National Wastewater Surveillance Programme - COVID-19

Weeks 36 & 37 (Weeks Ending 11 September & 18 September 2022)
Report prepared on 23 September 2022

99%
Sites tested in the last 2 weeks had SARS-CoV-2 detected (99/100 sites)

74%
NZ population covered by wastewater testing

Omicron BA.4/5 (>99%)
Most prevalent variant detected

Overall SARS-CoV-2 levels in wastewater continue to decline

In the most recent week (Week 37), **50%** of sites had levels of SARS-CoV-2 that were either **below the limit of quantitation or not detected**, compared with **10%** of sites four weeks ago. There is however site to site variation. For the week ending **18 September 2022**, **46%** of sites have **increased** SARS-CoV-2 levels compared to the previous week and **31%** have **decreased** levels. Compared to a month ago, **21%** of sites show an **increase** and **59%** of sites show a **decrease**.

SARS-CoV-2 wastewater levels from week 37 suggest reported case rates are **29% lower** than would be expected based on previously observed ratios of case rates to levels of SARS-CoV-2 in wastewater.

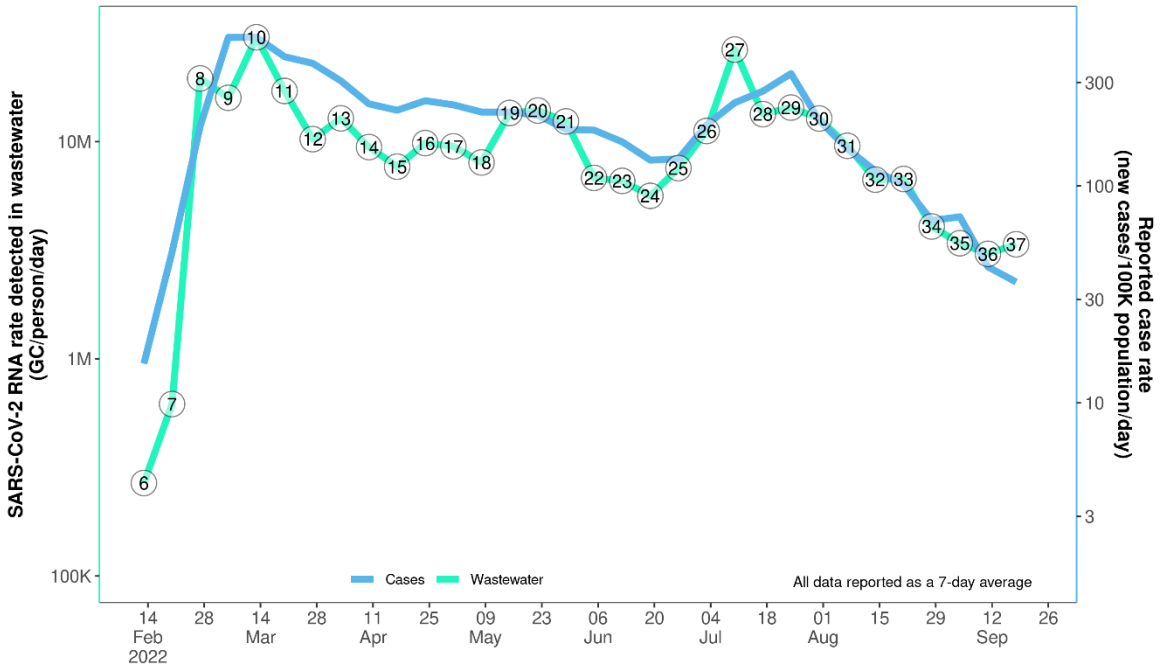


Figure 1. National timeseries of estimated SARS-CoV-2 genome copies (GC) in wastewater rate (GC/person/day, green line) and reported case rate (per 100,000 population per day, blue line). Numbers in the points are the week of the year. Log_{10} scale. Data reported as 7-day average.

Results For Weeks 36 & 37 (Weeks Ending 11 September & 18 September 2022)

In the two weeks ending 18 September 2022, 299 samples were collected from 100 locations across New Zealand. Analysis of one sample is still in progress (Moteuka, collected 16 September, arrived 21 September, Table 1).

SARS-CoV-2 RNA was **detected** in 287 samples from 99/100 (99%) sites tested during this period (Figure 2, Table 1). The 11 samples in which SARS-CoV-2 was **not detected** were from ten sites (Maungaturoto, Whangamata, Waihi Beach, Takapaua, Te Paerahi, Wairoa, Manaia, Woodville, Reefton and Bluff, Table 1). A total of 41 samples from 31 sites were below the limit of quantitation and are therefore "detected not quantified". In the most recent week (Week 37), 50% of sites had levels of SARS-CoV-2 that were either below the limit of quantitation or not detected, compared with 10% of sites four weeks ago. Across the last two weeks, Waihi Beach was the only site where SARS-CoV-2 was not detected in any samples.

Figure 2 below gives the proportion of sites with positive results for this and previous weeks.

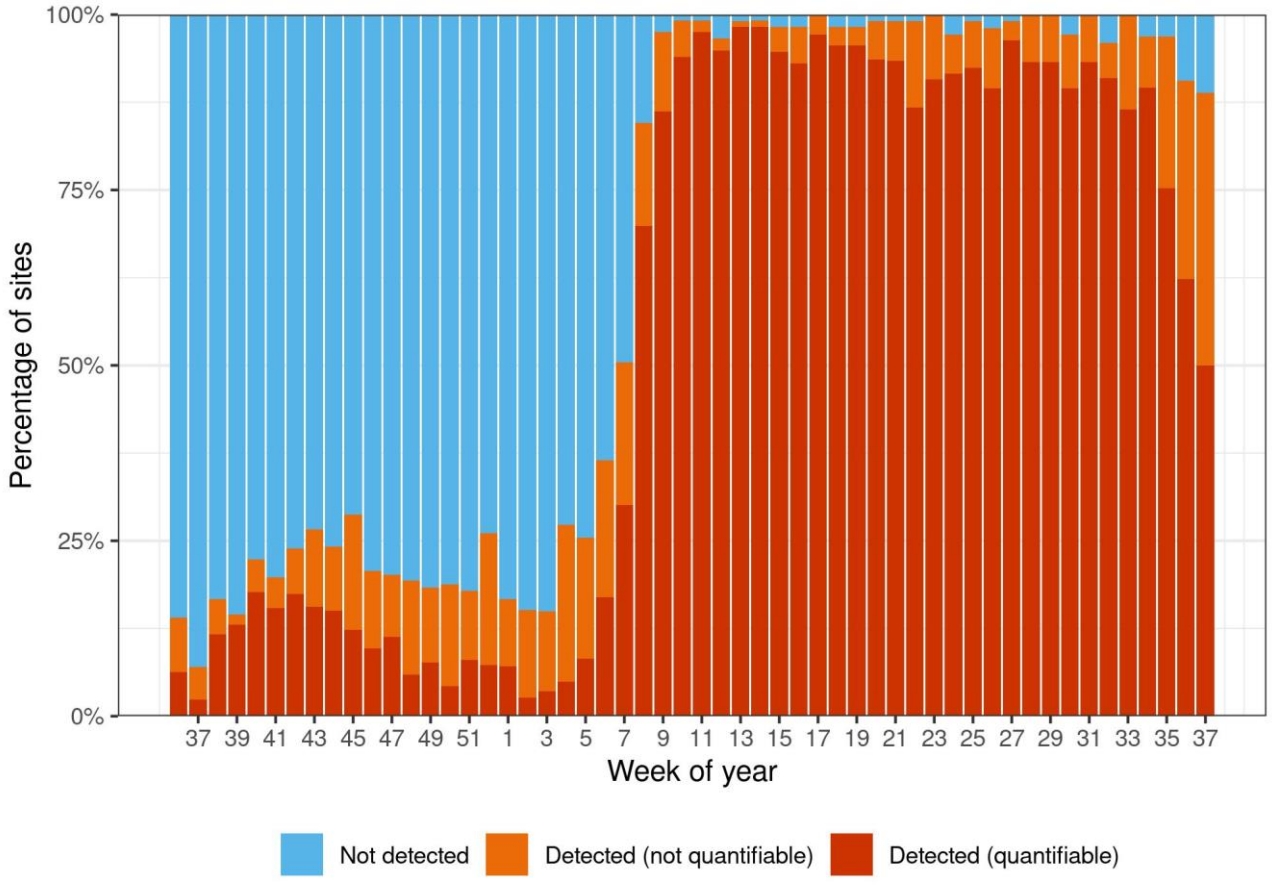


Figure 2. Results for SARS-CoV-2 RNA in wastewater collected across New Zealand.

Regional summaries (Figure 3) indicate that, overall within each region, there is an ongoing reduction in Northern and Auckland metro regions, and a levelling off in the other regions.

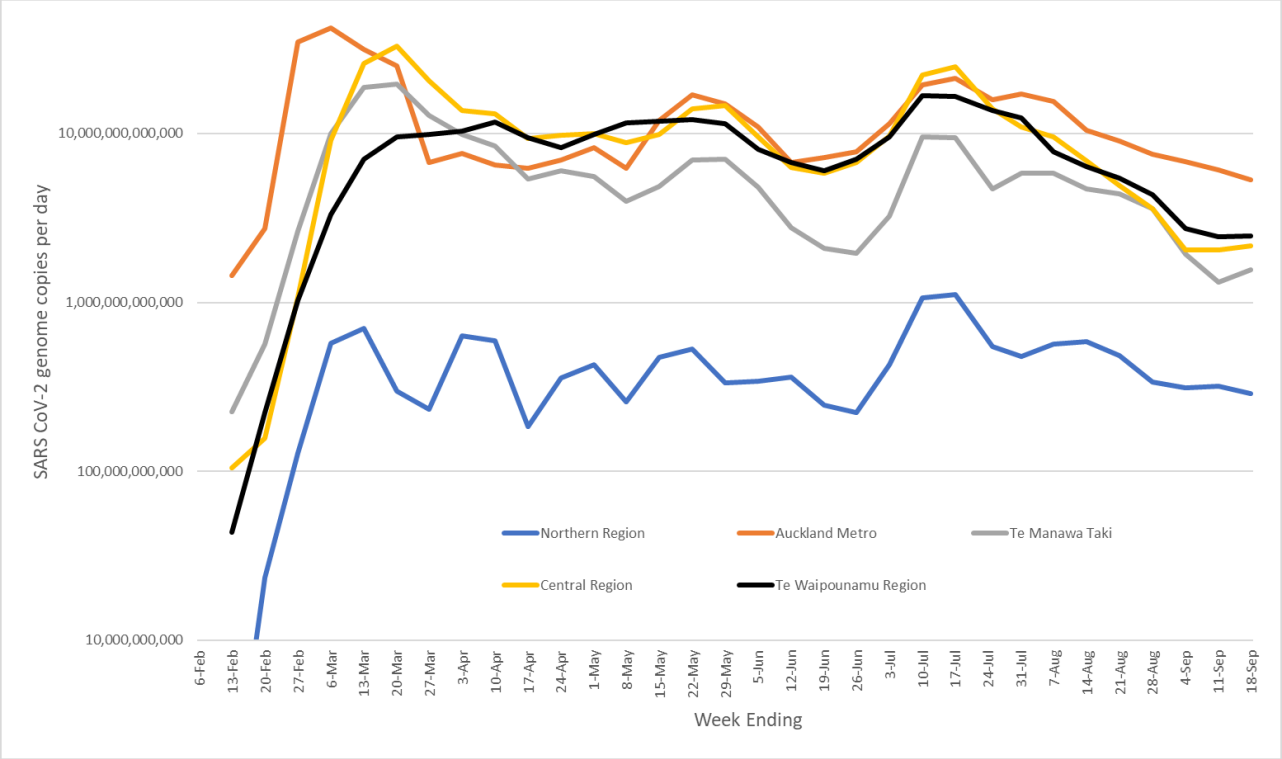


Figure 3. Total SARS-CoV-2 genome copies detected per day in the five Ministry of Health regions (Rolling two-week average)

There is however site to site variation as illustrated in Figure 4 and the individual site plots.

Compared to a month ago, **21%** of sites tested in the week ending **18 September 2022** show an **increase** and **59%** of sites show a **decrease** (Figure 4C). Sites with increases are primarily smaller sites: Omaha, TePuke, Whakatane, Woodend, Otane, Eketahuna, Levin, Pahiatua, Kaiwaka, Mangawhai, Balclutha, Green Island, Wanaka, Hawera, Kaponga, Opunake, Patea, Reefton, and Otaki.

Compared to the previous week **46%** of sites have **increased** SARS-CoV-2 levels and **31%** have **decreased** levels (Figure 4A). In addition to the smaller sites, those with increases on the previous week include Auckland Western region, Gisborne, Hastings, Levin, Nelson, Queenstown, Invercargill and Hamilton.

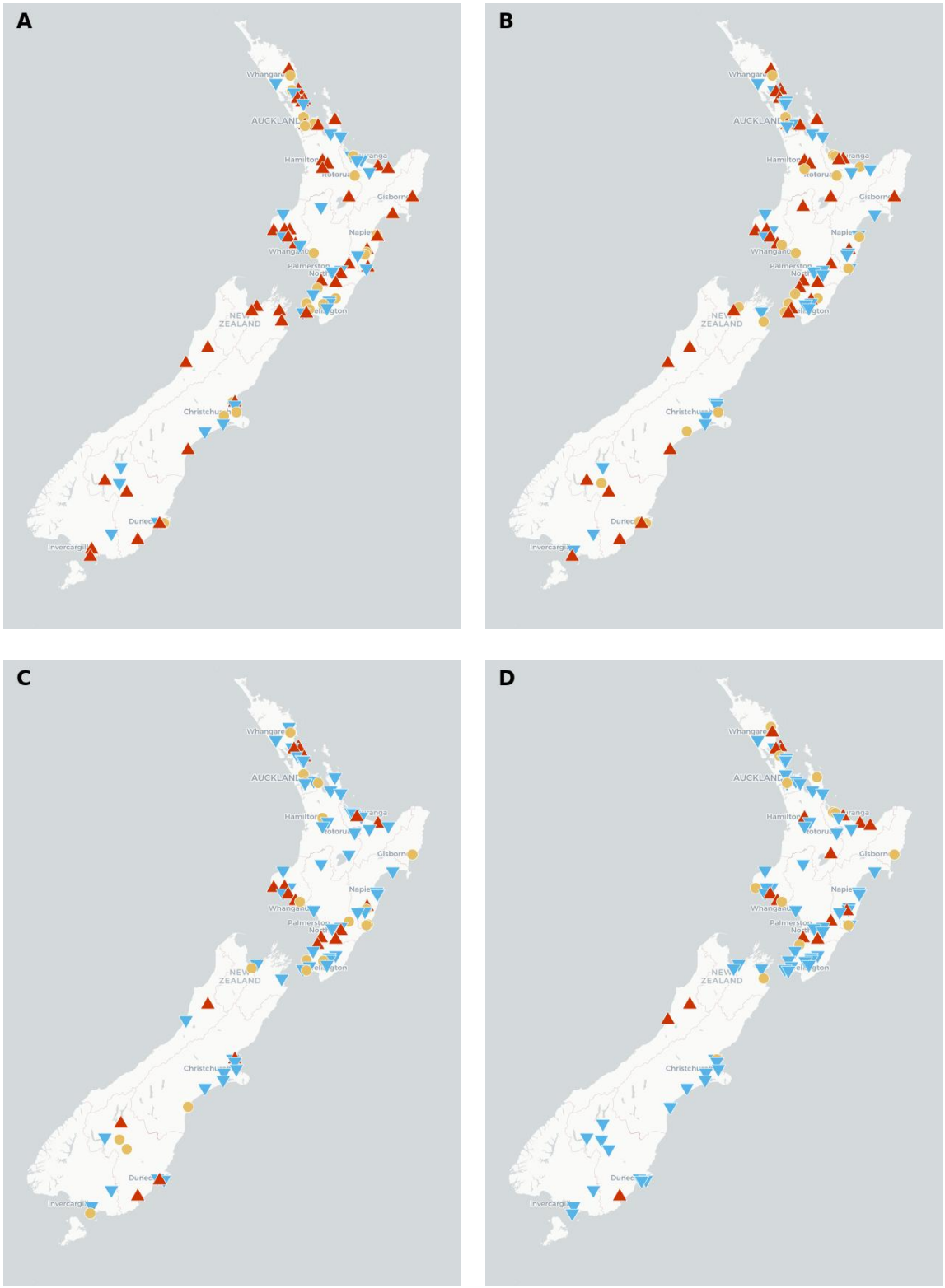


Figure 4. Comparison of SARS-CoV-2 levels for the week ending 18 September 2022, compared with the levels measured: A) 1 week ago; B) 2 weeks ago; C) 4 weeks ago; D) 12 weeks ago. Only sites with results for both time points are included. When the viral quantity is 30% or more higher this is labelled 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.esr.cri.nz/our-expertise/covid-19-response/wastewater-testing-results

Wastewater Variant Analysis

Consistent with whole genome sequencing (WGS) of clinical cases, the BA.4 and BA.5 variants are the dominant circulating variants across Aotearoa (national average of >99%). In the past fortnight 14 of 20 sites were 100% BA.4/5 (i.e., other variants could not be detected in these sites as they were either not present, or alternatively below the limits of detection).

Aggregated across all sentinel sites **the percentage of BA.4/5 remains >99% over the last 2 weeks.**

There is a possible low-level detection of BA.2.75 in the North Shore (week 36) it is ambiguous as the wastewater variant assay (called Wildspike 4) cannot distinguish between BA.1 and BA.2.75. These detections should be regarded as presumptive.

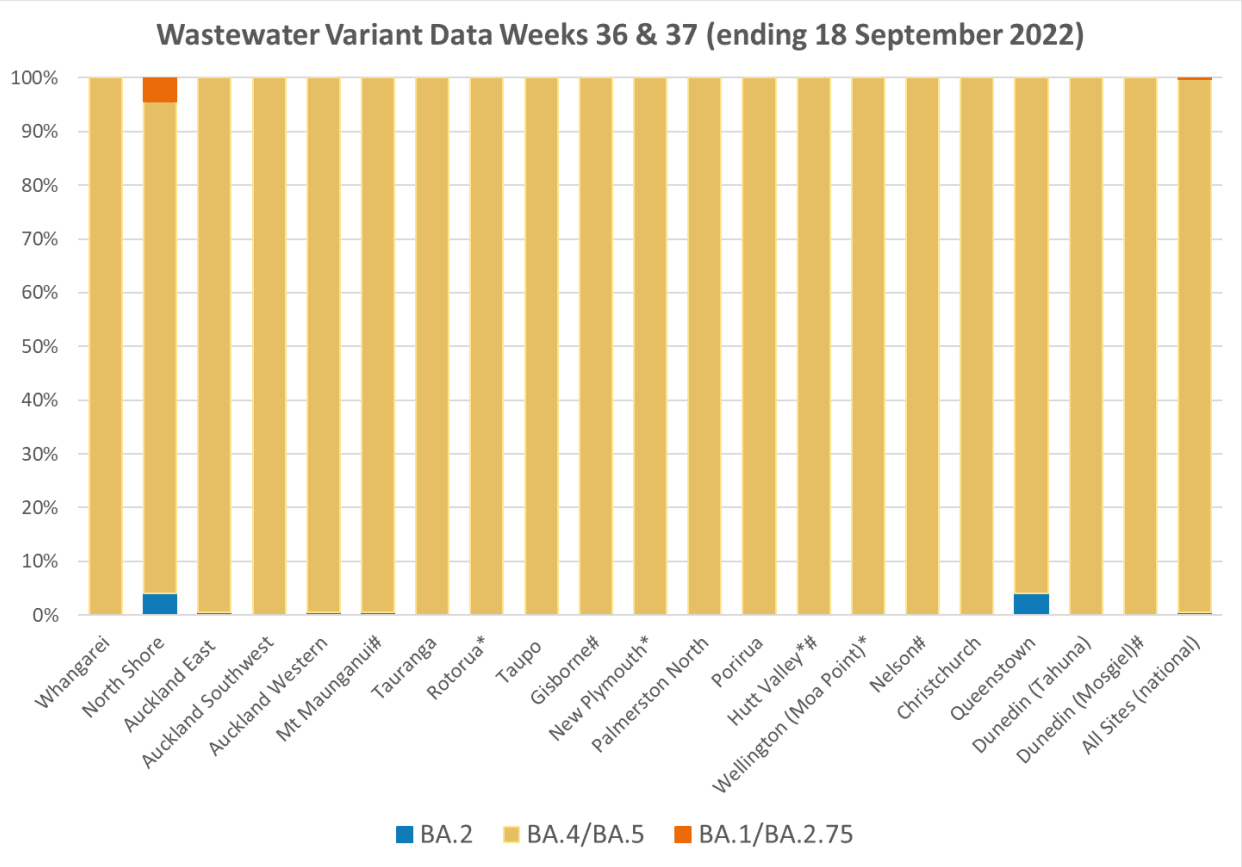


Figure 5. Data from sentinel wastewater sites across NZ using a S-gene (spike) barcoding assay able to 'call' the BA.2 (including BA.2.12.1), BA.1, BA.4/BA.5 and BA.2.75 (sub)variants. Wastewater samples were collected from up to 20 sentinel sites. *The level of precision and sensitivity in these percentage estimates can be uncertain. Samples marked with an * yielded stochastic detections of one or more variants.*

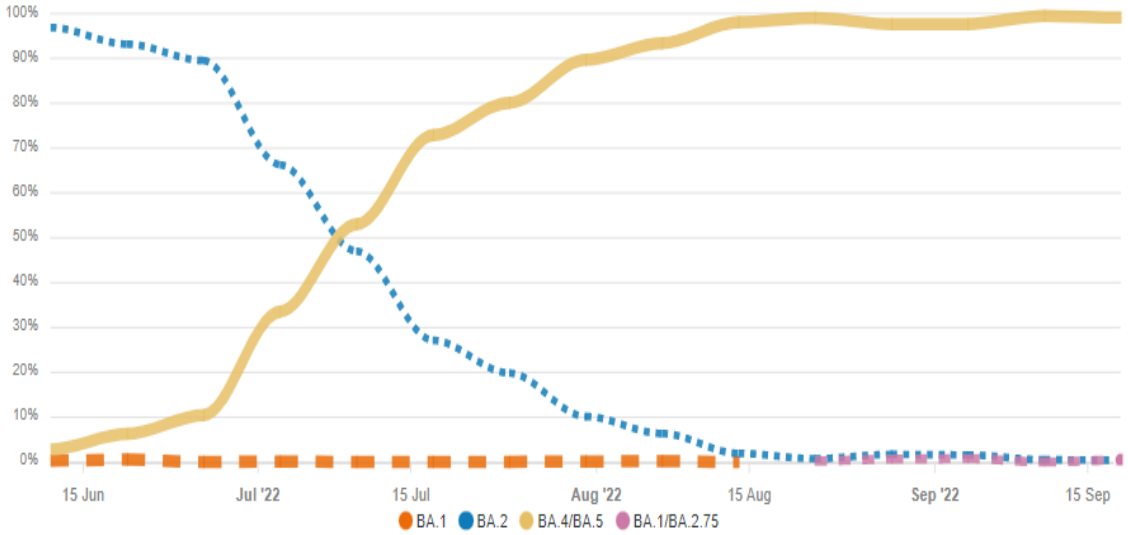
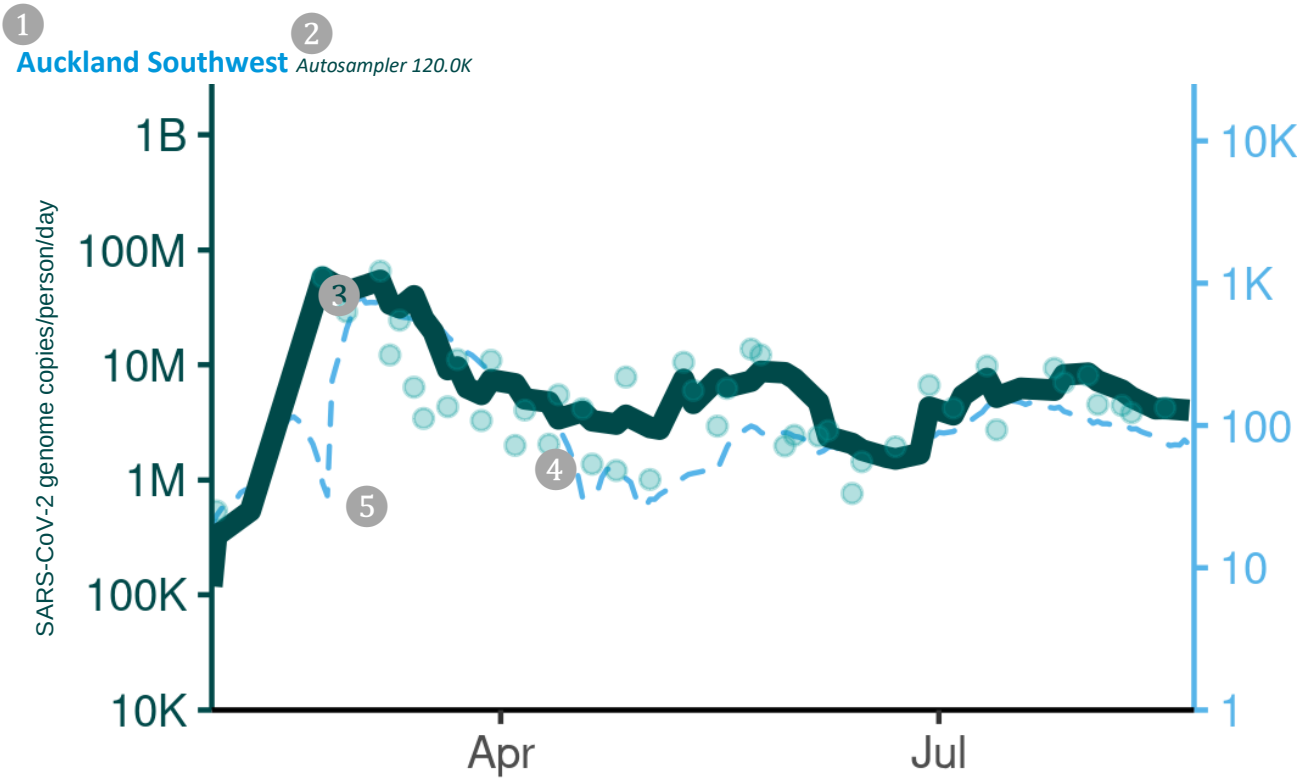


Figure 6. Change in variant prevalence over time at a national scale. Data are collected from up to 20 sentinel sites each week.

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.

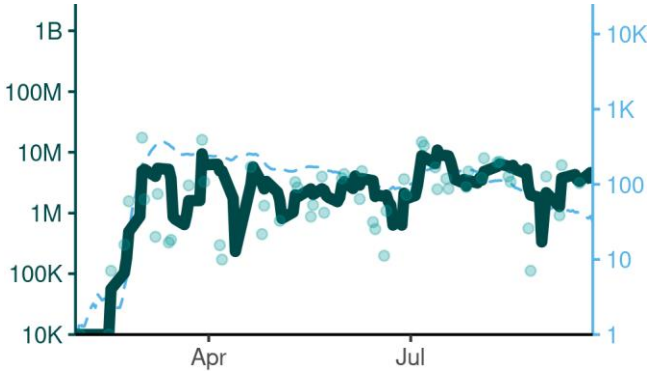
4 Individual results samples shown as circles | Rolling 14-day average of genome copies/person/day on a $\log_{10}$ scale.

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.

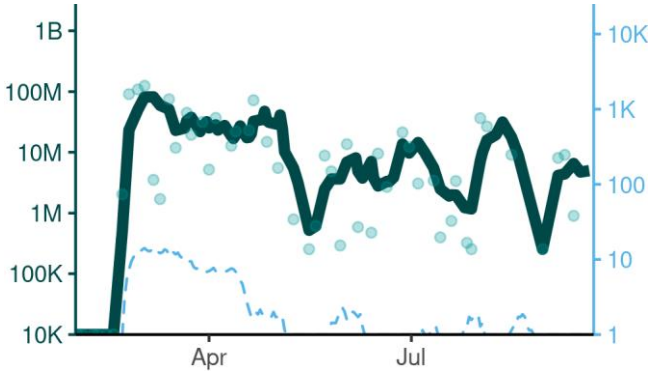
Note: Wastewater and cases data are on a $\log_{10}$ scale. Scales on all graphs have been normalized to cover the same scale on every graph. Care should be taken when interpreting the data

Northland

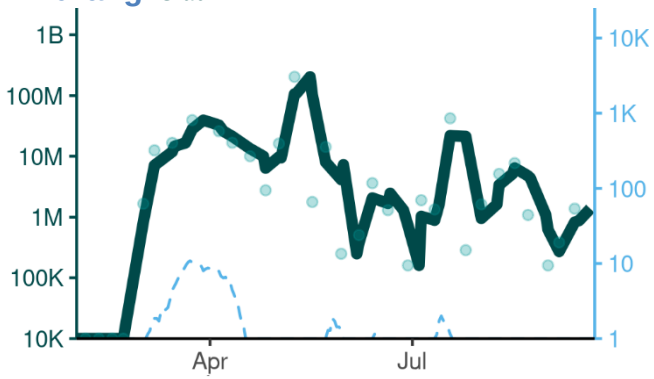
Whangarei *Autosampler 65.0K*



Dargaville *Grab 5.0K*

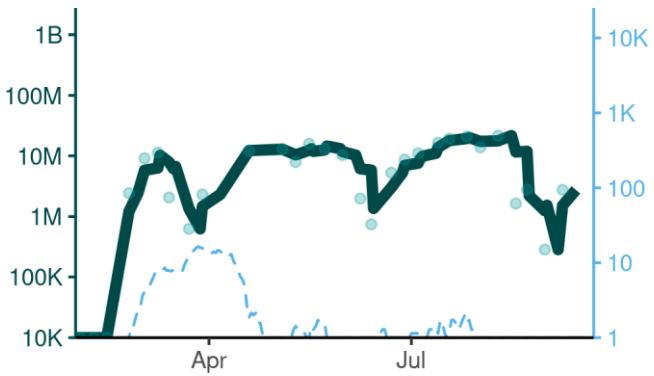


Hikurangi *Grab 1.7K*



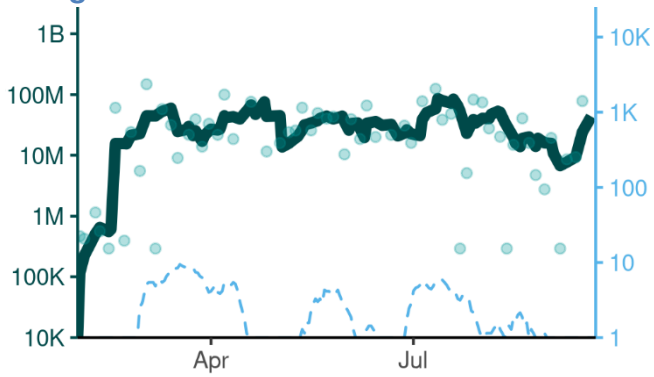
SARS-CoV-2 genome copies / day / person

Ruakaka *Grab 4.5K*

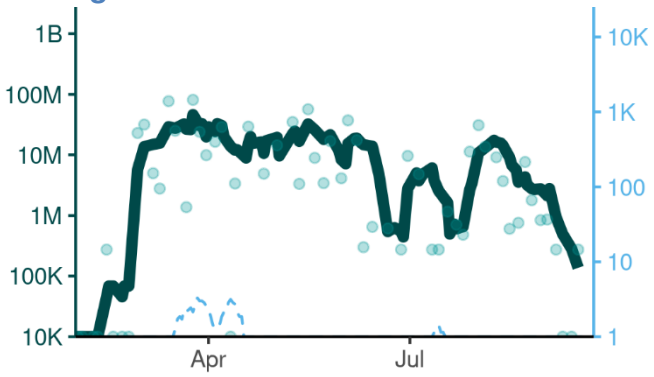


Cases - 7 day rolling average

Mangawhai *Grab 1.1K*

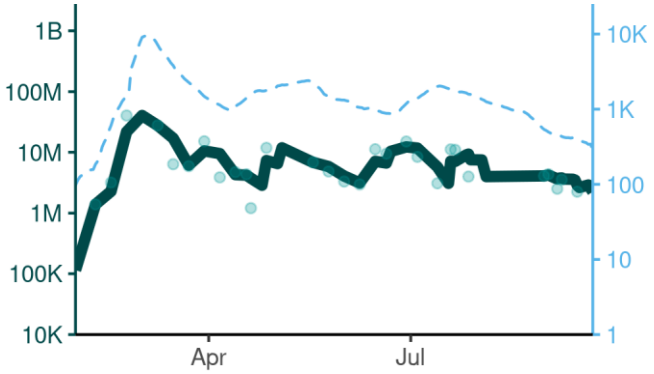


Maungaturoto *Grab 1.3K*

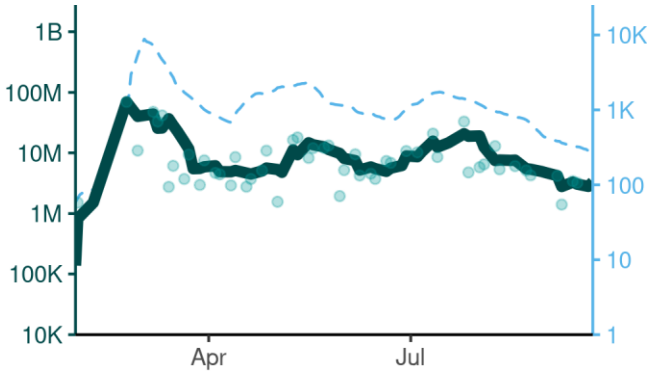


Auckland

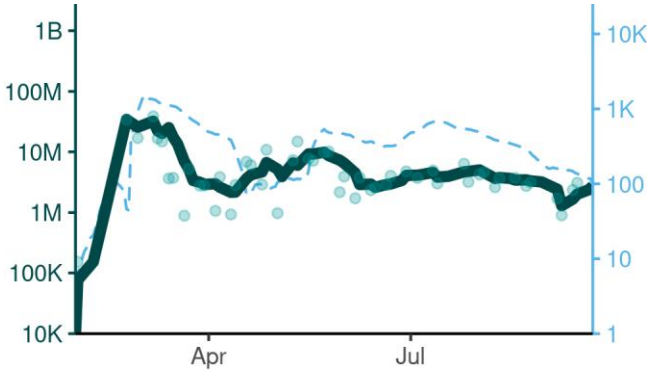
Auckland (Combined) *Autosampler 1.1M*



Auckland East *Autosampler 680.0K*

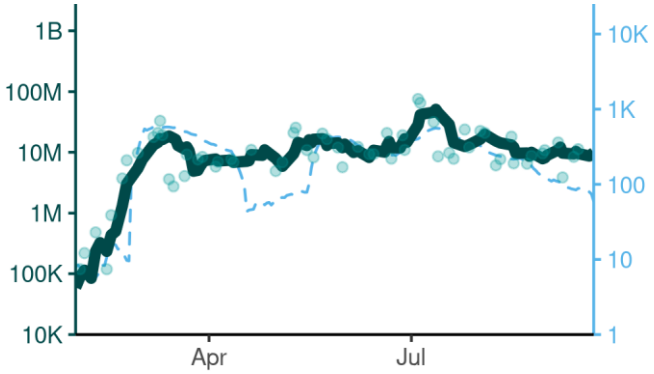


Auckland West *Autosampler 315.0K*

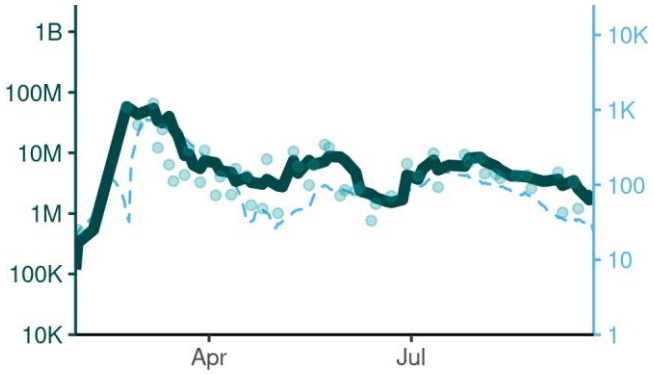


SARS-CoV-2 genome copies / day / person

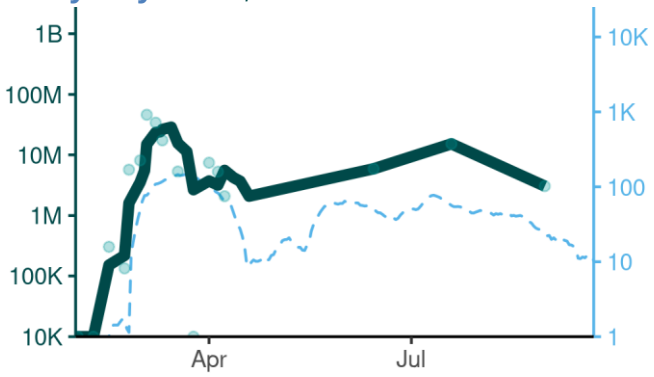
North Shore *Autosampler 240.0K*



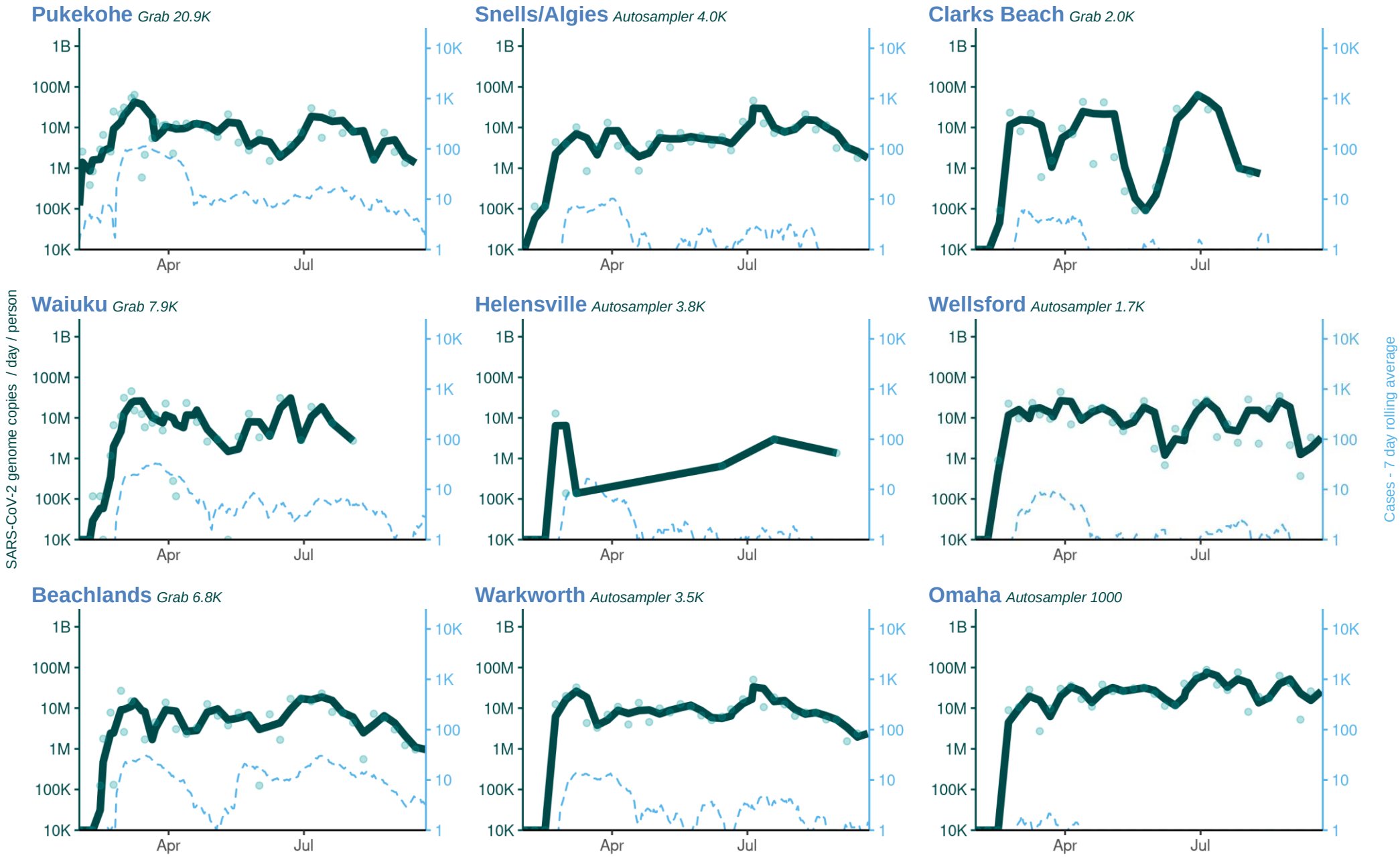
Auckland Southwest *Autosampler 120.0K*



Army Bay *Autosampler 42.0K*

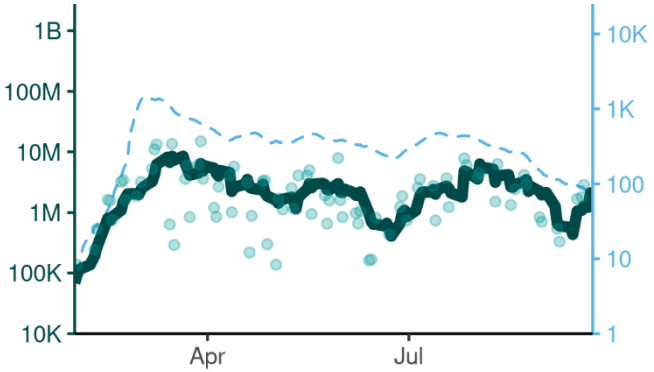


Cases - 7 day rolling average

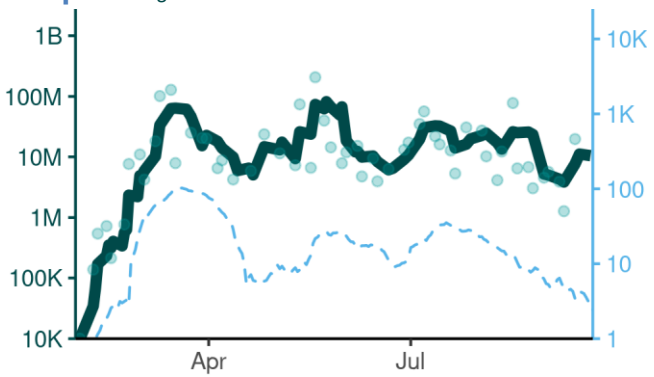

Pukekohe Grab 20.9K
Snells/Algies Autosampler 4.0K
Clarks Beach Grab 2.0K
Waiuku Grab 7.9K
Helensville Autosampler 3.8K
Wellsford Autosampler 1.7K
Beachlands Grab 6.8K
Warkworth Autosampler 3.5K
Omaha Autosampler 1000
SARS-CoV-2 genome copies / day / person
Cases - 7 day rolling average
1B
100M
10M
1M
100K
10K
1K
100
10
1
Apr
Jul

Waikato

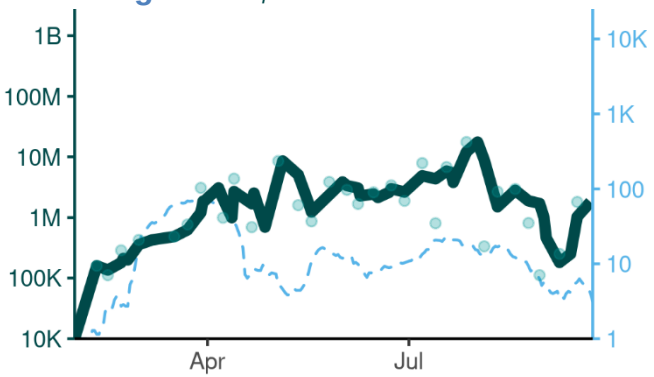
Hamilton *Autosampler 169.0K*



Taupo *Auto/grab 23.0K*

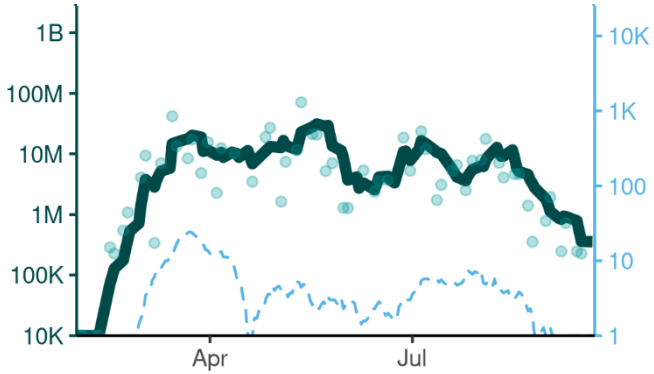


Cambridge *Autosampler 20.1K*

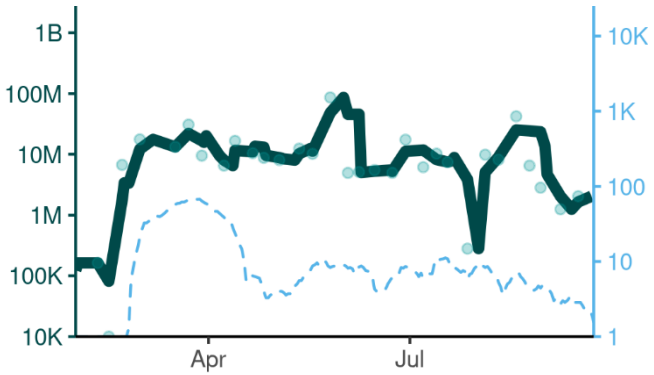


SARS-CoV-2 genome copies / day / person

Thames *Autosampler 7.5K*

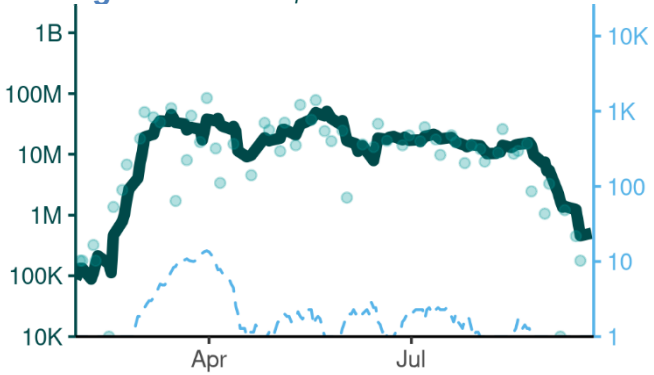


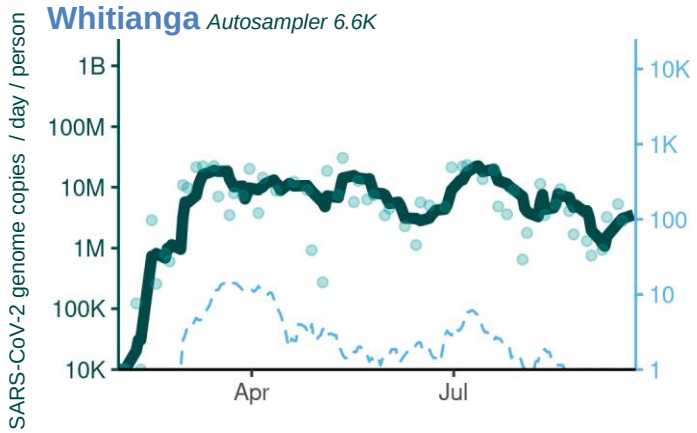
Te Awamutu *Autosampler 13.1K*



Cases - 7 day rolling average

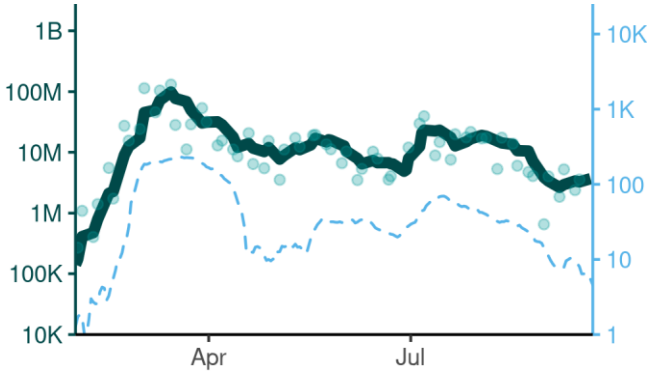
Whangamata *Autosampler 4.0K*



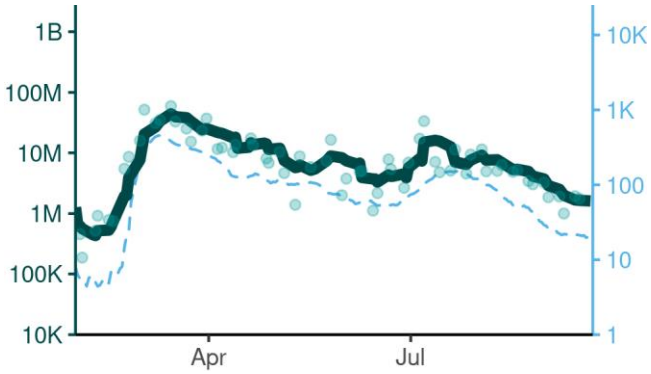

Whitianga Autosampler 6.6K
SARS-CoV-2 genome copies / day / person
1B
100M
10M
1M
100K
10K
Apr
Jul
10K
1K
100
10
1
Cases - 7 day rolling average

Bay of Plenty and Gisborne

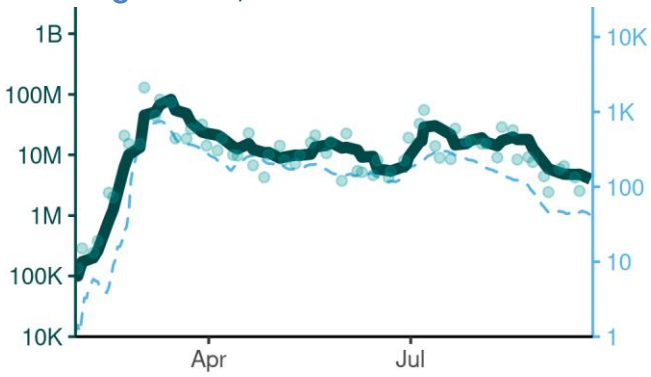
Mt Maunganui/Papamoa *Autosampler 65.0K*



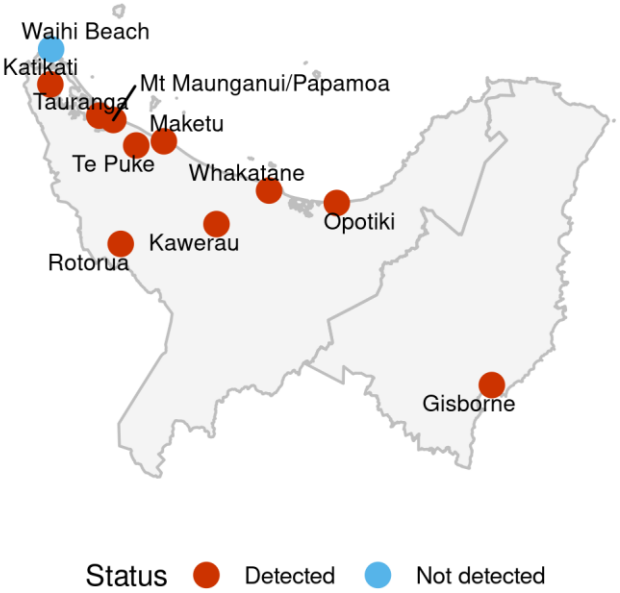
Rotorua *Autosampler 59.0K*



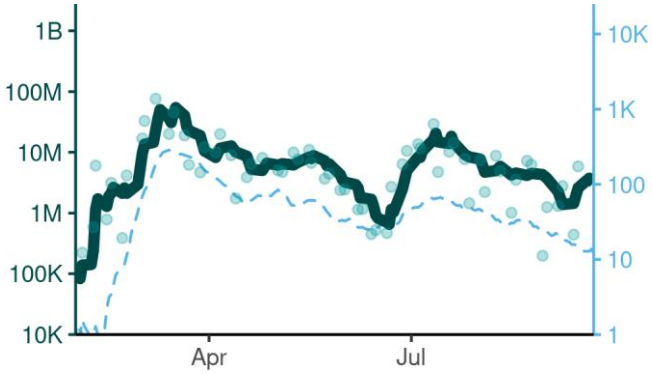
Tauranga *Autosampler 50.0K*



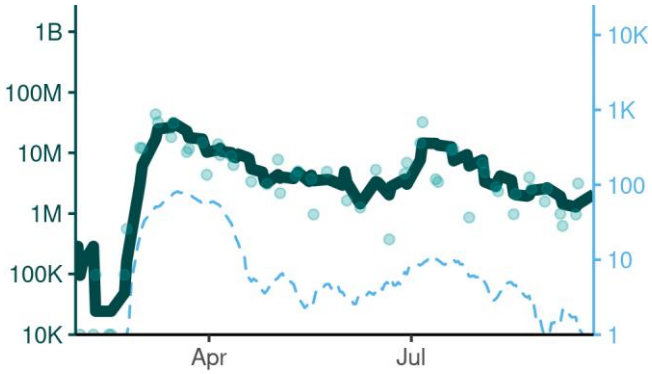
SARS-CoV-2 genome copies / day / person



Gisborne *Autosampler 37.0K*

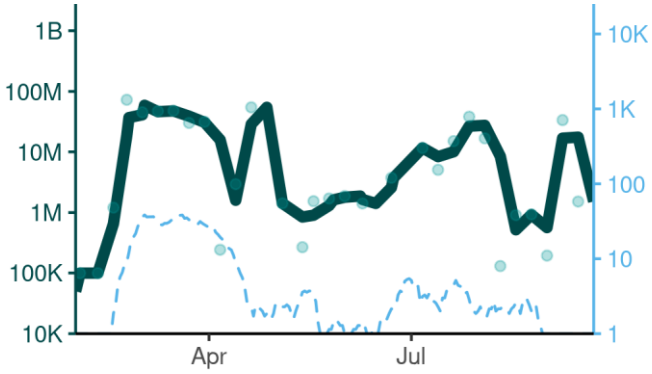


Whakatane *Autosampler 21.0K*

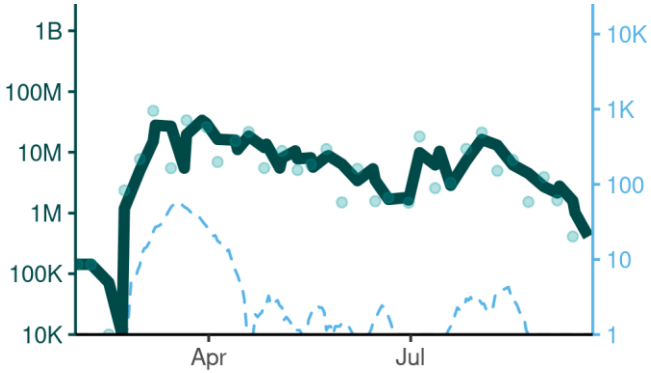


Cases - 7 day rolling average

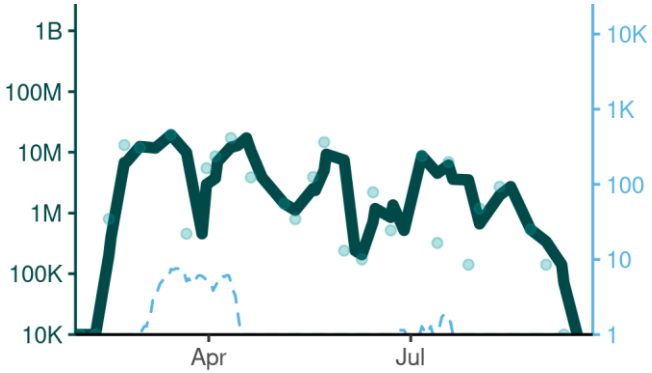
Te Puke *Autosampler 9.7K*



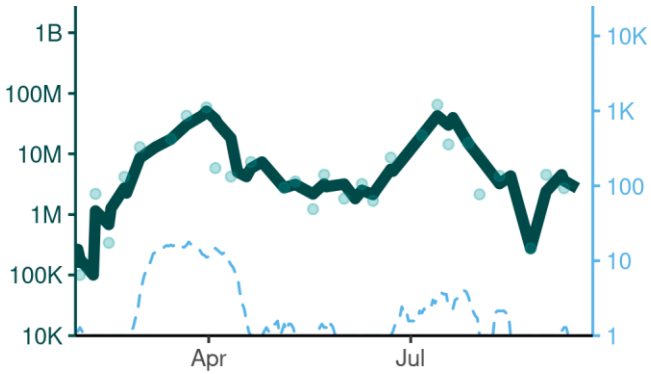
Kawerau *Autosampler 7.0K*



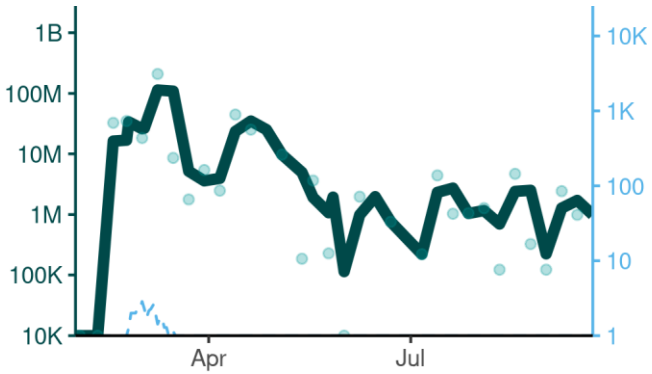
Waihi Beach *Autosampler 3.6K*



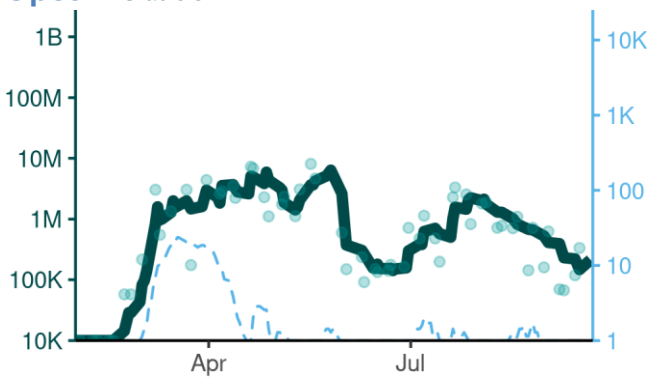
Katikati *Autosampler 5.5K*



Maketu *Autosampler 1.3K*



Opotiki *Grab 3.8K*

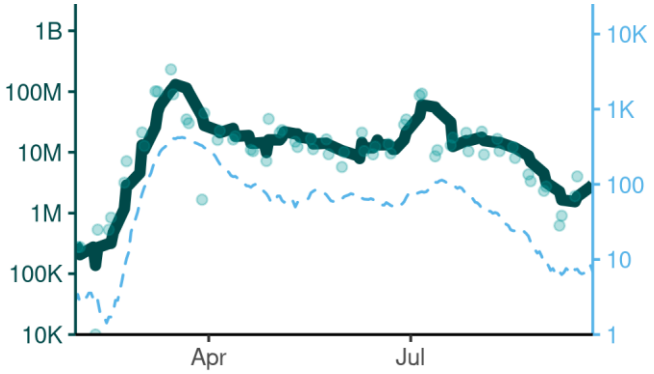


SARS-CoV-2 genome copies / day / person

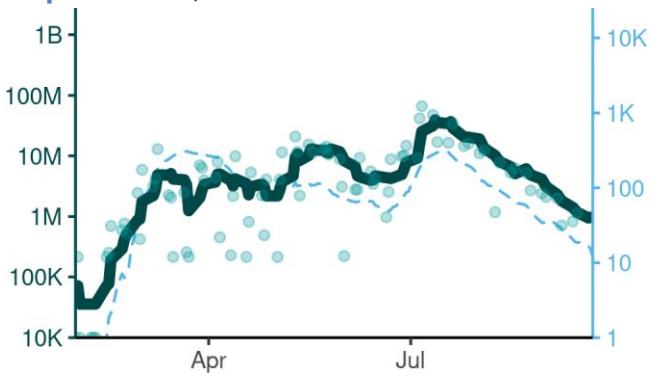
Cases - 7 day rolling average

Hawke's Bay

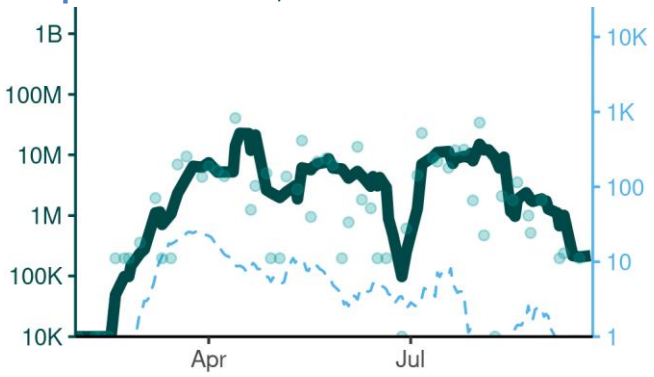
Hastings *Autosampler 80.0K*



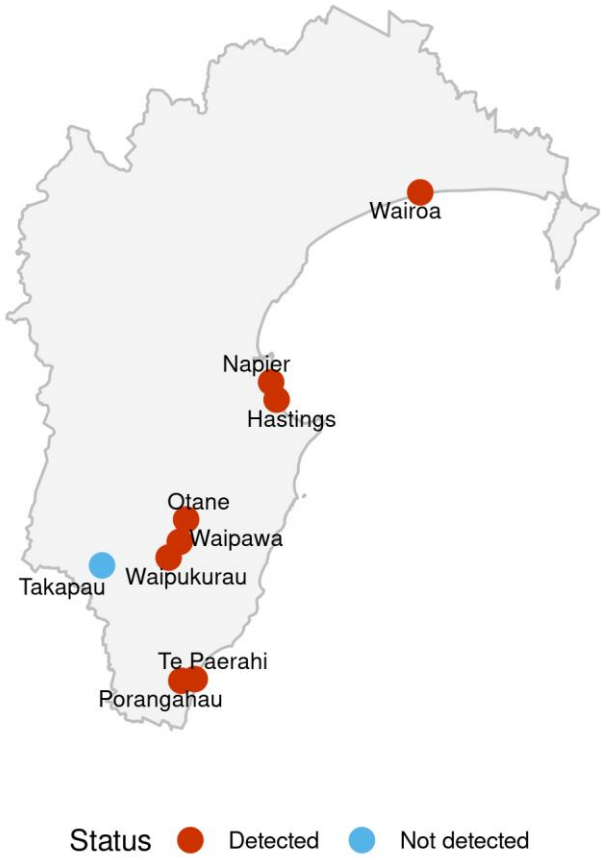
Napier *Autosampler 55.0K*



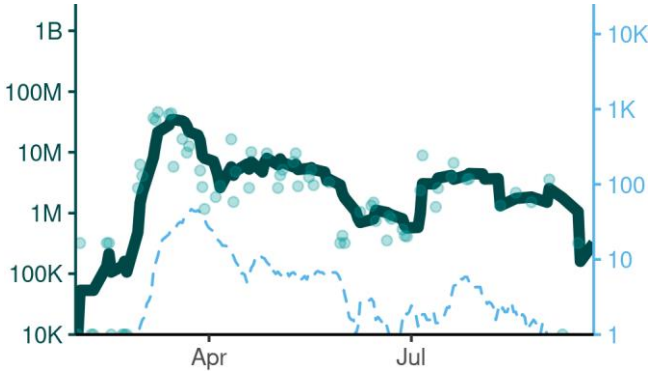
Waipukurau *Autosampler 4.6K*



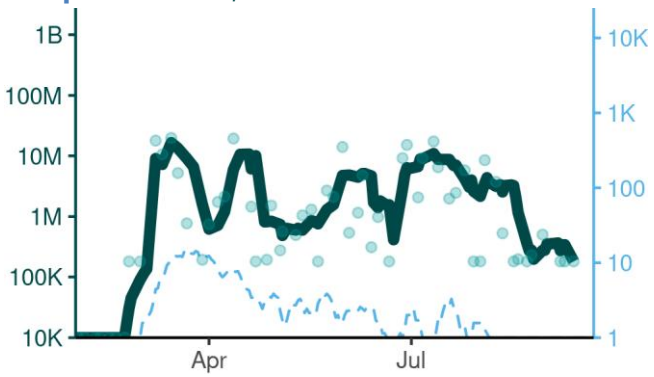
SARS-CoV-2 genome copies / day / person



Wairoa *Grab 4.4K*



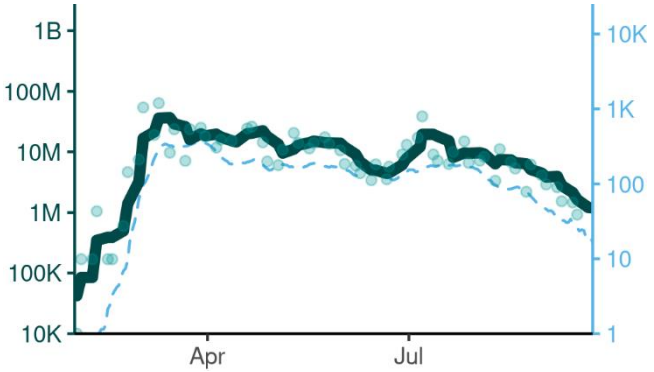
Waipawa *Autosampler 2.2K*



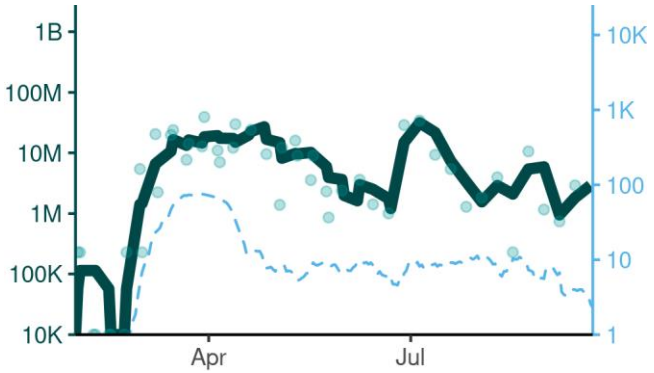
Cases - 7 day rolling average

Taranaki

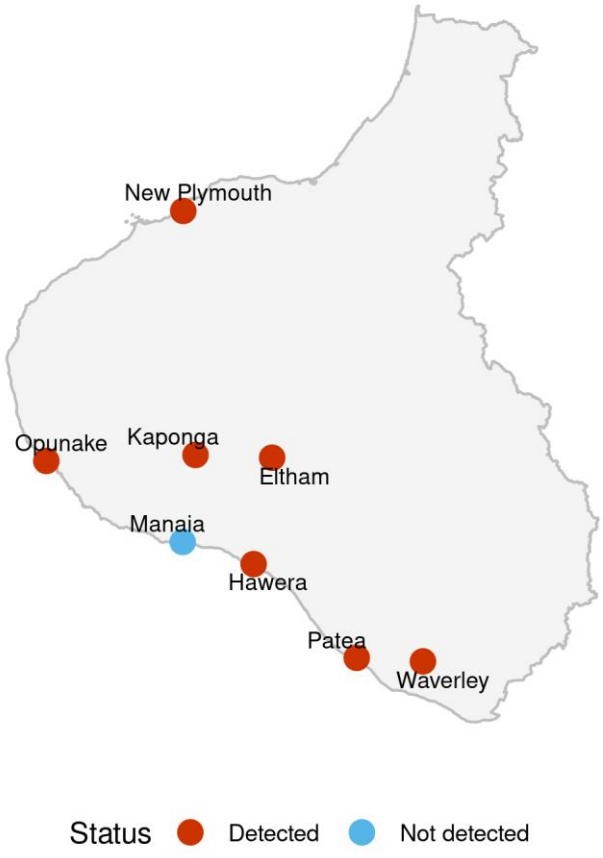
New Plymouth *Autosampler 88.0K*



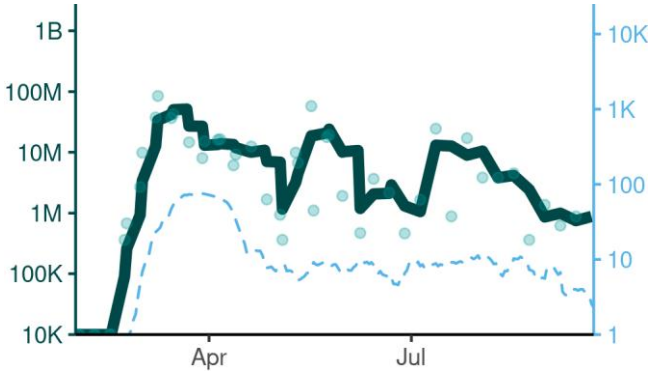
Hawera *Autosampler 12.0K*



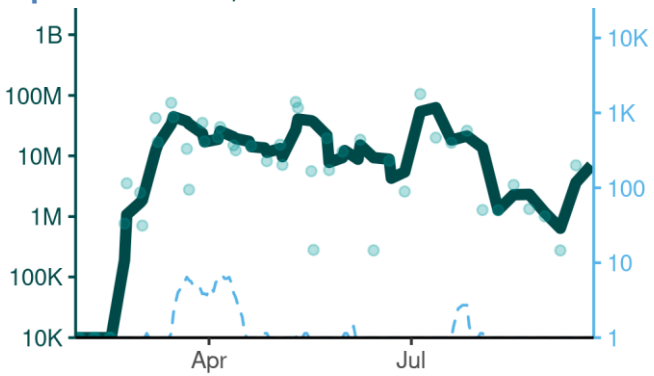
SARS-CoV-2 genome copies / day / person



Eltham *Autosampler 2.0K*

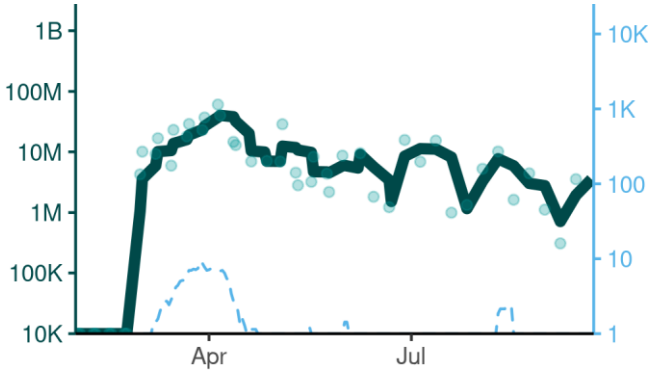


Opunake *Autosampler 1.4K*



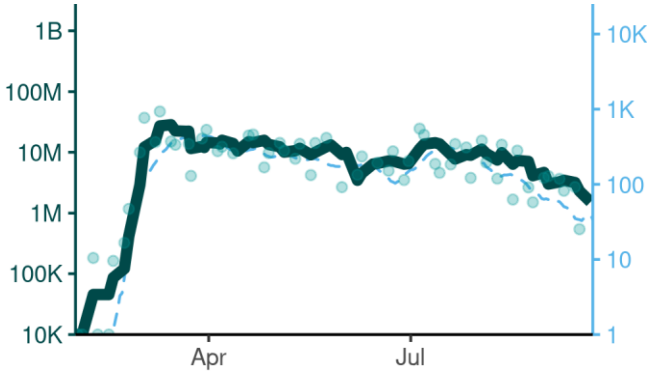
Cases - 7 day rolling average

Patea *Autosampler 1.2K*

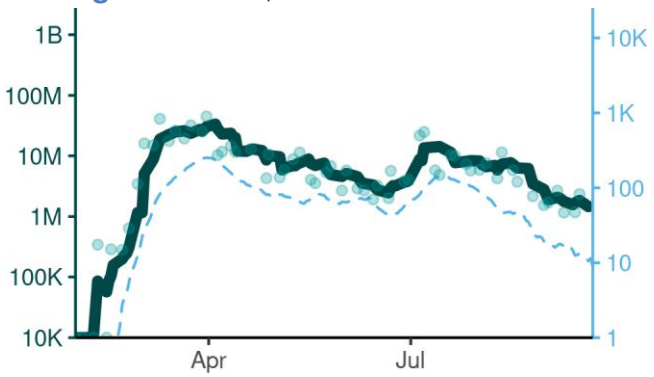


Manawatu-Whanganui

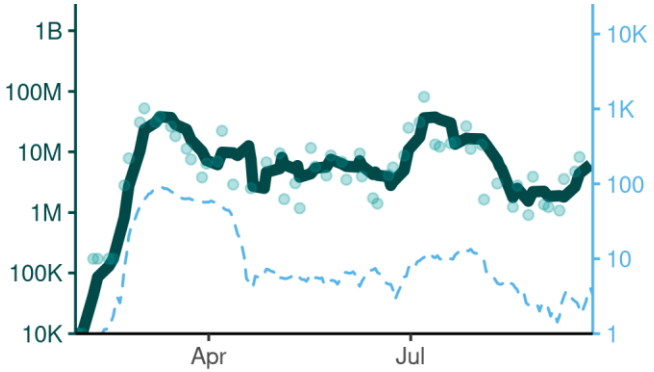
Palmerston North *Autosampler 90.0K*



Whanganui *Autosampler 44.5K*

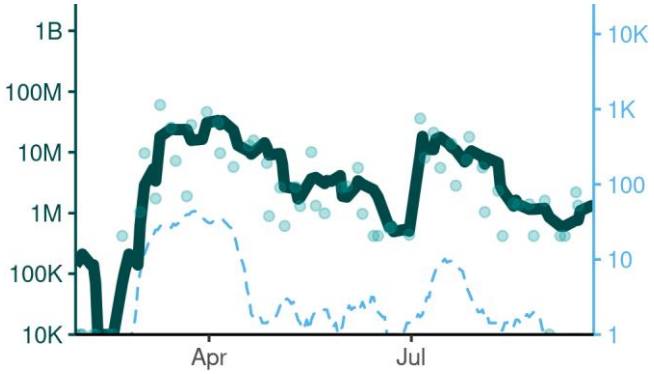


Levin *Autosampler 21.2K*

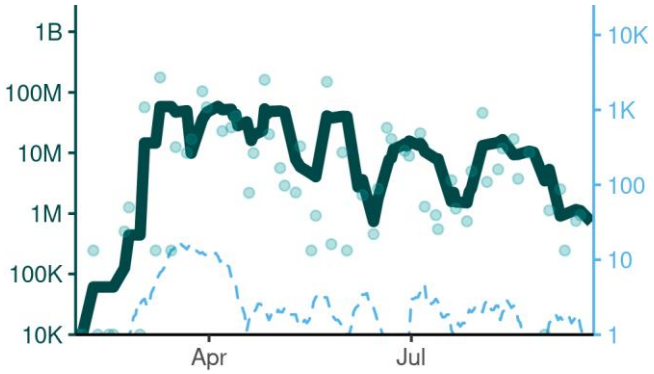


SARS-CoV-2 genome copies / day / person

Dannevirke *Grab 5.7K*

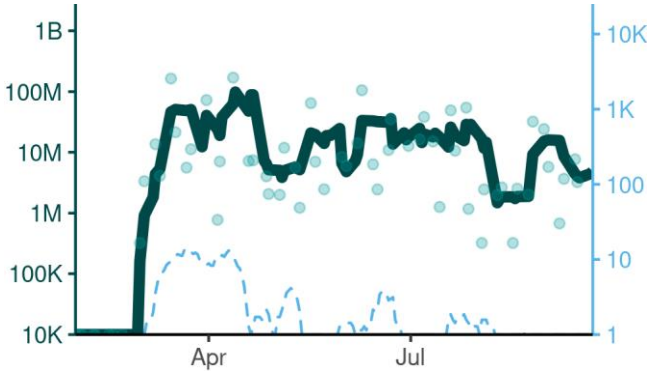


Taumarunui *Grab 4.0K*

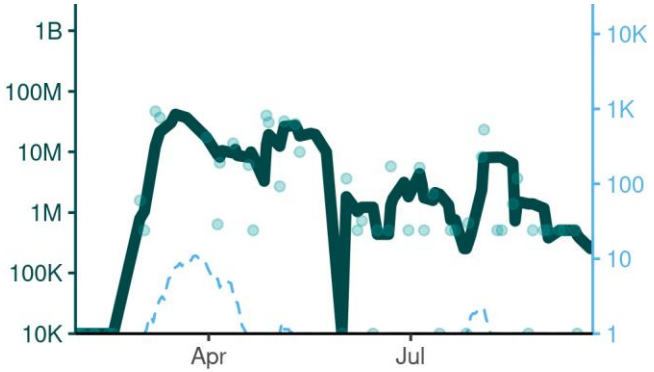


Cases - 7 day rolling average

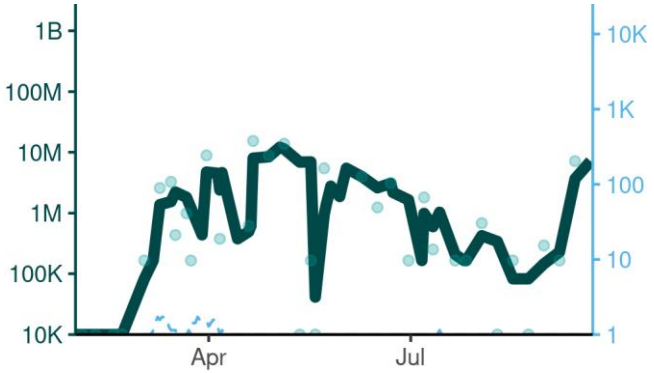
Pahiatua *Grab 2.8K*



Woodville *Grab 1.7K*



Eketahuna *Grab 1.6K*

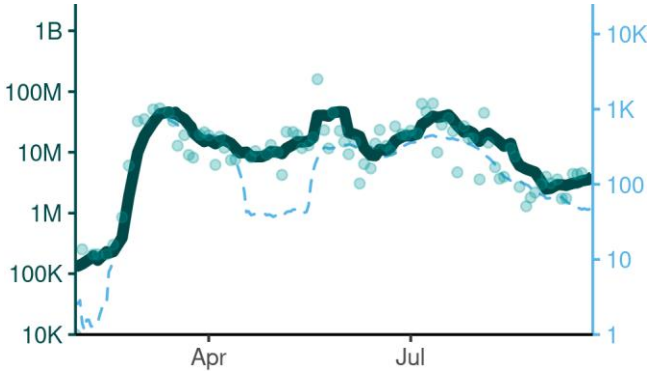


SARS-CoV-2 genome copies / day / person

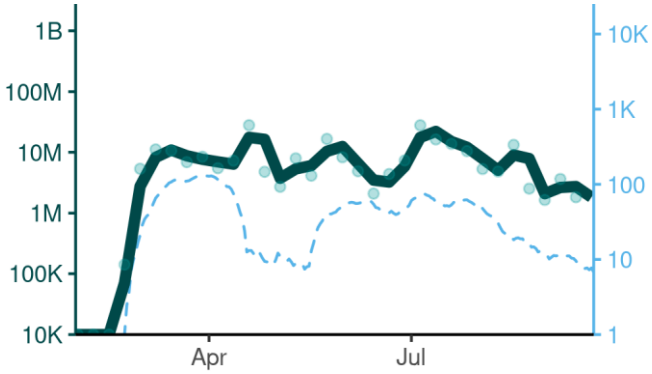
Cases - 7 day rolling average

Wellington

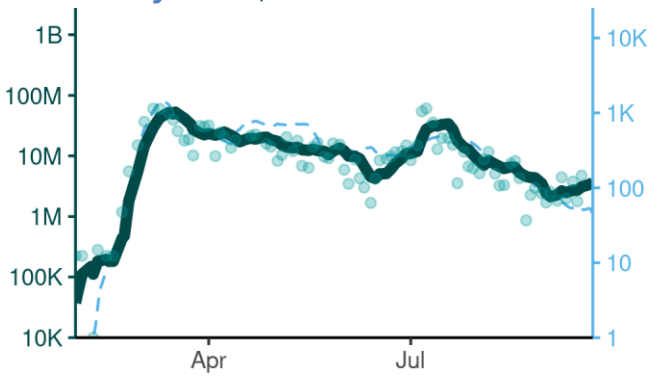
Wellington (Moa Point) *Autosampler 168.0K*



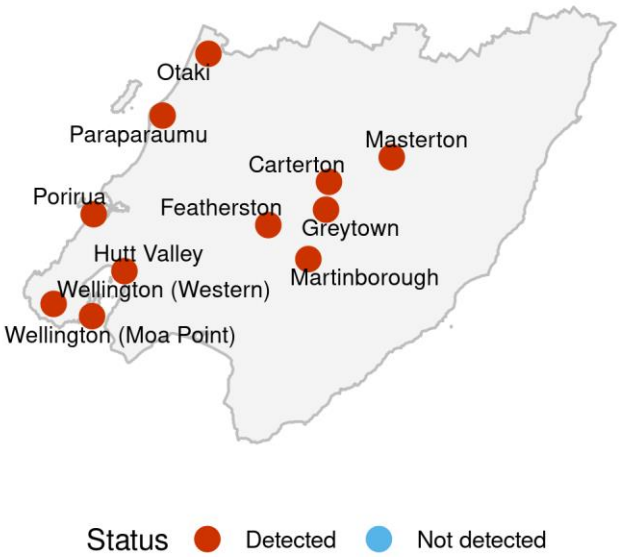
Paraparaumu *Autosampler 49.0K*



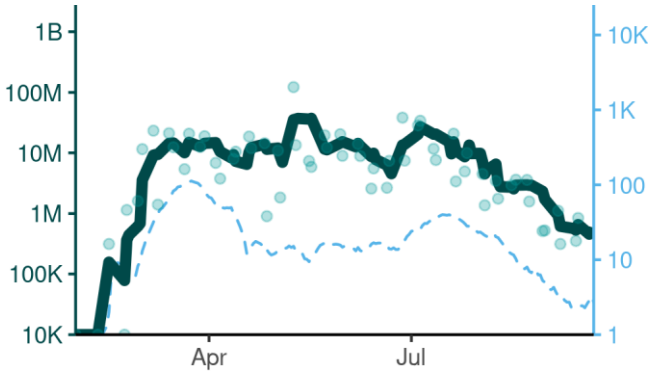
Hutt Valley *Autosampler 133.0K*



SARS-CoV-2 genome copies / day / person

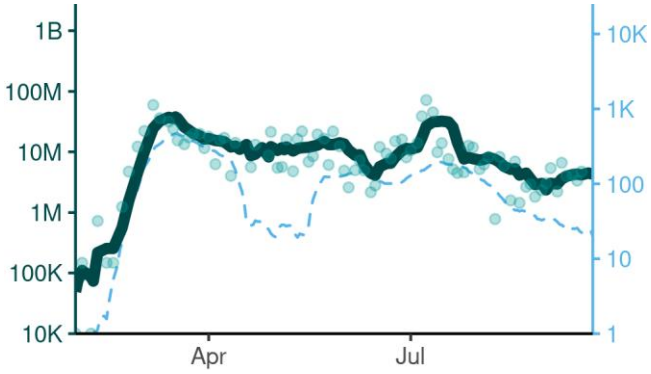


Masterton *Grab 20.7K*

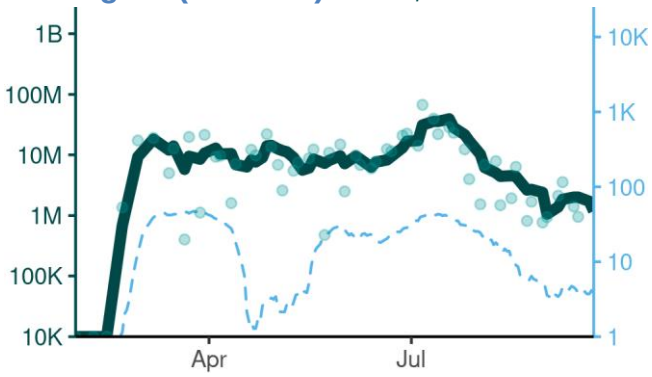


Cases - 7 day rolling average

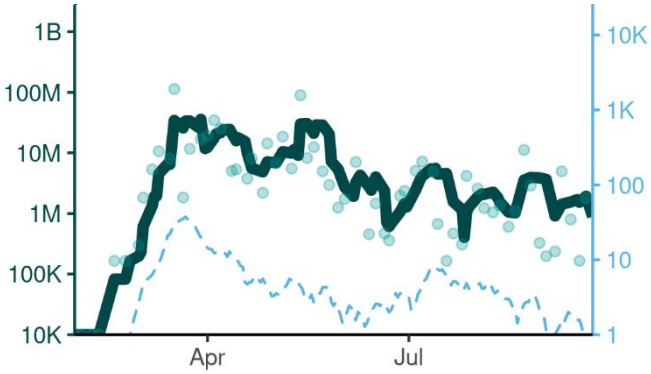
Porirua *Autosampler 85.0K*



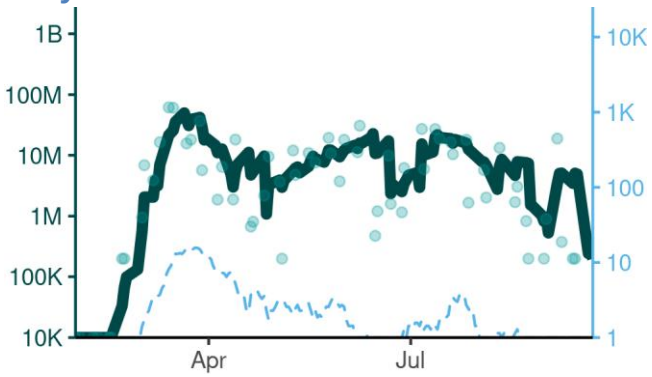
Wellington (Western) *Autosampler 14.0K*



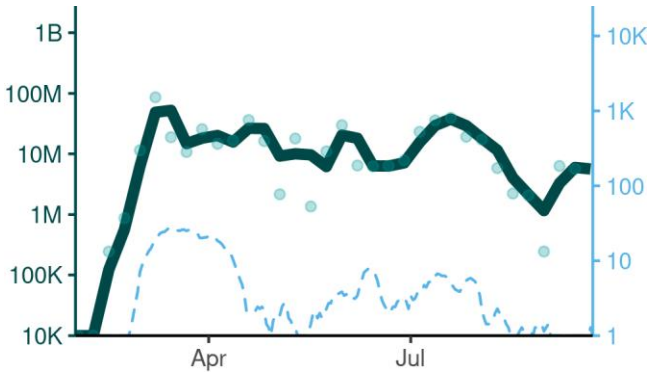
Carterton *Grab 5.8K*



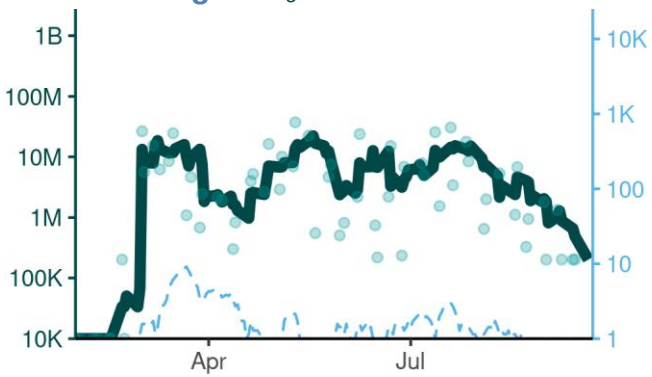
Greytown *Grab 2.4K*



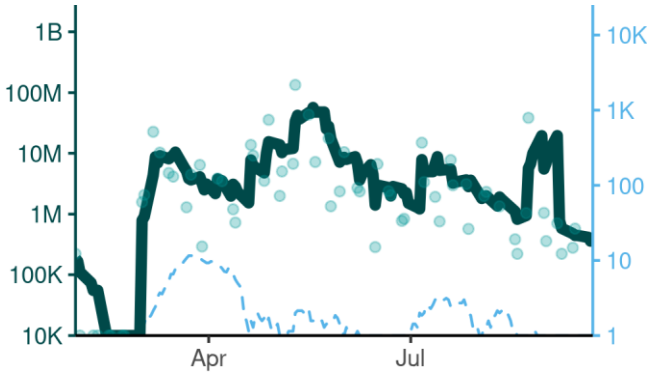
Otaki *Grab 3.5K*



Martinborough *Auto/grab 1.6K*



Featherston *Grab 2.5K*

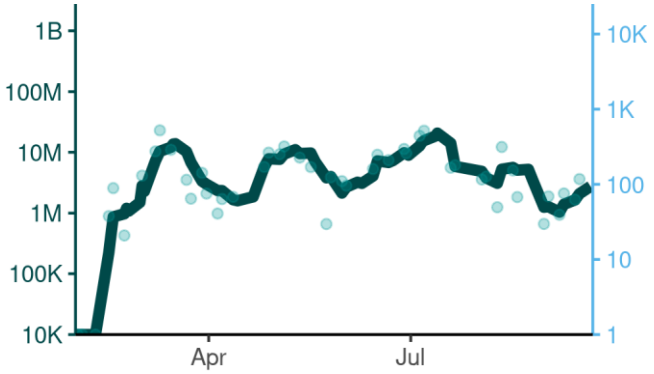


SARS-CoV-2 genome copies / day / person

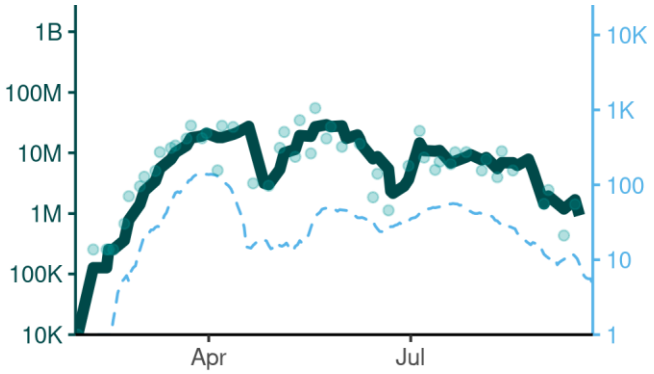
Cases - 7 day rolling average

Tasman, Nelson, and Marlborough

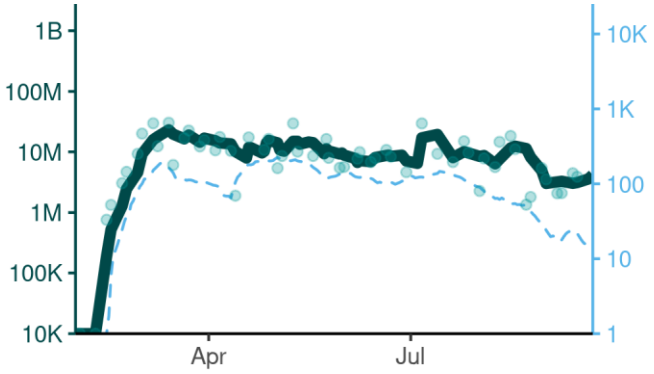
Richmond/Nelson South *Autosampler 60.0K*



Blenheim *Autosampler 31.0K*

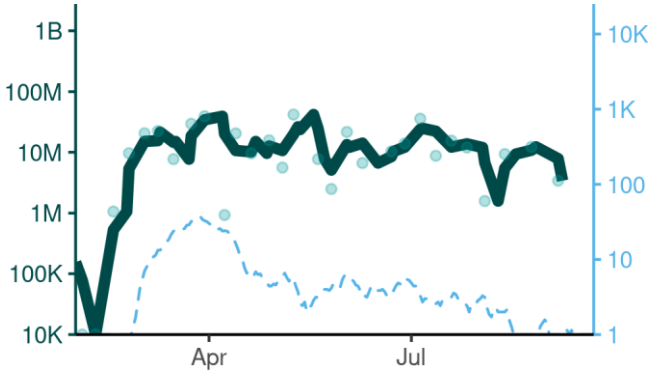


Nelson Central/North *Autosampler 26.0K*

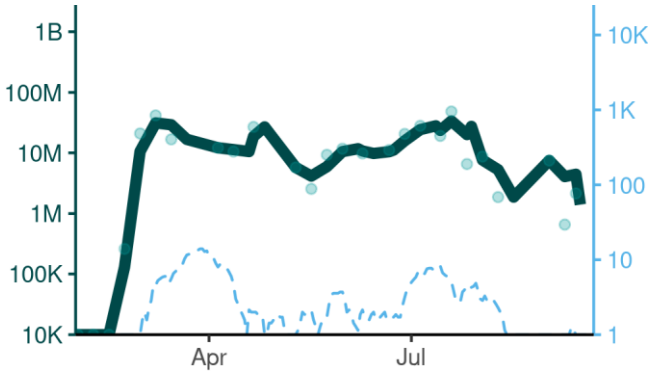


SARS-CoV-2 genome copies / day / person

Motueka *Autosampler 8.3K*



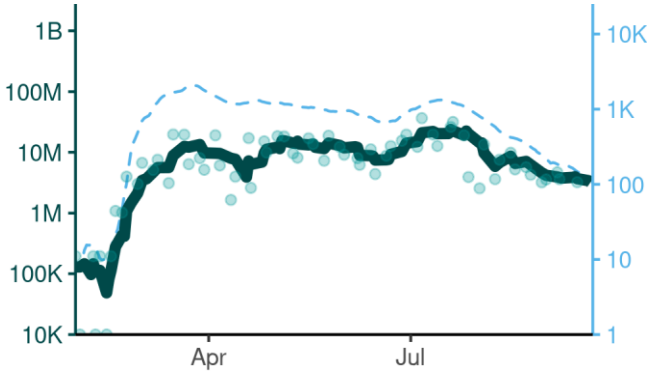
Picton *Autosampler 5.0K*



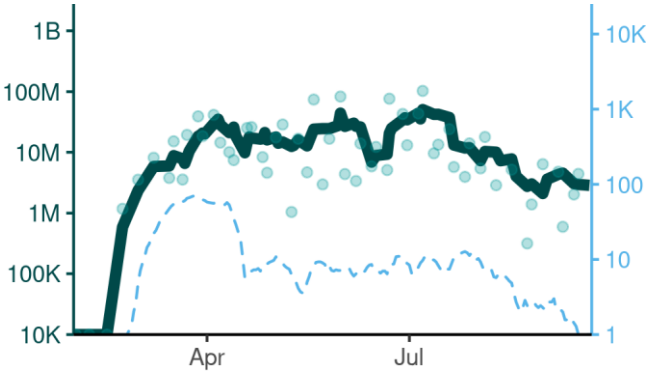
Cases - 7 day rolling average

West Coast and Canterbury

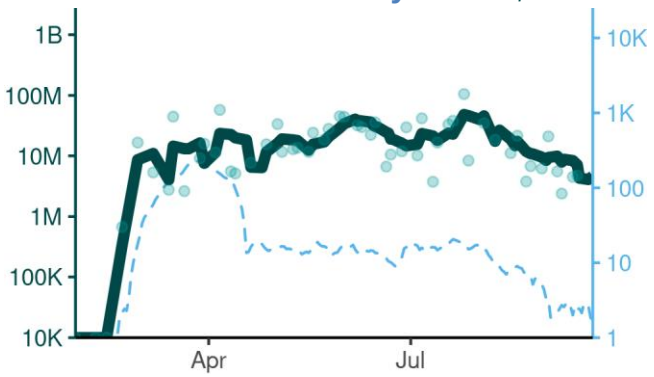
Christchurch *Autosampler 368.0K*



Rangiora *Grab 19.0K*

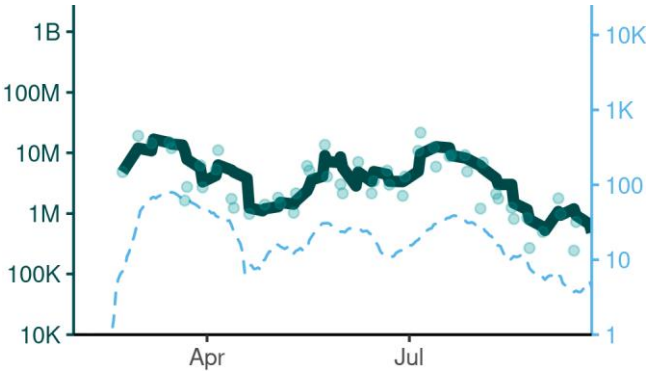


Rolleston & Eastern Selwyn *Autosampler 35.0K*



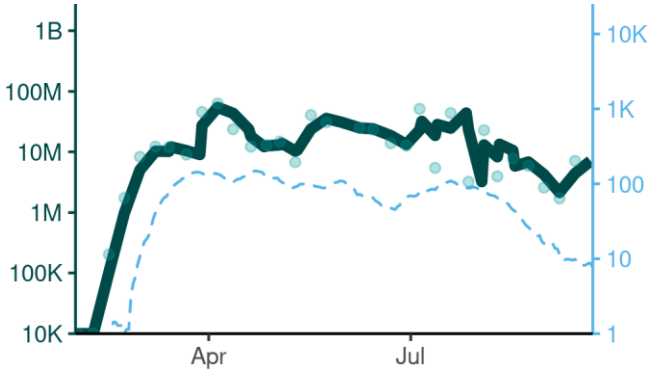
SARS-CoV-2 genome copies / day / person

Ashburton *Autosampler 18.0K*

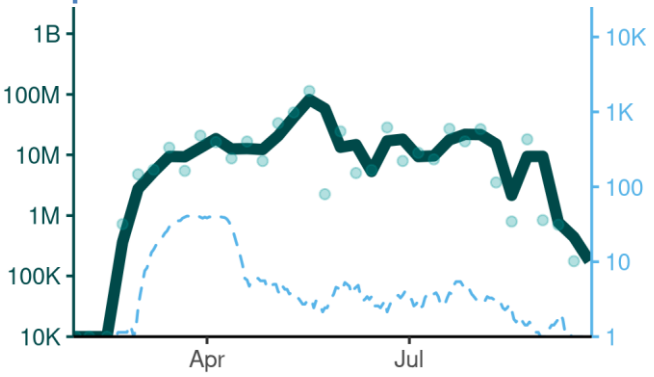


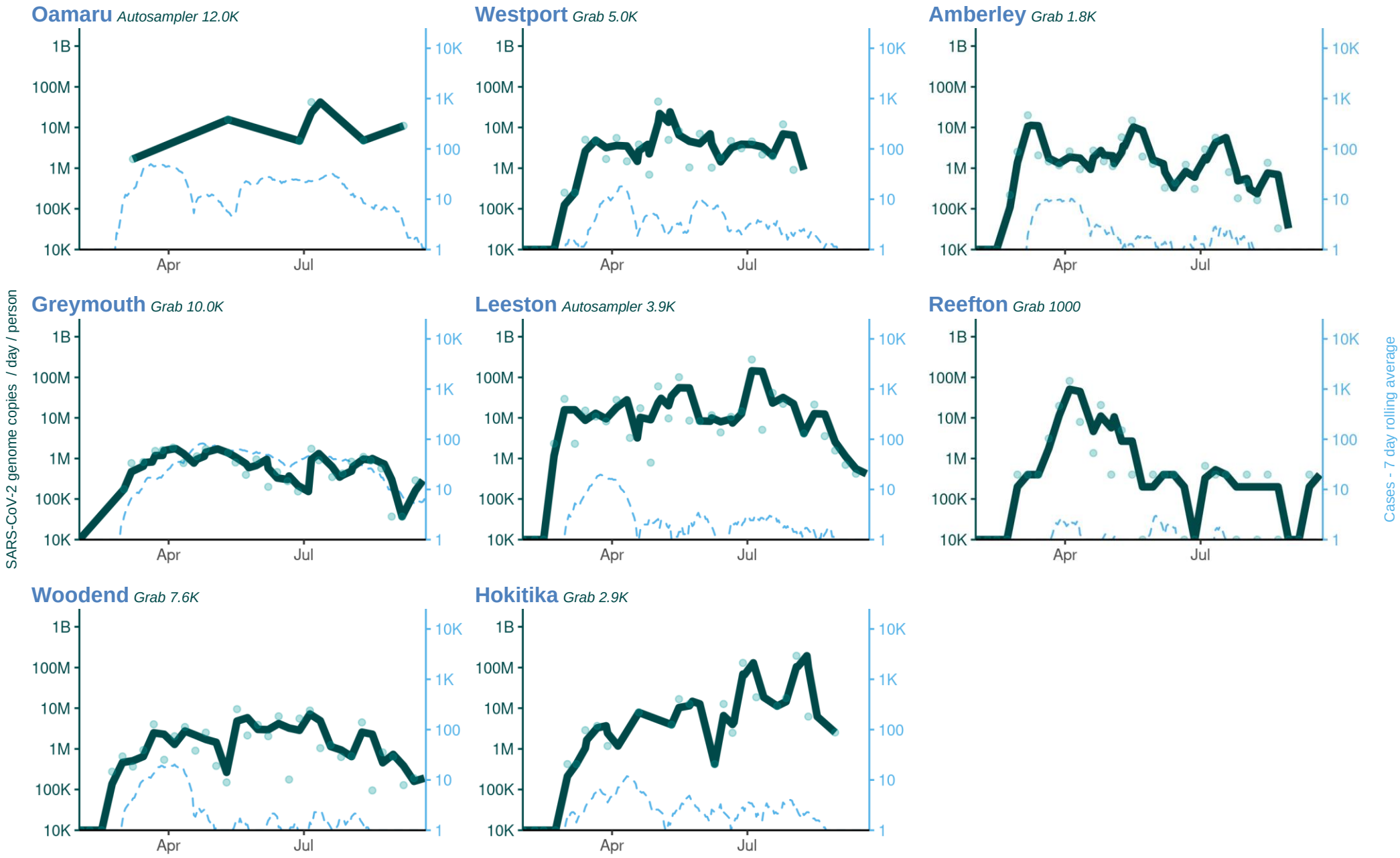
Cases - 7 day rolling average

Timaru *Autosampler 28.0K*



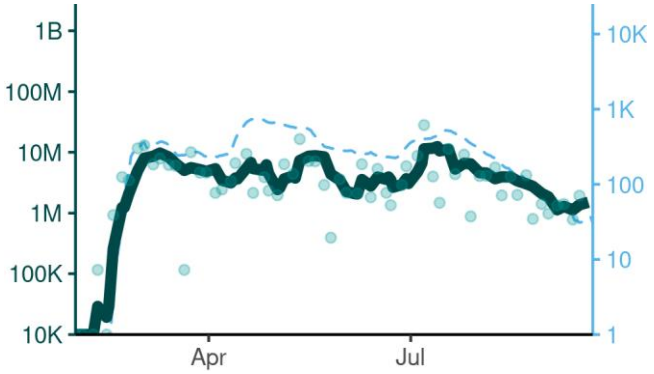
Kaiapoi *Grab 12.5K*



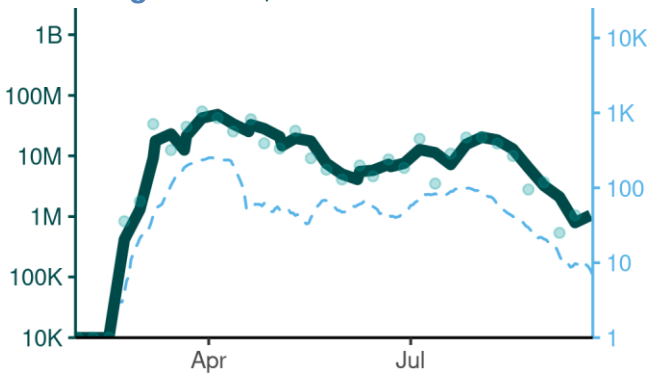

Oamaru Autosampler 12.0K
Westport Grab 5.0K
Amberley Grab 1.8K
Greymouth Grab 10.0K
Leeston Autosampler 3.9K
Reefton Grab 1000
Woodend Grab 7.6K
Hokitika Grab 2.9K
SARS-CoV-2 genome copies / day / person
Cases - 7 day rolling average
1B
100M
10M
1M
100K
10K
1K
100
10
1
Apr
Jul

Otago and Southland

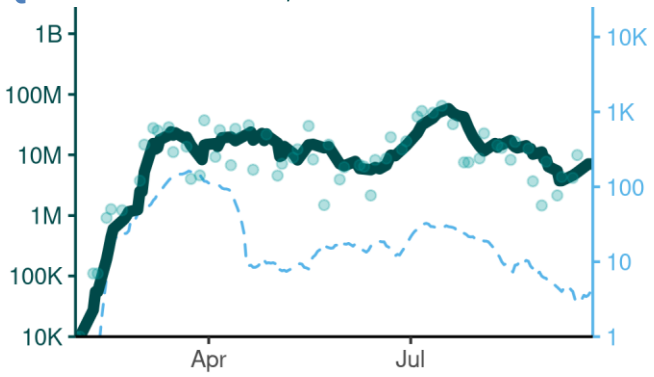
Dunedin (Tahuna) *Autosampler 84.0K*



Invercargill *Autosampler 50.0K*

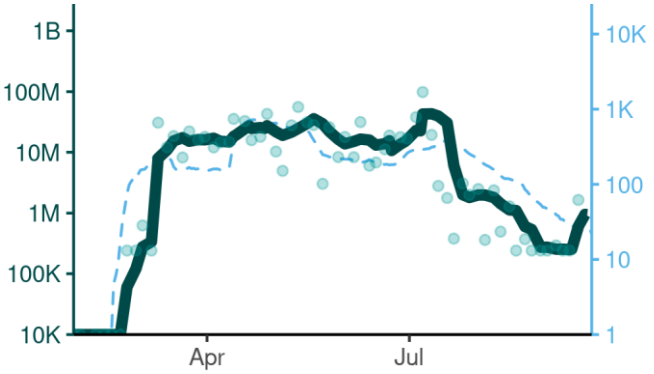


Queenstown *Autosampler 40.0K*

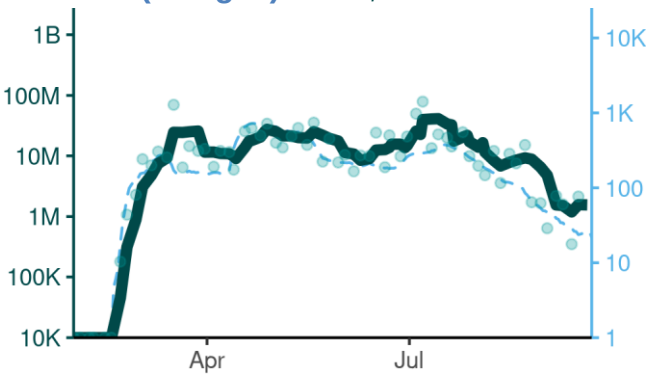


SARS-CoV-2 genome copies / day / person

Dunedin (Green Island) *Autosampler 22.9K*

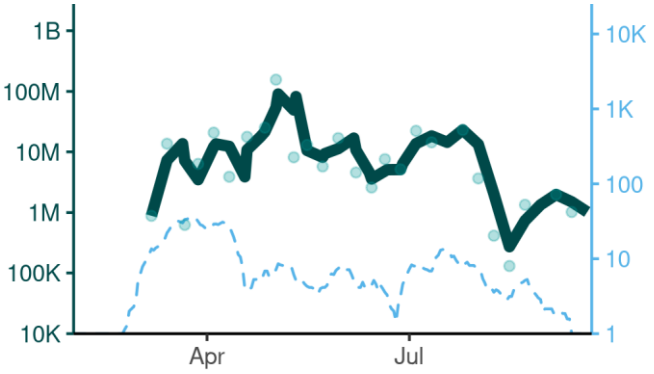


Dunedin (Mosgiel) *Autosampler 14.6K*

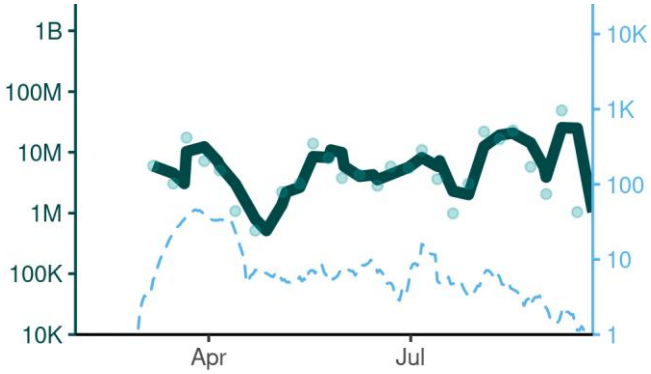


Cases - 7 day rolling average

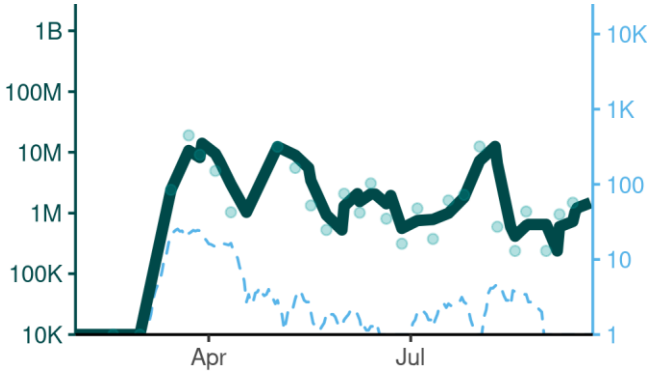
Wanaka *Grab 14.5K*



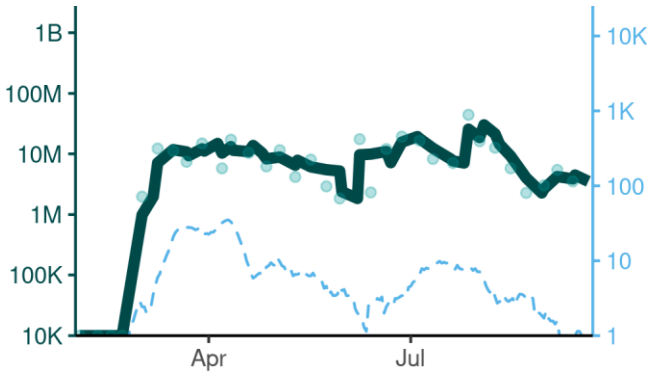
Gore *Autosampler 8.0K*



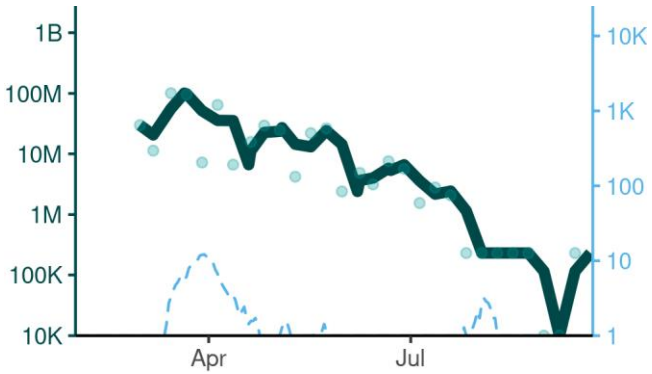
Balclutha *Grab 4.1K*



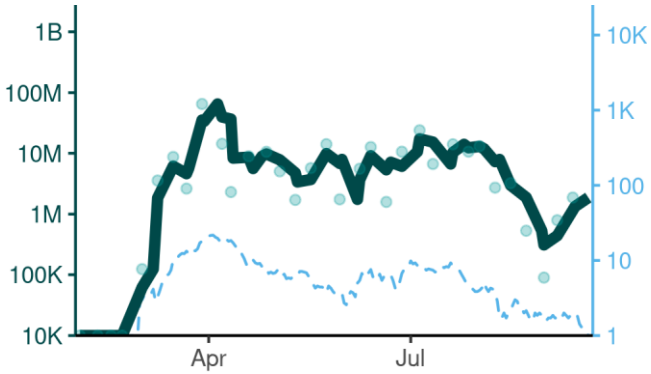
Cromwell *Autosampler 7.1K*



Bluff *Autosampler 2.0K*



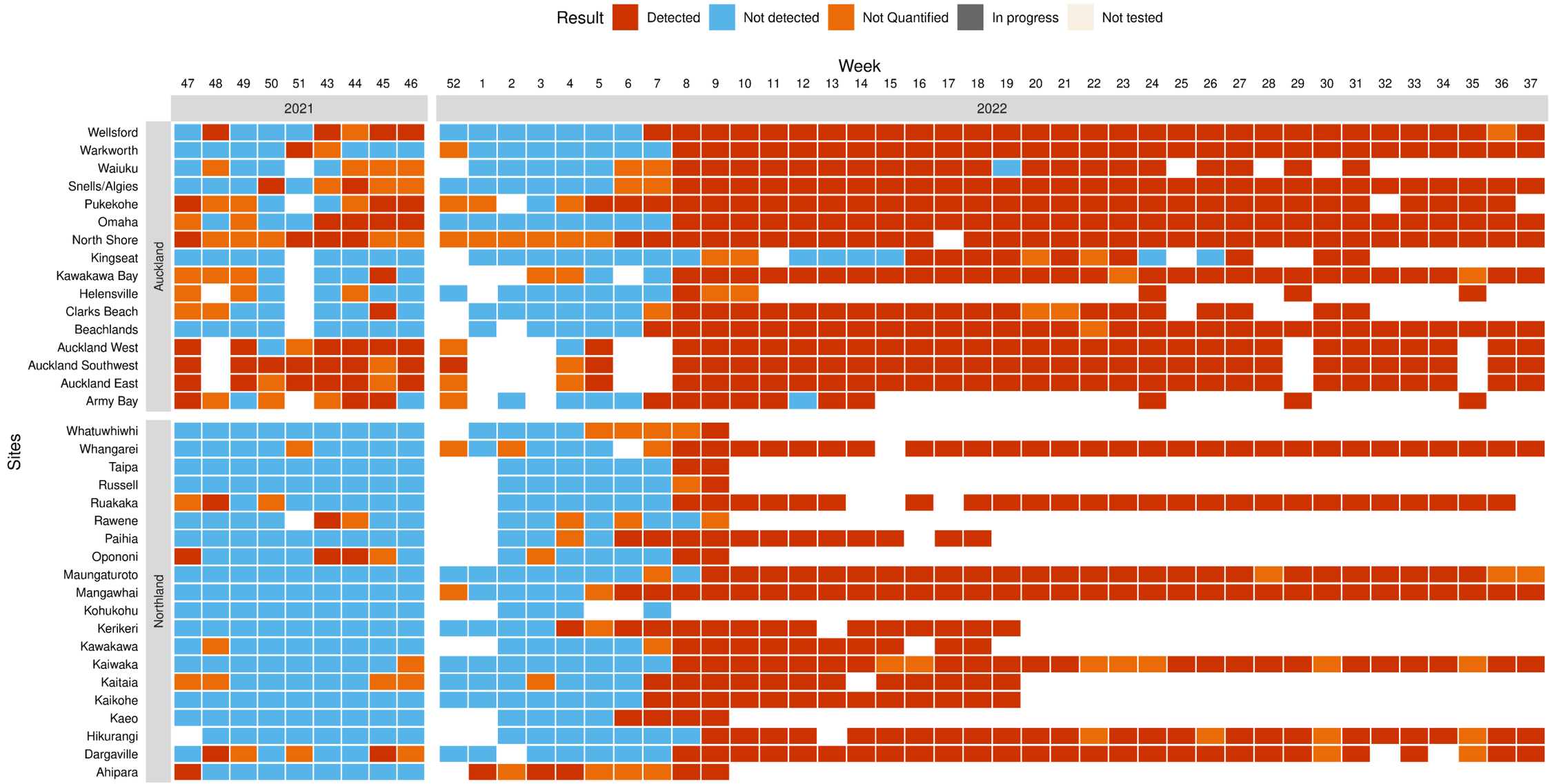
Alexandra *Autosampler 6.2K*

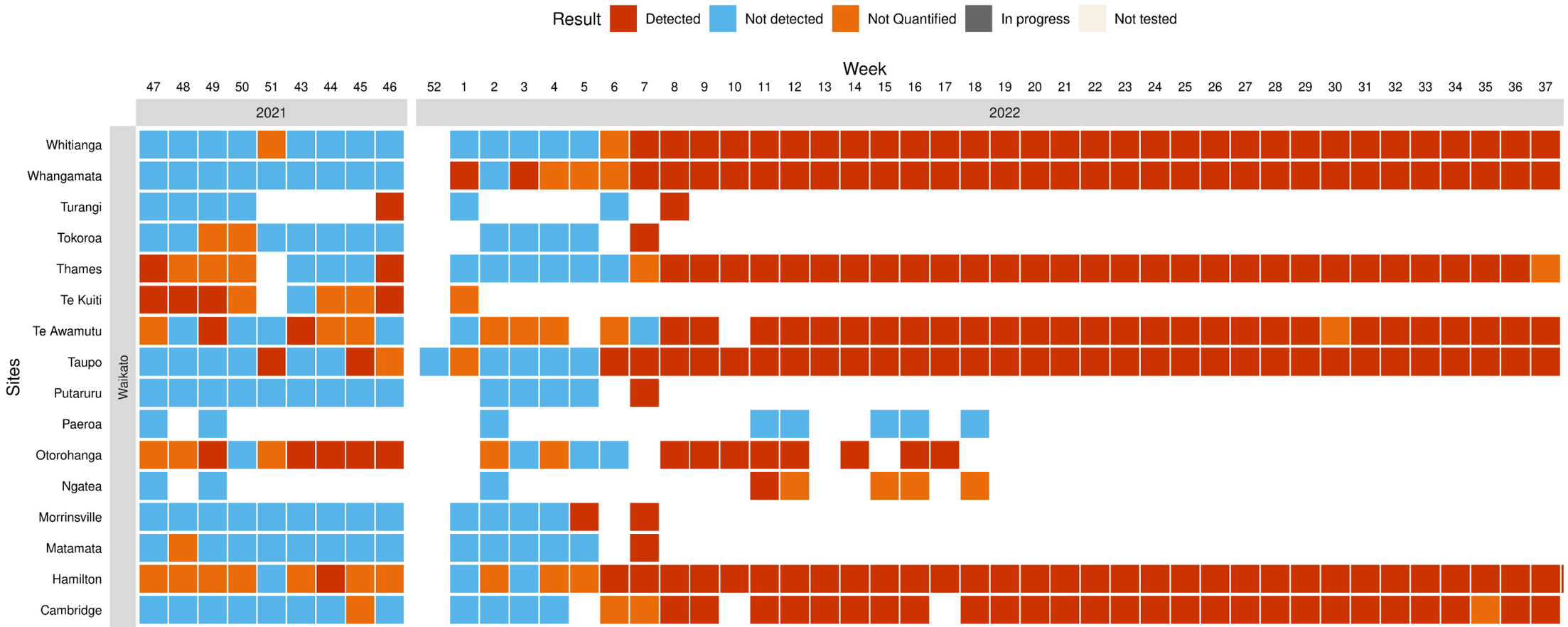


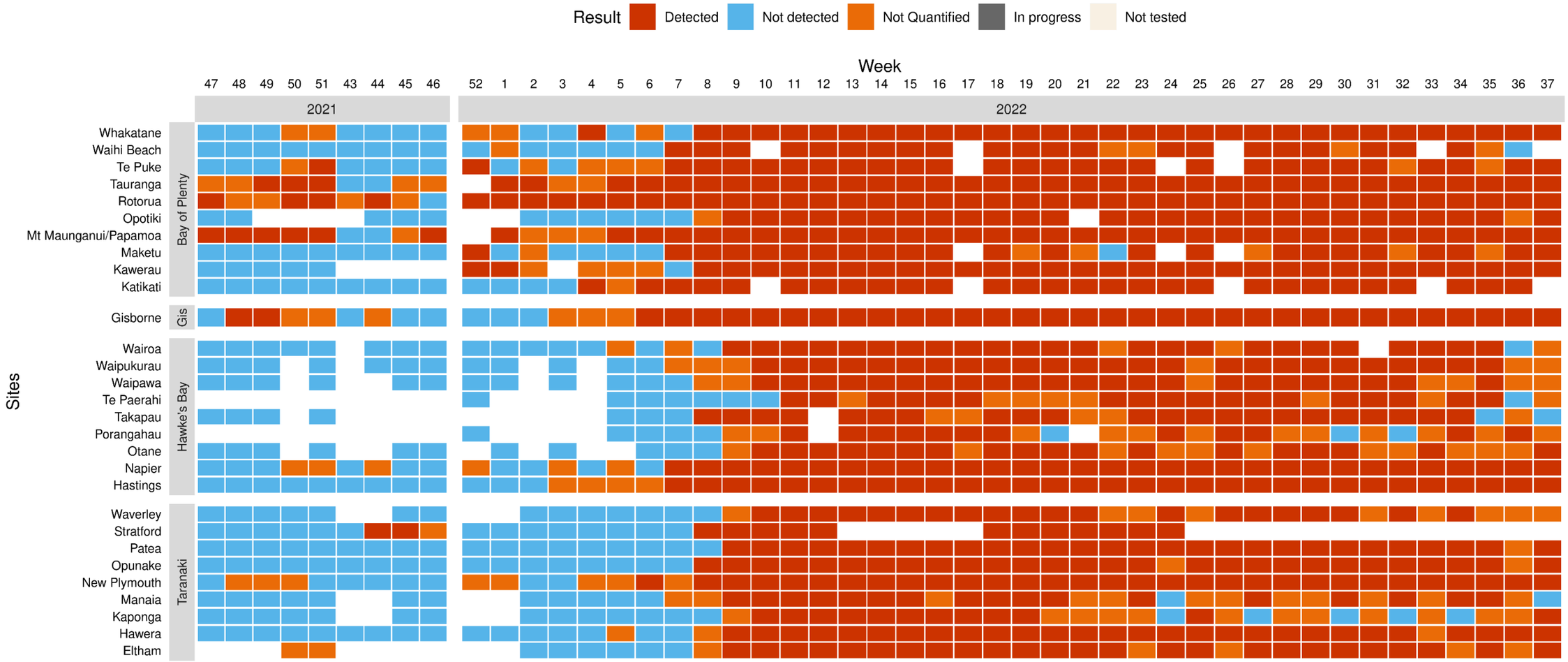
SARS-CoV-2 genome copies / day / person

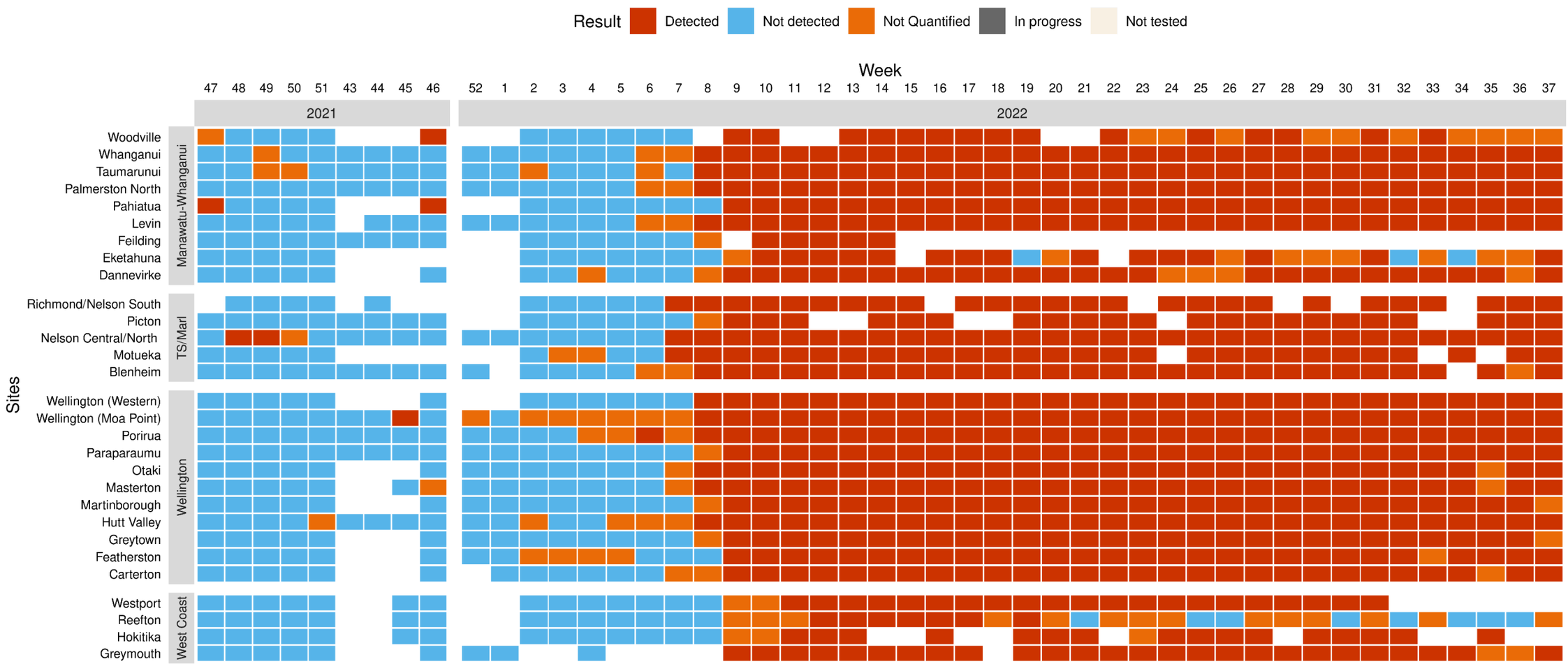
Cases - 7 day rolling average

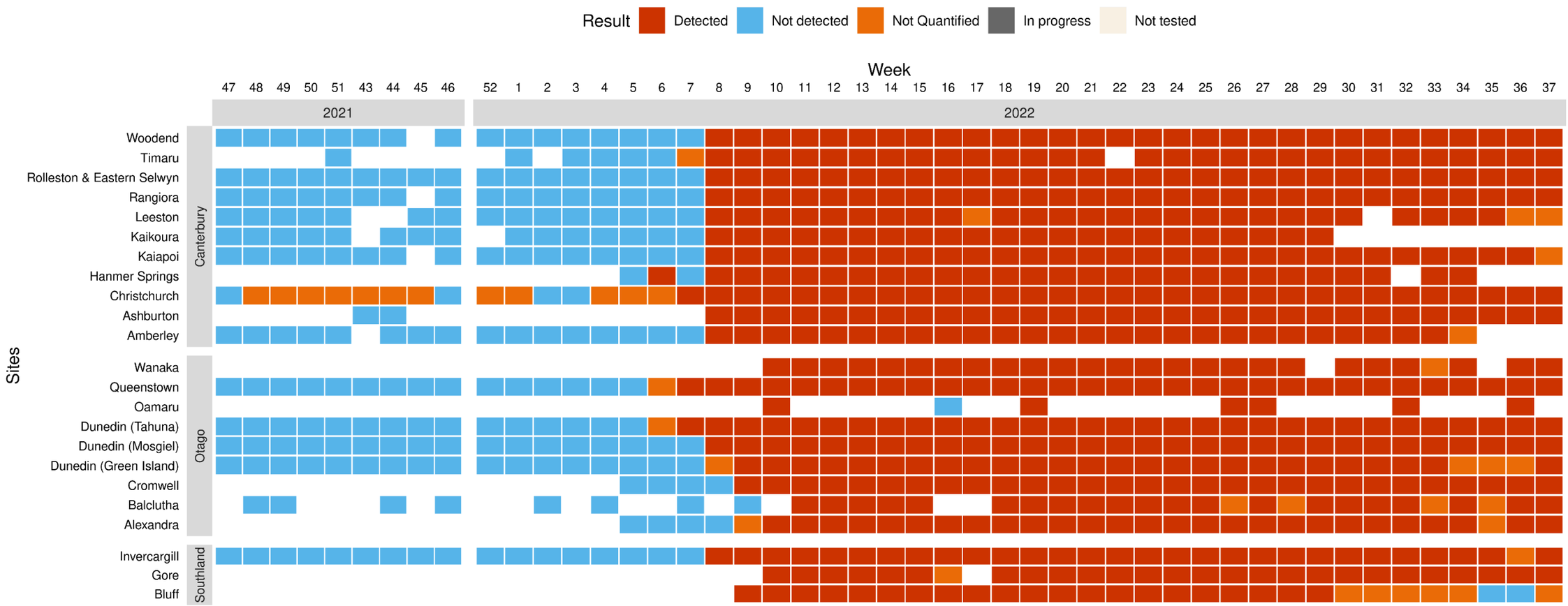
Table 2: Weekly summary of Wastewater Sampling Results for SARS-CoV-2




Result
Detected
Not detected
Not Quantified
In progress
Not tested
Week
47 48 49 50 51 43 44 45 46 52 1 2 3 4 5 6 7 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
2021
2022
Sites
Waikato
Whitianga
Whangamata
Turangi
Tokoroa
Thames
Te Kuiti
Te Awamutu
Taupo
Putaruru
Paeroa
Otorohanga
Ngatea
Morrinsville
Matamata
Hamilton
Cambridge


Result
Detected
Not detected
Not Quantified
In progress
Not tested
Week
47 48 49 50 51 43 44 45 46 52 1 2 3 4 5 6 7 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
2021
2022
Sites
Bay of Plenty
Whakatane
Waihi Beach
Te Puke
Tauranga
Rotorua
Opotiki
Mt Maunganui/Papamoa
Maketu
Kawerau
Katikati
Gis
Gisborne
Hawke's Bay
Wairoa
Waipukurau
Waipawa
Te Paerahi
Takapau
Porangahau
Otane
Napier
Hastings
Taranaki
Waverley
Stratford
Patea
Opunake
New Plymouth
Manaia
Kaponga
Hawera
Eltham


Result
Detected
Not detected
Not Quantified
In progress
Not tested
Week
47 48 49 50 51 43 44 45 46 52 1 2 3 4 5 6 7 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
2021
2022
Sites
Manawatu-Whanganui
Woodville
Whanganui
Taumarunui
Palmerston North
Pahiatua
Levin
Feilding
Eketahuna
Dannevirke
TS/Marl
Richmond/Nelson South
Picton
Nelson Central/North
Motueka
Blenheim
Wellington
Wellington (Western)
Wellington (Moa Point)
Porirua
Paraparaumu
Otaki
Masterton
Martinborough
Hutt Valley
Greytown
Featherston
Carterton
West Coast
Westport
Reefton
Hokitika
Greymouth


Result
Detected
Not detected
Not Quantified
In progress
Not tested
Week
47 48 49 50 51 43 44 45 46 52 1 2 3 4 5 6 7 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
2021
2022
Sites
Canterbury
Woodend
Timaru
Rolleston & Eastern Selwyn
Rangiora
Leeston
Kaikoura
Kaiapoi
Hanmer Springs
Christchurch
Ashburton
Amberley
Otago
Wanaka
Queenstown
Oamaru
Dunedin (Tahuna)
Dunedin (Mosgiel)
Dunedin (Green Island)
Cromwell
Balclutha
Alexandra
Southland
Invercargill
Gore
Bluff

Acknowledgements

This work represents the combined efforts of a large number of individuals and organisations.

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

The wastewater analysis has been undertaken at ESR by a team which may on any given week include contributions from Joanne Chapman, Dawn Croucher, Joanne Hewitt, Joycelyn Ho, Anower Jabed, Susan Lin, Olivia Macrae, Ashley McDonald, Andrew Ng, Ashley Orton, Paula Scholes and Fatiha Sulthana. Data science analysis, visualisation and reporting is the result of team effort from: Franco Andrews, Bridget Armstrong, Raewyn Campbell, Gerhard de Beer, Richard Dean, Brent Gilpin, Joanne Hewitt, Dawen Li, Helen Morris and Michael Bunce. Ongoing support for this work from the Ministry of Health and ESR management is appreciated.

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. A number of 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 one of the ESR laboratories (Porirua or Christchurch). 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).

In future, SARS-CoV-2 RNA concentrations will also be normalised by testing for the presence of pepper mild mottled virus (PMMoV). PMMoV is a virus that infects peppers but not humans. Consumption of peppers or pepper products, such as chilli sauce, means that PMMoV is detected in wastewater – normally at very high concentrations. Therefore, PMMoV has been found to be a useful proxy for the amount of faecal material in a wastewater sample. For normalisation, the concentration of SARS-CoV-2 RNA is divided by that of PMMoV in each sample. Different normalisation methods may result in changes to some data points, but trends are unlikely to change significantly.

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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