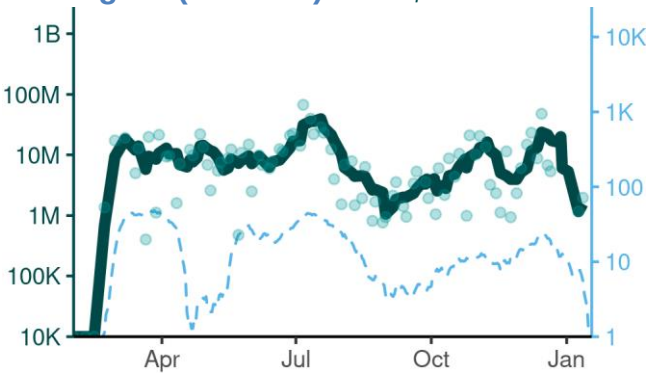


Masterton *Auto/grab 20.7K*

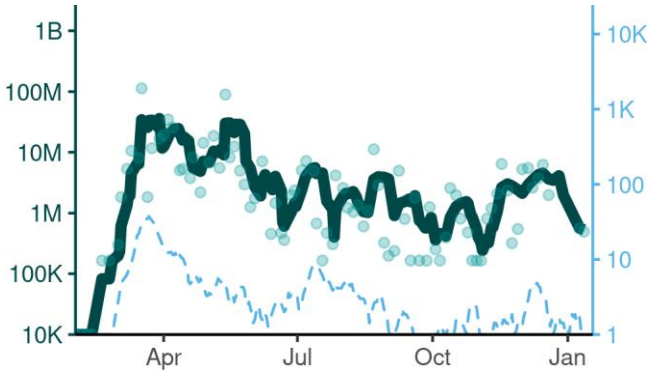


Cases - 7 day rolling average

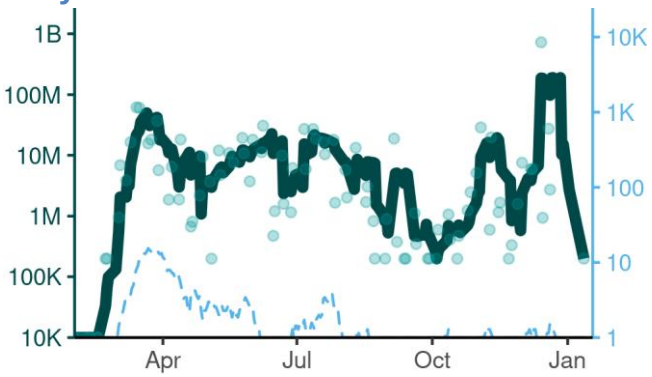
Wellington (Western) *Autosampler 14.0K*



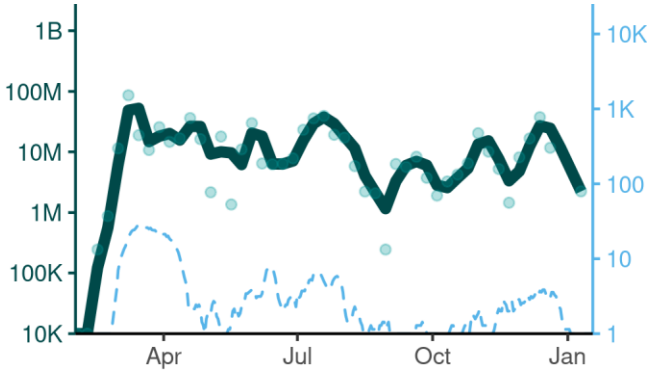
Carterton *Grab 5.8K*



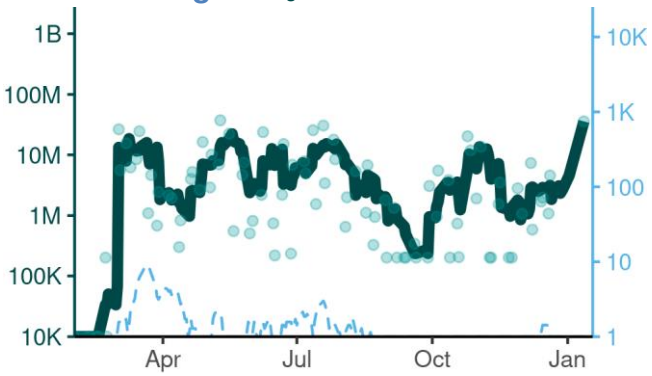
Greytown *Grab 2.4K*



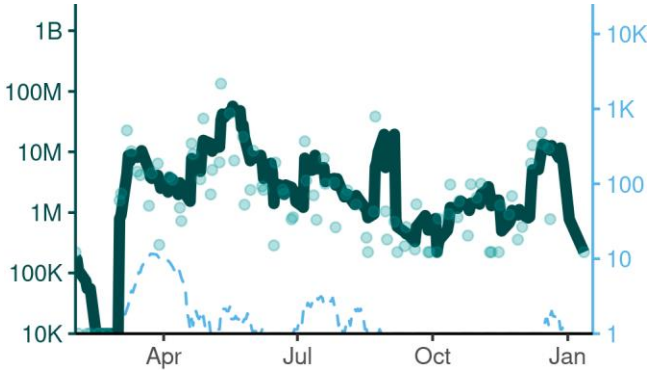
Otaki *Autosampler 3.5K*



Martinborough *Auto/grab 1.6K*



Featherston *Grab 2.5K*

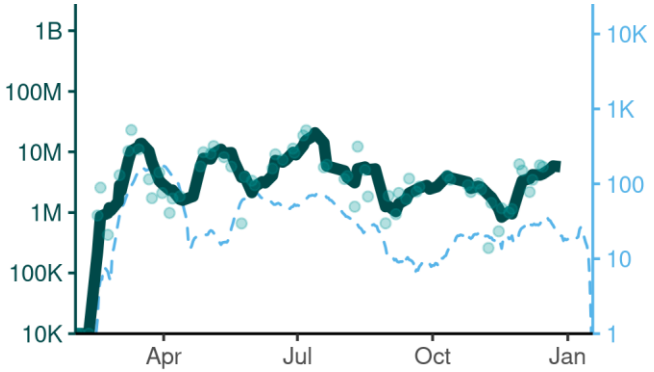


SARS-CoV-2 genome copies / day / person

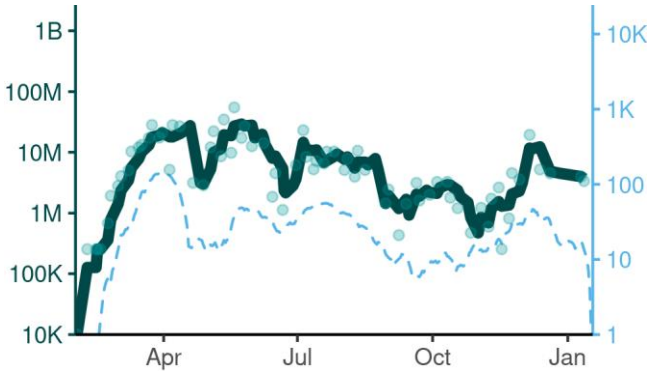
Cases - 7 day rolling average

Tasman, Nelson, and Marlborough

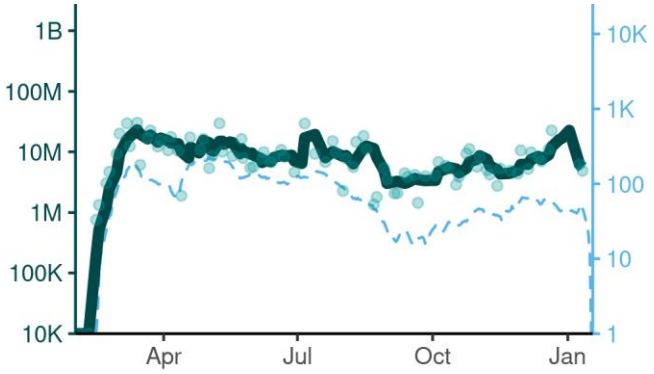
Richmond/Nelson South *Autosampler 60.0K*



Blenheim *Autosampler 31.0K*

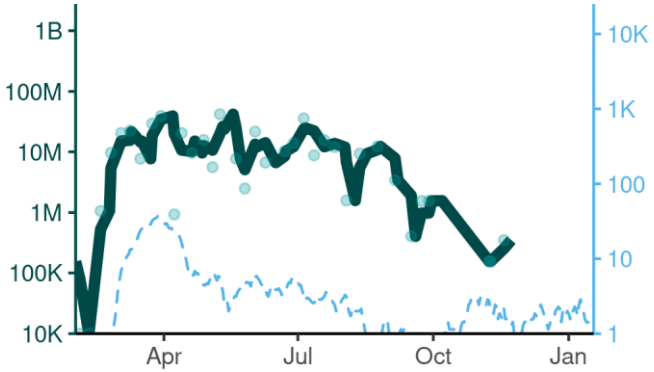


Nelson Central/North *Autosampler 26.0K*

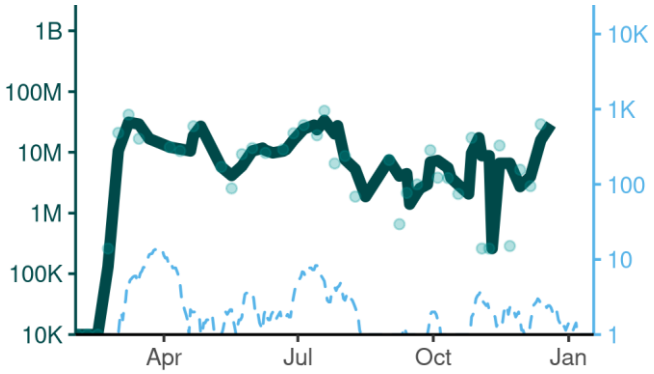


SARS-CoV-2 genome copies / day / person

Motueka *Autosampler 8.3K*



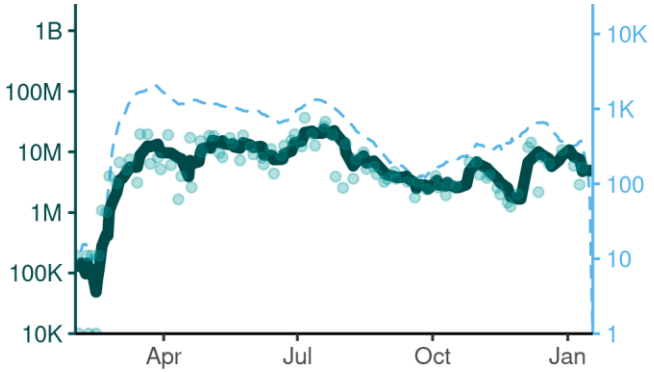
Picton *Autosampler 5.0K*



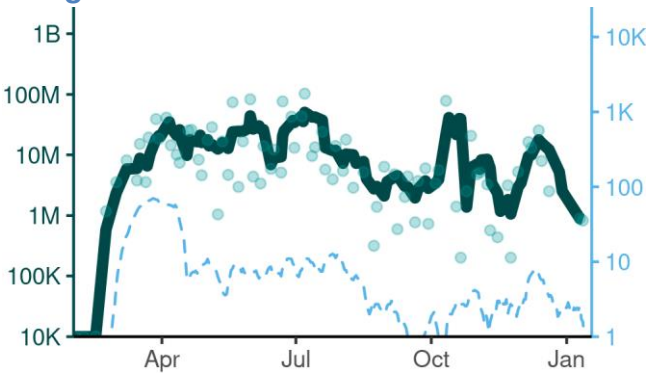
Cases - 7 day rolling average

West Coast and Canterbury

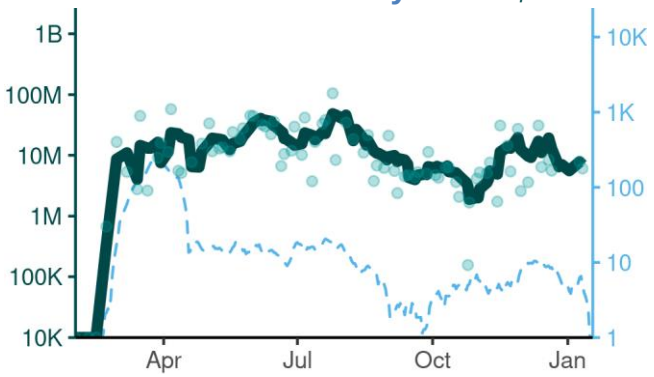
Christchurch *Autosampler 368.0K*



Rangiora *Grab 19.0K*

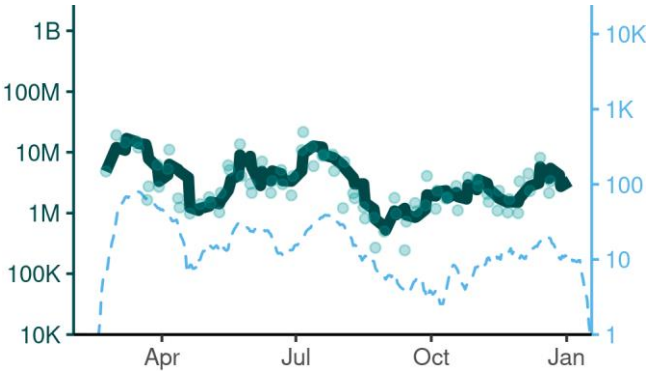


Rolleston & Eastern Selwyn *Autosampler 35.0K*



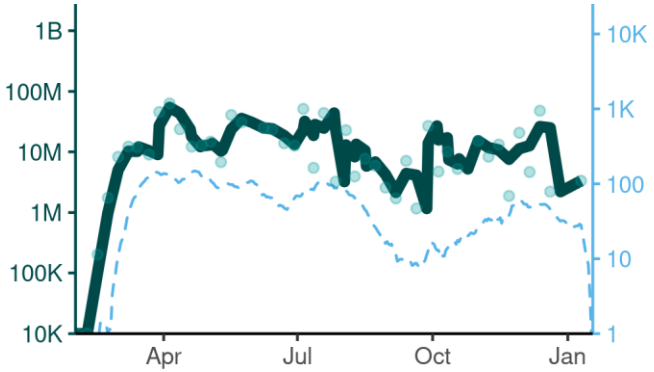
SARS-CoV-2 genome copies / day / person

Ashburton *Autosampler 18.0K*



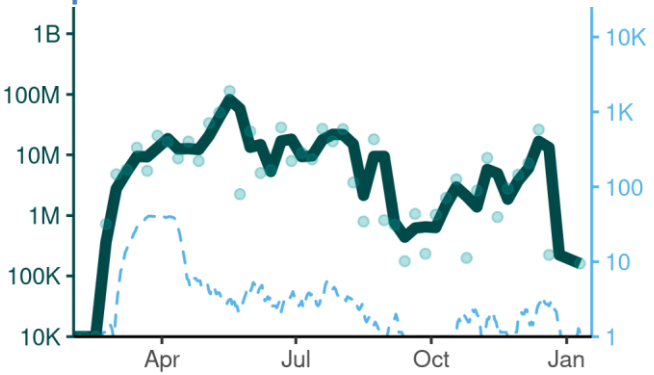
Cases - 7 day rolling average

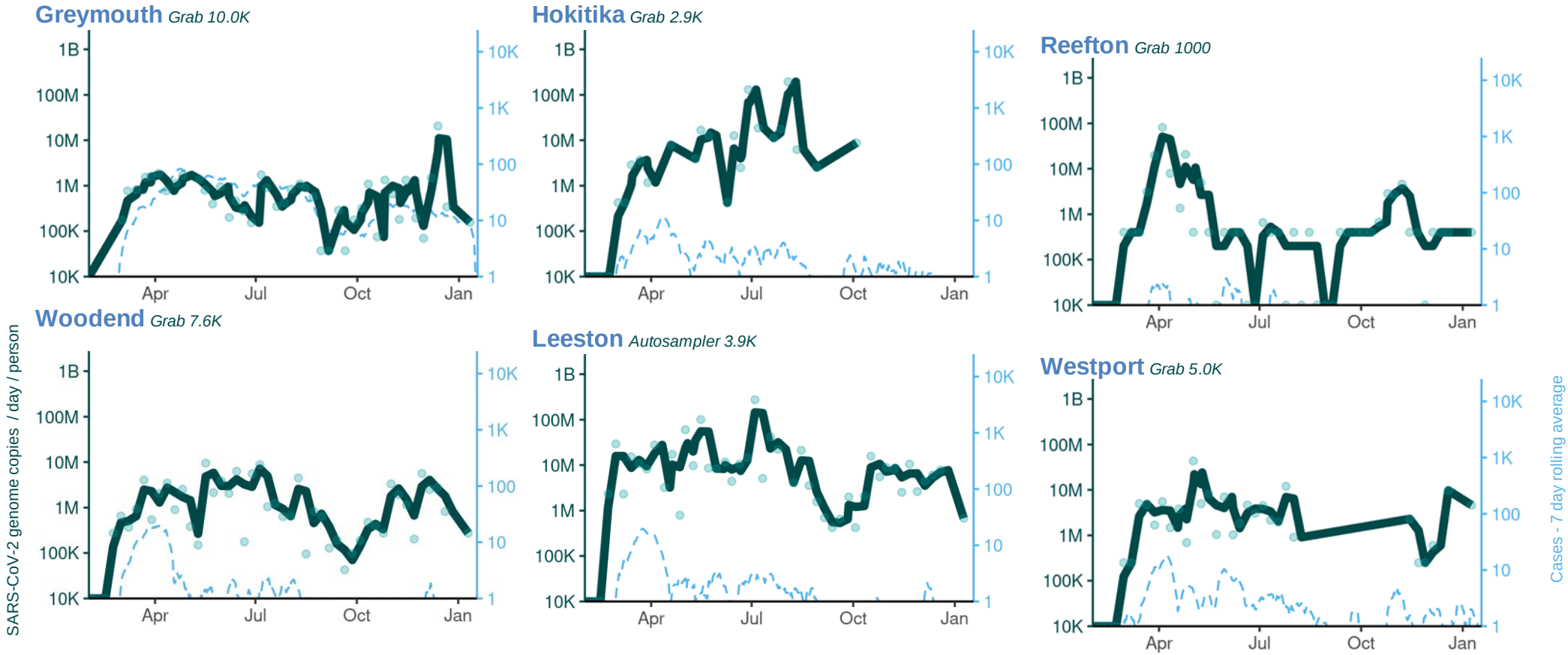
Timaru *Autosampler 28.0K*



Status Detected Not detected

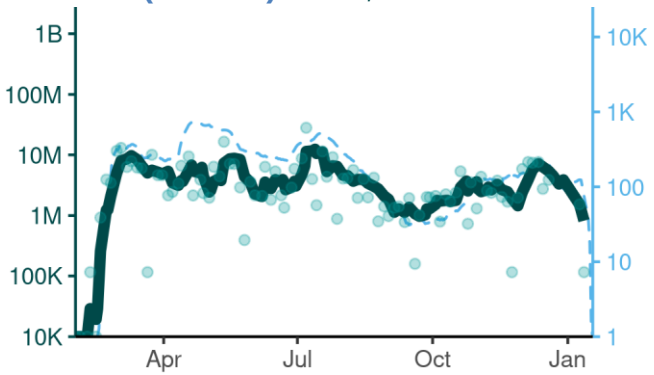
Kaiapoi *Grab 12.5K*



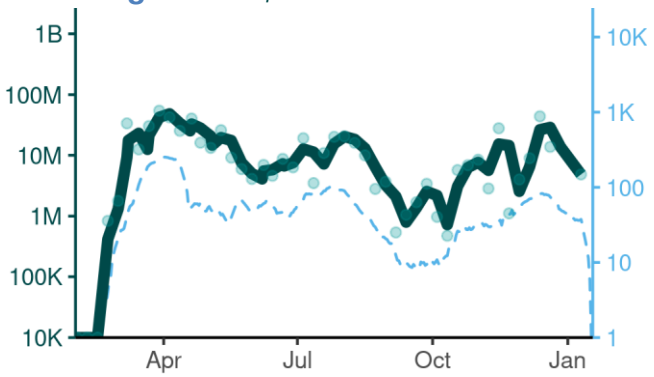

Greymouth Grab 10.0K
Hokitika Grab 2.9K
Reefton Grab 1000
Woodend Grab 7.6K
Leeston Autosampler 3.9K
Westport Grab 5.0K
SARS-CoV-2 genome copies / day / person
Cases - 7 day rolling average
1B
100M
10M
1M
100K
10K
1K
100
10
1
Apr
Jul
Oct
Jan

Otago and Southland

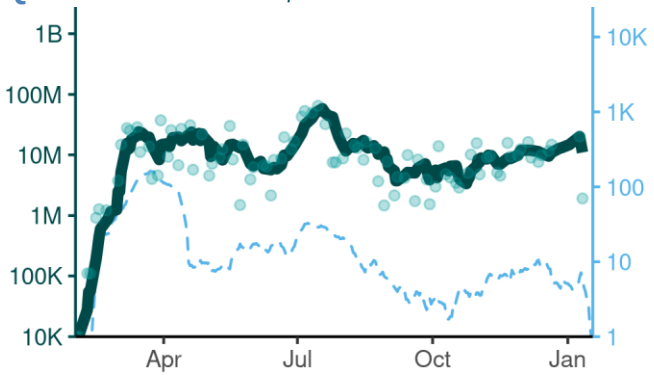
Dunedin (Tahuna) *Autosampler 84.0K*



Invercargill *Autosampler 50.0K*

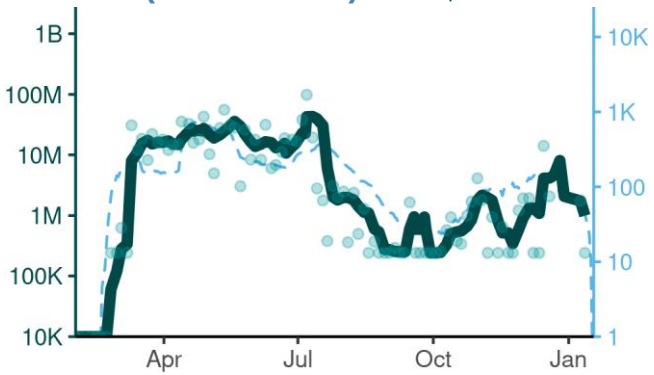


Queenstown *Autosampler 40.0K*

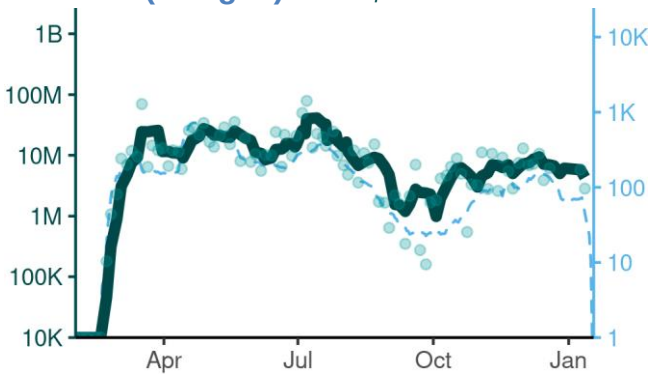


SARS-CoV-2 genome copies / day / person

Dunedin (Green Island) *Autosampler 22.9K*

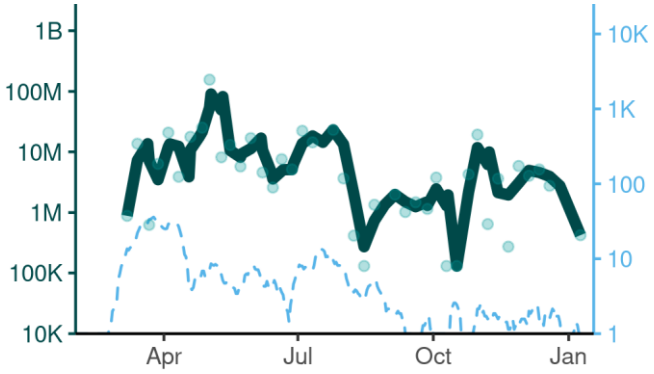


Dunedin (Mosgiel) *Autosampler 14.6K*



Cases - 7 day rolling average

Wanaka *Grab 14.5K*



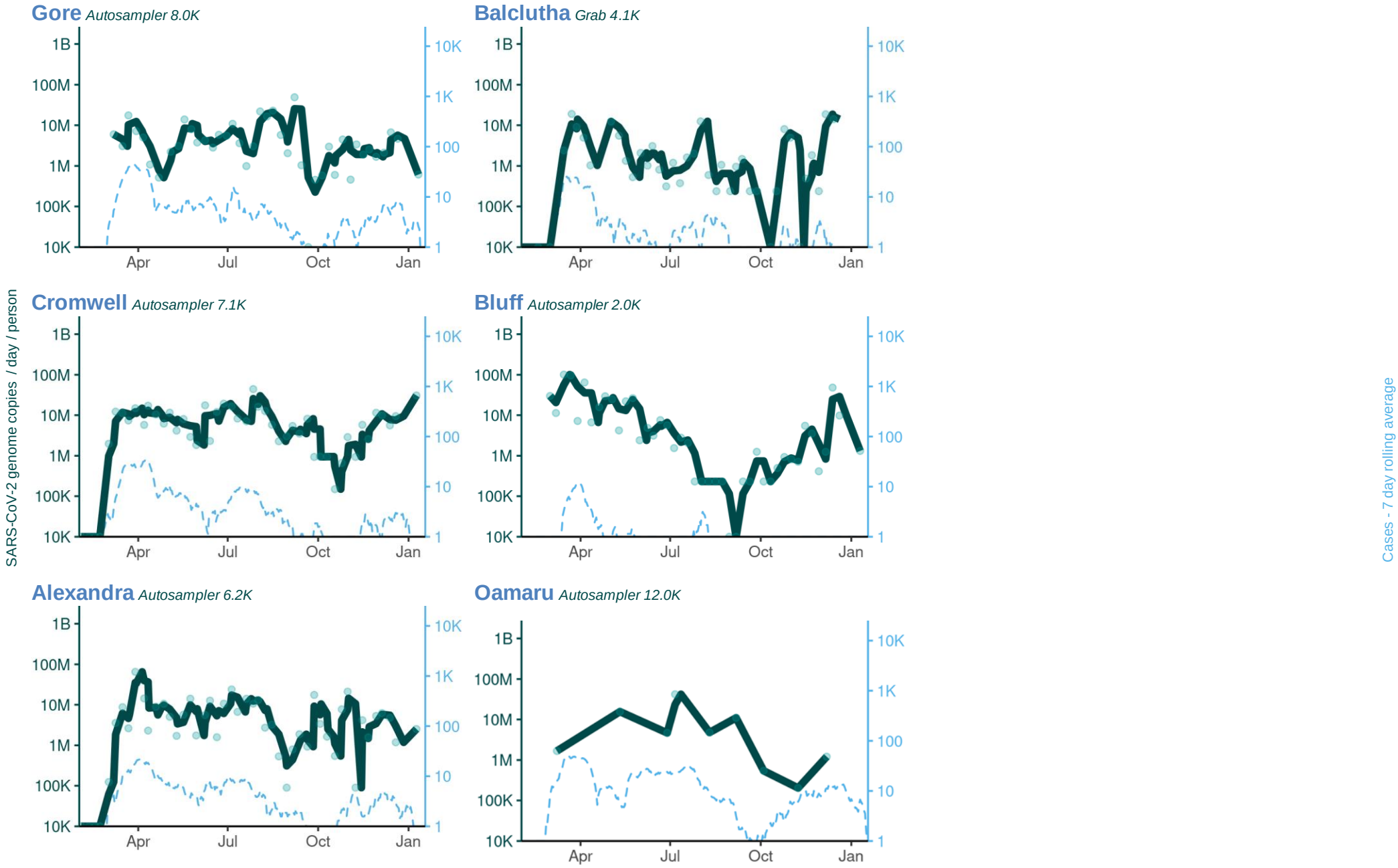
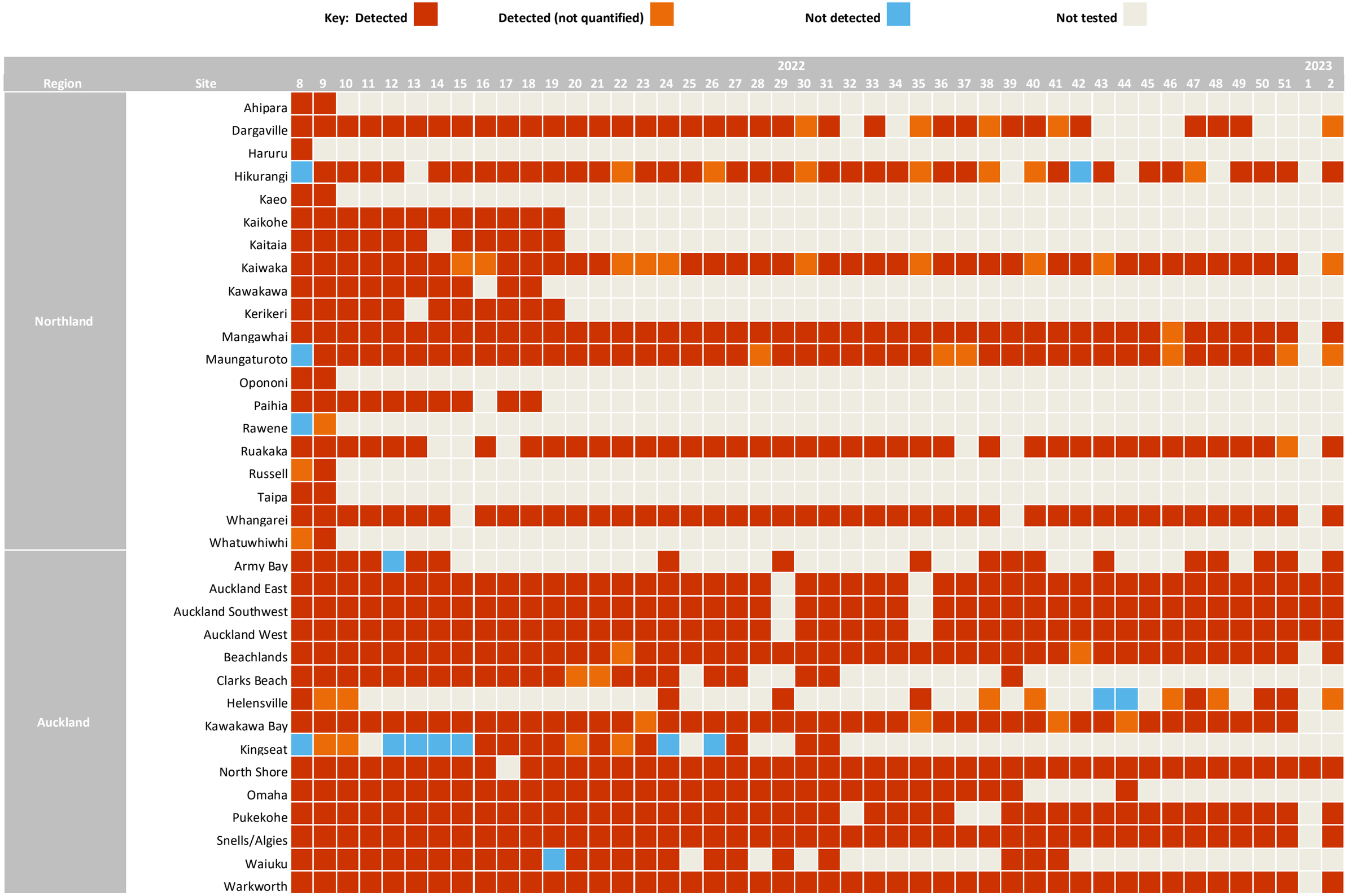

Gore Autosampler 8.0K
Balclutha Grab 4.1K
Cromwell Autosampler 7.1K
Bluff Autosampler 2.0K
Alexandra Autosampler 6.2K
Oamaru Autosampler 12.0K
SARS-CoV-2 genome copies / day / person
Cases - 7 day rolling average
1B
100M
10M
1M
100K
10K
1K
100
10
1
Apr
Jul
Oct
Jan

Table 2: Weekly Summary of Wastewater Sampling Results for SARS-CoV-2



Region	Site	2022 8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	2023 1	2
	Wellsford																																														
Waikato	Cambridge																																														
	Hamilton																																													
	Ngatea																																													
	Otorohanga																																													
	Paeroa																																													
	Taupo																																													
	Te Awamutu																																													
	Thames																																													
	Turangi																																													
	Waihi																																													
	Whangamata																																													
	Whitianga																																													
Bay of Plenty	Katikati																																													
	Kawerau																																													
	Maketu																																													
	Mt Maunganui/Papamoa																																													
	Opotiki																																													
	Rotorua																																													
	Tauranga																																													
	Te Puke																																													
	Waihi Beach																																													
	Whakatane																																													
Gisborne	Gisborne																																													
Hawke's Bay	Hastings																																													
	Mahia																																													
	Napier																																													
	Otane																																													
	Porangahau																																													
	Takapau																																													
	Te Paerahi																																													
	Waipawa																																													
	Waipukurau																																													
	Wairoa																																													
Taranaki	Eltham																																													
	Hawera																																													
	Kaponga																																													
	Manaia																																													
	New Plymouth																																													
	Opunake																																													

Region	Site	2022 8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	2023 1	2
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	Stratford																																														
	Waverley																																														
	Dannevirke																																														
	Eketahuna																																														
	Feilding																																														
	Levin																																														
	Pahiatua																																														
	Palmerston North																																														
	Taumarunui																																														
	Whanganui																																														
	Woodville																																														
Wellington	Carterton																																														
	Featherston																																														
	Greytown																																														
	Hutt Valley																																														
	Martinborough																																														
	Masterton																																														
	Otaki																																														
	Paraparaumu																																														
	Porirua																																														
	Wellington (Moa Point)																																														
	Wellington (Western)																																														
Tasman	Motueka																																														
Nelson	Nelson Central/North																																														
	Richmond/Nelson South																																														
Marlborough	Blenheim																																														
	Picton																																														
West Coast	Greymouth																																														
	Hokitika																																														
	Reefton																																														
	Westport																																														
Canterbury	Amberley																																														
	Ashburton																																														
	Christchurch																																														
	Hanmer Springs																																														
	Kaiapoi																																														
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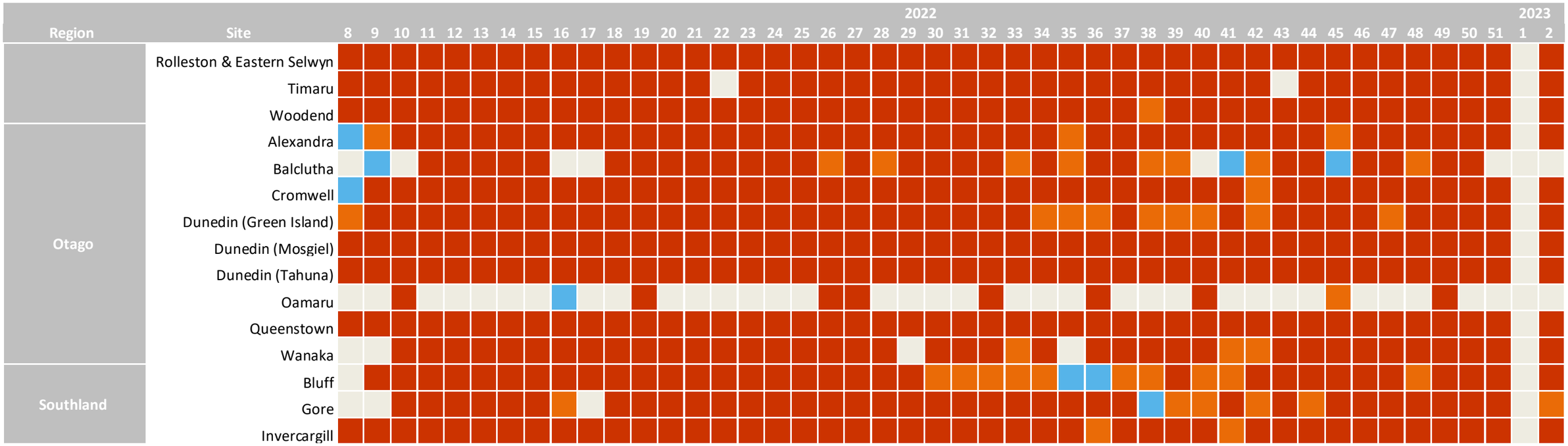
	Leeston																																														
	Rangiora																																														


Region
Site
2022
2023
8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 1 2
Rolleston & Eastern Selwyn
Timaru
Woodend
Alexandra
Balclutha
Cromwell
Dunedin (Green Island)
Dunedin (Mosgiel)
Dunedin (Tahuna)
Oamaru
Queenstown
Wanaka
Bluff
Gore
Invercargill
Otago
Southland

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We continue to be indebted to the teams across the country who are collecting the wastewater that underpins this work.

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Notes

Sites and frequency of sample collection: The catchment population sites selected for the surveillance range from approximately 100 to over 1,000,000 individuals. The sites cover all regions of the country. Most major towns and all cities, as well as many smaller communities, are included. In early 2022, the wastewater catchment areas cover over 80% of the population connected to wastewater treatment plants. The sites from which samples have been collected have varied over the last 12 months. New sites may be added over time, and/or sampling may reduce in frequency or cease for other sites. The selection and frequency of sampling vary depending on the local population, access to wastewater collection points, staff availability to collect samples and risk factors. When included, samples are collected at least weekly, with twice weekly sampling being common. Several samples have also been collected from non-WWTP sites (manholes and pump stations- mostly in Auckland).

Sampling method: The preferred option is to automatically collect a 24 hour 'composite' sample. This is where a pump automatically collects a small volume of wastewater every 15 minutes over 24 hours using a composite sampler. These samplers are available in some wastewater treatment plants. When composite samplers are not available, 'grab' samples are collected. These range from a sample being taken at a single point in time, to 3 samples taken over 30 minutes, to samples collected over a day. Grab samples represent only the composition of the source at that time of collection and may not be as representative as a 24-hour composite sampler. More variation may be expected with grab samples.

Laboratory analysis of wastewater samples: Samples are sent from each wastewater treatment plant to ESR. Processing of each sample commences within an hour or two of receipt. Processing involves the concentration of virus from 250 mL sample to approx. 1 mL using centrifugation and polyethylene glycol. Viral RNA is then extracted from a small volume of 0.2 mL concentrate to give a final volume of 0.05 mL The presence of SARS-CoV-2 RNA is determined using RT-qPCR. SARS-CoV-2 is considered detected when any of the RT-qPCR replicates are positive.

RT-qPCR: Reverse transcription (RT) to convert RNA to complementary DNA (cDNA), followed by quantitative PCR (qPCR). RT-qPCR is used for detection and quantification of viral RNA.

Method sensitivity: The protocol used to concentrate SARS-CoV-2 from wastewater allows for the sensitive detection of SARS-CoV-2 by RT-qPCR. ESR has shown that when 10 individuals are actively shedding SARS-CoV-2 RNA in a catchment of 100,000 individuals, there was a high likelihood of detecting viral RNA in wastewater (https://doi.org/10.1016/j.watres.2021.118032). Shedding by one individual may be detected in wastewater, but it does depend on many factors including the amount and duration of shedding. Very low levels in wastewater may be not able to be quantified (i.e., less than the limit of quantification- see below).

SARS-CoV-2 RNA detected (positive result): A positive detection in the wastewater indicates that at least one person has been shedding SARS-CoV-2 into the wastewater at some point during the time period that the sample

was being collected. In some cases, detections could also be due to the shedding of low levels of SARS-CoV-2 RNA by a recently recovered case. The detection of SARS-CoV-2 RNA does not indicate that infectious virus is present.

SARS-CoV-2 RNA not detected (negative result): A negative result can occur because there are no active 'shedding' cases in the catchment or because the SARS-CoV-2 RNA concentration is too low to be detected, most likely because there are a very low number of cases in the wastewater catchment. Therefore, negative finding does not necessarily guarantee the absence of COVID-19 in the community.

Viral loads and normalisation: When detected, the SARS-CoV-2 RNA concentration is calculated as genome copies per L of wastewater. This is then converted to a viral load of **genome copies/day/person**. This conversion takes into account the flow rate of wastewater entering the treatment plant (the influent) and the population in the catchment. The **flow rate** is the total volume (m3 per day) recorded at the inlet of the wastewater treatment plant over 24 hours. This is a **population-normalised viral load**. Currently, the flow rate is the average annual flow rate, but will be replaced with daily flow rate when available (note that rainfall may significantly increase the flow rate at the inlet, diluting the sample, and may result in lower concentrations and a false negative result).

Limit of quantification: The lowest concentration of the target that can be reliably quantified is referred to as the limit of quantification. For those samples where SARS-CoV-2 is detected but cannot be quantified, a value of 5 genome copies/mL wastewater is used. While a standard method is being used, virus recovery can vary from sample to sample, and this may affect the quantitation.

Data subject to change: Data generated for the New Zealand Wastewater COVID-19 Surveillance Programme should be considered provisional and may be subject to change. Data may be incomplete for the most recent 2-week period due to processing, testing and reporting delays.

Data not shown:

- Data from 'ad hoc' sampling locations including from individual facilities/building (e.g., workplaces, prisons, MIQs) are not included.
- Results from certain samples may not be shown, as the result was either deemed invalid, or the sample could not be tested (e.g., leaked in transit, not labelled).

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