

## National Wastewater Surveillance Programme - COVID-19

Weeks 48 & 49 (Weeks ending 04 December & 11 December 2022)

Report prepared on 14 December 2022

**100%**

sites tested in the last 2 weeks had SARS-CoV-2 detected (86/86 sites)

**73%**

NZ population covered by wastewater testing

**Omicron  
BA.2.75\***

Most prevalent variants detected

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### Nationally, SARS-CoV-2 levels in wastewater have increased over the last fortnight

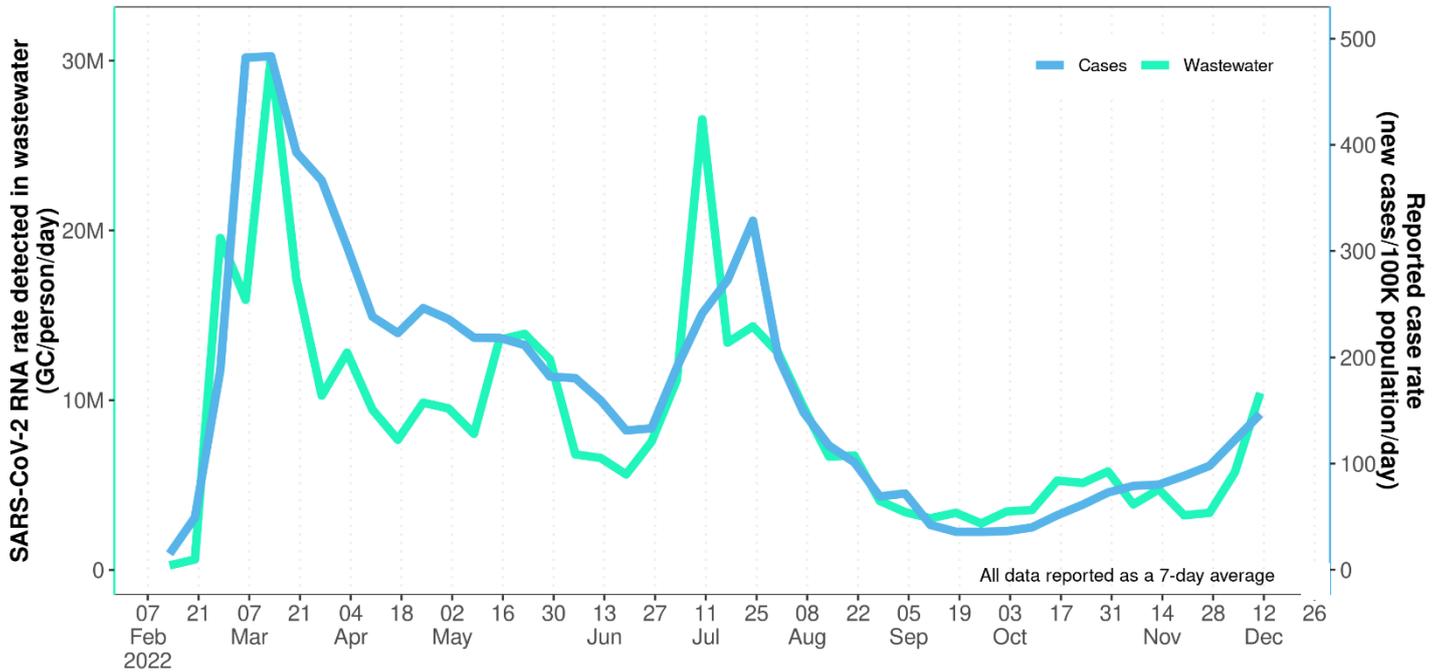
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- In week 49 compared to week 48, 58% of sites showed an increase in SARS-CoV-2 levels while 20% of sites showed a decrease.
- Compared to a month ago (week 45, week ending 13 November 2022), 67% of sites show an increase in SARS-CoV-2 levels while 15% sites showed a decrease in SARS-CoV-2.
- BA.2.75\* (~58%), BA.4/BA.5 (~19%) and BQ.1.1 (~18%) were the main variants detected in wastewater this fortnight<sup>1</sup>. Detections of XBB (~2%) and XBC (~3%) were steady.

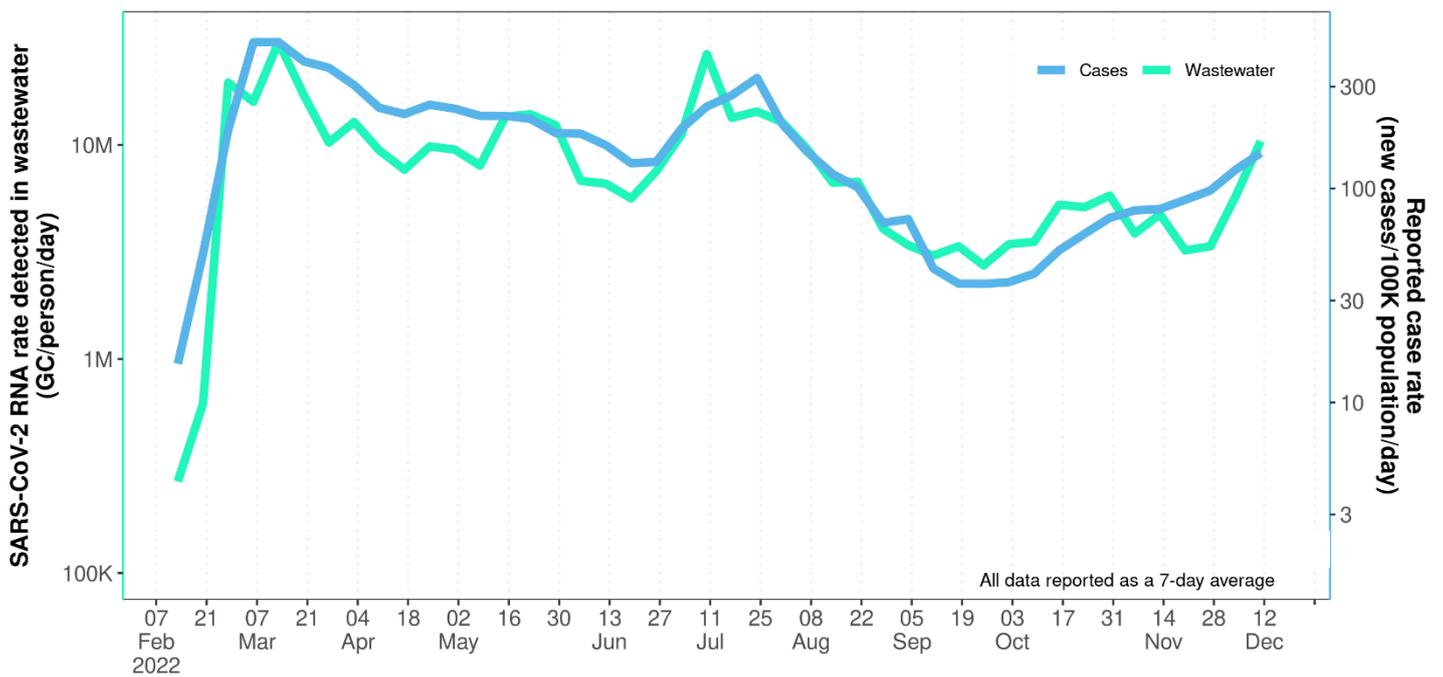
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<sup>1</sup> BA.2.75\* refers to BA.2.75/CH.1.1/BR.2 constellation of subvariants

**Figure 1A**



**Figure 1B**



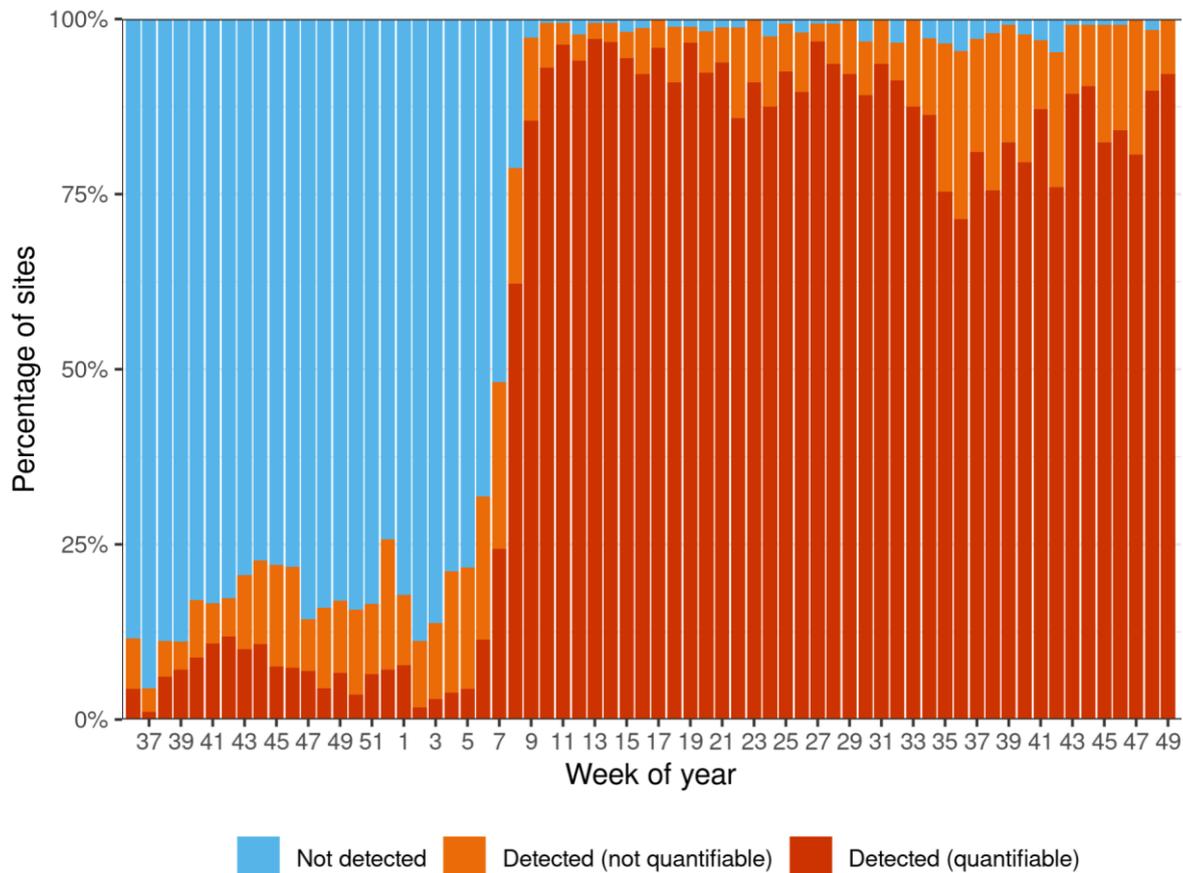
**Figure 1.** National timeseries of estimated SARS-CoV-2 genome copies (GC) in wastewater rate (GC/person/day, green line) and reported case rate (new cases/100,000 population/day, blue line). Numbers in the points are the week of the year. A. Linear scale. B. Log<sub>10</sub> scale. Data reported as 7-day average.

## Results for Weeks 48 & 49 (Weeks ending 04 December & 11 December 2022)

In the two weeks ending 11 December 2022, 249 samples were collected from 86 locations across New Zealand.

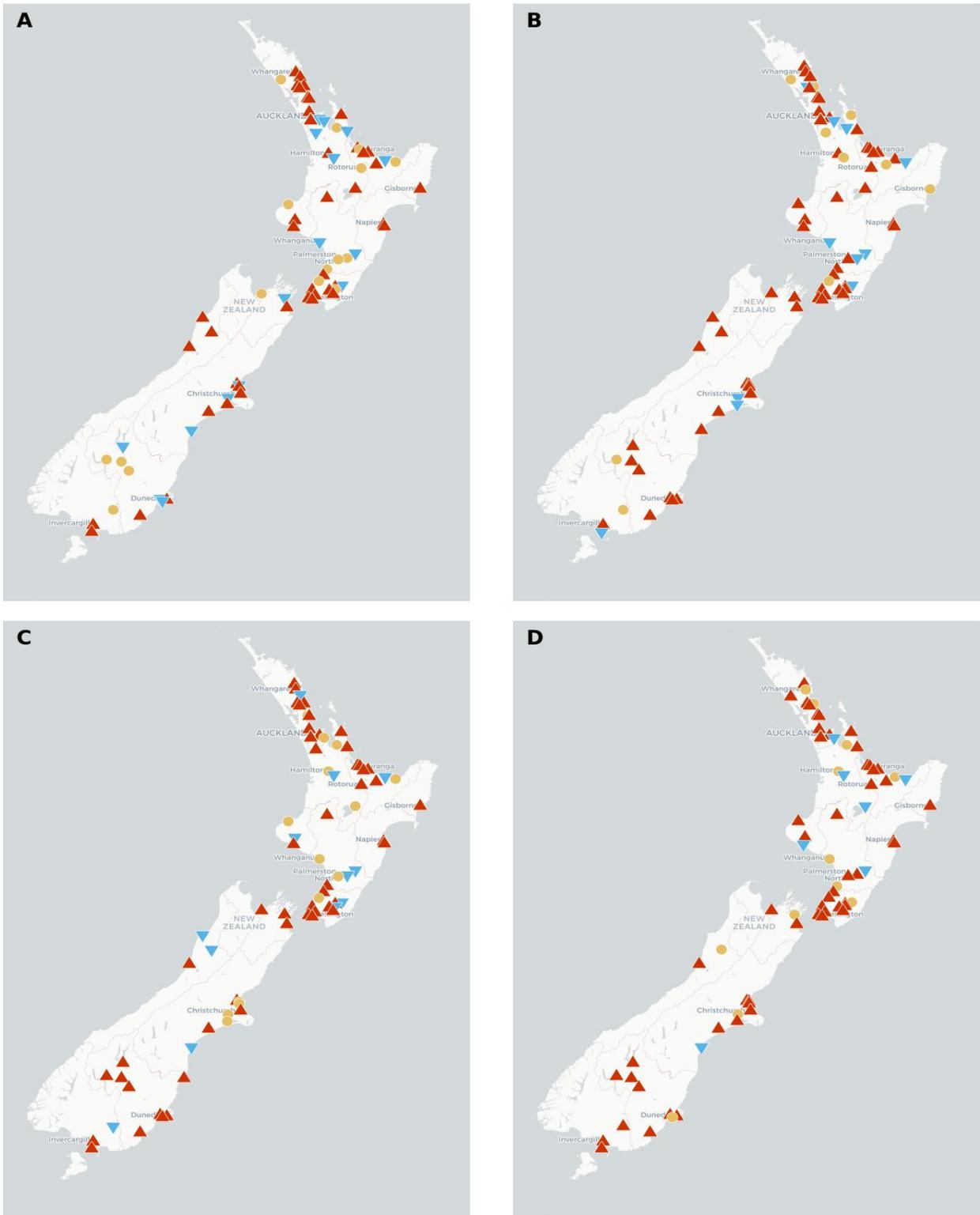
As of 14 December 2022, testing of four samples collected during week ending 11 December 2022 (week 49) was in progress and so are not reported (Table 2).

SARS CoV-2 RNA was detected/detected (not quantified) in 243/245 (99%) of tested samples from 86/86 (100%) of sites (Figure 2, Table 2).



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





**Figure 4.** Comparison of SARS-CoV-2 levels for the week ending 11 December 2022, 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/>.

## Wastewater Variant Analysis

In collaboration with Wilderlab, ESR generated the variant analysis results (Table 1, Figure 5) from a set of nationwide sentinel sites: Week 48 (ending 4 December 2022) and Week 49 (ending 11 December 2022).

Consistent with the WGS of clinical cases, the wastewater results show the continued spread of the BA.2.75\* constellation (includes BA.2.75/CH.1.1/ BR.2) of variants both locally and nationally. Compared to week 46, when BA.2.75\* was detected in 11 sites and represented ~28% of sequences nationally, and week 47 - 15 sites and ~46% of sequences nationally; in weeks 48 and 49, BA.2.75\* was detected at every sentinel site and represented ~62% and ~53% of sequences respectively.

The BA.4/BA.5 variant group accounted for slightly fewer than 20% of sequences nationally this fortnight, but is still widespread throughout the country, particularly in week 49.

BQ.1.1 levels in wastewater have increased over the last month, from ~11% nationally in week 46, ~12% in week 47, ~13% in week 48 and ~22% in week 49; and increasing in geographic spread from 6 sites in week 46, 9 sites in week 47, 15 sites in week 48 and 18 sites in week 49.

The XBB variant was detected in nine sites (~3% of sequences nationally) in week 48 and nine sites (~2% of sequences nationally) in week 49. Following its first detection in wastewater in week 46, the XBC variant was detected in wastewater in both week 48 (6 sites, ~2% of sequences nationally) and week 49 (13 sites, ~5% of sequences nationally).

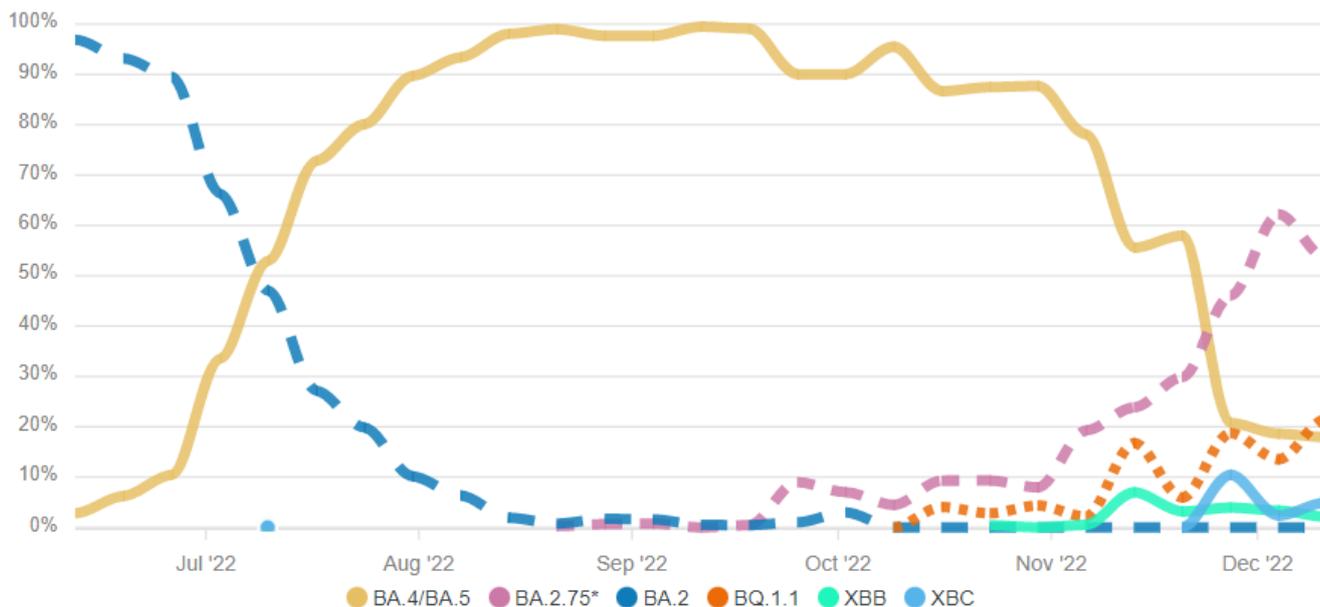
	Week 48					Week 49				
	BA.4/BA.5	BA.2.75*	BQ.1.1	XBB	XBC	BA.4/BA.5	BA.2.75*	BQ.1.1	XBB	XBC
Whangarei	Coloured	Coloured	Coloured	Coloured	Coloured	Coloured	Coloured	Coloured	Coloured	Coloured
North Shore	Coloured	Coloured	Coloured	Coloured	Coloured	Coloured	Coloured	Coloured	Coloured	Coloured
Auckland East	Coloured	Coloured	Coloured	Coloured	Coloured	Coloured	Coloured	Coloured	Coloured	Coloured
Auckland Southwest	Coloured	Coloured	Coloured	Coloured	Coloured	Coloured	Coloured	Coloured	Coloured	Coloured
Auckland Western	Coloured	Coloured	Coloured	Coloured	Coloured	Coloured	Coloured	Coloured	Coloured	Coloured
Mt Maunganui	Coloured	Coloured	Coloured	Coloured	Coloured	Coloured	Coloured	Coloured	Coloured	Coloured
Tauranga	Coloured	Coloured	Coloured	Coloured	Coloured	Coloured	Coloured	Coloured	Coloured	Coloured
Rotorua	Coloured	Coloured	Coloured	Coloured	Coloured	Coloured	Coloured	Coloured	Coloured	Coloured
Taupo	Coloured	Coloured	Coloured	Coloured	Coloured	Coloured	Coloured	Coloured	Coloured	Coloured
Gisborne	Coloured	Coloured	Coloured	Coloured	Coloured	Coloured	Coloured	Coloured	Coloured	Coloured
New Plymouth	Coloured	Coloured	Coloured	Coloured	Coloured	Coloured	Coloured	Coloured	Coloured	Coloured
Palmerston North	Coloured	Coloured	Coloured	Coloured	Coloured	Coloured	Coloured	Coloured	Coloured	Coloured
Porirua	Coloured	Coloured	Coloured	Coloured	Coloured	Coloured	Coloured	Coloured	Coloured	Coloured
Hutt Valley	Coloured	Coloured	Coloured	Coloured	Coloured	Coloured	Coloured	Coloured	Coloured	Coloured
Wellington (Moa Point)	Coloured	Coloured	Coloured	Coloured	Coloured	Coloured	Coloured	Coloured	Coloured	Coloured
Nelson	Coloured	Coloured	Coloured	Coloured	Coloured	Coloured	Coloured	Coloured	Coloured	Coloured
Christchurch	Coloured	Coloured	Coloured	Coloured	Coloured	Coloured	Coloured	Coloured	Coloured	Coloured
Queenstown	Coloured	Coloured	Coloured	Coloured	Coloured	Coloured	Coloured	Coloured	Coloured	Coloured
Dunedin (Tahuna)	Coloured	Coloured	Coloured	Coloured	Coloured	Coloured	Coloured	Coloured	Coloured	Coloured
Dunedin (Mosgiel)	Coloured	Coloured	Coloured	Coloured	Coloured	Coloured	Coloured	Coloured	Coloured	Coloured
All Sites (national)	19	62	13	3	2	18	53	22	2	5

**Table 1.** Data from 20 wastewater sentinel sites across NZ using a S-gene (spike) barcoding assay able to ‘call’ the BA.4/BA.5, the BA.2.75\* constellation (includes BA.2.75/CH.1.1/BR.2 subvariants), BQ.1.1, XBB 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.

Numbers in the bottom row denote the estimated percentage of each variant at the national scale for weeks 48 and 49.

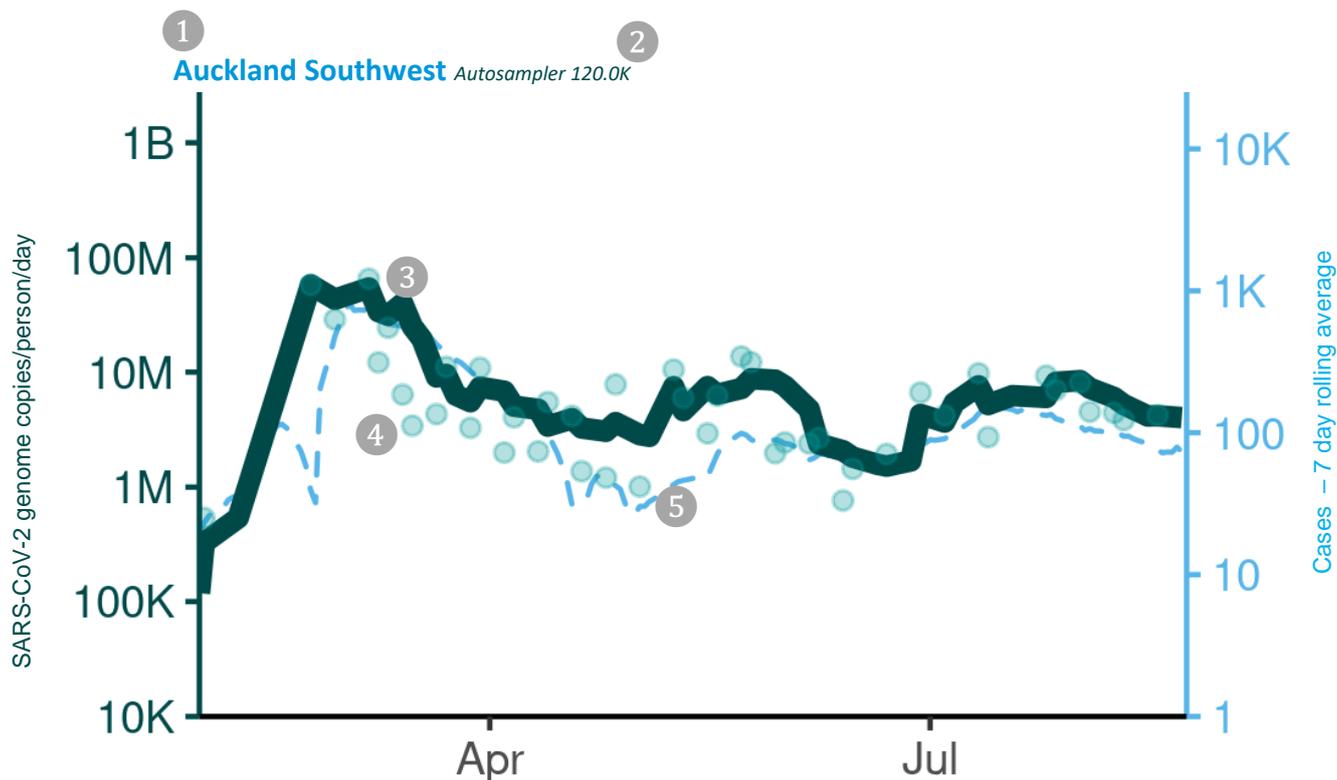
Due to the increasing complexity of variants in the population, each at relatively low levels, the current approach for sequencing wastewater samples is no longer precise enough to report as percentages for each variant at the sentinel site level. Instead, the presence of each lineage is reported (Table 1). ESR are actively testing and developing methods to address the current uncertainty and increase the resolution at which variants can be identified in wastewater.

### Variant Timeline - National



**Figure 5.** Change in variant prevalence over time at a national scale. Data are collected from up to 20 sentinel sites each week

## Interpreting Sites Graphs

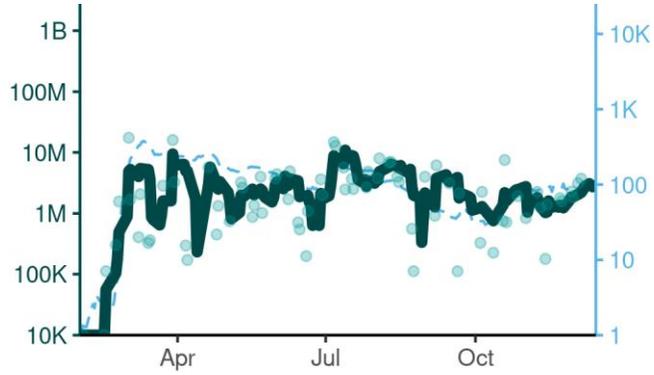


- 1 Site Name
- 2 Sample collection method and population. Results based on autosampler may be more representative than grab sample-based results.
- 3 Wastewater results shown as solid line | 14-day average of genome copies/person/day on a  $\log_{10}$  scale.
- 4 Individual results samples shown as 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.

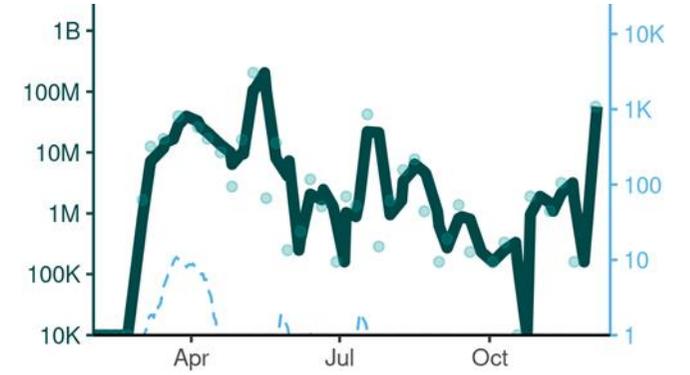
*Note: Wastewater and cases data are on a  $\log_{10}$  scale. Scales on all graphs have been normalized to cover the same scale on every graph. Care should be taken when interpreting the data.*

# Northland

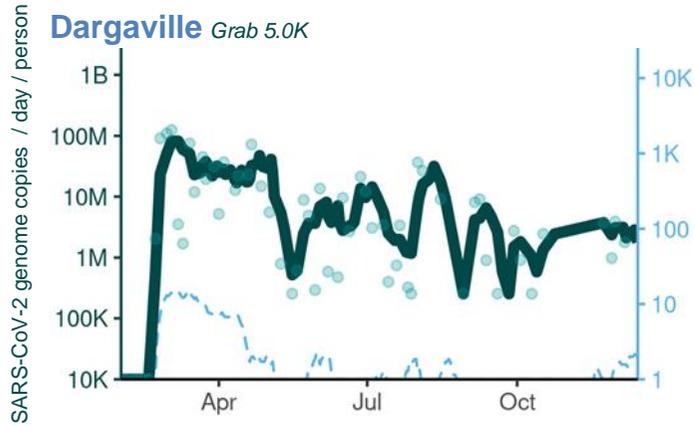
**Whangarei** Autosampler 65.0K



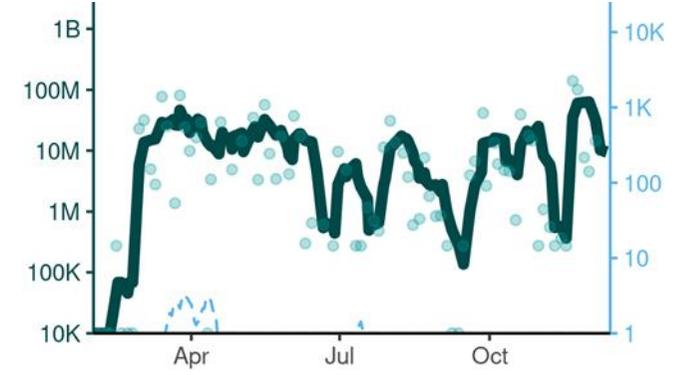
**Hikurangi** Grab 1.7K



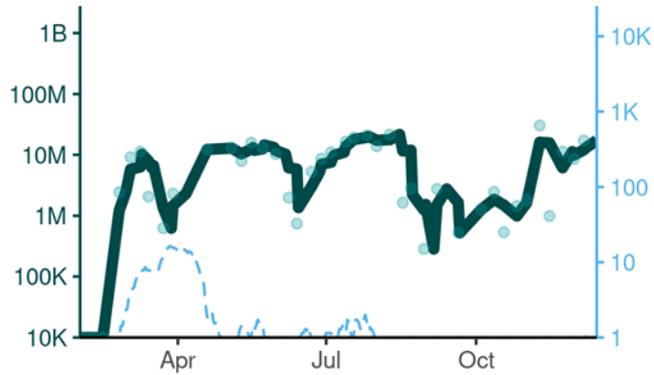
**Dargaville** Grab 5.0K



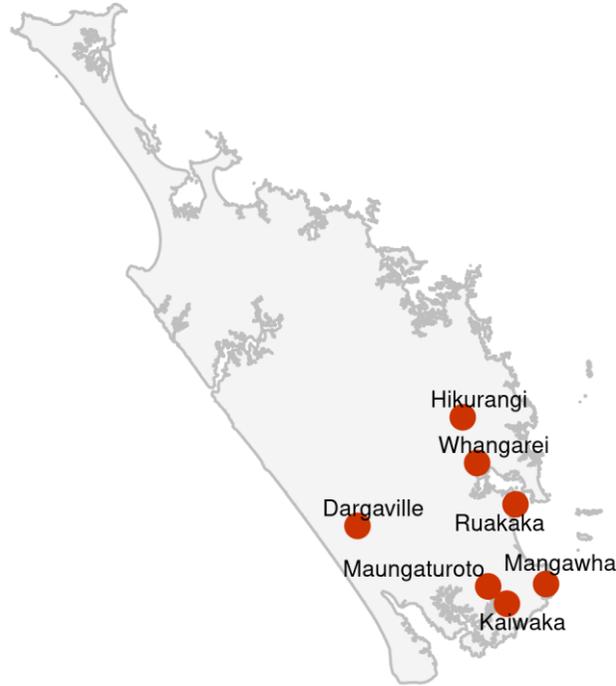
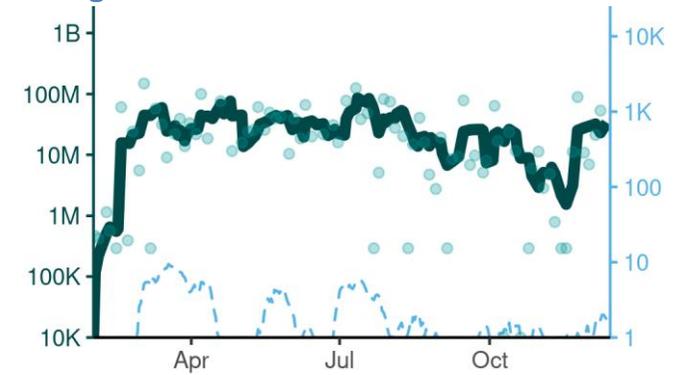
**Maungaturoto** Grab 1.3K



**Ruakaka** Grab 4.5K



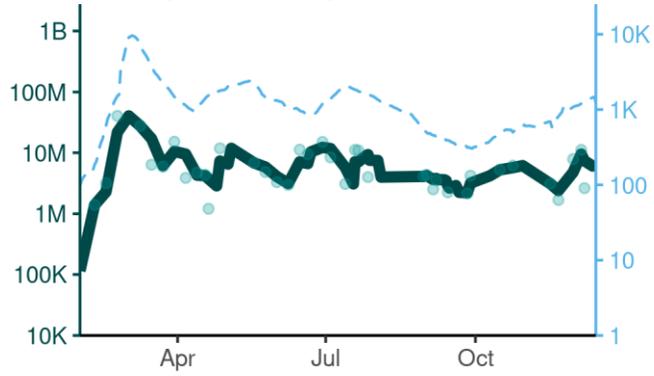
**Mangawhai** Grab 1.1K



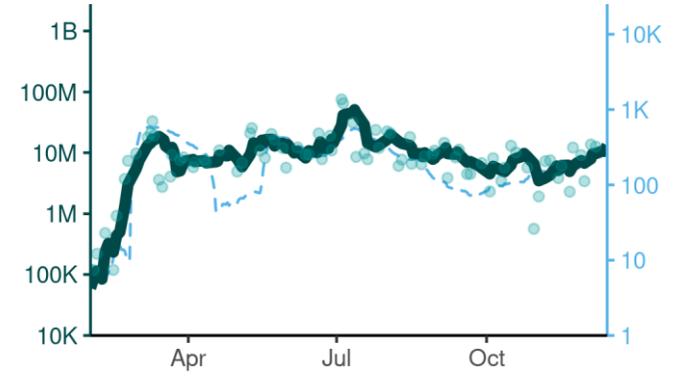
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# Auckland

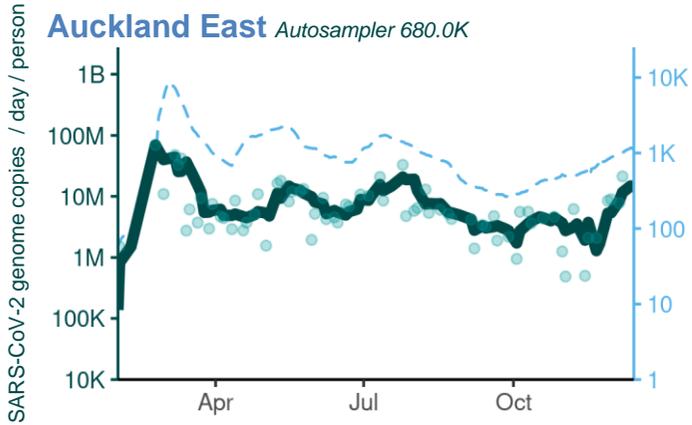
**Auckland (Combined)** Autosampler 1.1M



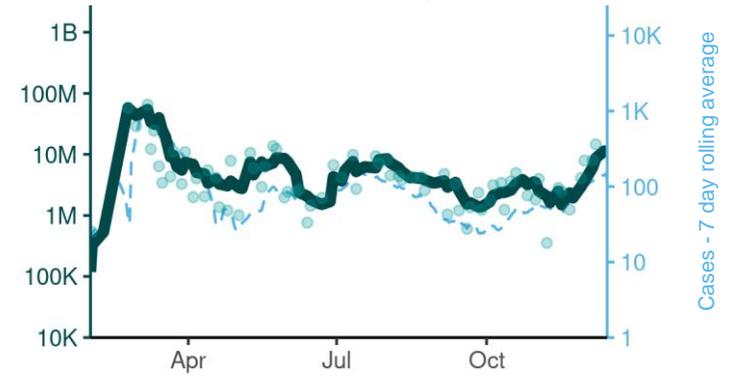
**North Shore** Autosampler 240.0K



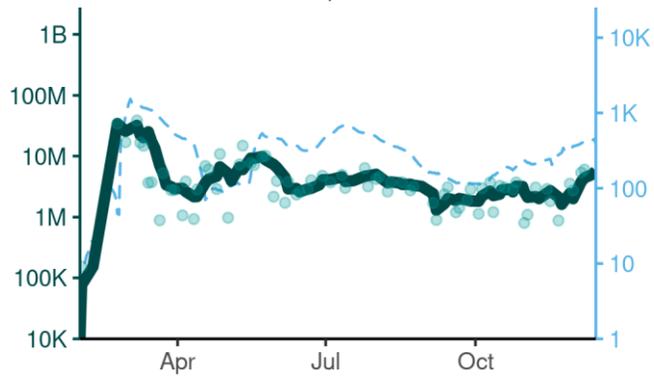
**Auckland East** Autosampler 680.0K



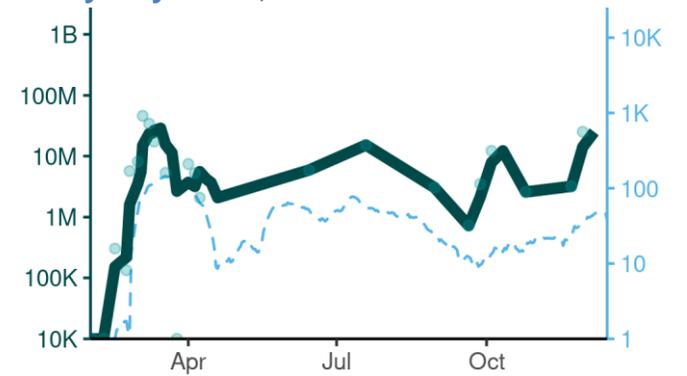
**Auckland Southwest** Autosampler 120.0K



**Auckland West** Autosampler 315.0K

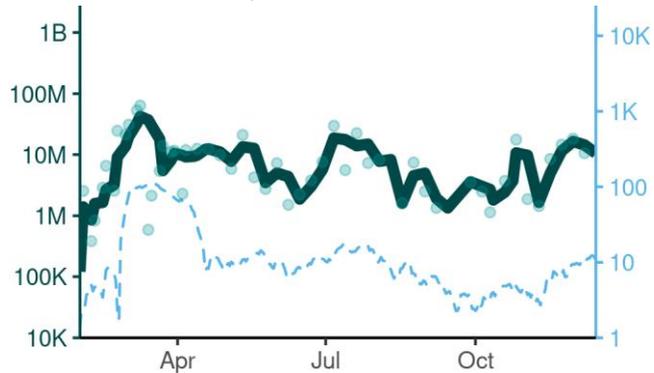


**Army Bay** Autosampler 42.0K

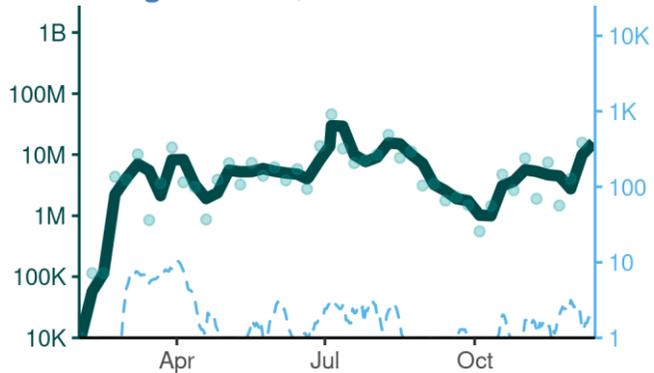


Status ● Detected ● Not detected

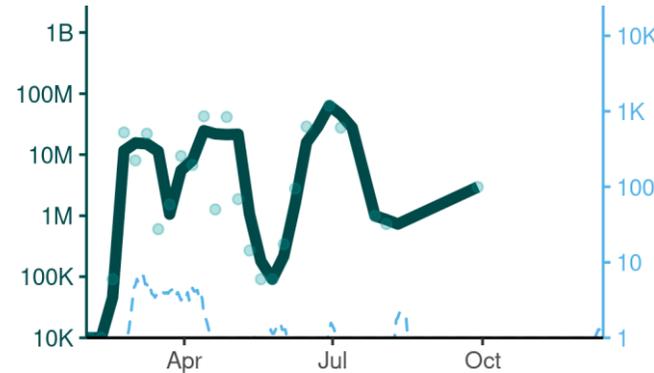
**Pukekohe** Autosampler 20.9K



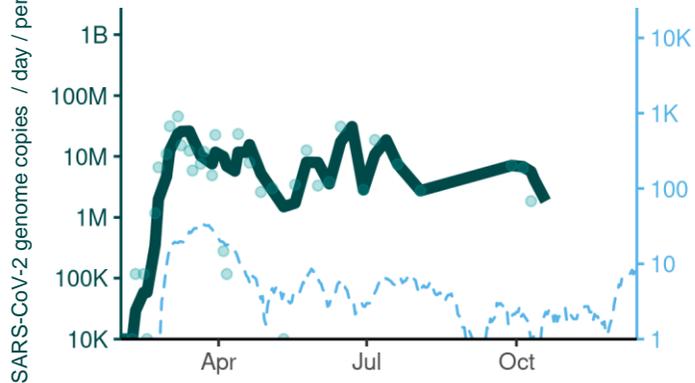
**Snells/Algies** Autosampler 4.0K



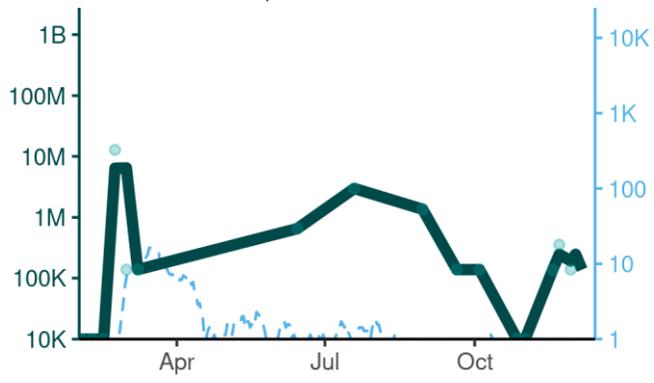
**Clarks Beach** Grab 2.0K



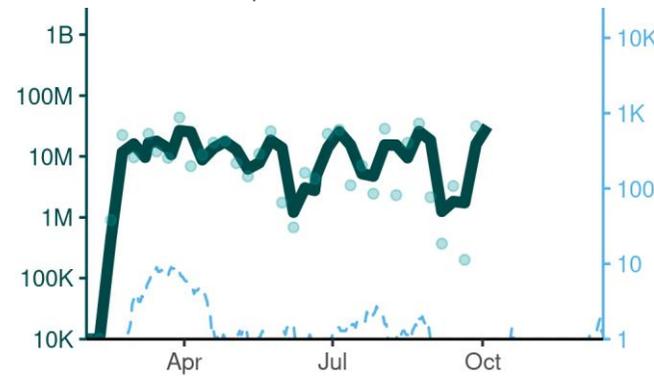
**Waiuku** Grab 7.9K



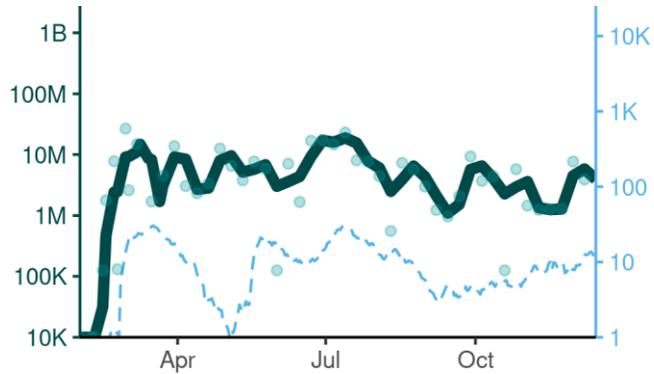
**Helensville** Autosampler 3.8K



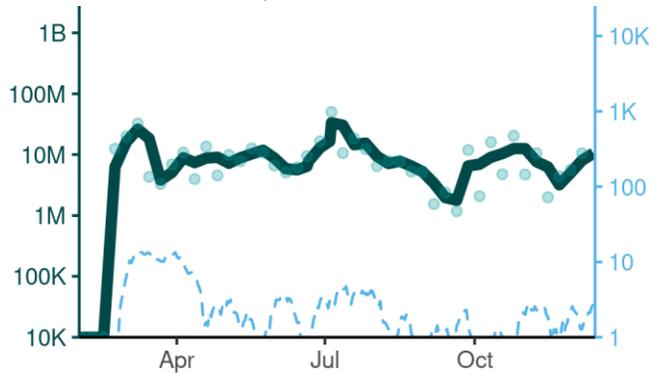
**Wellsford** Autosampler 1.7K



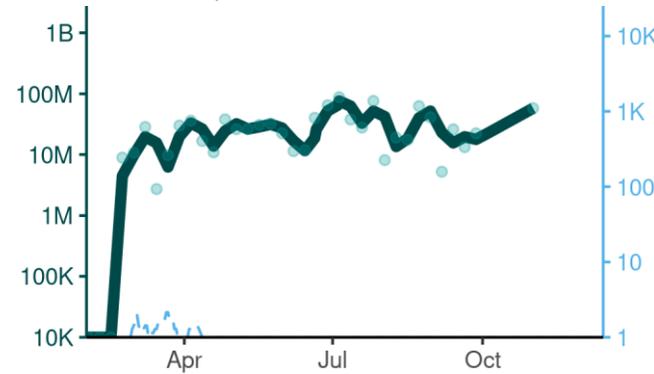
**Beachlands** Grab 6.8K



**Warkworth** Autosampler 3.5K



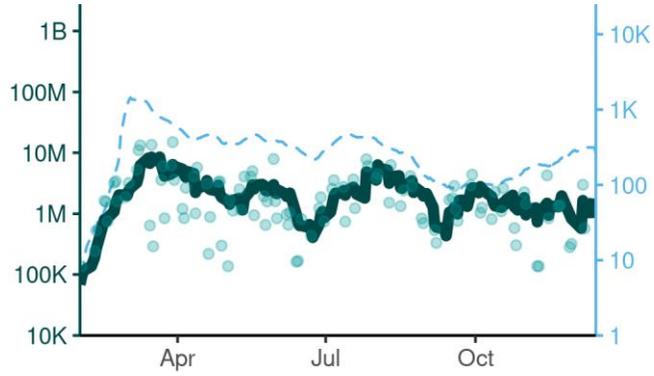
**Omaha** Autosampler 1000



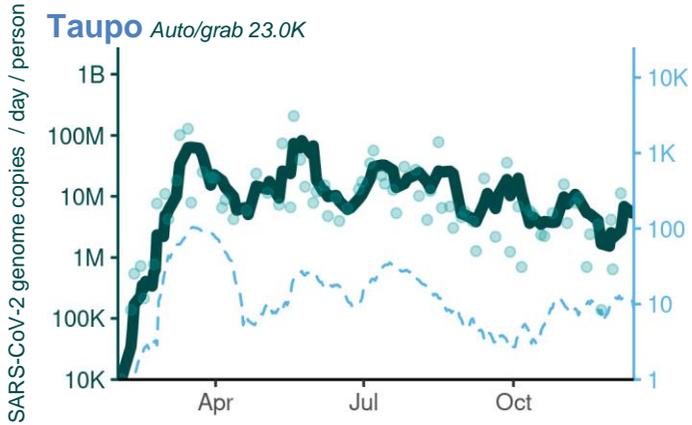
Cases - 7 day rolling average

# Waikato

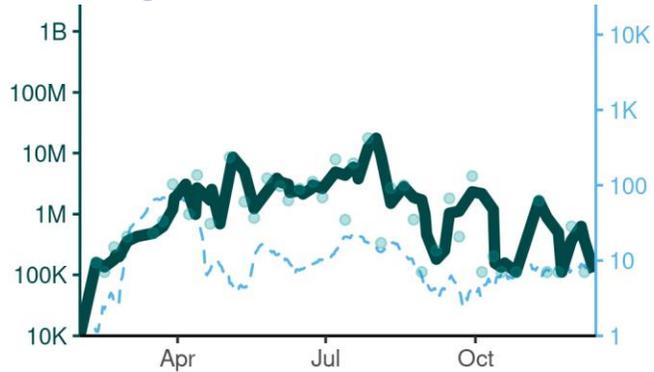
**Hamilton** Autosampler 169.0K



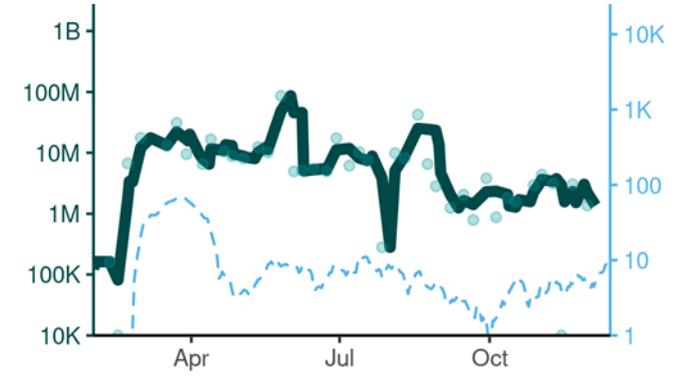
**Taupo** Auto/grab 23.0K



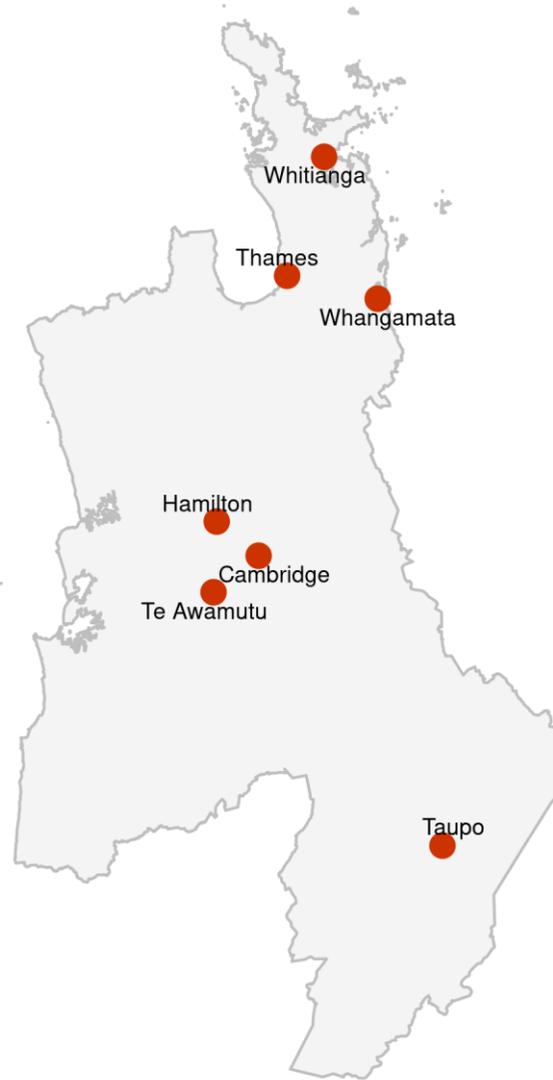
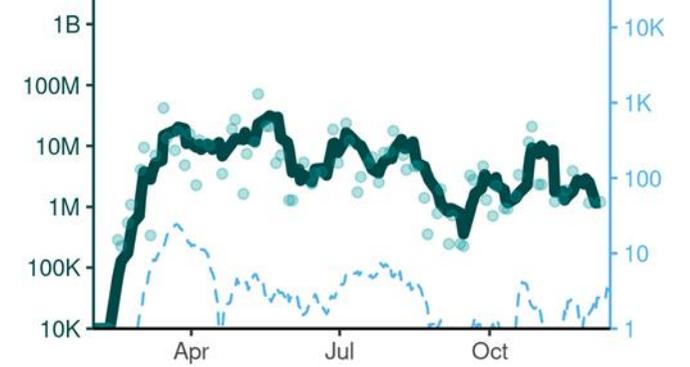
**Cambridge** Autosampler 20.1K



**Te Awamutu** Autosampler 13.1K



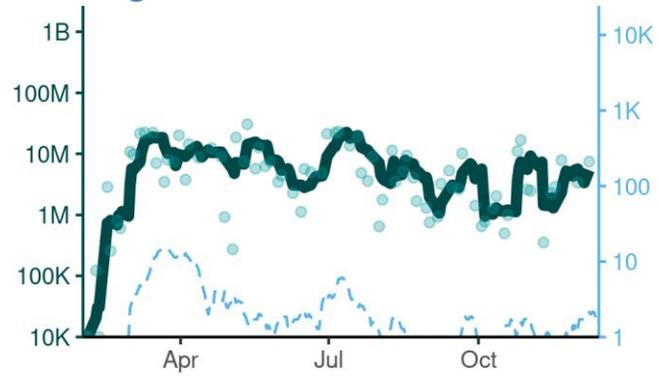
**Thames** Autosampler 7.5K



Status ● Detected ● Not detected

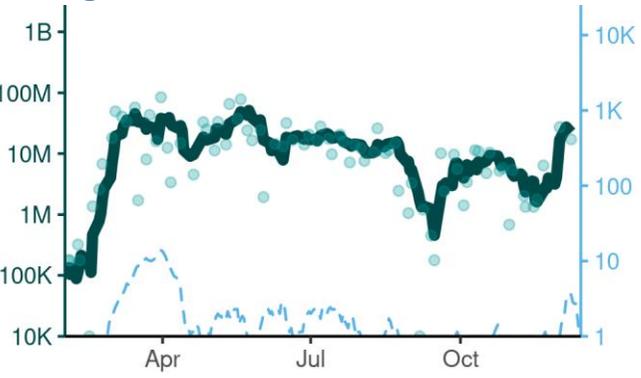
Cases - 7 day rolling average

**Whitianga** Autosampler 6.6K



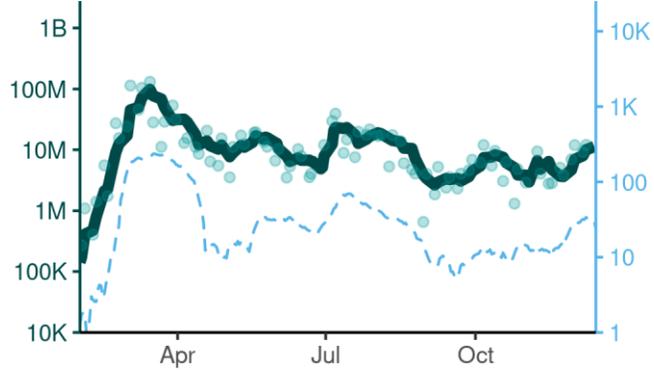
SARS-CoV-2 genome copies / day / person

**Whangamata** Autosampler 4.0K

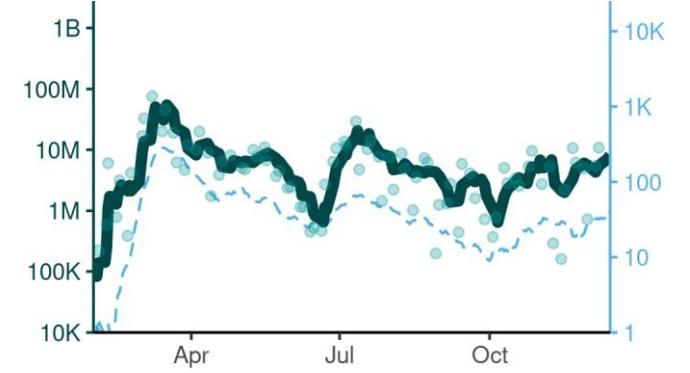


## Bay of Plenty and Gisborne

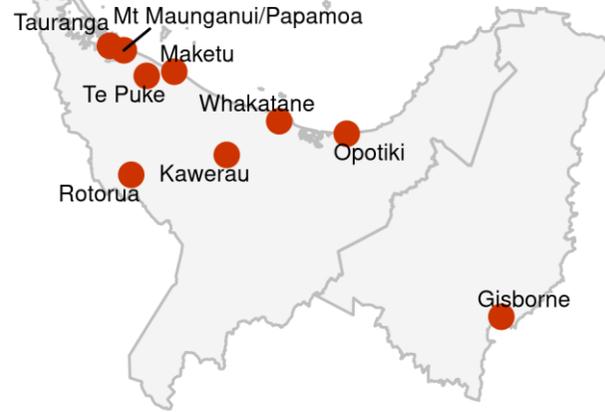
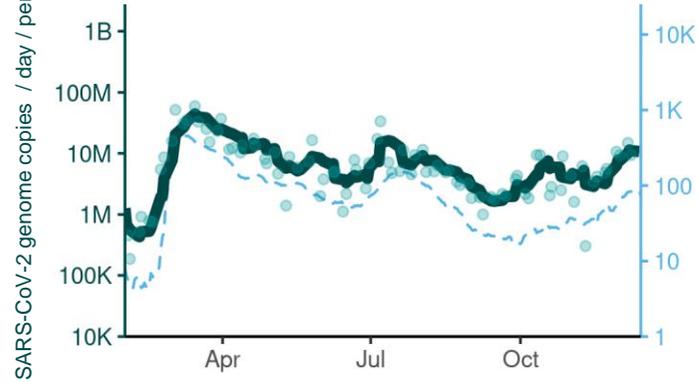
**Mt Maunganui/Papamoa** Autosampler 65.0K



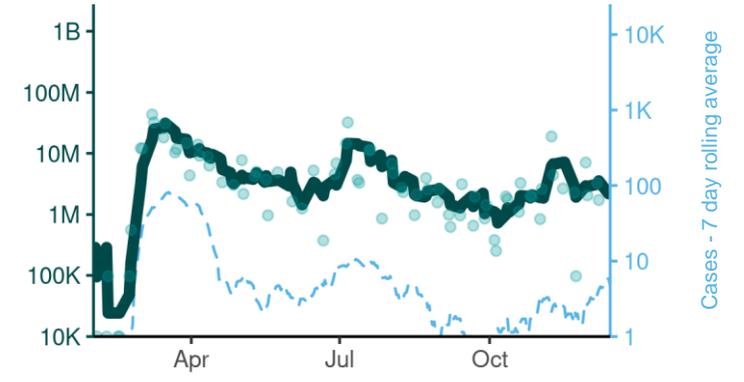
**Gisborne** Autosampler 37.0K



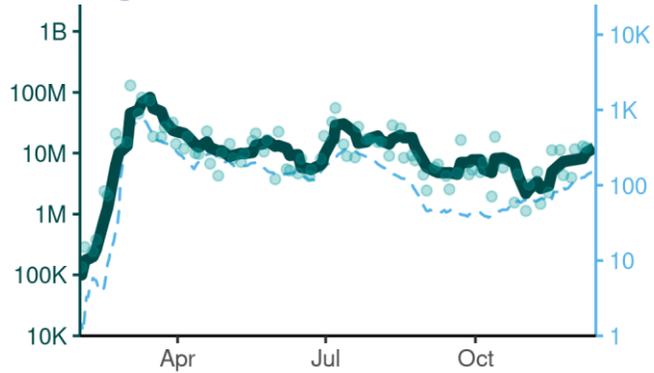
**Rotorua** Autosampler 59.0K



**Whakatane** Autosampler 21.0K

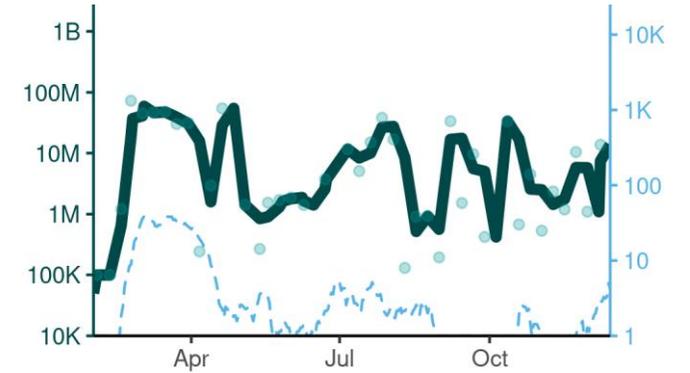


**Tauranga** Autosampler 50.0K

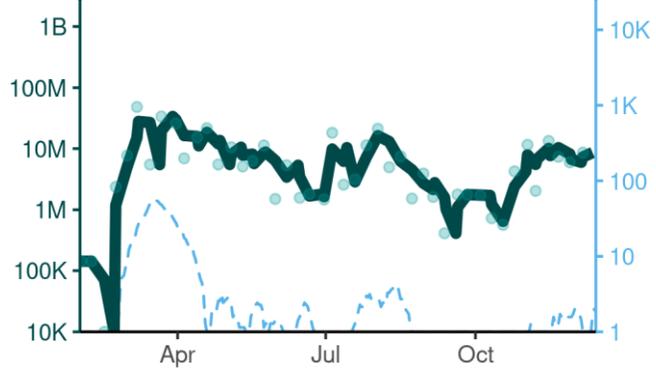


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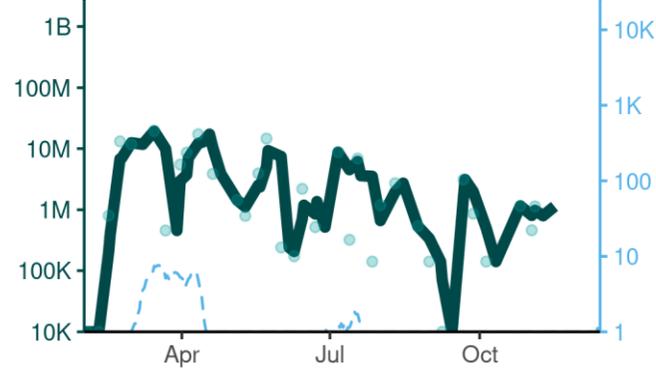
**Te Puke** Autosampler 9.7K



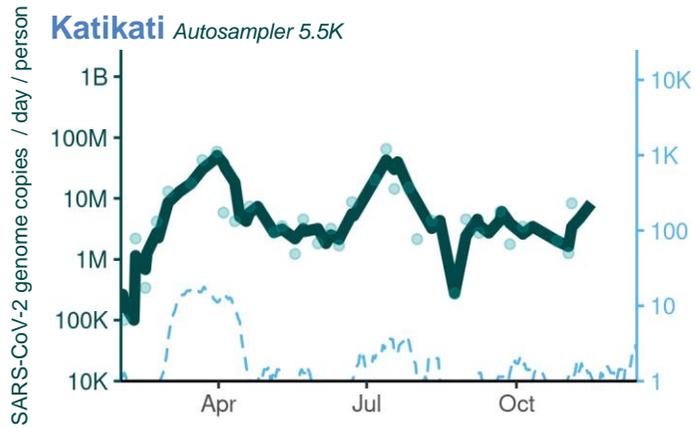
**Kawerau** Autosampler 7.0K



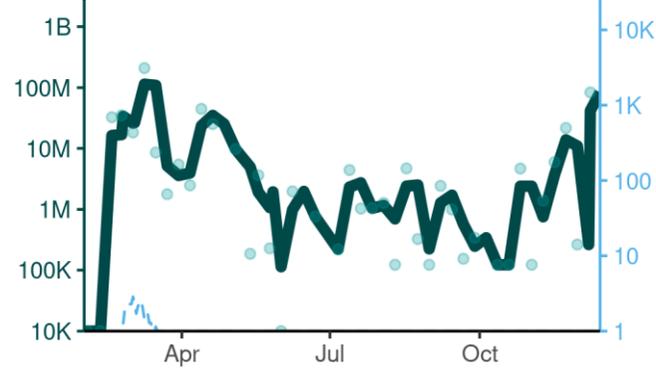
**Waihi Beach** Autosampler 3.6K



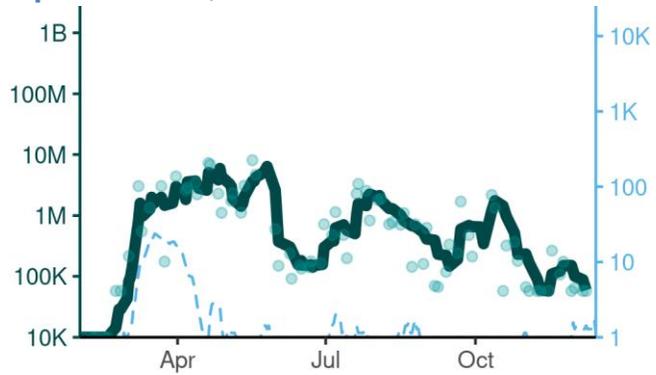
**Katikati** Autosampler 5.5K



**Maketu** Autosampler 1.3K



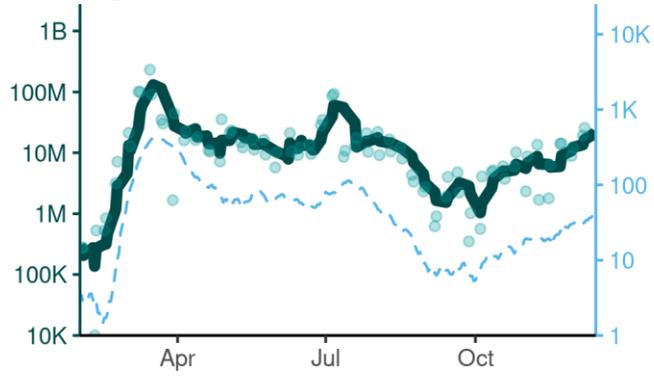
**Opotiki** Autosampler 3.8K



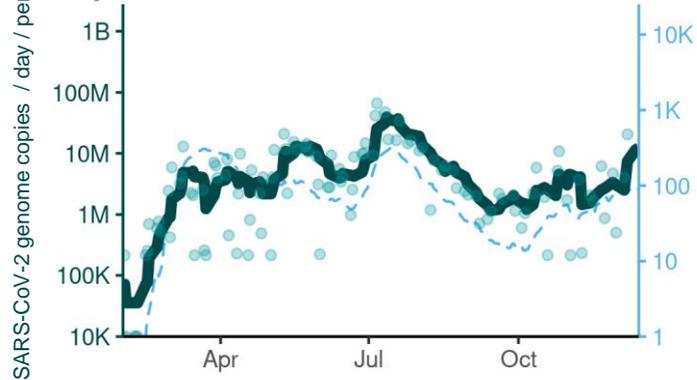
Cases - 7 day rolling average

## Hawke's Bay

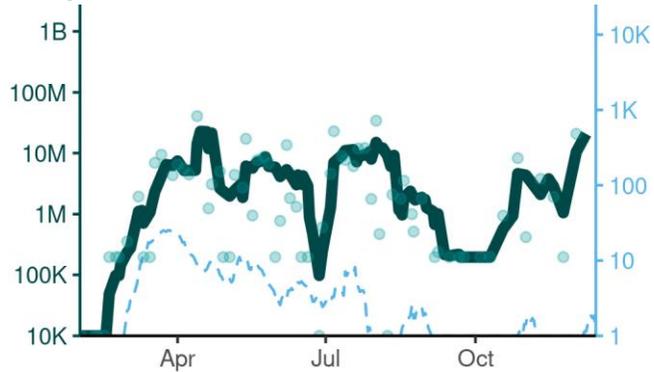
**Hastings** Autosampler 80.0K



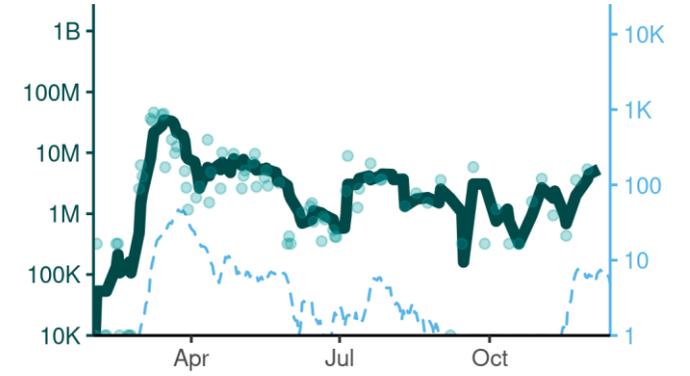
**Napier** Autosampler 55.0K



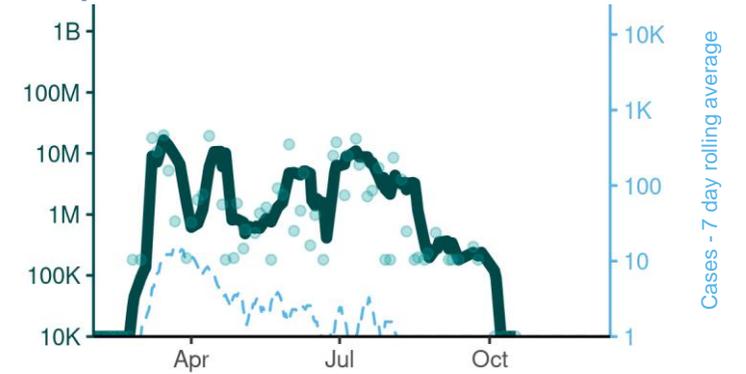
**Waipukurau** Autosampler 4.6K



**Wairoa** Grab 4.4K



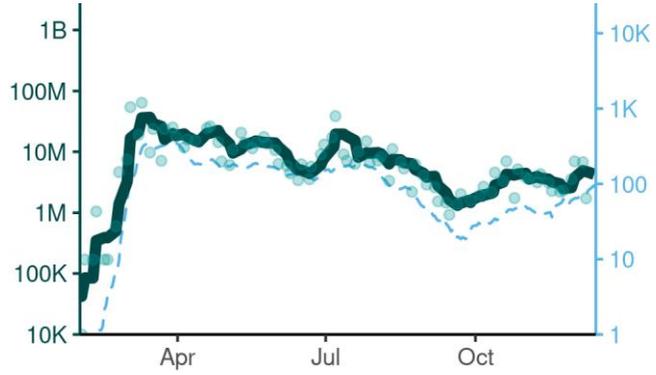
**Waipawa** Autosampler 2.2K



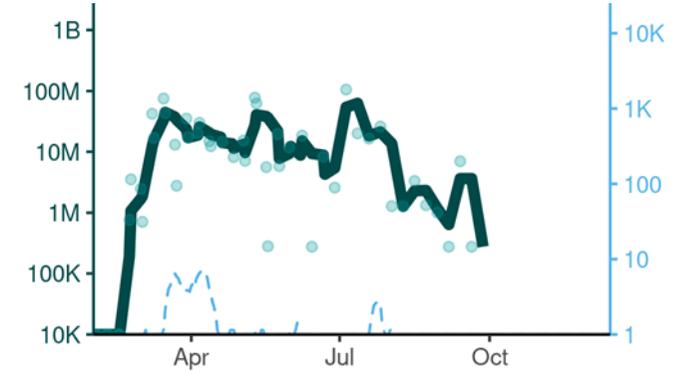
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# Taranaki

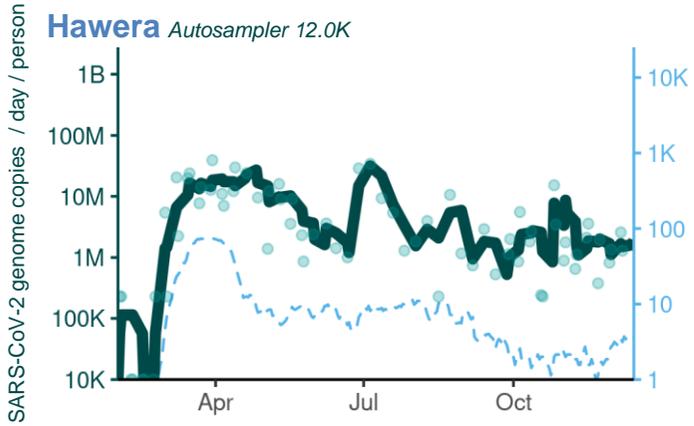
**New Plymouth** Autosampler 88.0K



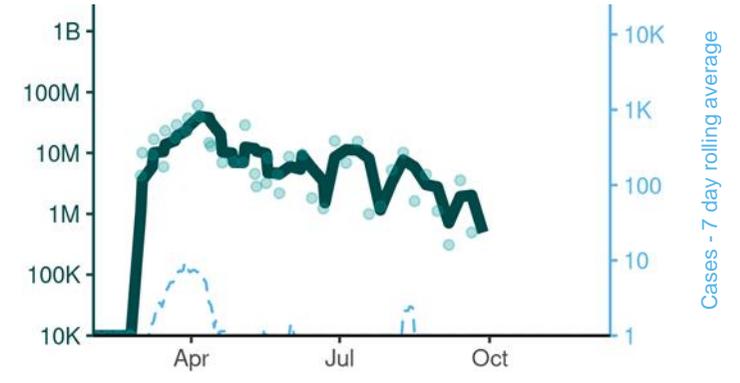
**Opunake** Autosampler 1.4K



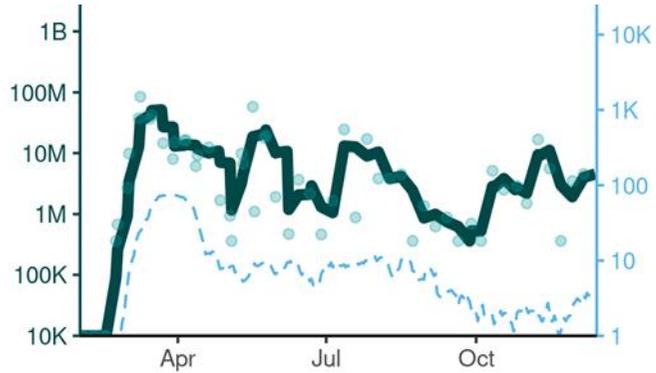
**Hawera** Autosampler 12.0K



**Patea** Autosampler 1.2K



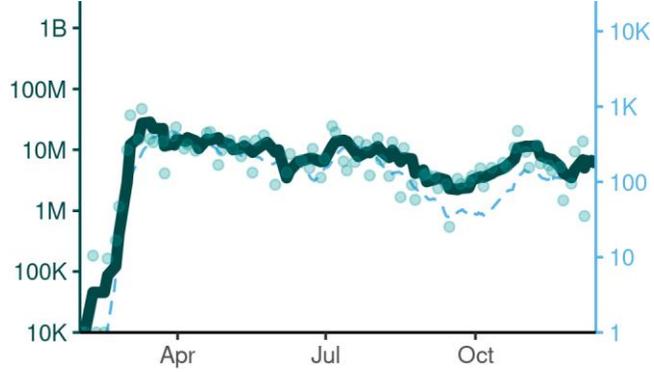
**Eltham** Autosampler 2.0K



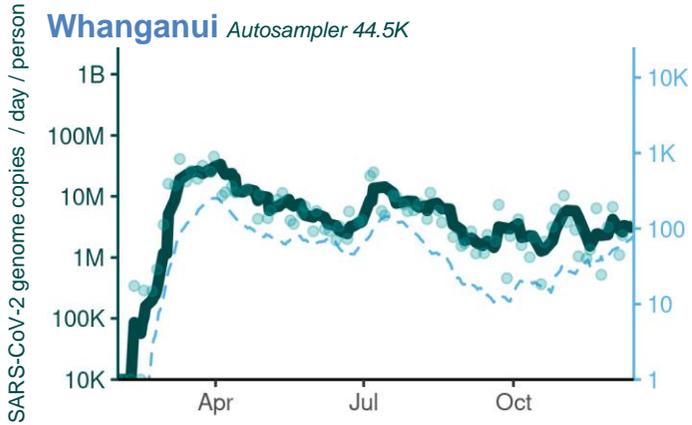
Status ● Detected ● Not detected

# Manawatu-Whanganui

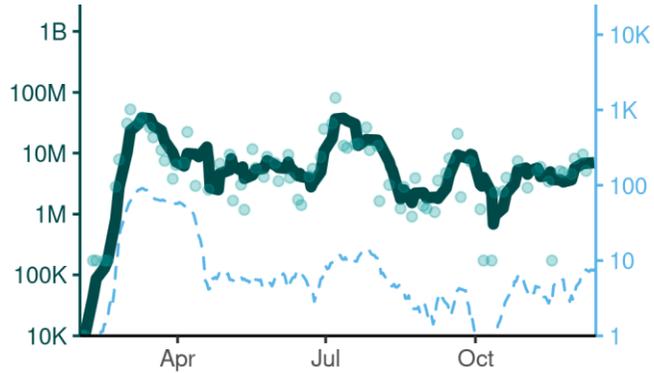
**Palmerston North** Autosampler 90.0K



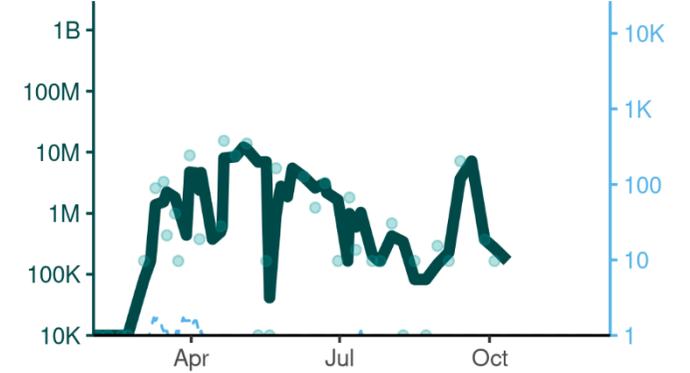
**Whanganui** Autosampler 44.5K



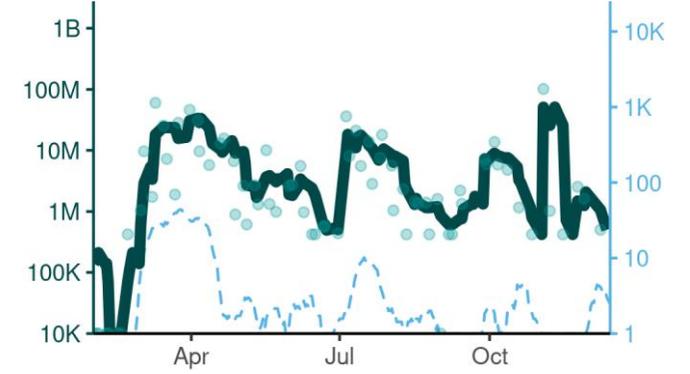
**Levin** Autosampler 21.2K



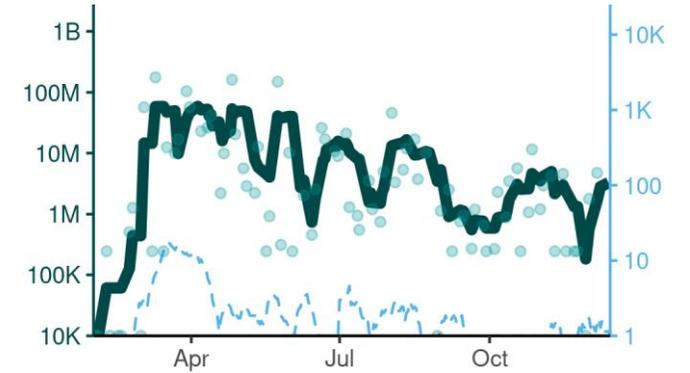
**Eketahuna** Grab 1.6K



**Dannevirke** Grab 5.7K



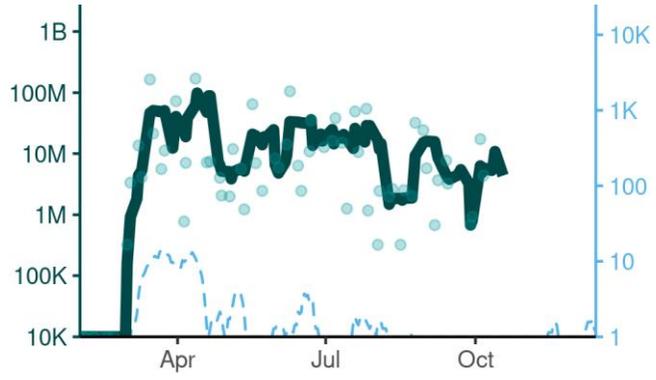
**Taumarunui** Grab 4.0K



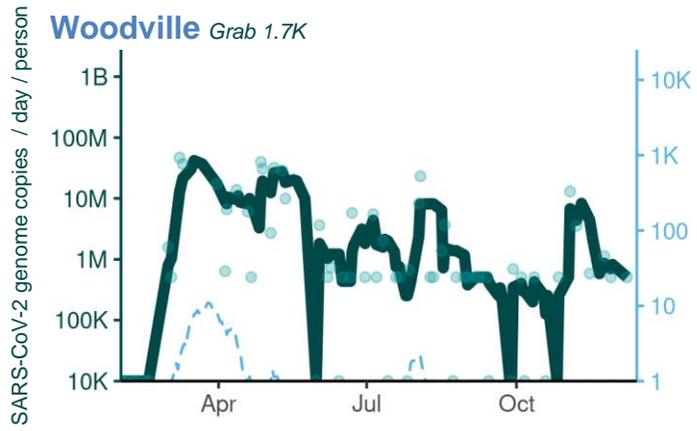
Status ● Detected ● Not detected

Cases - 7 day rolling average

**Pahiatua** Grab 2.8K



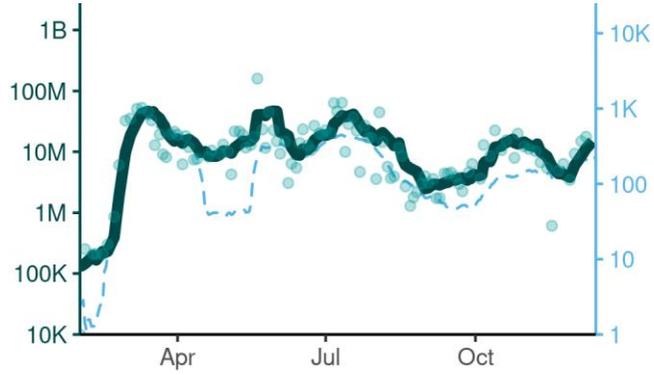
**Woodville** Grab 1.7K



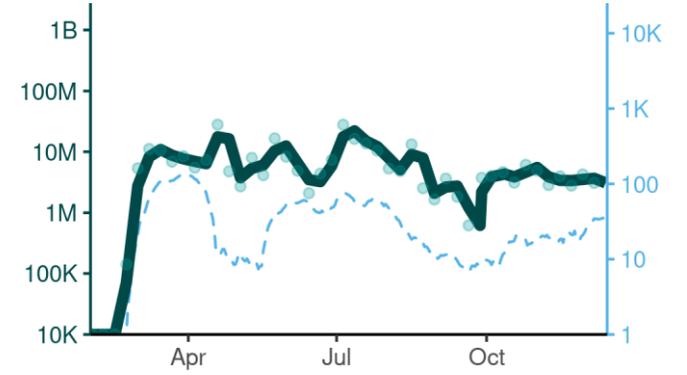
Cases - 7 day rolling average

# Wellington

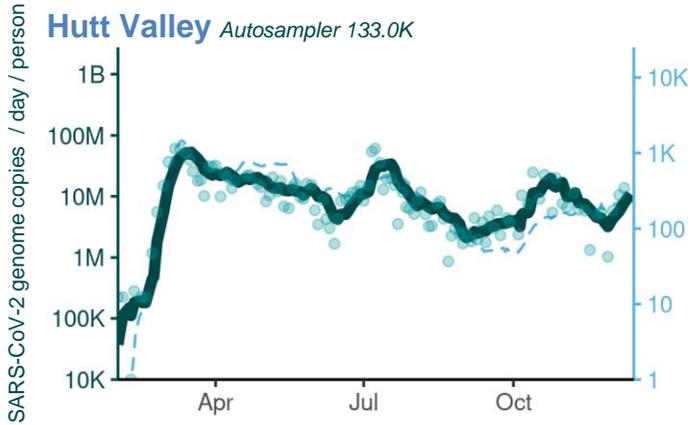
Wellington (Moa Point) Autosampler 168.0K



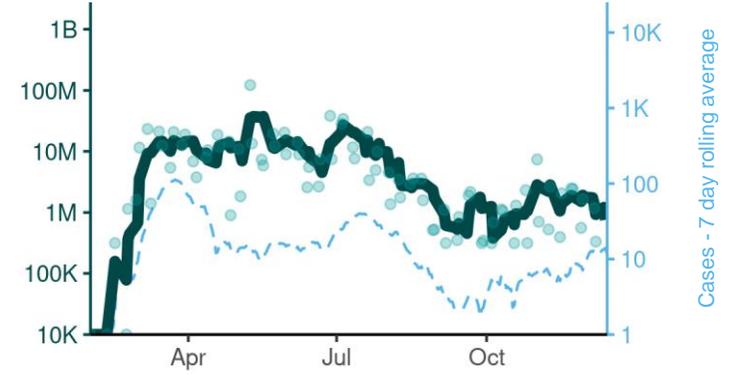
Paraparaumu Autosampler 49.0K



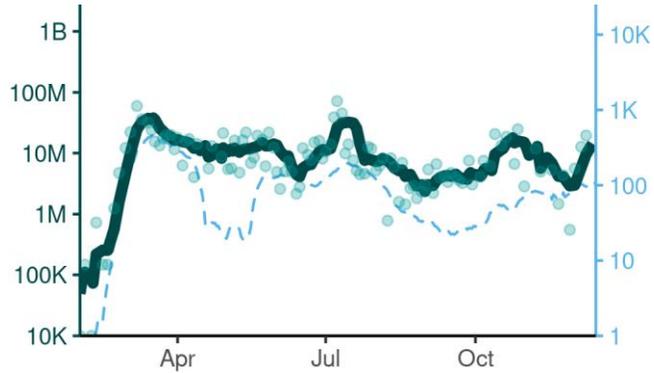
Hutt Valley Autosampler 133.0K



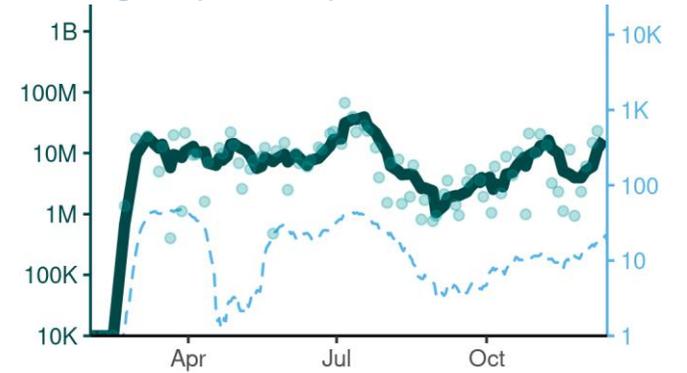
Masterton Auto/grab 20.7K



Porirua Autosampler 85.0K



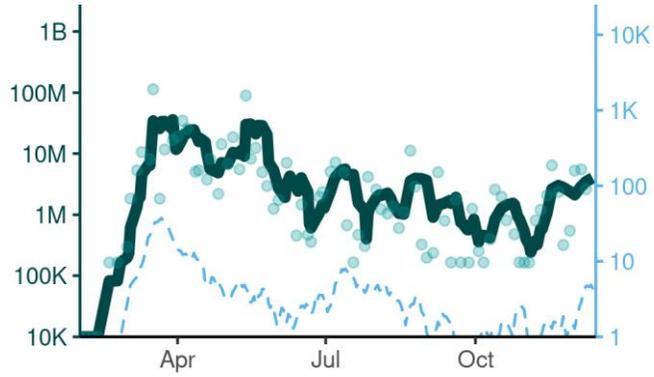
Wellington (Western) Autosampler 14.0K



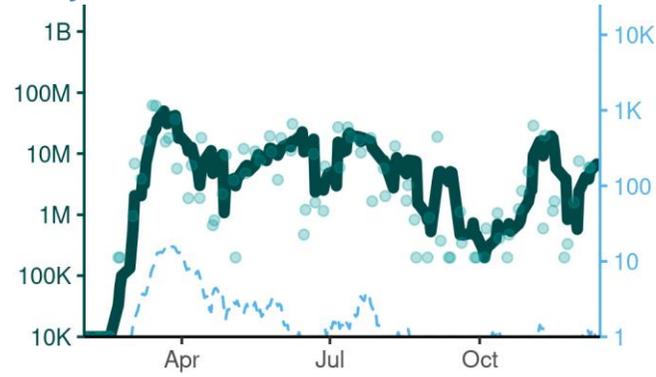
Status ● Detected ● Not detected

Cases - 7 day rolling average

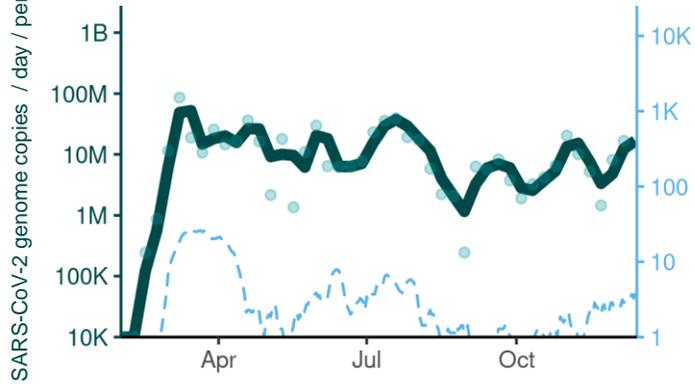
**Carterton** *Grab 5.8K*



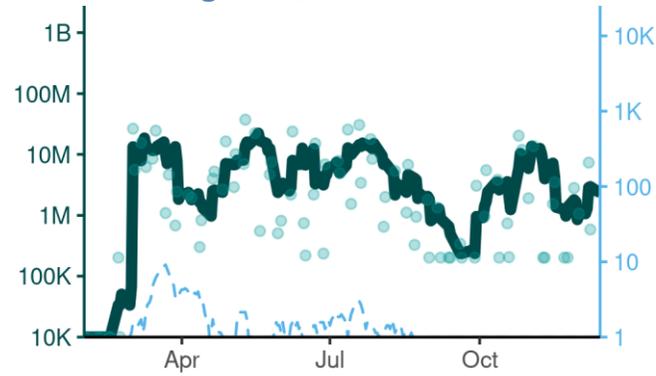
**Greytown** *Grab 2.4K*



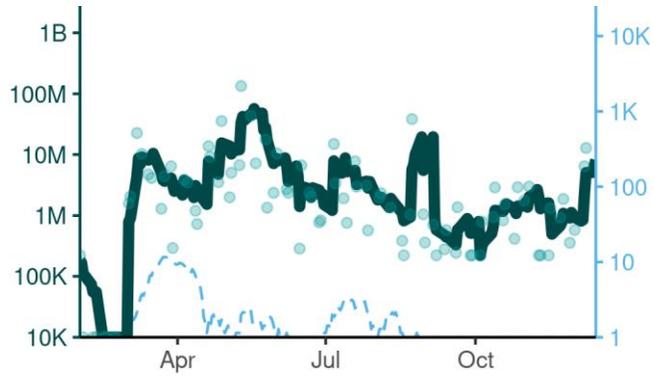
**Otaki** *Autosampler 3.5K*



**Martinborough** *Auto/grab 1.6K*



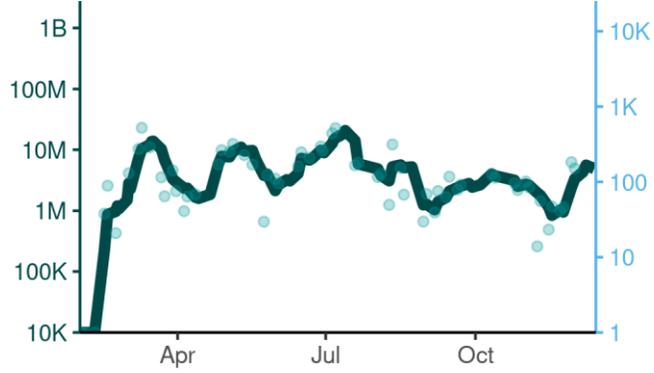
**Featherston** *Grab 2.5K*



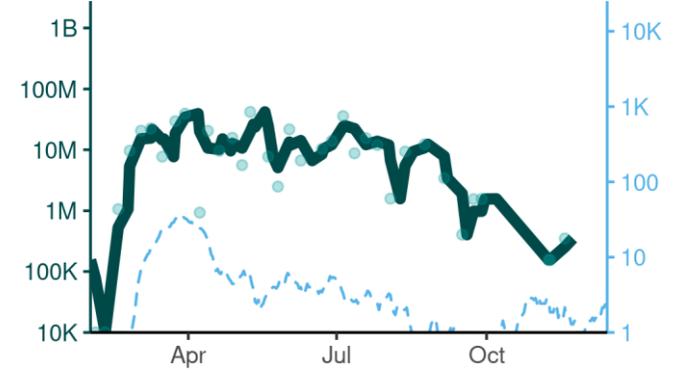
Cases - 7 day rolling average

## Tasman, Nelson, and Marlborough

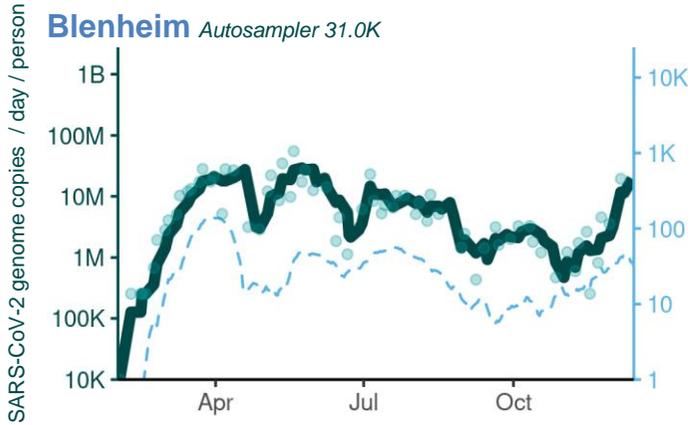
**Richmond/Nelson South** Autosampler 60.0K



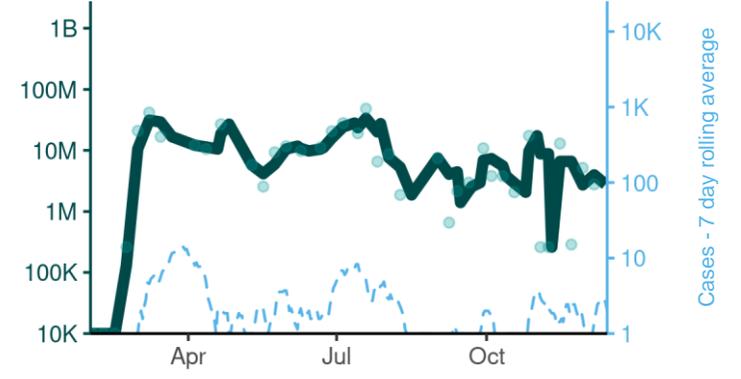
**Motueka** Autosampler 8.3K



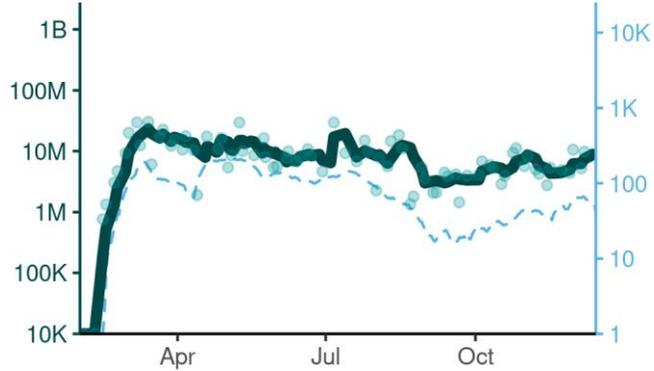
**Blenheim** Autosampler 31.0K



**Picton** Autosampler 5.0K



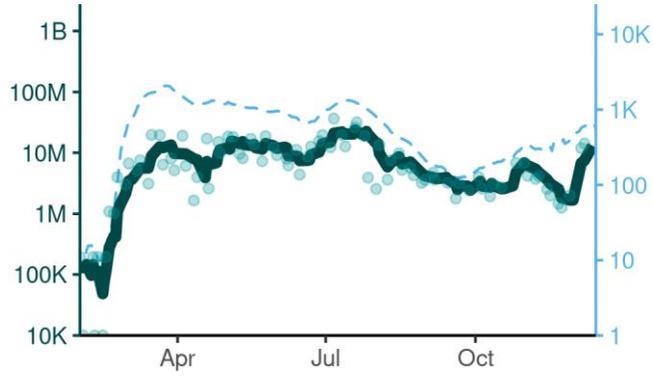
**Nelson Central/North** Autosampler 26.0K



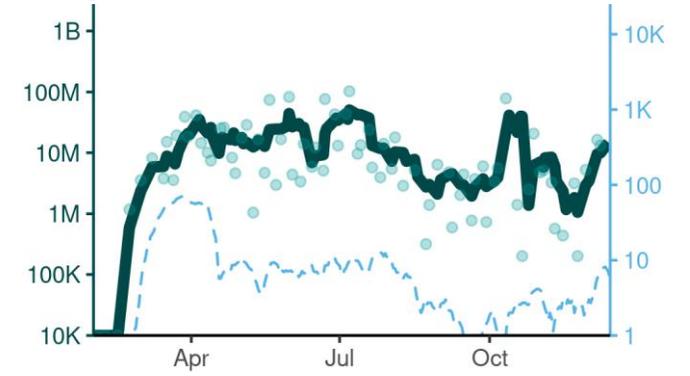
Status ● Detected ● Not detected

## West Coast and Canterbury

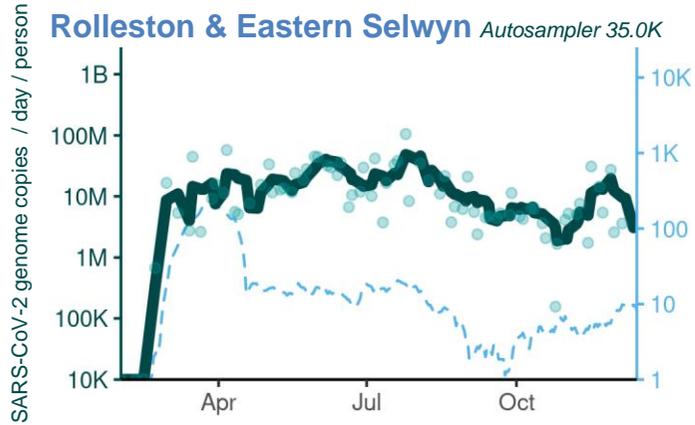
**Christchurch** Autosampler 368.0K



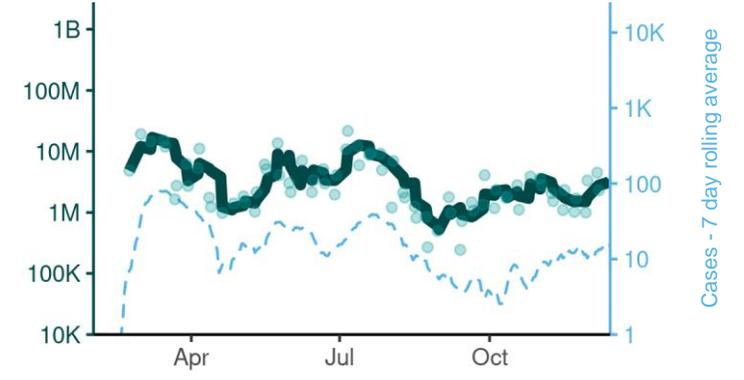
**Rangiora** Grab 19.0K



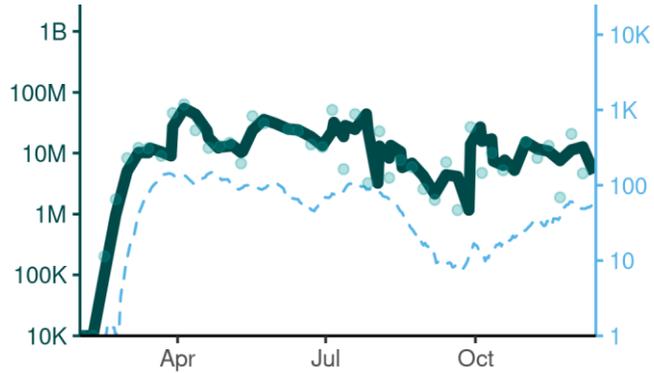
**Rolleston & Eastern Selwyn** Autosampler 35.0K



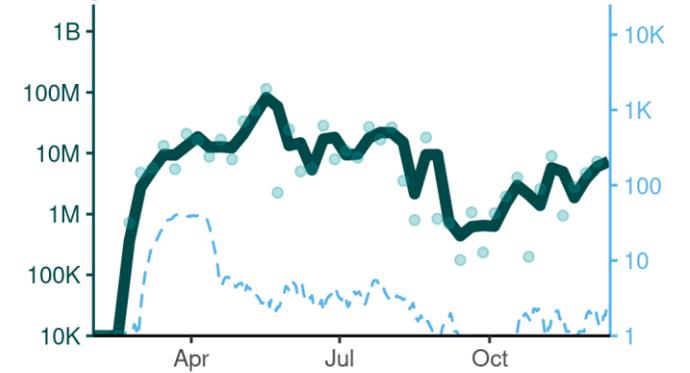
**Ashburton** Autosampler 18.0K



**Timaru** Autosampler 28.0K

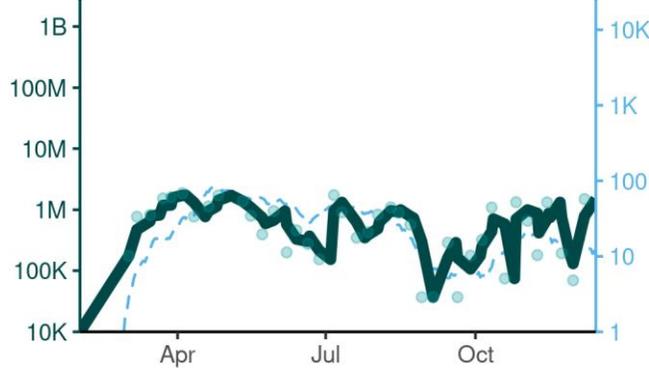


**Kaiapoi** Grab 12.5K

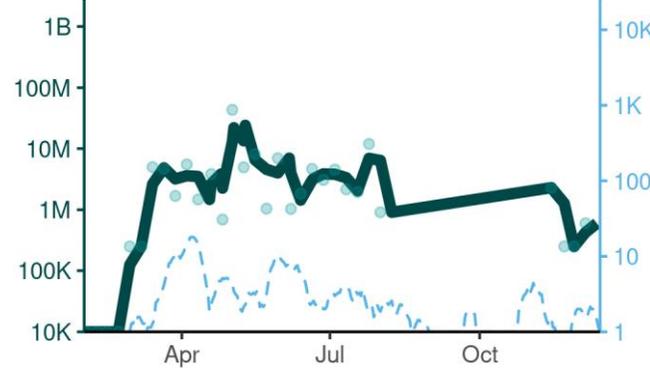


Status ● Detected ● Not detected

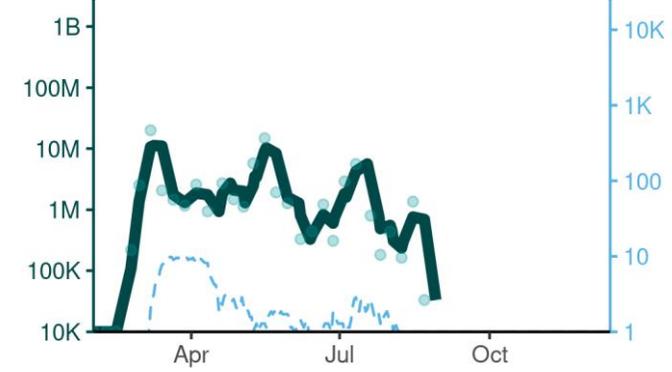
**Greymouth** Grab 10.0K



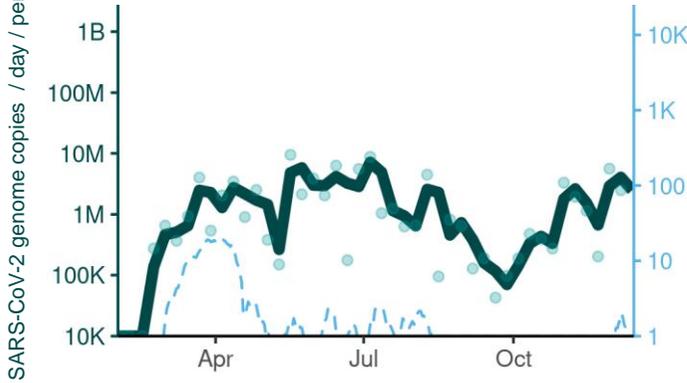
**Westport** Grab 5.0K



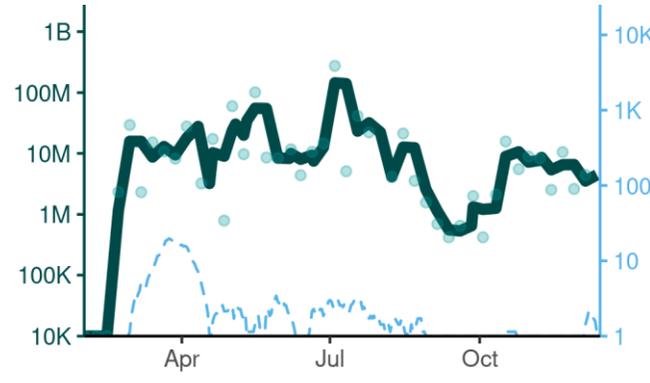
**Amberley** Grab 1.8K



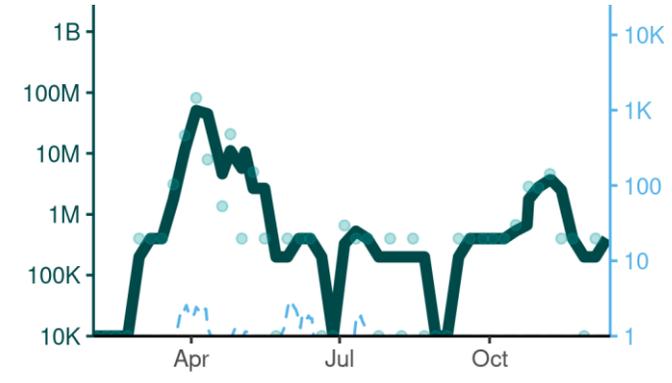
**Woodend** Grab 7.6K



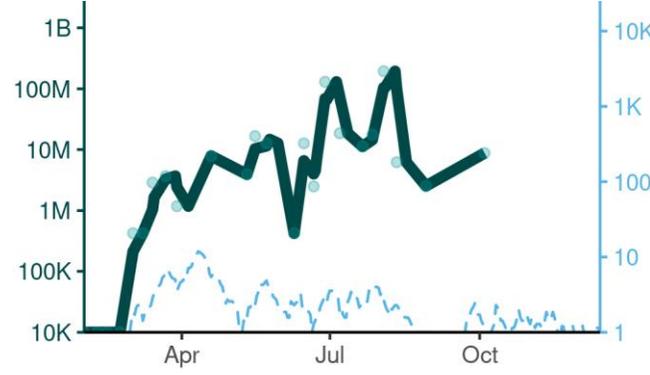
**Leeston** Autosampler 3.9K



**Reefton** Grab 1000



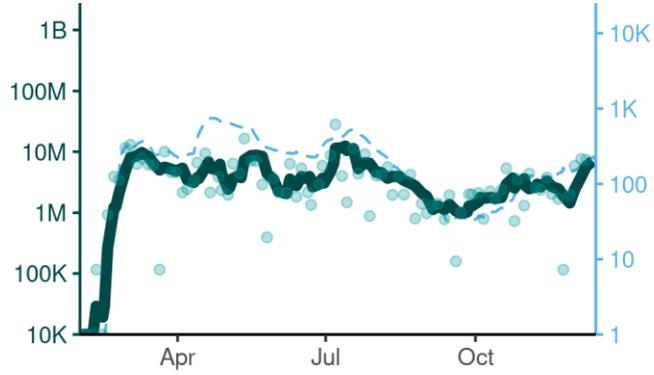
**Hokitika** Grab 2.9K



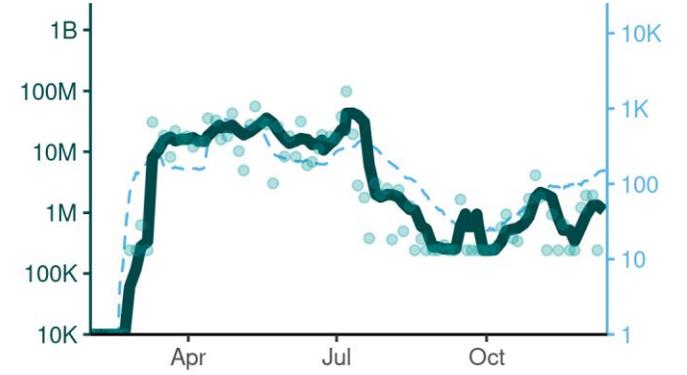
Cases - 7 day rolling average

# Otago and Southland

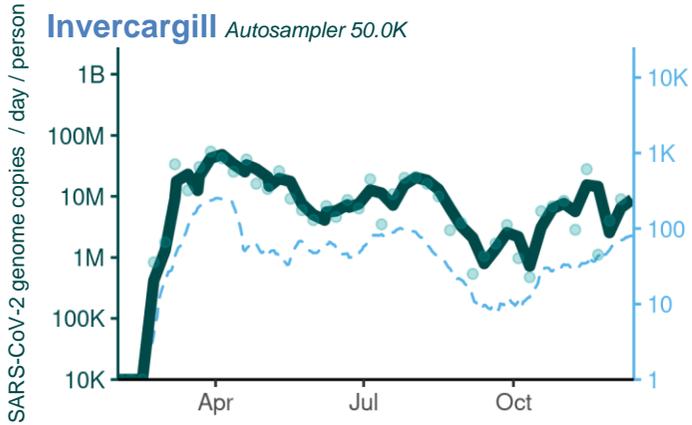
**Dunedin (Tahuna)** Autosampler 84.0K



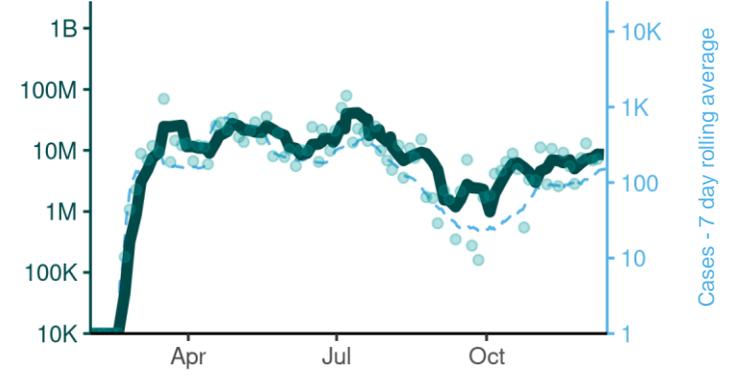
**Dunedin (Green Island)** Autosampler 22.9K



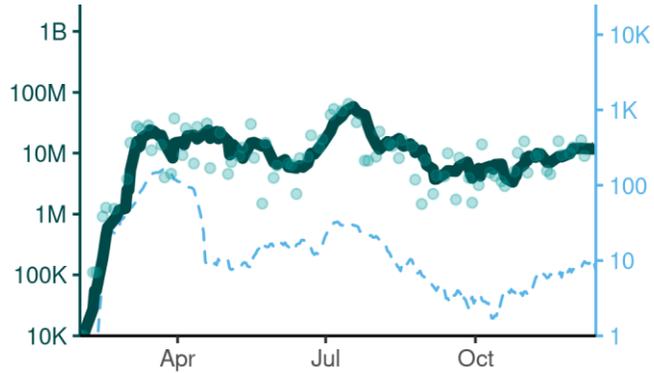
**Invercargill** Autosampler 50.0K



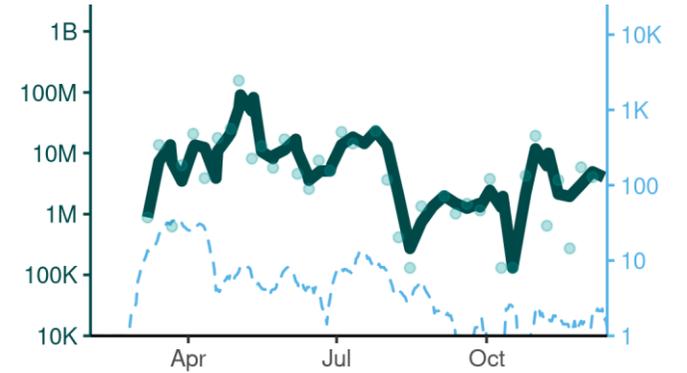
**Dunedin (Mosgiel)** Autosampler 14.6K



**Queenstown** Autosampler 40.0K

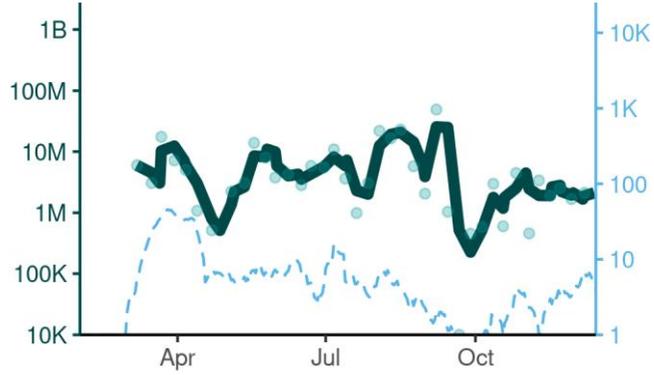


**Wanaka** Grab 14.5K

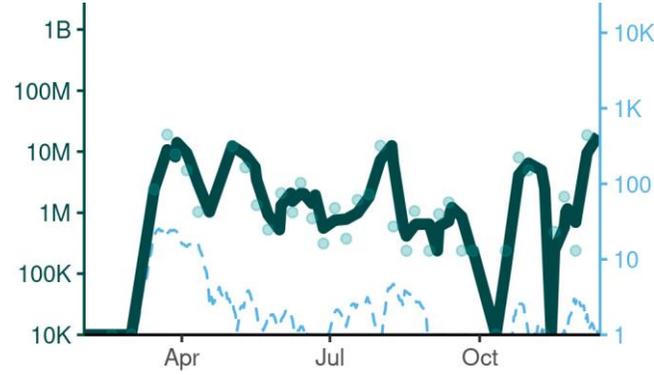


Status ● Detected ● Not detected

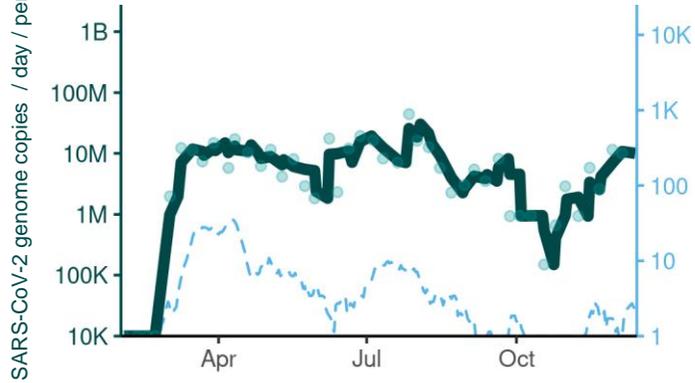
**Gore** Autosampler 8.0K



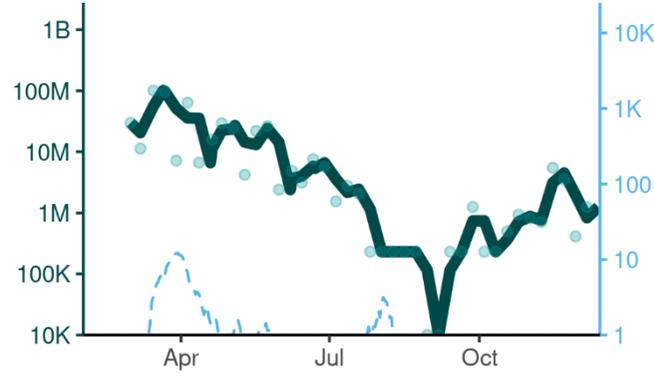
**Balclutha** Grab 4.1K



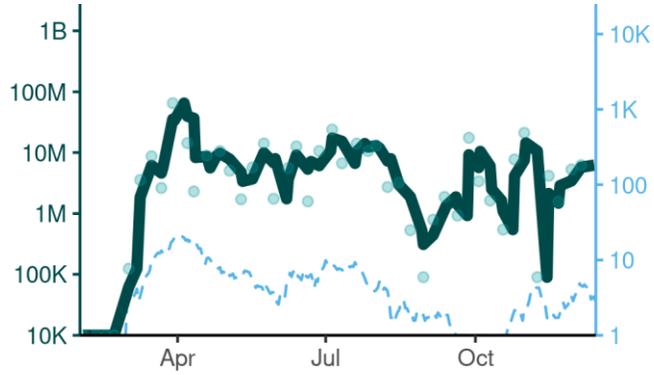
**Cromwell** Autosampler 7.1K



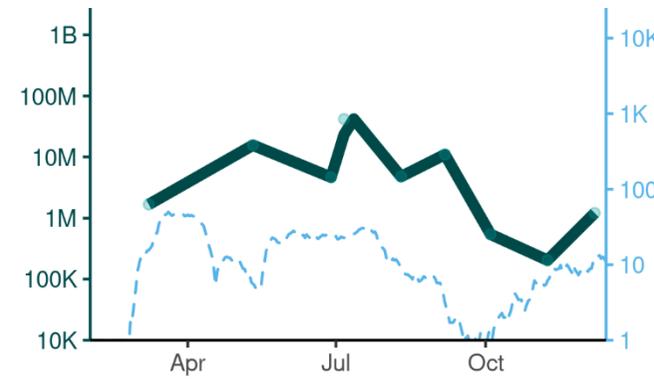
**Bluff** Autosampler 2.0K



**Alexandra** Autosampler 6.2K



**Oamaru** Autosampler 12.0K











## Acknowledgements

This work represents the combined efforts of many 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 Javed, 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, Joanne Chapman, Lei Chen, Gerhard de Beer, Richard Dean, Brent Gilpin, Joanne Hewitt, Dawen Li, Jonathan Marshall, Helen Morris and Leighton Watson. 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. 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 to ESR (at Porirua). 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 (m<sup>3</sup> 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).

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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