National Wastewater Surveillance Programme - COVID-19

Weeks 9 & 10 (Weeks ending 5 March & 12 March 2023)

Report prepared on 15 March 2023

| **100%**	**66%**	**Omicron**
		XBB (~43%)
sites tested had SARS-CoV-2 detected (83/83 sites) in week 10	NZ population covered by wastewater testing in week 10	Most prevalent variant detected in week 10

Nationally, SARS-CoV-2 levels have moderately increased but are lower than 12 weeks ago. Variant analysis suggests that XBB and CH.1.1 continue to be the most common variants detected.

- Comparing this week ending 12 March to week ending 5 March 2023, 38% of sites show an increase in SARS-CoV-2 levels while 38% sites showed a decrease in SARS-CoV-2.
- Comparing this week ending 12 March 2023 to one month ago (week ending 12 February 2023), 54% of sites show and increase in SARS-CoV-2 levels while 28% of sites showed a decrease in SARS-CoV-2 levels.
- The main variants detected in wastewater in the week ending 12 March 2023 (week 10) were XBB (includes XBB.1.5, ~43%), CH.1.1 (~28%), BA.2.75* (includes XBF, ~25%). Minor contributions from BQ.1.1 (~2%), and XBC (~2%). BA.4/BA.5 not detected.
- Weather-related impacts in late January and February 2023 resulted in fewer samples being collected in some regions. For example, Northland and Auckland sites were impacted by flooding in late January, and Hawke's Bay and Gisborne by Cyclone Gabrielle in early February. While many sites had recommended regular sampling by week 10, others continue to be missing (for example South Western Interceptor, Napier and Gisborne).
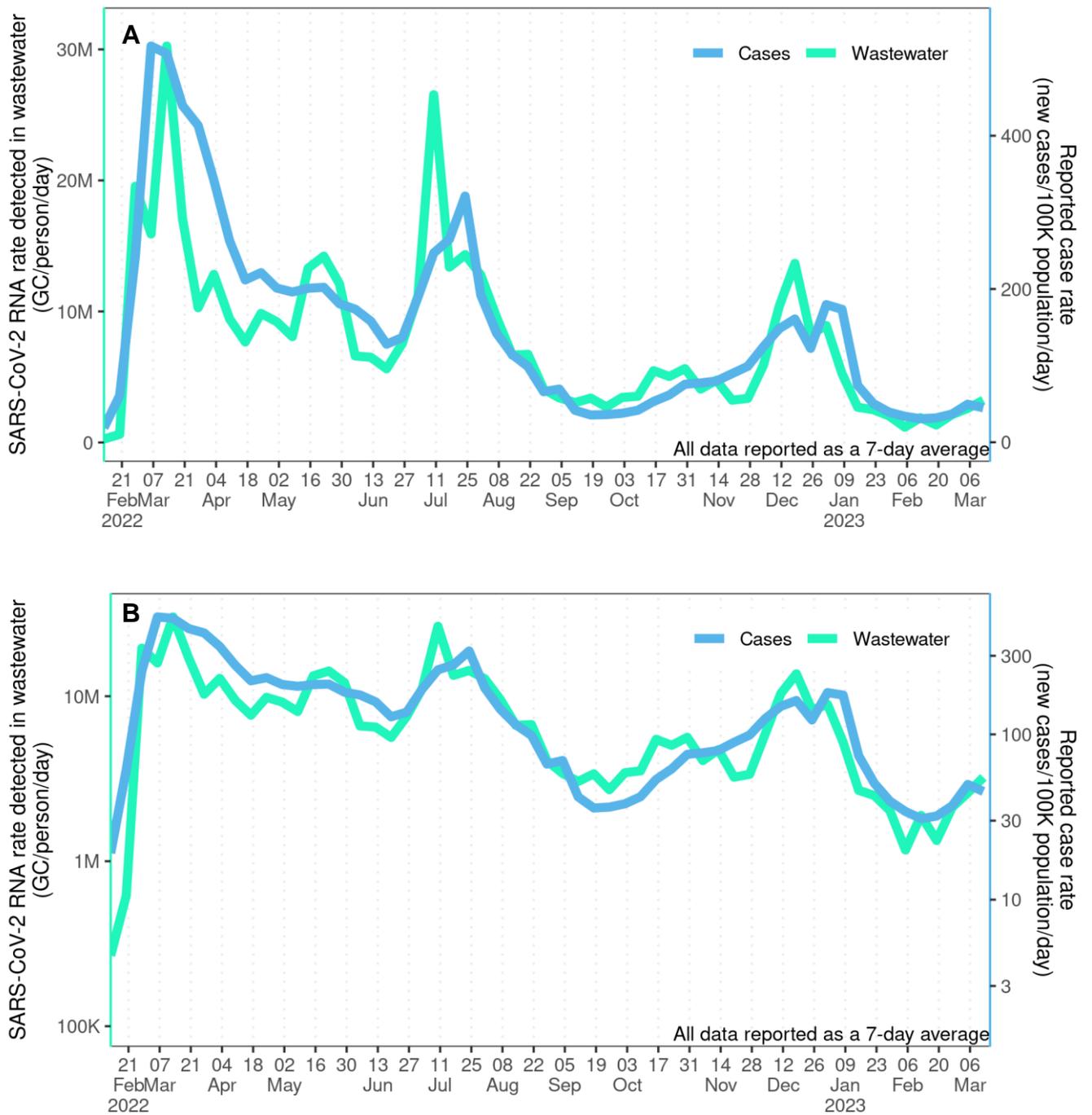
Figure 1. National timeseries of estimated SARS-CoV-2 genome copies (GC) in wastewater rate (GC/person/day, green line) and reported case rate (new cases/100,000 population/day, blue line) on a linear scale (**A**) and Log$_{10}$ scale (**B**). Data reported as 7-day average.

Results for Weeks 9 & 10 (Weeks ending 5 March & 12 March 2023)

In the two weeks ending 12 March 2023, 221 samples were collected from 83 locations across New Zealand.

SARS CoV-2 RNA was detected in 217/221 (98%) samples from 83/83 (100%) sites (Figure 2, Table 1).

No sampling from the Auckland South Western Interceptor has been possible from week 5 following subsidence to the surrounding ground around the sampler during the Auckland flooding. Currently, there is no safe access point to sample from the South Western Interceptor. A combined sample from Mangere treatment plant is being collected that includes the South Western catchment.

In week 10, sampling from all seven regular Northland sites had recommenced (4 sites collected in week 9). No samples from Gisborne and Napier were collected in weeks 9 and 10 (nor in week 8).
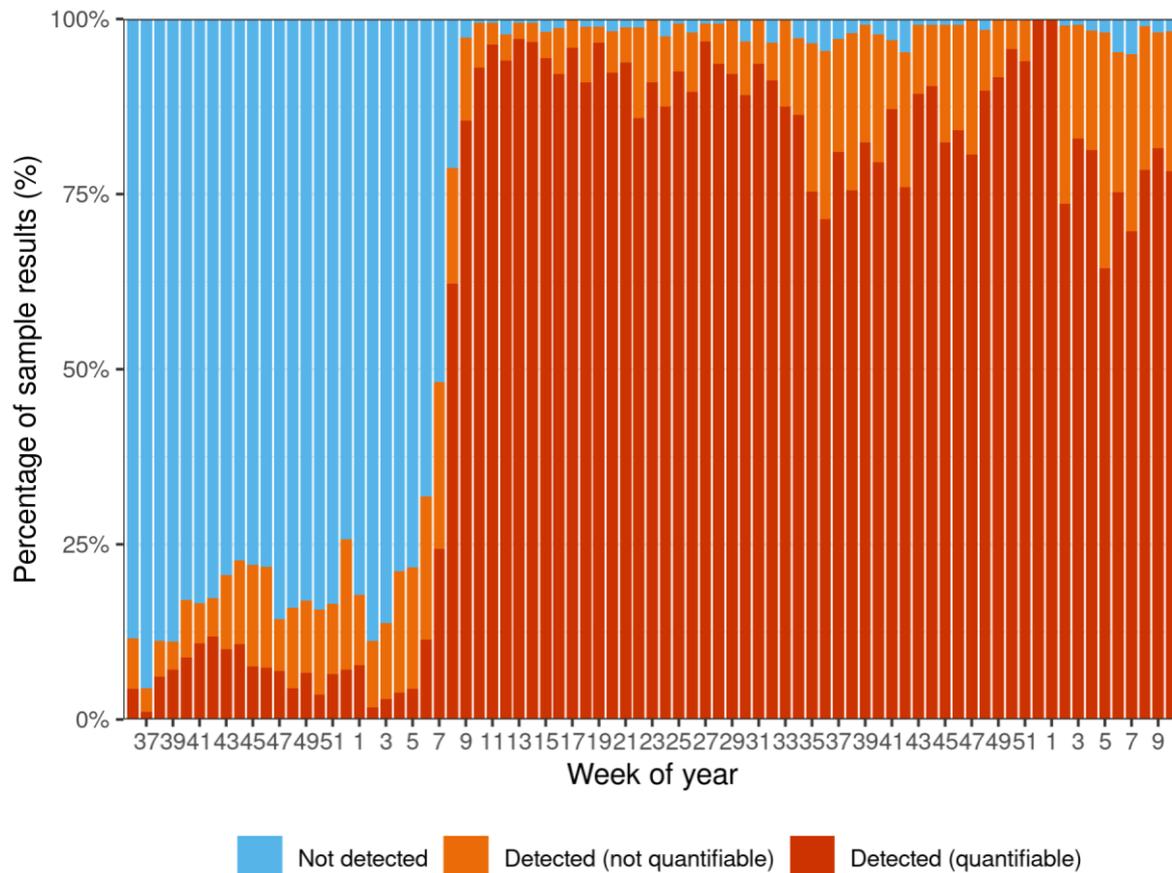

**Figure 2**. Results for SARS-CoV-2 RNA in wastewater collected across New Zealand.

Regional Trends

Regional summaries (Figure 3) of the wastewater data indicates generally steady or increasing viral levels in all regions in week 10 compared to previous weeks. 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).

Due to the weather-related impacts in February 2023, fewer samples were collected in some regions. The Central regional summary excludes Hawke's Bay samples in weeks 8-10, and analysis for the Northern region was not possible in between weeks 7-9 due to too few samples being received from this region. The dashed blue line shows inferred level in this region during this time (Figure 3).
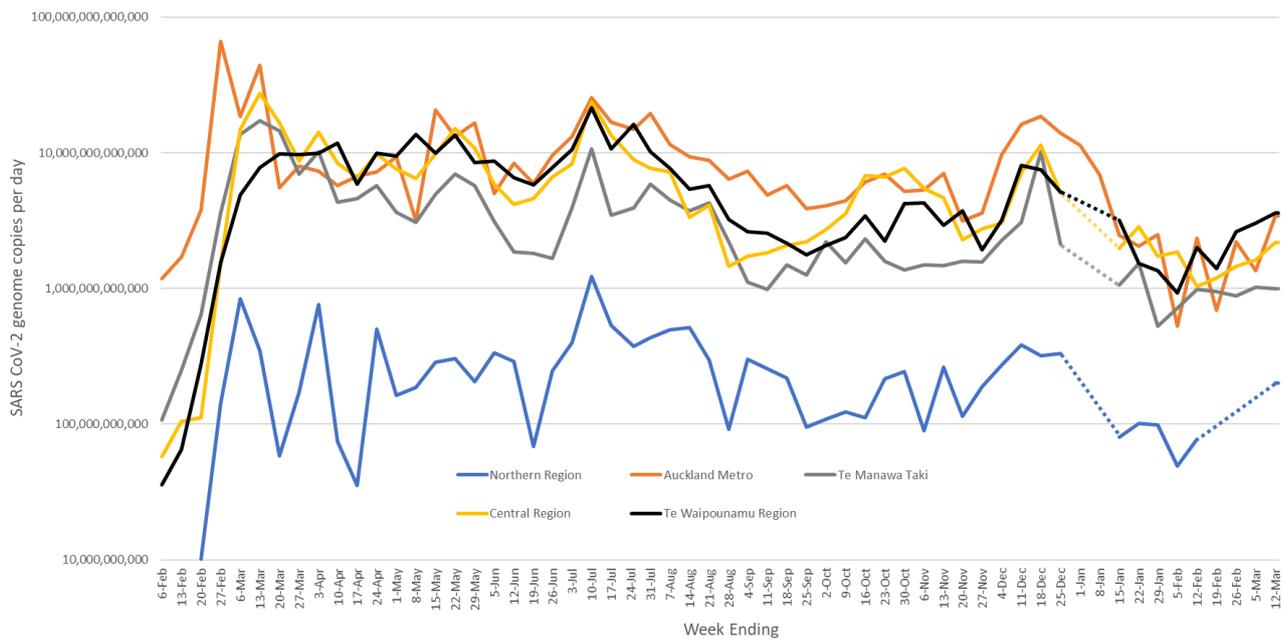
Figure 3. Total SARS-CoV-2 genome copies detected per day in the five Ministry of Health regions. Dashed lines are inferred levels during periods when samples were either not collected (Christmas period) or insufficient numbers collected (due to weather impacts) for the region.
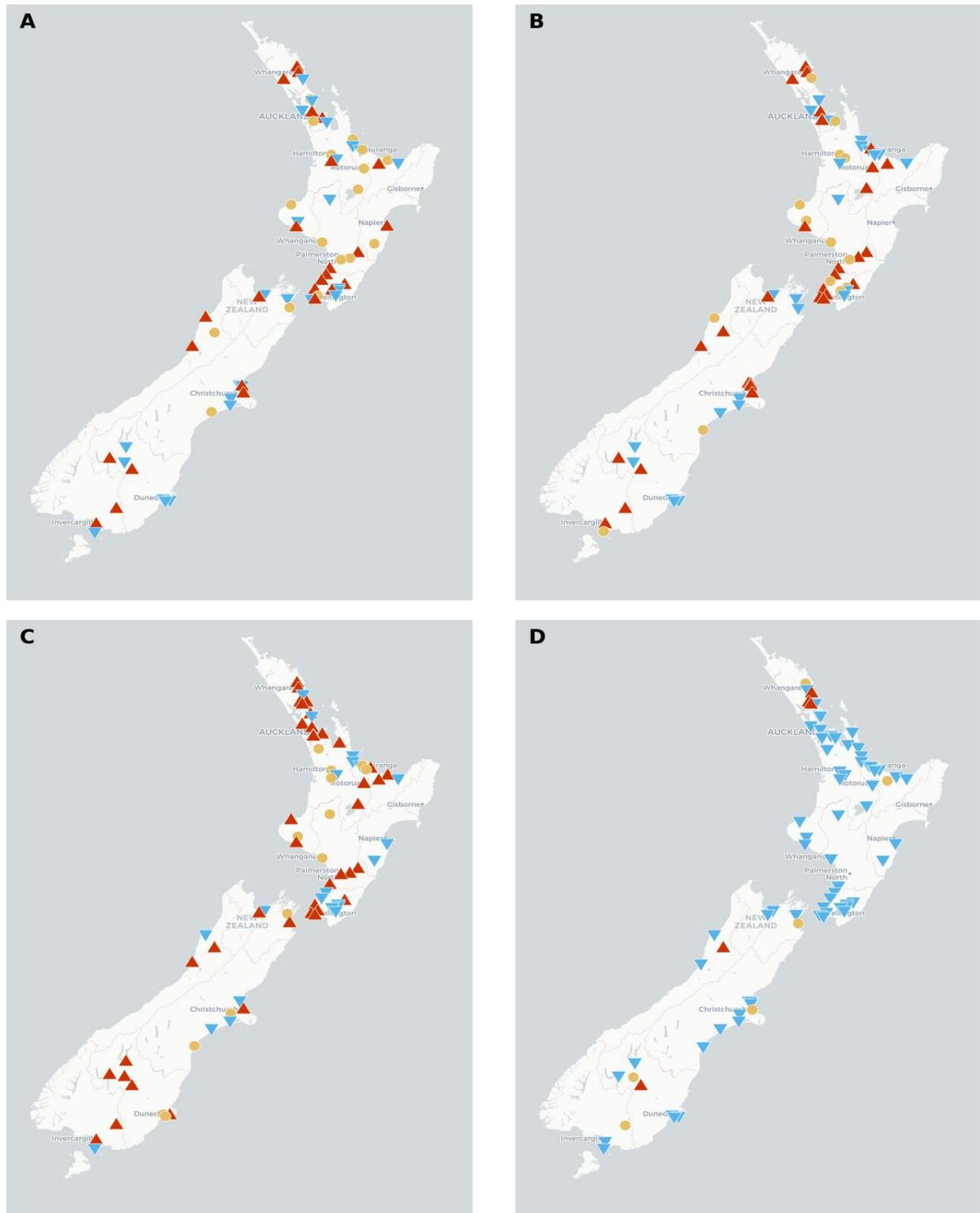
Figure 4. Comparison of SARS-CoV-2 levels for the week ending 12 March 2023, compared to levels measured: A) 1 week ago; B) 2 weeks ago; C) 4 weeks ago; D) 12 weeks ago. Only sites with results for both time points are included. When the viral quantity is 30% or more higher this is labelled as increased (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/

Wastewater Variant Analysis

In collaboration with Wilderlab, ESR generated the variant analysis results (Table 1, Figure 5) from sentinel sites in week 9 (ending 5 March 2023) and week 10 (ending 12 March 2023).

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.

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.

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

Results for weeks 9 and 10

CH.1.1 was **frequently detected** in weeks 9 (14/17 sites) and 10 (14/18 sites). CH.1.1 comprised ~41% of sequencing reads nationally in week 9, declining to ~28% sequencing reads in week 10. Other subvariants in the BA.2.75* group (including BM.4, BR.2, XBF and BA.2.75) accounted for another ~4% reads in week 9. This rose to ~25% of sequencing reads nationally in week 10.

XBB (includes XBB.1.5) was also **frequently detected**, comprising ~46% of reads nationally in week 9 (14/17 sites), and ~43% of reads nationally in week 10 (15/18 sites).

BQ.1.1 was only identified in ~4% of national sequence reads in week 9 and ~2% in week 10, and with no consistency between weeks in which sites had BQ.1.1 detections (2/17 sites in week 9, 3/18 sites in week 10, Table 1).

The XBC variant also remains at low levels, comprising ~4% (week 9) and ~2% (week 10) of sequencing reads nationally.

The BA.4/BA.5 variant group (including BF.7) was only detected in Palmerston North in week 9 (accounting for ~1% of sequences nationally) and not detected at any site in week 10.

6

|	Week 9							Week 10					
	BA.4/BA.5	BA.2.75*	CH.1.1	BQ.1.1	XBB	XBC		BA.4/BA.5	BA.2.75*	CH.1.1	BQ.1.1	XBB	XBC
Whangarei		■	■		■	■			■	■		■	■
North Shore									■	■	■	■	
Auckland East		■			■				■	■		■	
Auckland Southwest	grey	grey	grey	grey	grey	grey		grey	grey	grey	grey	grey	grey
Auckland West	grey	grey	grey	grey	grey	grey			■	■		■	■
Mt Maunganui			■		■	■							
Tauranga			■		■	■							
Rotorua		■	■						■	■			
Taupo										■		■	
Gisborne	grey	grey	grey	grey	grey	grey		grey	grey	grey	grey	grey	grey
New Plymouth			■		■				■	■			
Palmerston North	■												
Porirua				■	■				■			■	■
Hutt Valley			■	■									
Wellington (Moa Point)					■					■		■	
Nelson										■	■		
Christchurch		■	■						■	■		■	
Queenstown			■		■				■	■			
Dunedin (Tahuna)			■							■			
Dunedin (Mosgiel)		■	■		■				■	■	■	■	
All Sites (national)	1	4	41	4	46	4			25	28	2	43	2

Table 1. Data from 17 wastewater sentinel sites sampled in week 9 (ending 5 March 2023) and 18 sentinel sites sampled in week 10 (ending 12 March 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, white box denotes that the variant was not detected, and grey box denotes site was not sampled that week. Numbers in the bottom row denote the estimated percentage of each variant at the national scale.

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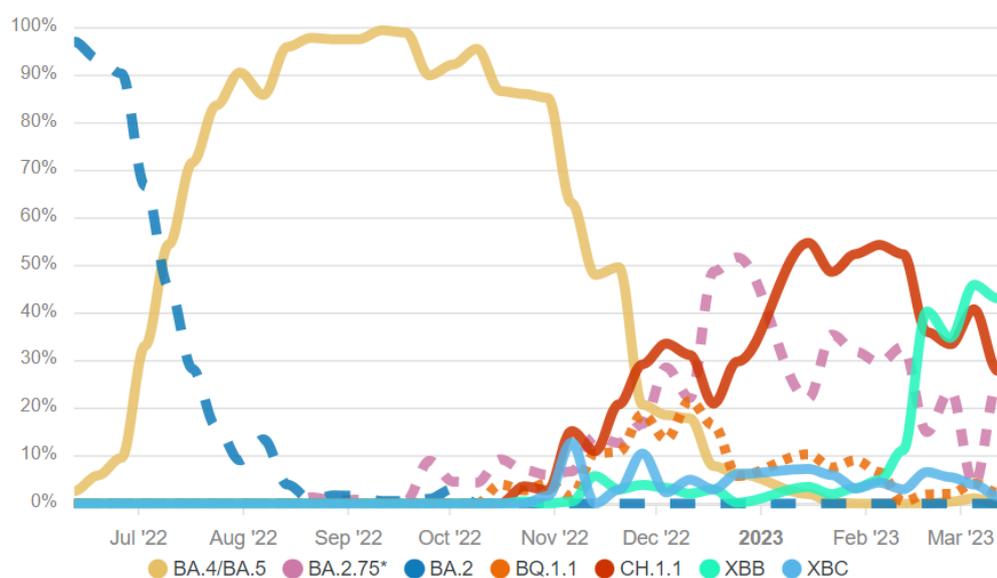
Figure 5. Change in variant prevalence over time at a national scale. Data are collected from up to 20 sentinel sites each week.

7

Interpreting Sites Graphs

Auckland Southwest *Autosampler 120.0K*
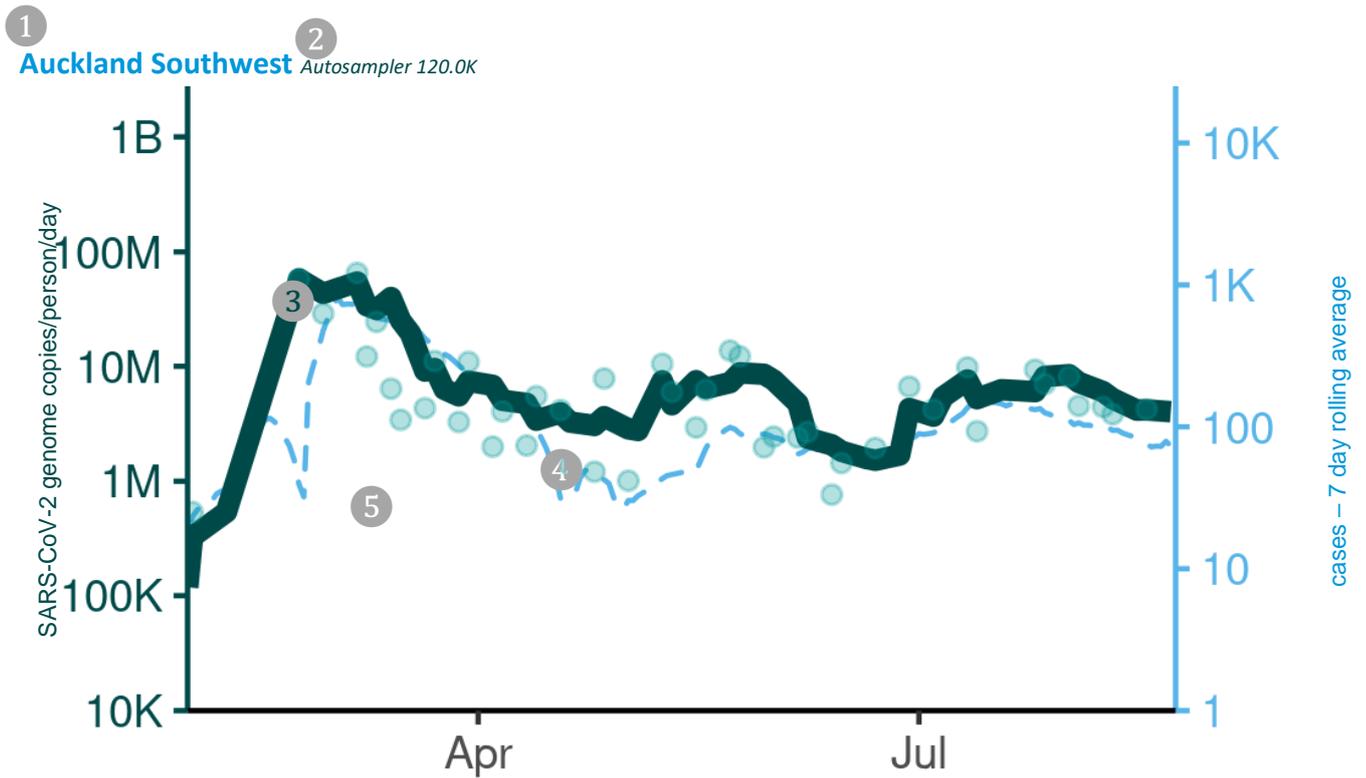
1   Site Name

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*
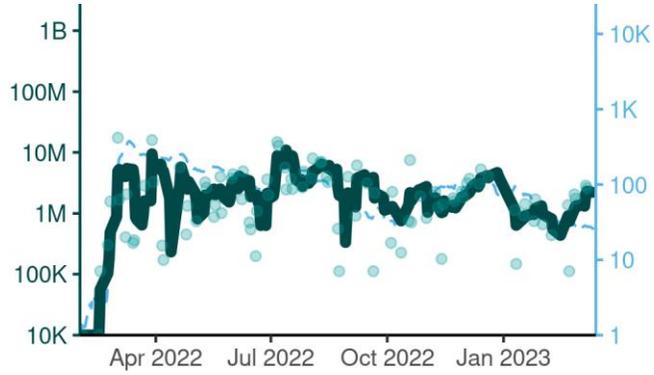
Dargaville *Grab 5.0K*

Kerikeri *Grab 6.2K*

SARS-CoV-2 genome copies / day / person
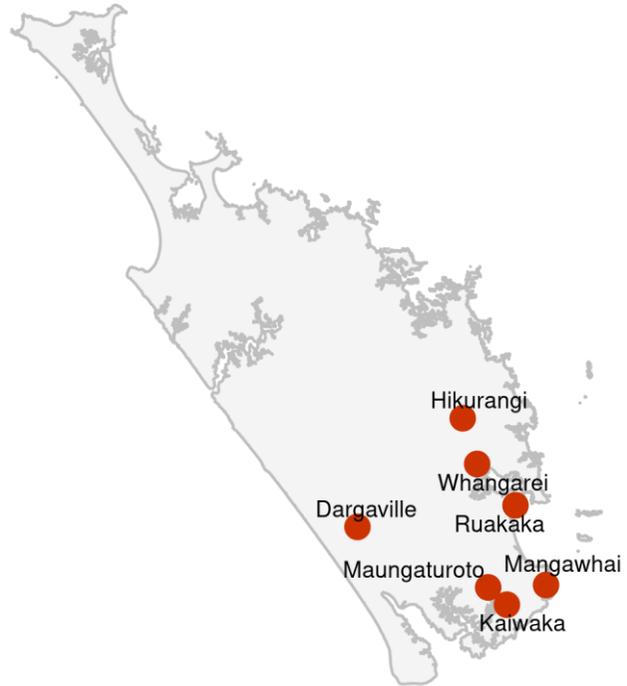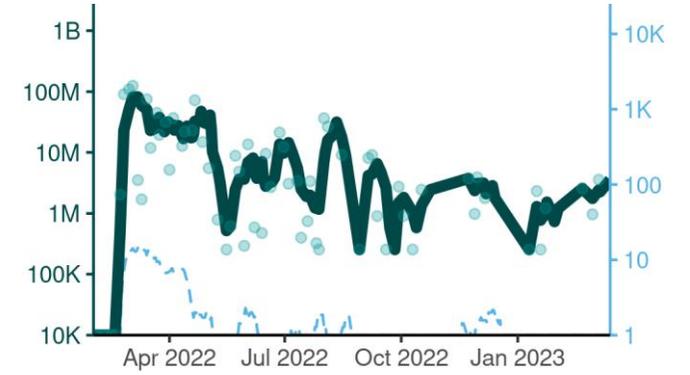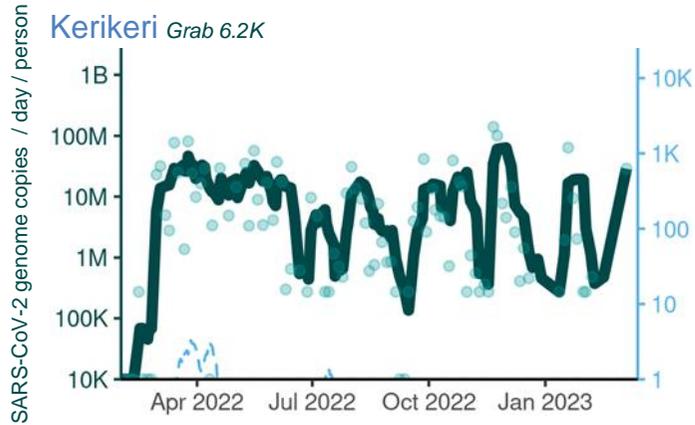
Ruakaka *Grab 4.5K*
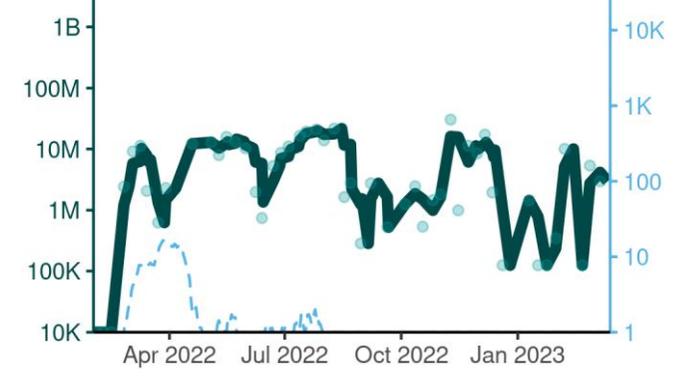
Hikurangi *Grab 1.7K*

Mangawhai *Grab 1.1K*

Hikurangi
Whangarei
Dargaville
Ruakaka
Maungaturoto Mangawhai
Kaiwaka

Status   ● Detected   ● Not detected

9
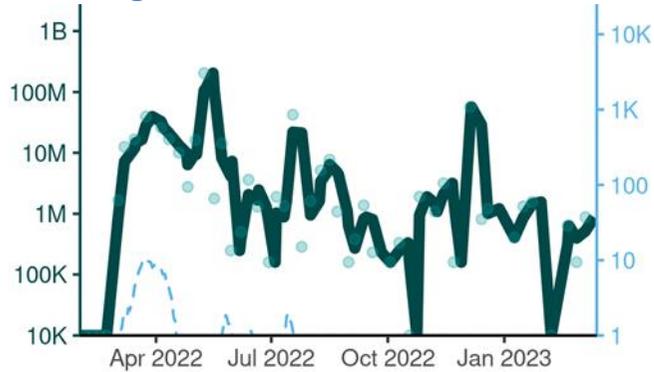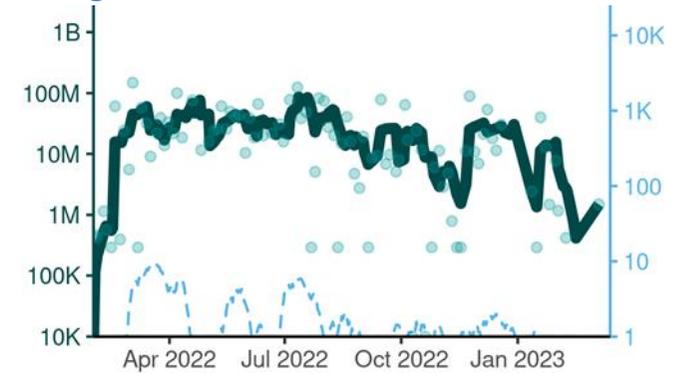
Auckland

Auckland (Combined) *Autosampler 1.1M*
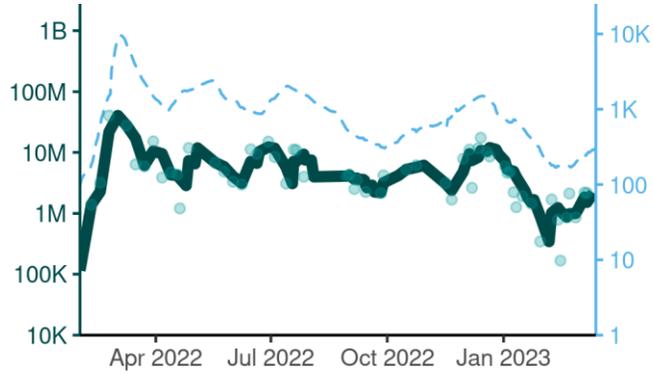
North Shore *Autosampler 240.0K*
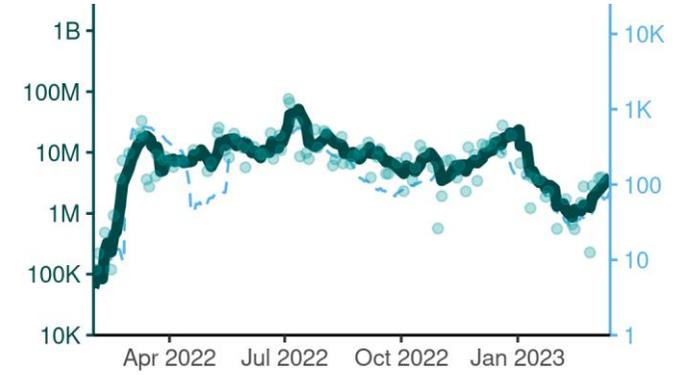
Auckland East *Autosampler 680.0K*
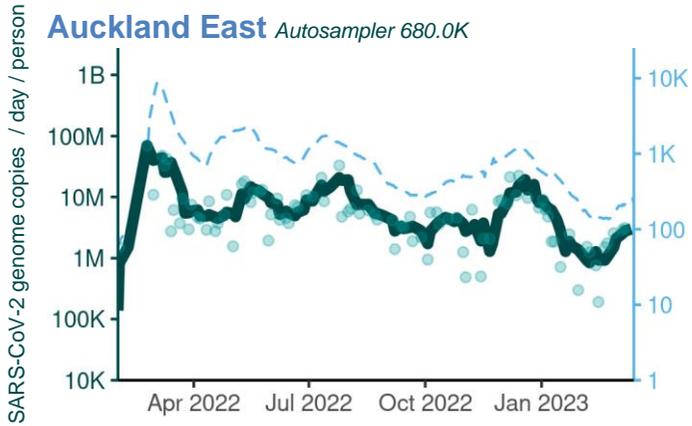
Auckland Southwest *Autosampler 120.0K*
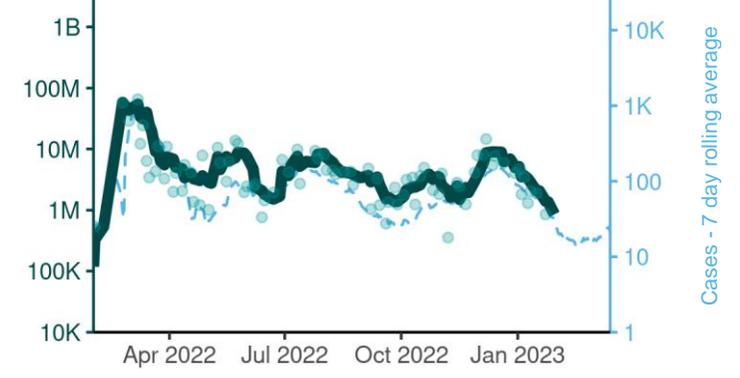
Auckland West *Autosampler 315.0K*
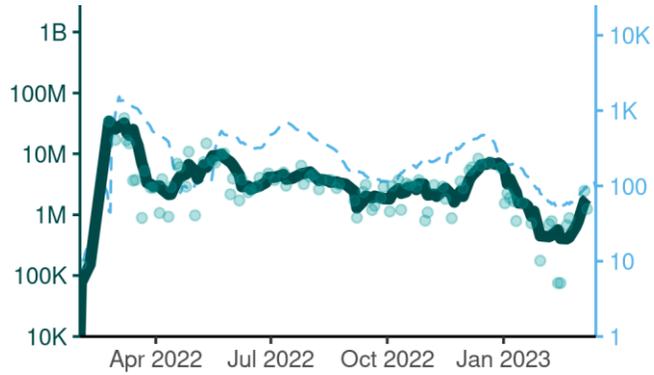
Army Bay *Autosampler 42.0K*

SARS-CoV-2 genome copies / day / person

Cases - 7 day rolling average

Map labels: Warkworth, Snells/Algies, Army Bay, Helensville, North Shore, Beachlands, Auckland West, Auckland East, Kawakawa Bay, Auckland (Combined), Pukekohe

Status: Detected — Not detected

10
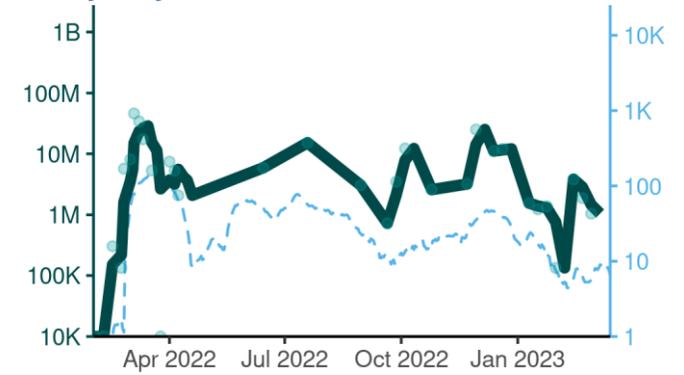
Pukekohe *Autosampler 20.9K*
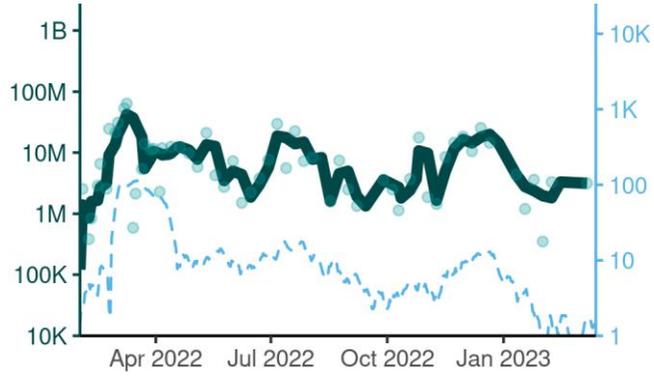
Snells/Algies *Autosampler 4.0K*
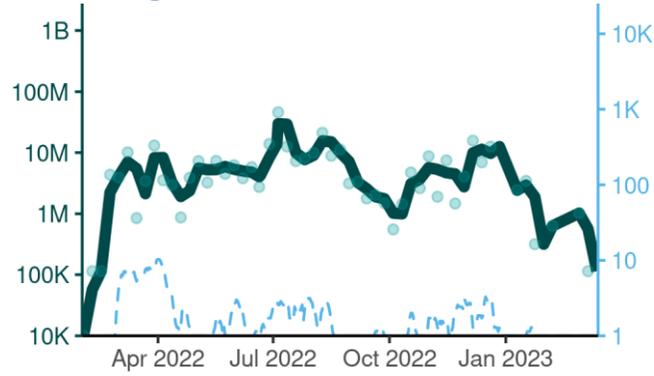
Waiuku *Grab 7.9K*
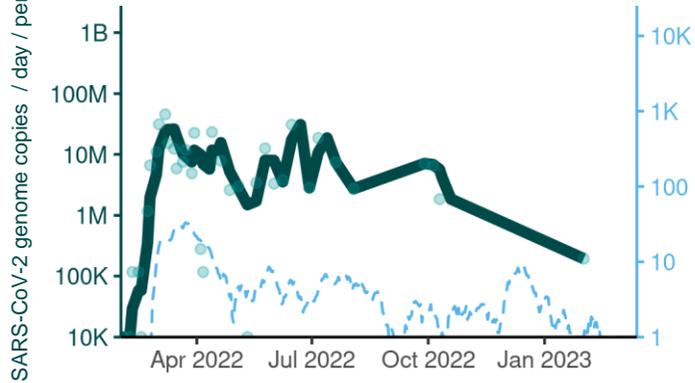
Helensville *Autosampler 3.8K*
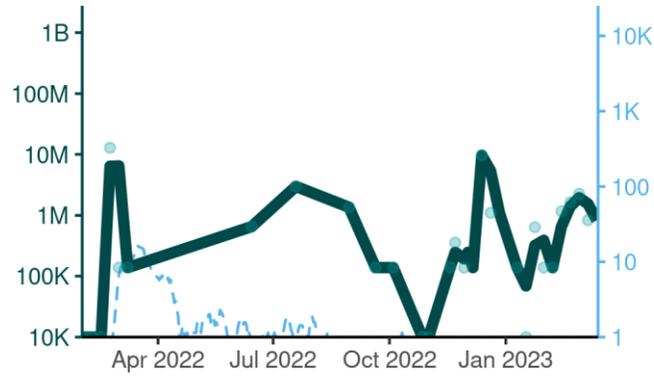
Beachlands *Grab 6.8K*
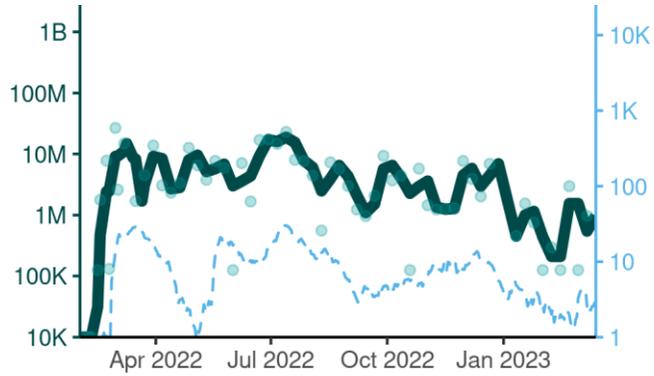
Warkworth *Autosampler 3.5K*

SARS-CoV-2 genome copies / day / person
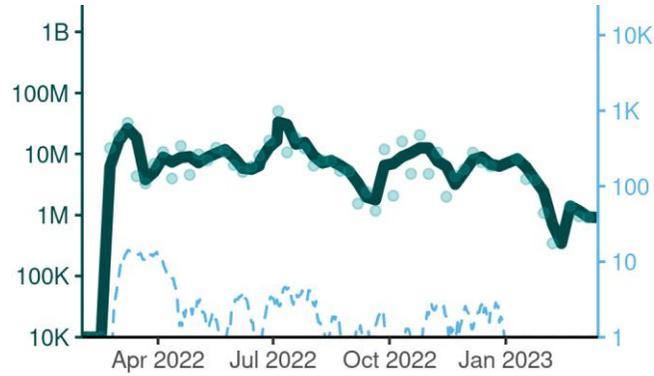
Cases - 7 day rolling average

Waikato
Hamilton *Autosampler 169.0K*
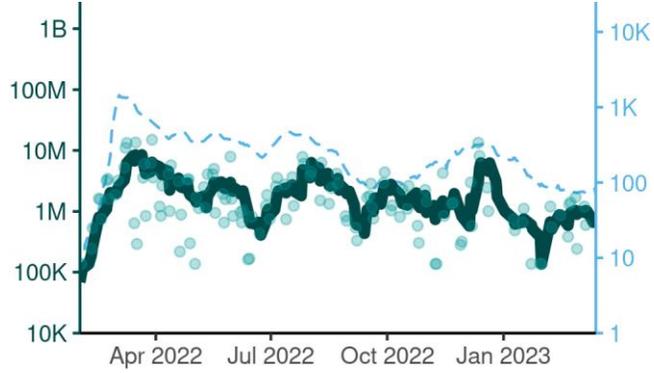
Taupo *Auto/grab 23.0K*
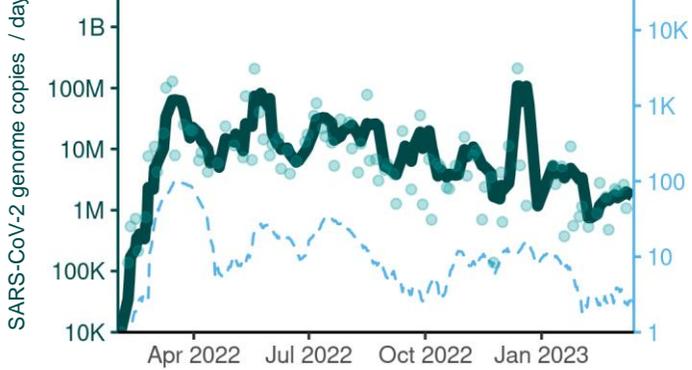
Cambridge *Autosampler 20.1K*

SARS-CoV-2 genome copies / day / person
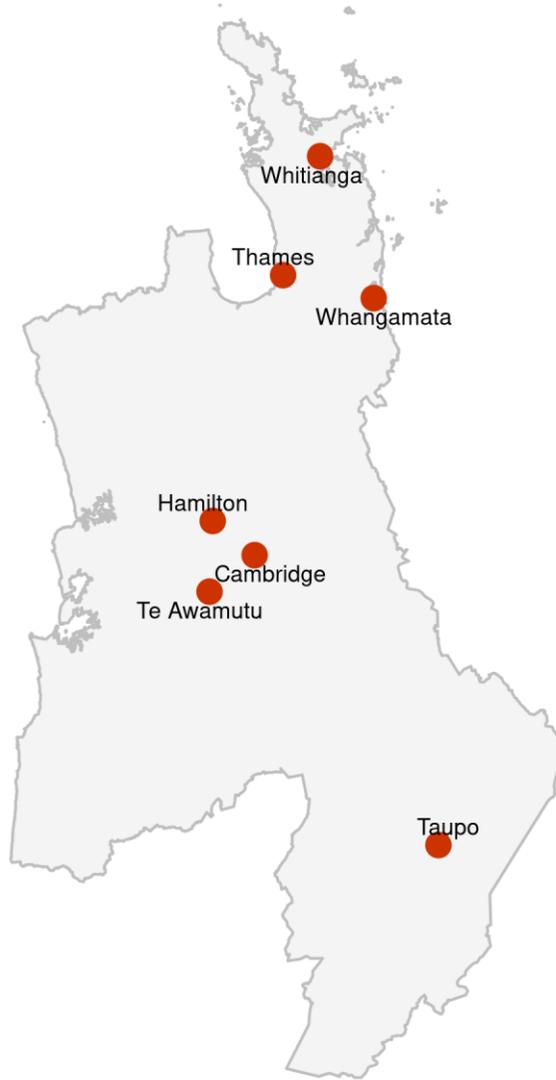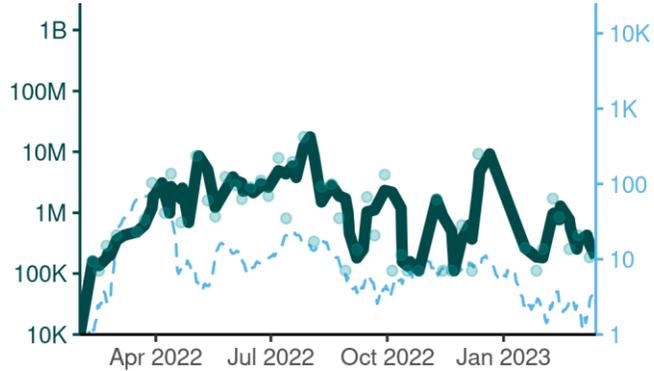
Thames *Autosampler 7.5K*
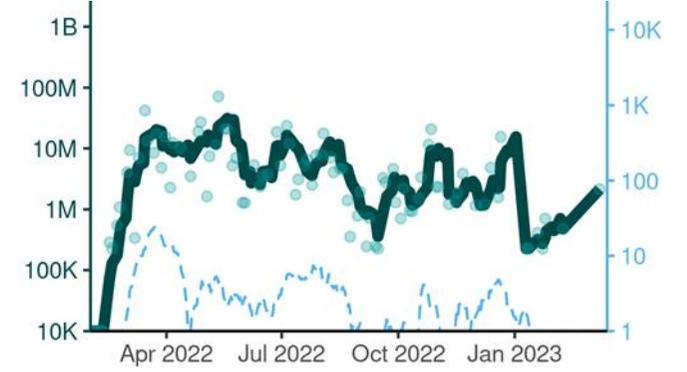
Te Awamutu *Autosampler 13.1K*
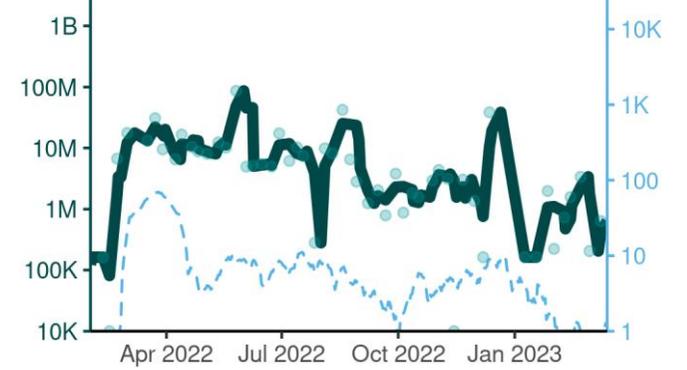
Whitianga *Autosampler 6.6K*

Cases - 7 day rolling average

Status ● Detected ● Not detected
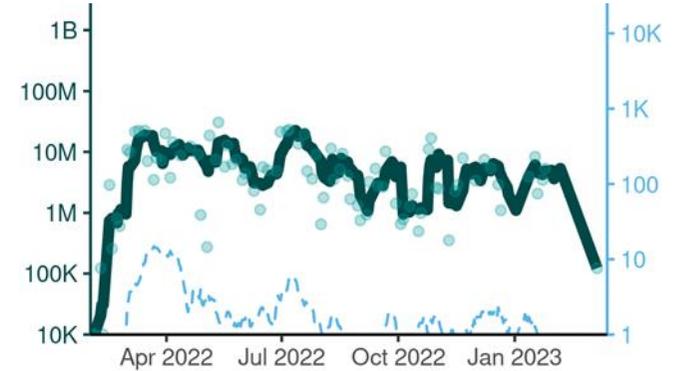
Bay of Plenty and Gisborne

Mt Maunganui/Papamoa *Autosampler 65.0K*
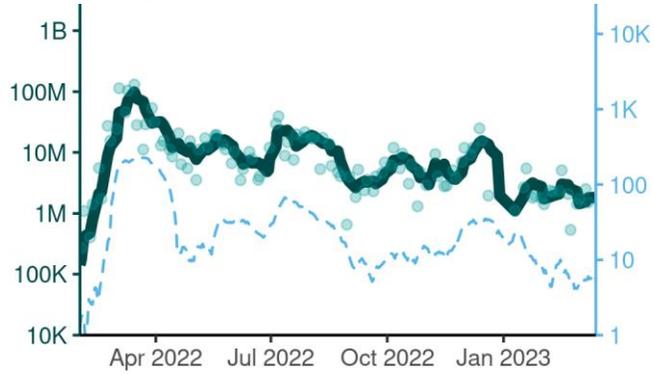
Gisborne *Autosampler 37.0K*
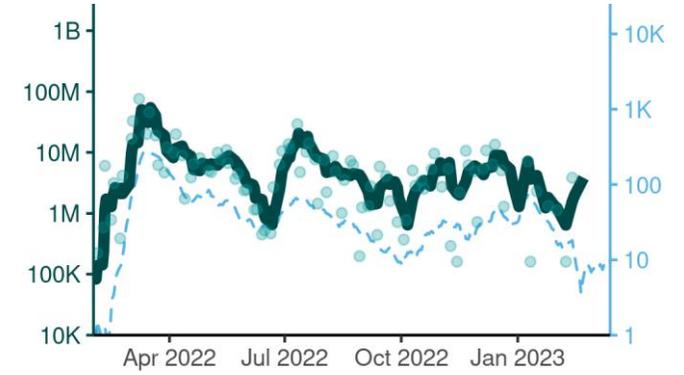
Rotorua *Autosampler 59.0K*
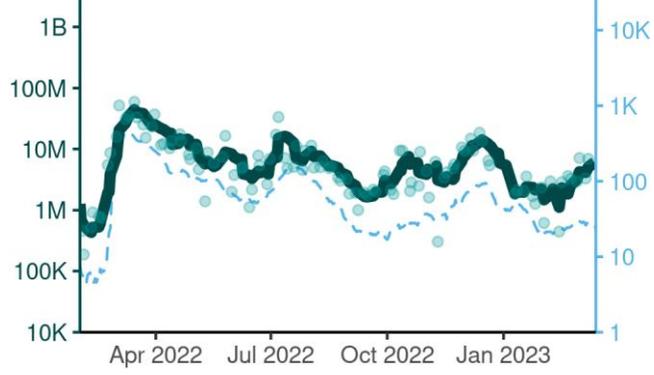
Whakatane *Autosampler 21.0K*
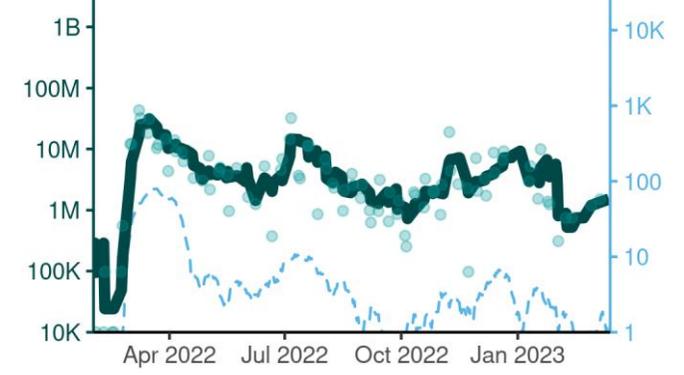
Tauranga *Autosampler 50.0K*

Te Puke *Autosampler 9.7K*

SARS-CoV-2 genome copies / day / person

Cases - 7 day rolling average

Status — Detected — Not detected

Map labels: Waihi Beach, Katikati, Tauranga, Mt Maunganui/Papamoa, Maketu, Te Puke, Whakatane, Opotiki, Kawerau, Rotorua
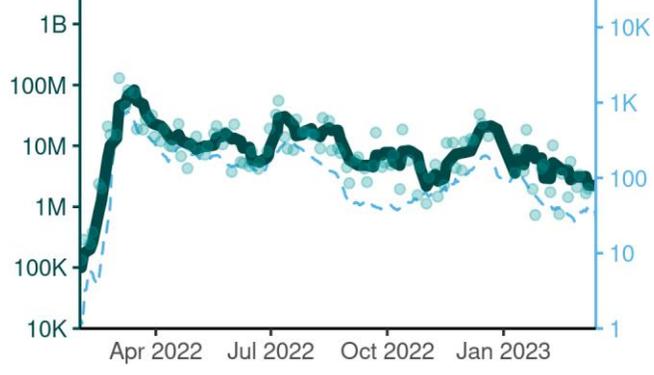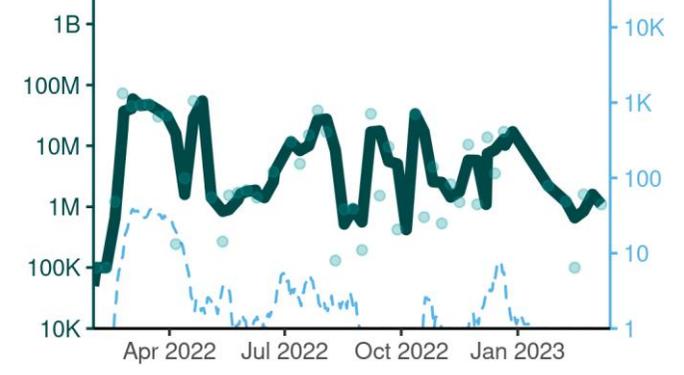
Kawerau *Autosampler 7.0K*
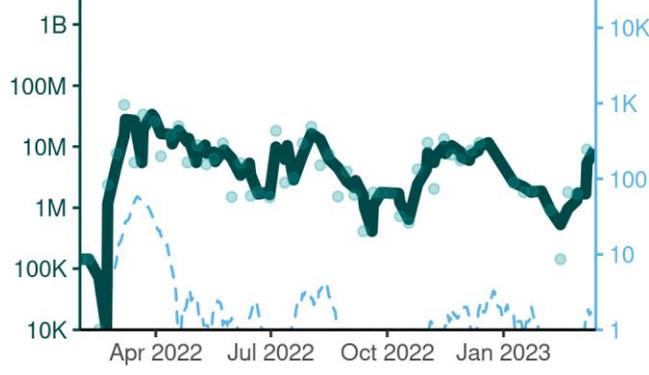
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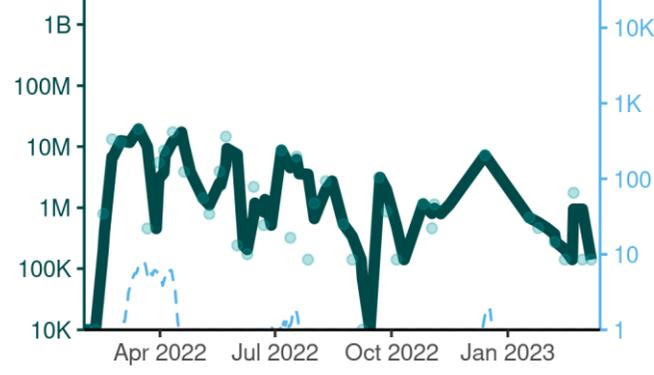
Katikati *Autosampler 5.5K*
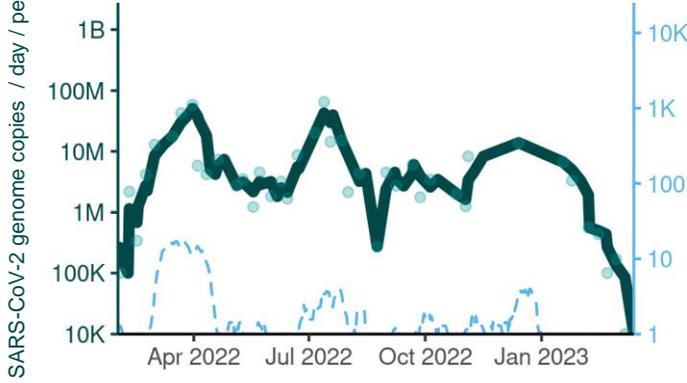
Maketu *Autosampler 1.3K*
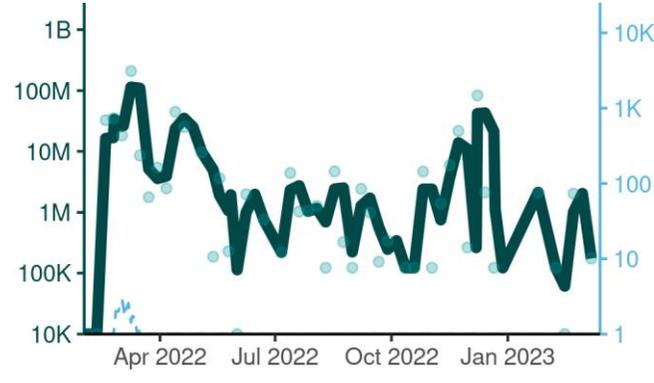
Opotiki *Autosampler 3.8K*

SARS-CoV-2 genome copies / day / person

Cases - 7 day rolling average

14
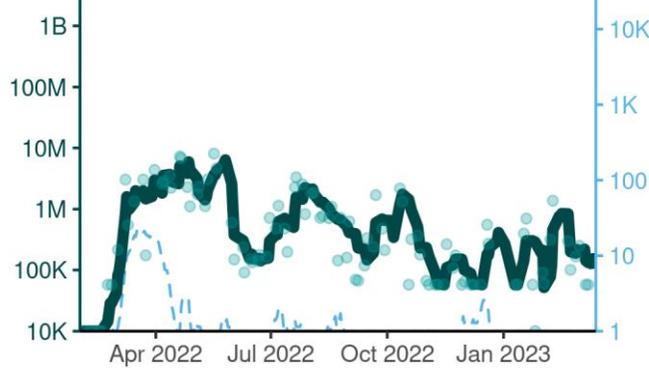
Hawke's Bay
Hastings *Autosampler 80.0K*
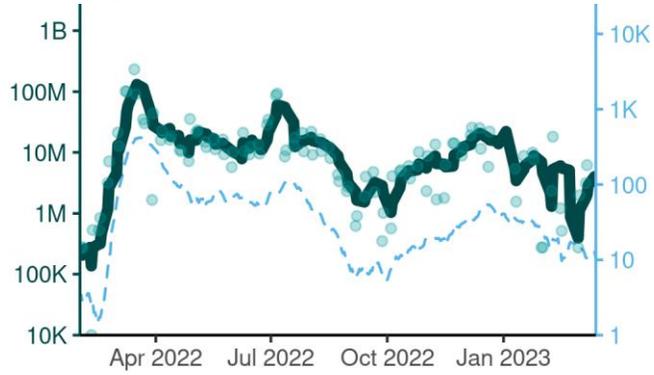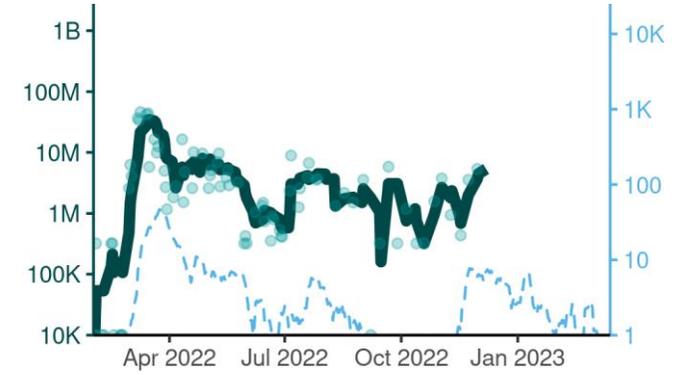
Napier *Autosampler 55.0K*

SARS-CoV-2 genome copies / day / person
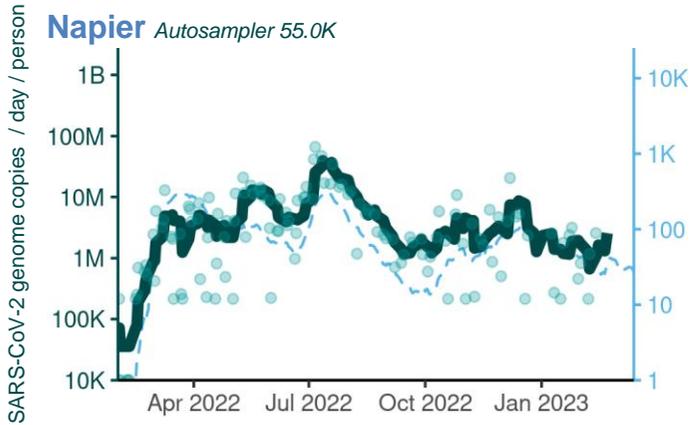
Waipukurau *Autosampler 4.6K*

Wairoa *Grab 4.4K*

Cases - 7 day rolling average

Hastings

Waipukurau
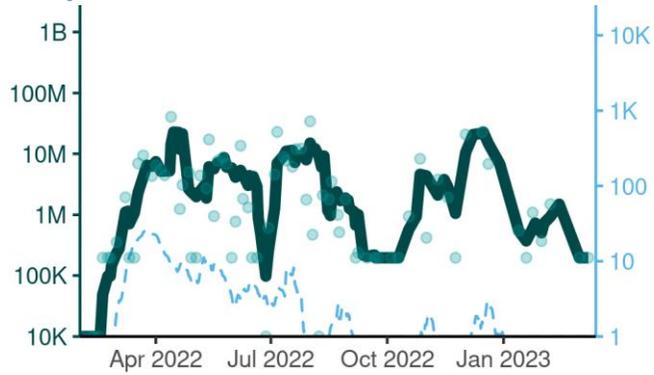
Status   ● Detected   ● Not detected

Taranaki
New Plymouth *Autosampler 88.0K*
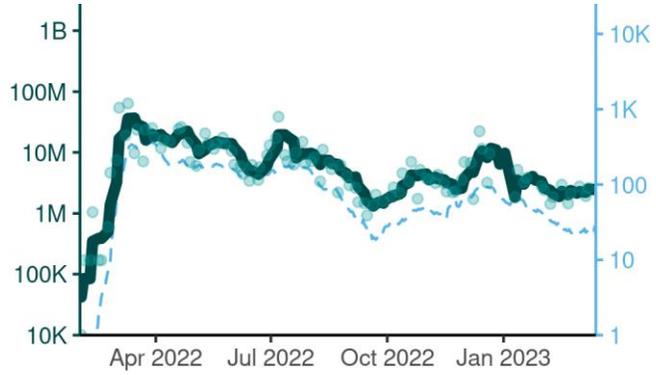
Hawera *Autosampler 12.0K*

SARS-CoV-2 genome copies / day / person
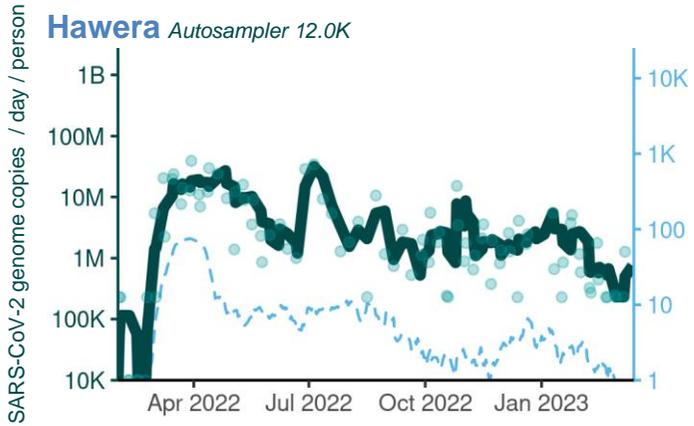
Eltham *Autosampler 2.0K*

Cases - 7 day rolling average

Status ● Detected ● Not detected

16
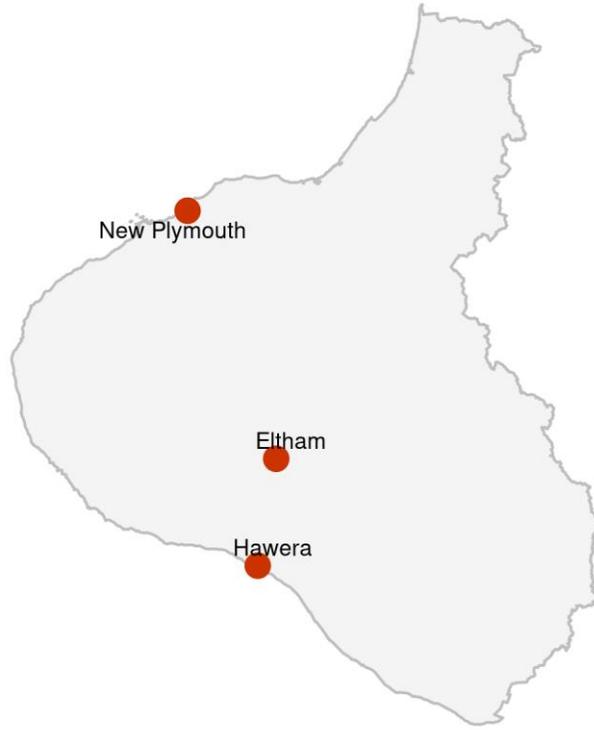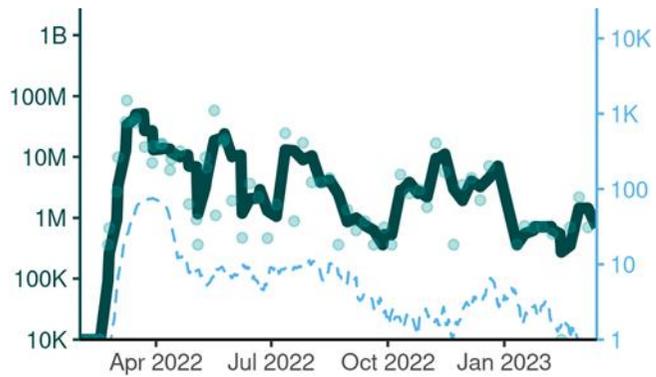
Manawatu-Whanganui
Palmerston North *Autosampler 90.0K*
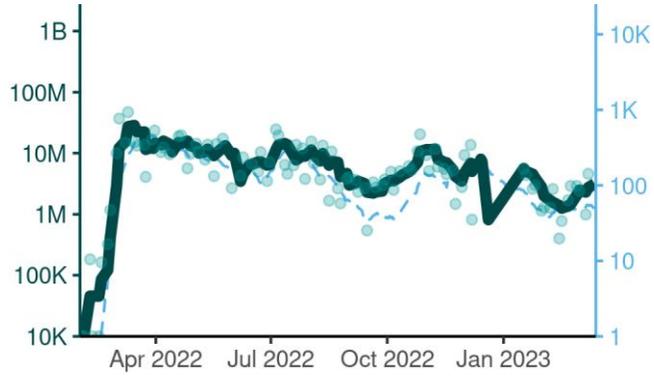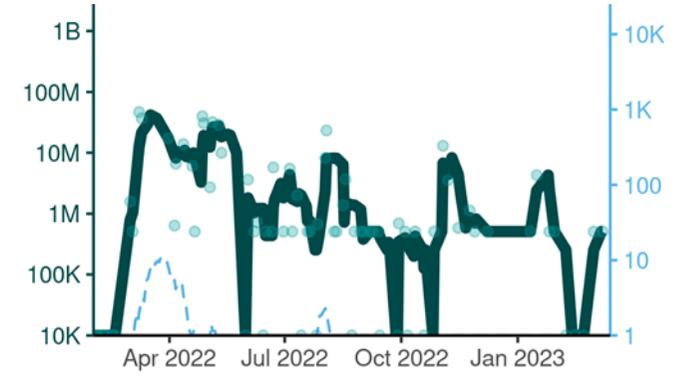
Whanganui *Autosampler 44.5K*

Levin *Autosampler 21.2K*

Woodville *Grab 1.7K*
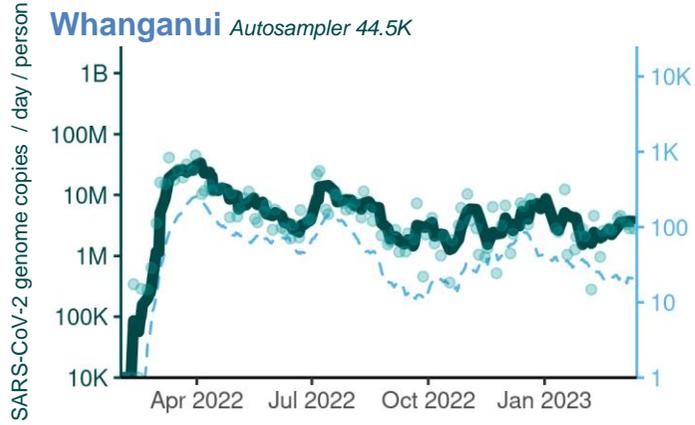
Dannevirke *Grab 5.7K*

Taumarunui *Grab 4.0K*

SARS-CoV-2 genome copies / day / person

Taumarunui

Whanganui

Dannevirke

Woodville

Palmerston North
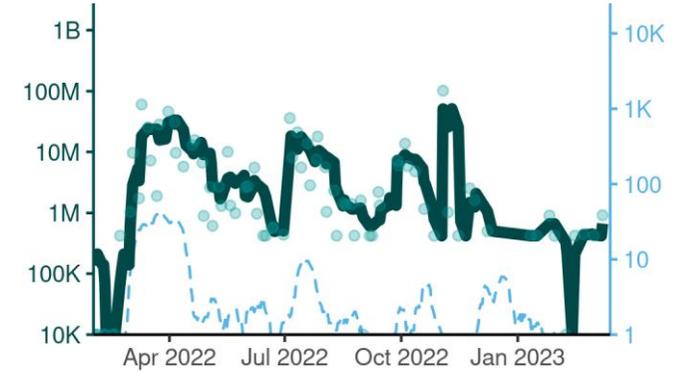
Levin
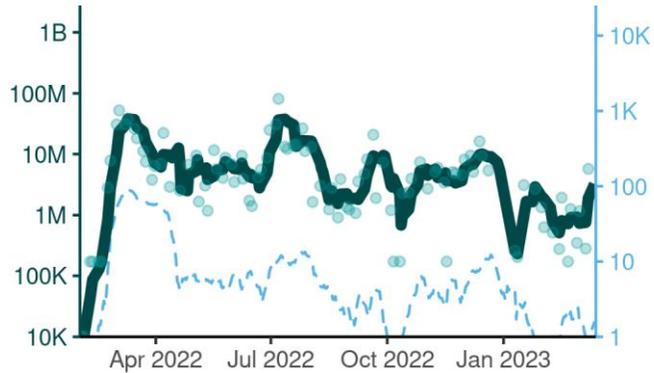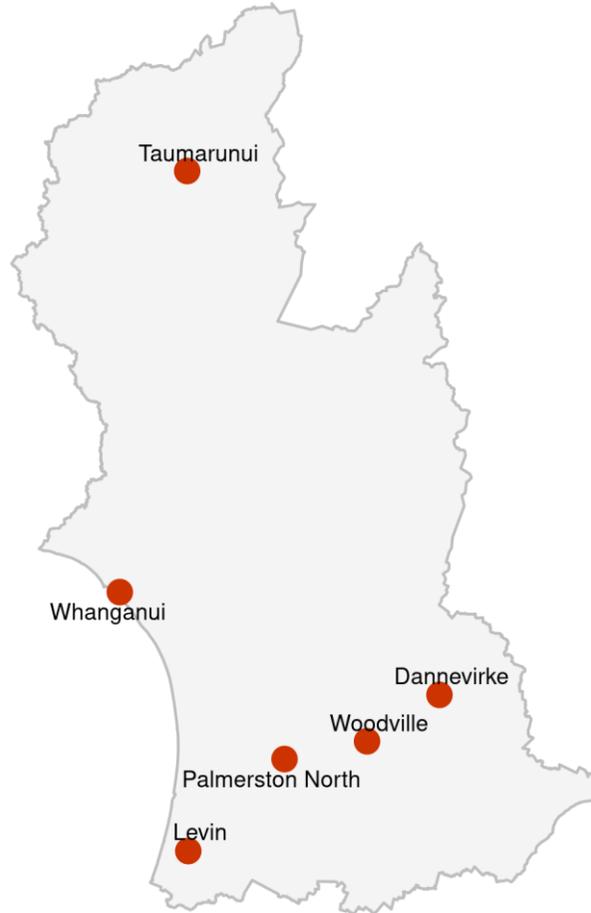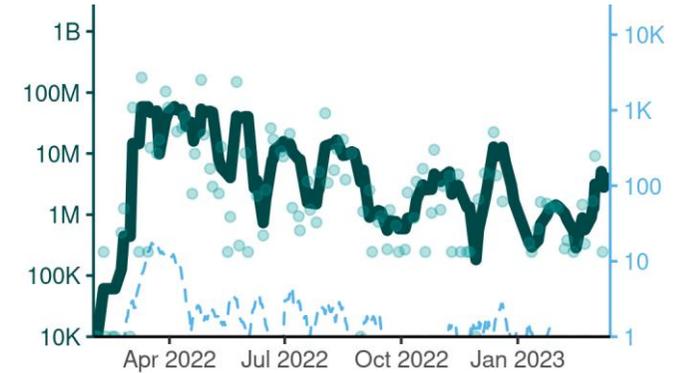
Status   ● Detected   ● Not detected

Wellington
Wellington (Moa Point) *Autosampler 168.0K*
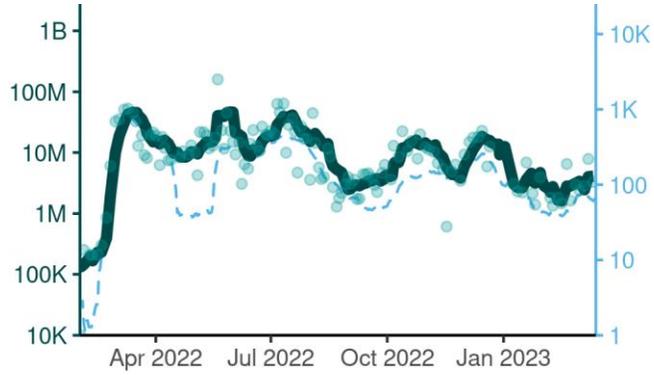
Paraparaumu *Autosampler 49.0K*
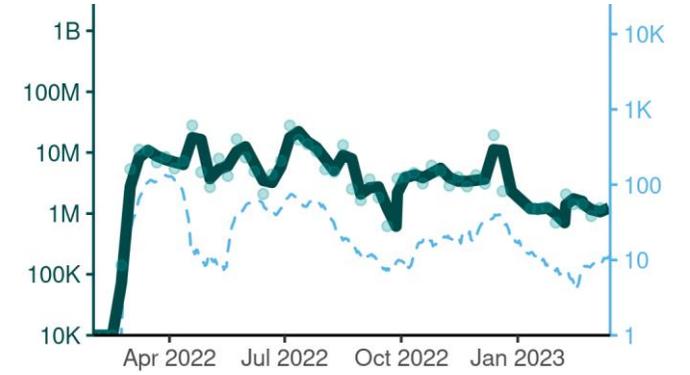
Hutt Valley *Autosampler 133.0K*
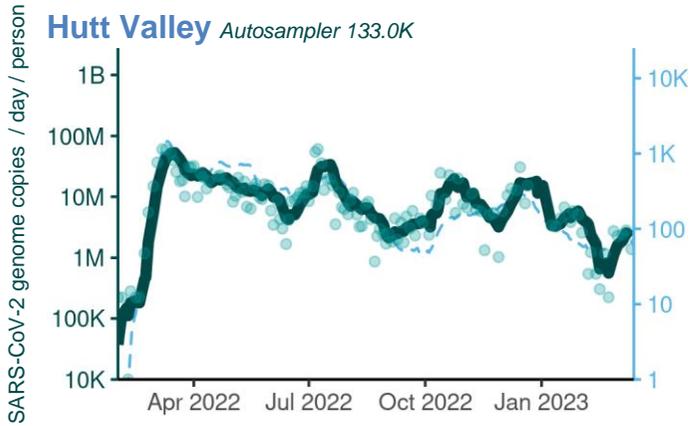
Masterton *Auto/grab 20.7K*

Otaki
Paraparaumu
Masterton
Carterton
Featherston
Greytown
Porirua
Hutt Valley
Martinborough
Wellington (Western)
Wellington (Moa Point)

Status   ● Detected   ● Not detected

SARS-CoV-2 genome copies / day / person

Cases - 7 day rolling average
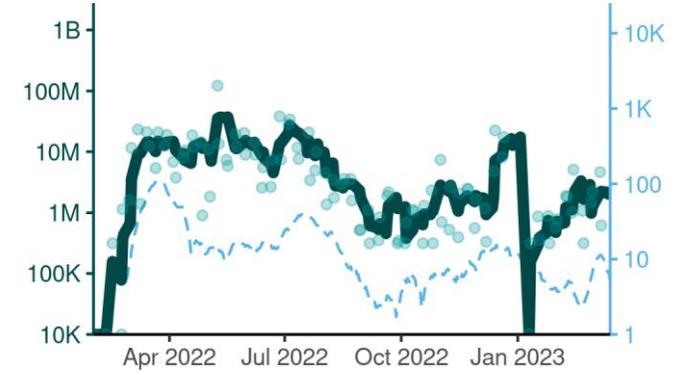
Porirua *Autosampler 85.0K*
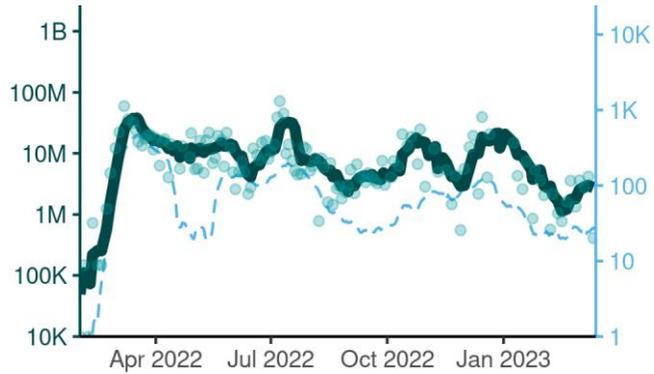
Wellington (Western) *Autosampler 14.0K*

18
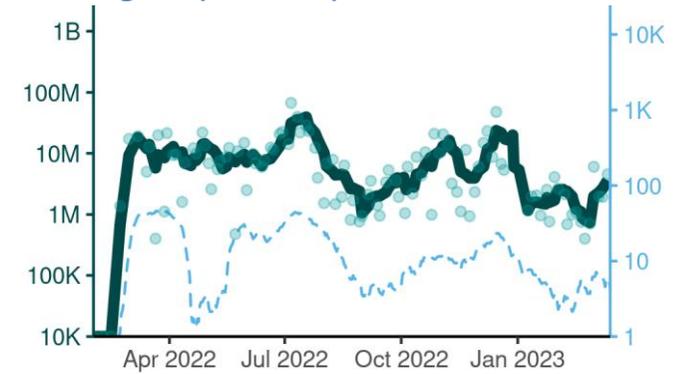
Carterton *Grab 5.8K*
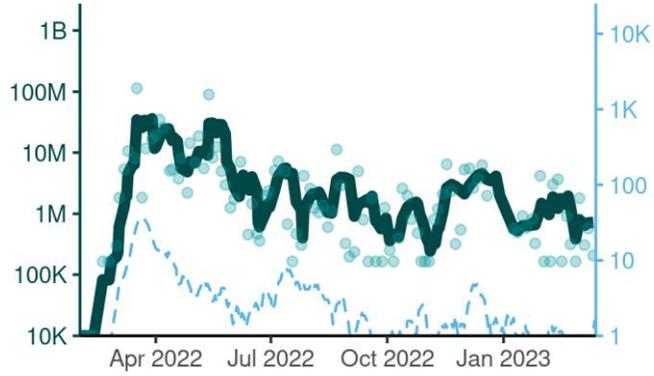
Greytown *Grab 2.4K*
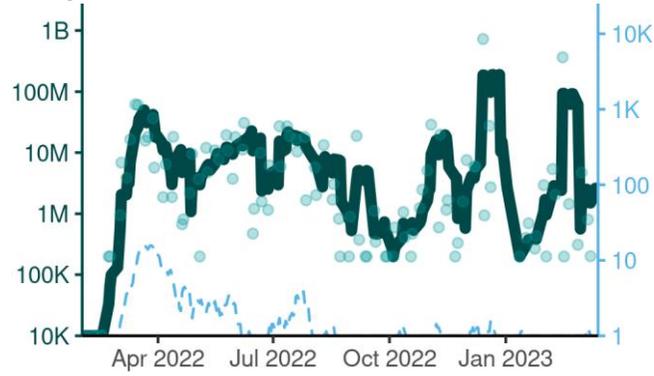
Otaki *Autosampler 3.5K*
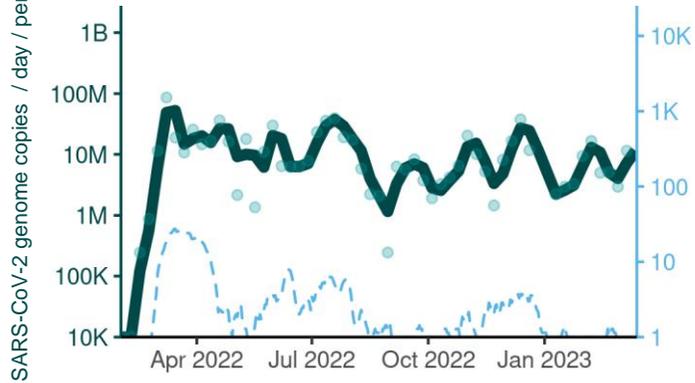
Martinborough *Auto/grab 1.6K*
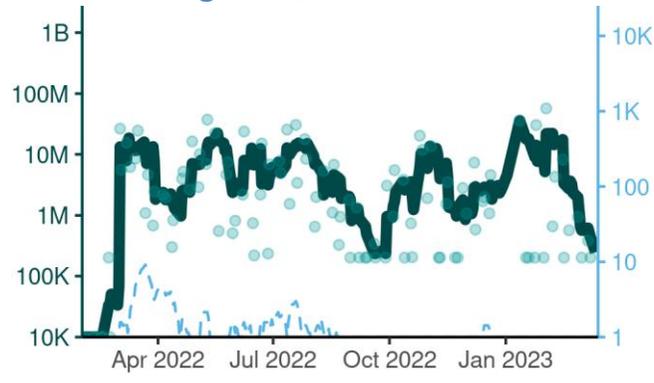
Featherston *Grab 2.5K*

SARS-CoV-2 genome copies / day / person
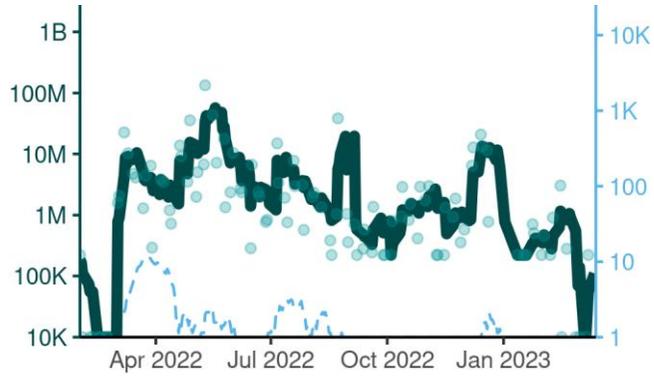
Cases - 7 day rolling average

Tasman, Nelson, and Marlborough

Richmond/Nelson South *Autosampler 60.0K*
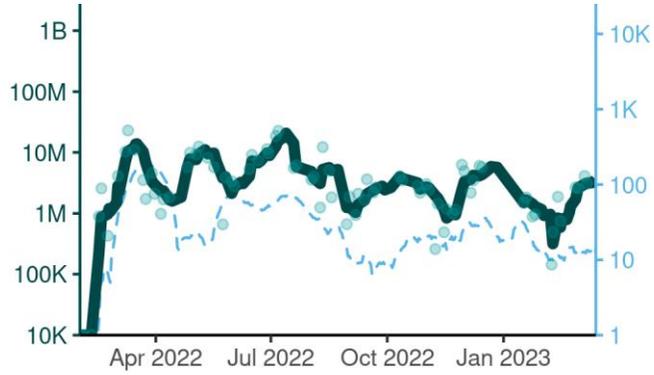
Blenheim *Autosampler 31.0K*
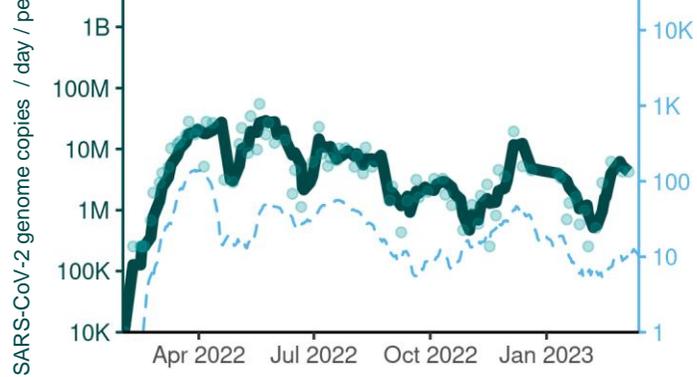
Nelson Central/North *Autosampler 26.0K*
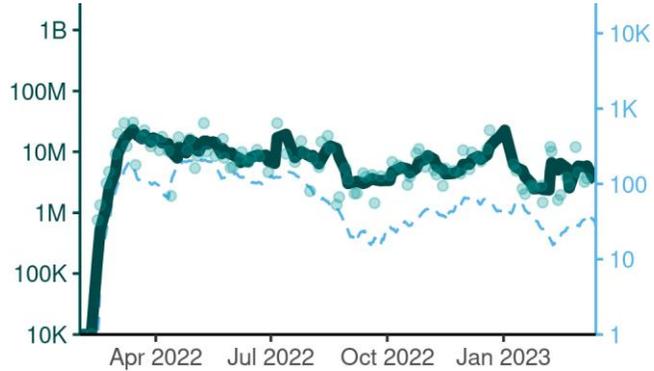
Motueka *Autosampler 8.3K*
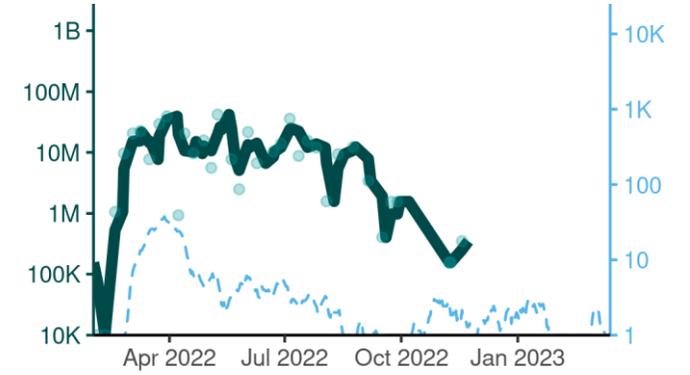
Picton *Autosampler 5.0K*
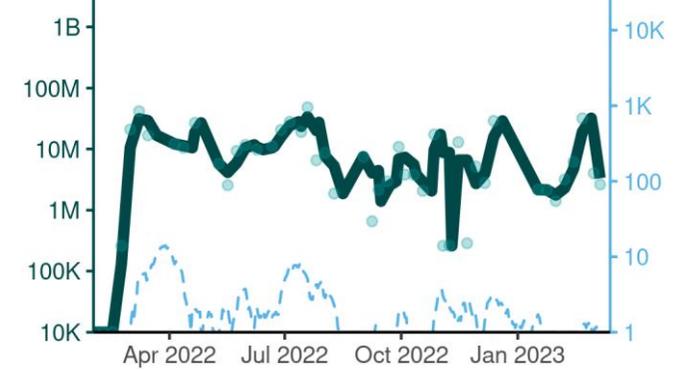
Status ● Detected ● Not detected

West Coast and Canterbury
Christchurch *Autosampler 368.0K*
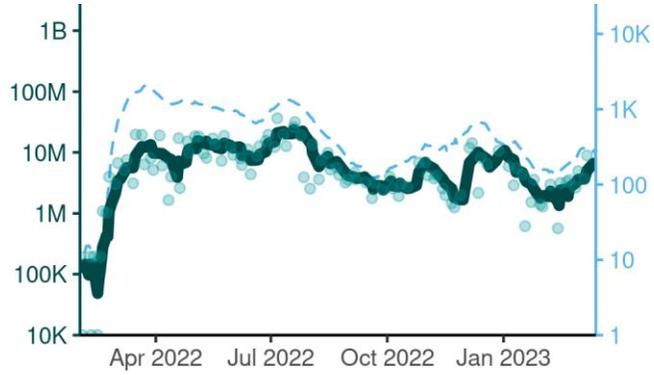
Rangiora *Grab 19.0K*
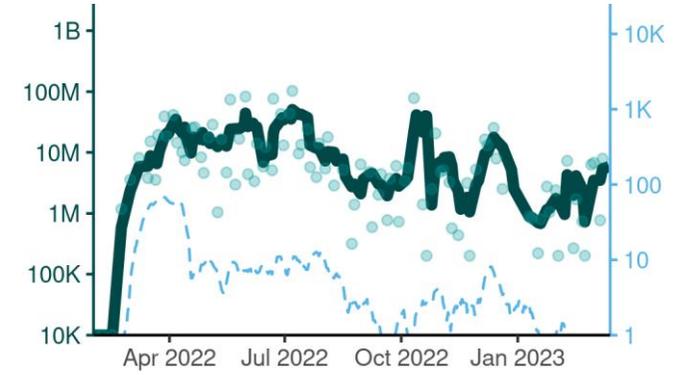
Rolleston & Eastern Selwyn *Autosampler 35.0K*
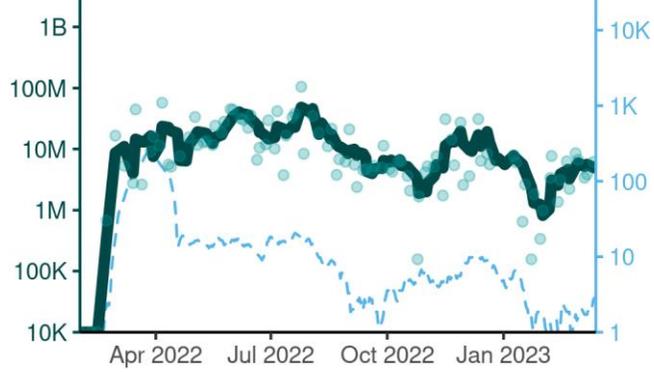
Ashburton *Autosampler 18.0K*
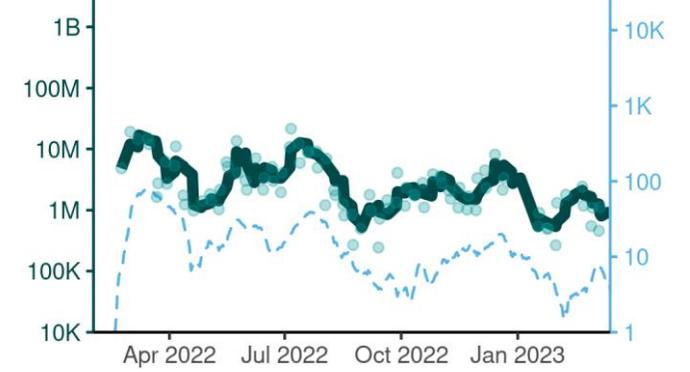
Timaru *Autosampler 28.0K*

Kaiapoi *Grab 12.5K*

Westport
Reefton
Greymouth
Woodend
Rangiora — Kaiapoi
Rolleston & Eastern Selwyn — Christchurch
Leeston
Ashburton
Timaru
Oamaru

SARS-CoV-2 genome copies / day / person
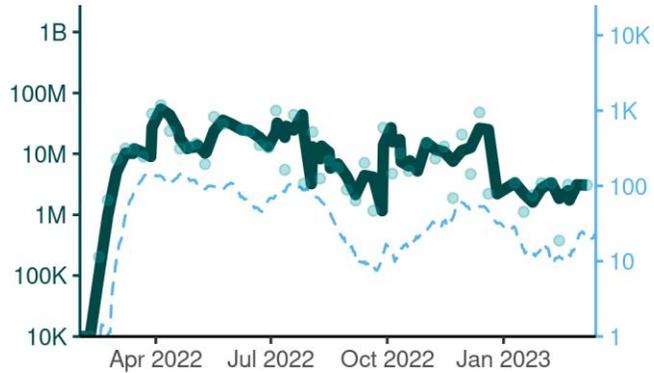
Cases - 7 day rolling average
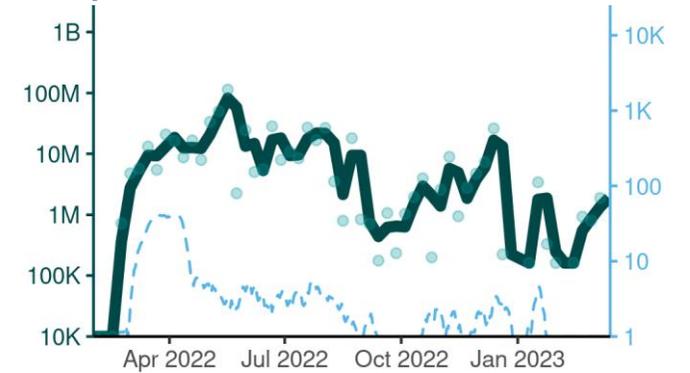
Status ● Detected ● Not detected

Leeston *Autosampler 3.9K*
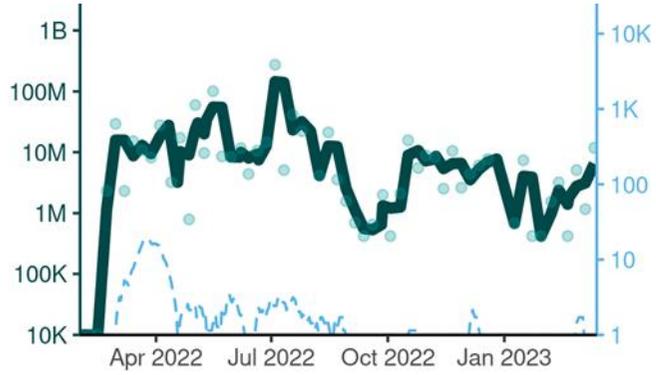
Westport *Grab 5.0K*
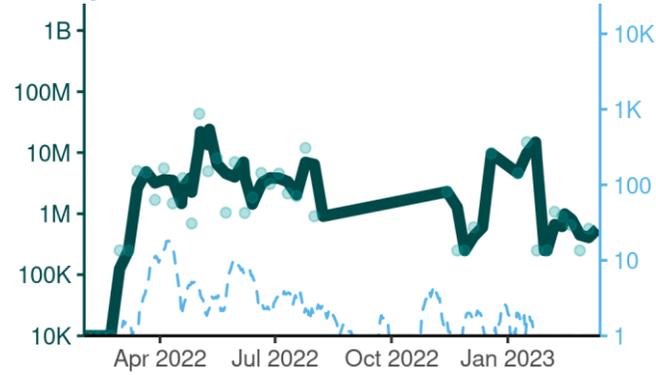
Greymouth *Grab 10.0K*
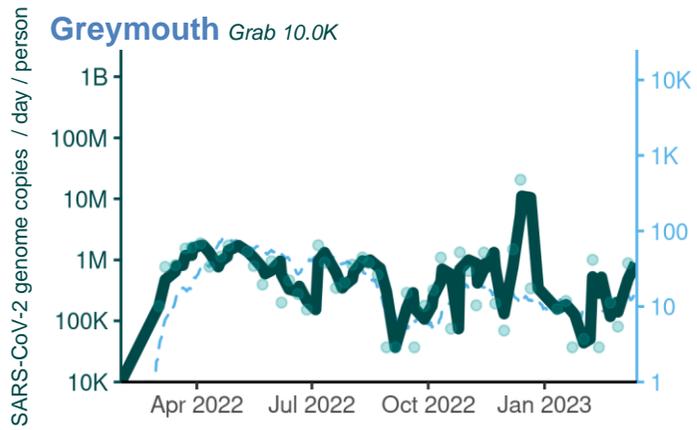
Reefton *Grab 1000*

Woodend *Grab 7.6K*

SARS-CoV-2 genome copies / day / person
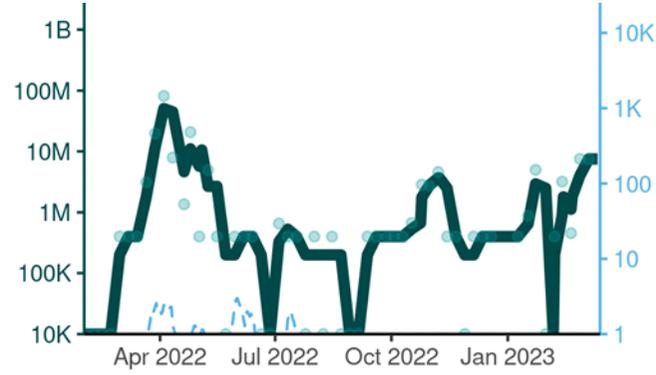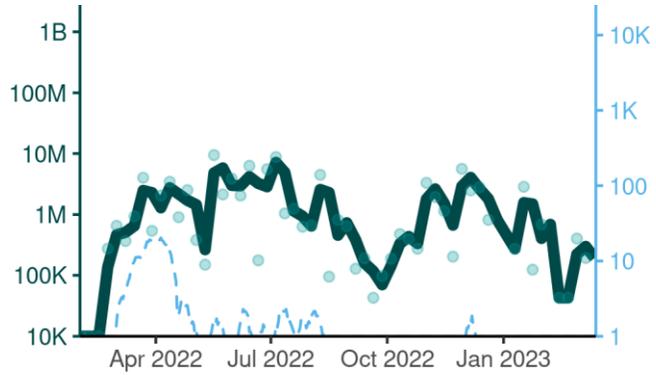
Cases - 7 day rolling average

Otago and Southland

Dunedin (Tahuna) *Autosampler 84.0K*
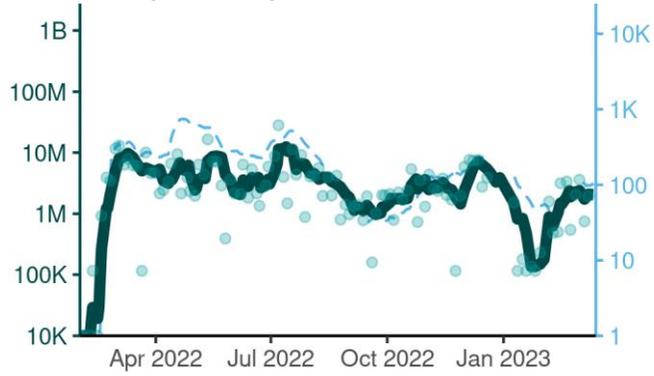
Dunedin (Green Island) *Autosampler 22.9K*
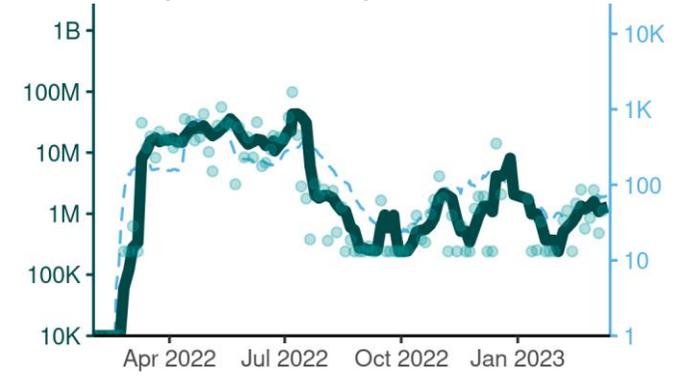
Invercargill *Autosampler 50.0K*
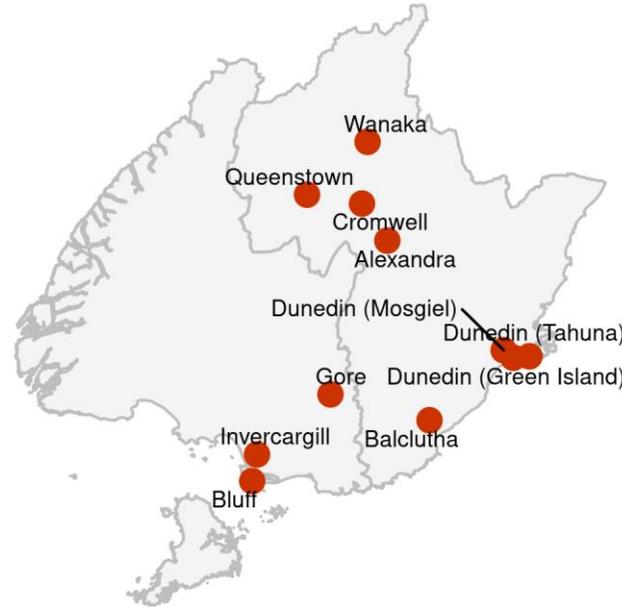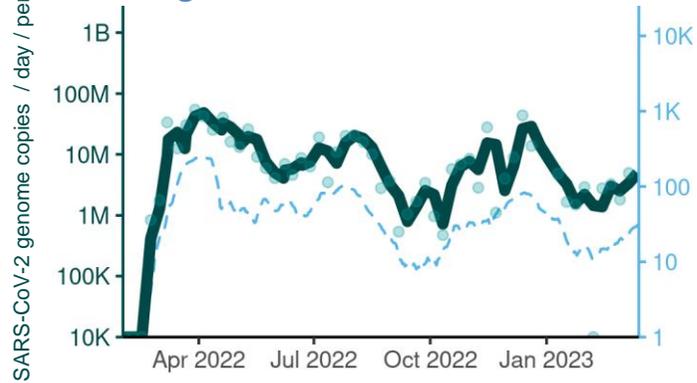
Dunedin (Mosgiel) *Autosampler 14.6K*
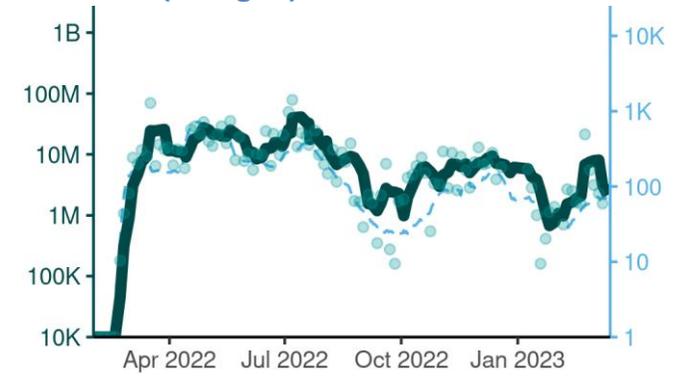
Queenstown *Autosampler 40.0K*
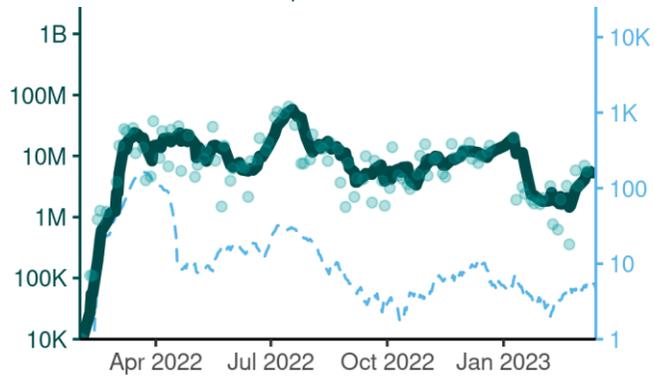
Wanaka *Grab 14.5K*

SARS-CoV-2 genome copies / day / person

Cases - 7 day rolling average

Status — Detected — Not detected

Wanaka
Queenstown
Cromwell
Alexandra
Dunedin (Mosgiel)
Dunedin (Tahuna)
Gore
Dunedin (Green Island)
Invercargill
Balclutha
Bluff
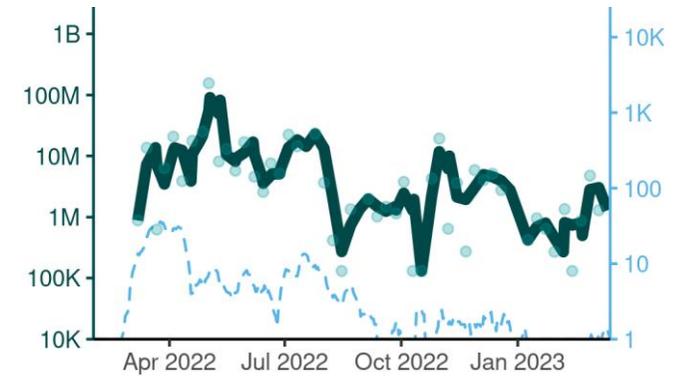
Gore *Autosampler 8.0K*
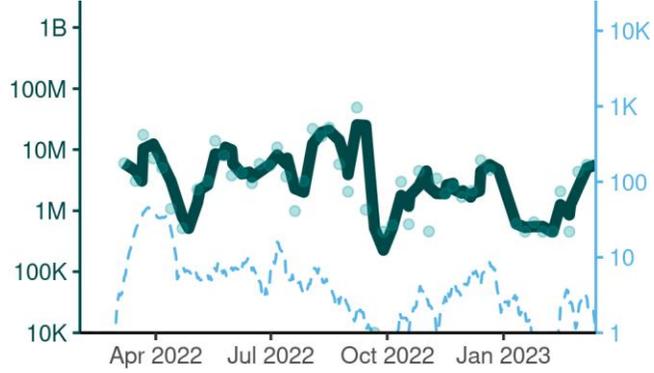
Balclutha *Grab 4.1K*
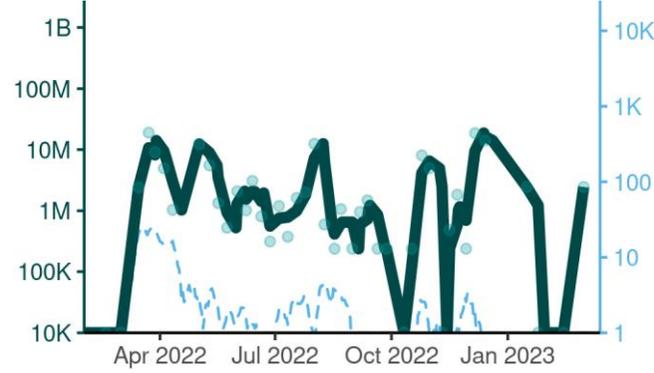
Cromwell *Autosampler 7.1K*
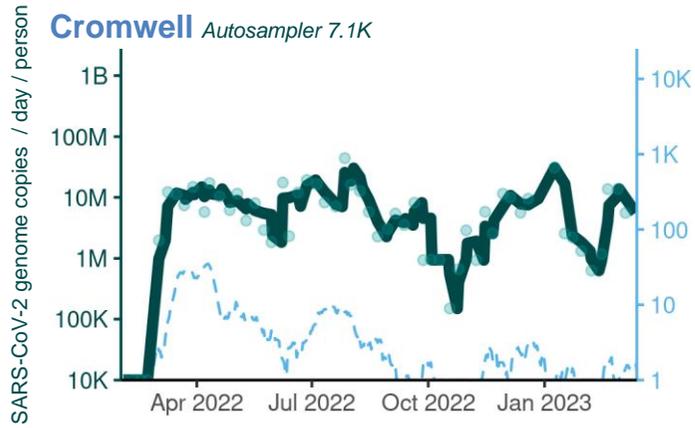
Bluff *Autosampler 2.0K*
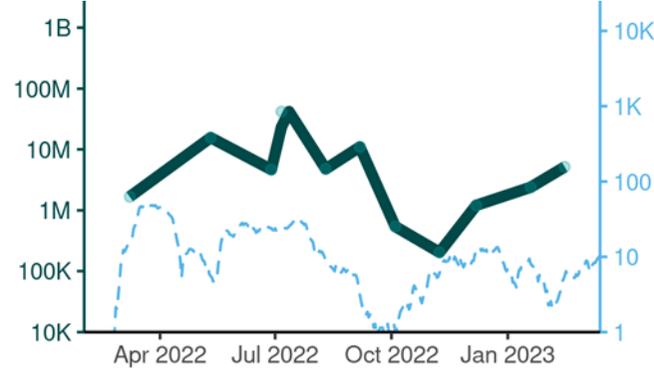
Alexandra *Autosampler 6.2K*
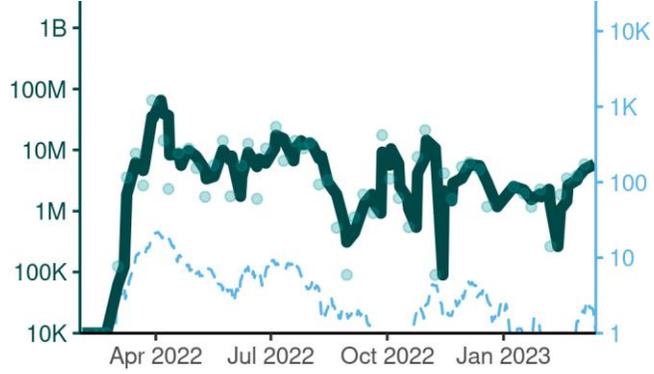
Oamaru *Autosampler 12.0K*

SARS-CoV-2 genome copies / day / person

Cases - 7 day rolling average

24
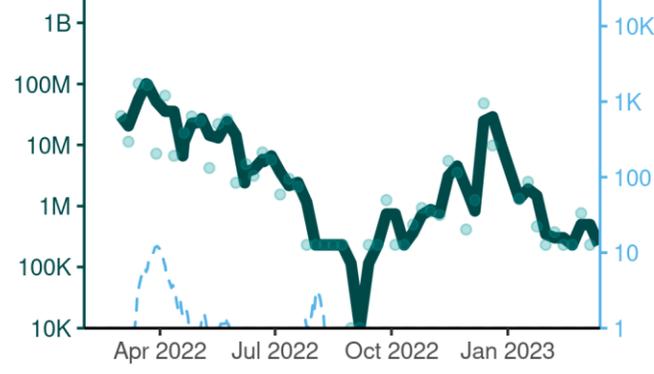
Table 2: Results for weeks 9 & 10 (ending 5 March and 12 March 2023)

Wastewater testing results. Grab samples are collected usually over 15-30 minutes. Autosampler are 24-hour composites.

| Region	Site	Population	Sample Type	Mon 27	Tue 28	Wed 01	Thu 02	Fri 03	Mon 06	Tue 07	Wed 08	Thu 09	Fri 10
Northland	Dargaville	5,000	Grab			Detected			Detected				
	Hikurangi	1,730	Grab	Detected					Detected				
	Kaiwaka	400	Grab						Detected				
	Mangawhai	1,100	Grab						Detected				
	Maungaturoto	1,300	Grab						Detected				
	Ruakaka	4,500	Grab	Detected						Detected			
	Whangarei	65,000	Autosampler	Detected						Detected	Detected		
Auckland	Army Bay	42,000	Autosampler		Detected								
	Auckland East	680,000	Autosampler	Detected					Detected		Detected		
	Auckland West	315,000	Autosampler						Detected		Detected		
	Beachlands	6,760	Grab			Detected					Detected		
	Helensville	3,800	Autosampler		Detected					Detected			
	Kawakawa Bay	600	Grab			Detected					Detected		
	North Shore	240,000	Autosampler	Detected		Detected			Detected		Detected		
	Pukekohe	20,900	Autosampler								Detected		
	Snells/Algies	4,000	Autosampler		Detected					Detected			
	Warkworth	3,500	Autosampler		Detected				Detected				
Waikato	Cambridge	20,100	Autosampler			Detected							Detected
	Hamilton	169,000	Autosampler	Detected	Detected				Detected	Detected			
	Taupo	23,000	Auto/grab		Detected		Detected			Detected		Detected	
	Te Awamutu	13,100	Autosampler			Detected							Detected
	Thames	7,500	Autosampler									Detected	
	Whangamata	4,000	Autosampler						Detected				
	Whitianga	6,600	Autosampler						Detected				
Bay of Plenty	Katikati	5,500	Autosampler			Detected					Not detected		
	Kawerau	7,000	Autosampler		Detected						Detected		
	Maketu	1,300	Autosampler								Detected		
	Mt Maunganui/Papamoa	65,000	Autosampler		Detected		Detected		Detected			Detected	
	Opotiki	3,800	Autosampler	Detected			Detected		Detected			Detected	
	Rotorua	59,000	Autosampler		Detected		Detected		Detected			Detected	
	Tauranga	50,000	Autosampler		Detected		Detected		Detected			Detected	
	Te Puke	9,700	Autosampler								Detected		
	Waihi Beach	3,600	Autosampler			Detected					Detected		
	Whakatane	21,020	Autosampler		Detected				Detected				
Hawke's Bay	Hastings	80,000	Autosampler			Detected	Detected		Detected		Detected		
	Waipukurau	4,610	Autosampler				Detected					Detected	
Taranaki	Eltham	2,006	Autosampler			Detected					Detected		
	Hawera	12,000	Autosampler		Detected	Detected				Detected	Detected		
	New Plymouth	88,000	Autosampler				Detected		Detected			Detected	
Manawatu-Whanganui	Dannevirke	5,696	Grab				Detected					Detected	
	Levin	21,200	Autosampler		Detected		Detected			Detected		Detected	
	Palmerston North	90,000	Autosampler		Detected		Detected		Detected			Detected	
	Taumarunui	4,000	Grab			Detected		Detected				Detected	
	Whanganui	44,500	Autosampler		Detected		Detected		Detected			Detected	
	Woodville	1,657	Grab				Detected					Detected	
Wellington	Carterton	5,800	Grab	Detected			Detected		Detected			Detected	

Region	Site	Population	Sample Type	Mon 27	Tue 28	Wed 01	Thu 02	Fri 03	Mon 06	Tue 07	Wed 08	Thu 09	Fri 10
	Featherston	2,500	Grab	Not detected			Not detected			Not detected		Detected	
	Greytown	2,438	Grab	Detected			Detected			Detected		Detected	
	Hutt Valley	133,000	Autosampler	Detected			Detected		Detected			Detected	
	Martinborough	1,641	Auto/grab	Detected			Detected			Detected		Detected	
	Masterton	20,700	Auto/grab		Detected	Detected				Detected	Detected		
	Otaki	3,500	Autosampler		Detected					Detected			
	Paraparaumu	49,000	Autosampler		Detected					Detected			
	Porirua	85,000	Autosampler	Detected			Detected		Detected			Detected	
	Wellington (Moa Point)	168,000	Autosampler	Detected			Detected		Detected			Detected	
	Wellington (Western)	14,000	Autosampler	Detected			Detected		Detected			Detected	
Nelson	Nelson Central/North	26,000	Autosampler	Detected		Detected			Detected		Detected		
	Richmond/Nelson South	60,000	Autosampler	Detected		Detected			Detected		Detected		
Marlborough	Blenheim	31,000	Autosampler				Detected			Detected			
	Picton	5,000	Autosampler				Detected			Detected			
West Coast	Greymouth	10,000	Grab		Detected						Detected		
	Reefton	1,000	Grab	Detected					Detected				
	Westport	5,000	Grab	Detected					Detected				
Canterbury	Ashburton	18,000	Autosampler		Detected	Detected			Detected	Detected			
	Christchurch	368,000	Autosampler	Detected		Detected			Detected		Detected		
	Kaiapoi	12,500	Grab		Detected					Detected			
	Leeston	3,900	Autosampler	Detected					Detected				
	Rangiora	19,000	Grab		Detected		Detected			Detected		Detected	
	Rolleston & Eastern Selwyn	35,000	Autosampler	Detected		Detected			Detected		Detected		
	Timaru	28,000	Autosampler								Detected		
	Woodend	7,600	Grab		Detected					Detected			
Otago	Alexandra	6,200	Autosampler		Detected				Detected				
	Balclutha	4,100	Grab				Detected						
	Cromwell	7,100	Autosampler		Detected				Detected				
	Dunedin (Green Island)	22,900	Autosampler	Detected			Detected		Detected			Detected	
	Dunedin (Mosgiel)	14,600	Autosampler	Detected			Detected		Detected			Detected	
	Dunedin (Tahuna)	84,000	Autosampler	Detected			Detected		Detected			Detected	
	Queenstown	40,000	Autosampler	Detected		Detected			Detected		Detected		
	Wanaka	14,500	Grab	Detected					Detected				
Southland	Bluff	2,000	Autosampler		Detected					Detected			
	Gore	8,000	Autosampler			Detected					Detected		
	Invercargill	50,000	Autosampler		Detected					Detected			

Table 3: Weekly Summary of Wastewater Sampling Results for SARS-CoV-2

Key: Detected ■ Detected (not quantified) ■ Not detected ■ Not tested ■

Region	Site	2022: 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 3 4 5 6 7 8 9 10
Northland	Dargaville		
	Hikurangi		
	Kaikohe		
	Kaitaia		
	Kaiwaka		
	Kawakawa		
	Kerikeri		
	Mangawhai		
	Maungaturoto		
	Paihia		
	Ruakaka		
	Whangarei		
Auckland	Army Bay		
	Auckland East		
	Auckland Southwest		
	Auckland West		
	Beachlands		
	Clarks Beach		
	Helensville		
	Kawakawa Bay		
	Kingseat		
	North Shore		
	Omaha		
	Pukekohe		
	Snells/Algies		
	Waiuku		
	Warkworth		
	Wellsford		
Waikato	Cambridge		
	Hamilton		
	Ngatea		
	Otorohanga		
	Paeroa		

Region	Site	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 3 4 5 6 7 8 9 10
	Taupo		
	Te Awamutu		
	Thames		
	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		
	Patea		
	Stratford		
	Waverley		
Manawatu-Whanganui	Dannevirke		
	Eketahuna		
	Levin		

Region	Site	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	3	4	5	6	7	8	9	10
Wellington	Pahiatua																																														
	Palmerston North																																															
	Taumarunui																																															
	Whanganui																																															
	Woodville																																															
	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																																															
	Kaikoura																																															
	Leeston																																															
	Rangiora																																															
	Rolleston & Eastern Selwyn																																															
	Timaru																																															
	Woodend																																															
Otago	Alexandra																																															
	Balclutha																																															
	Cromwell																																															

		2022																																			2023									
Region	Site	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	3	4	5	6	7	8	9	10
	Dunedin (Green Island)																																														
	Dunedin (Mosgiel)																																														
	Dunedin (Tahuna)																																														
	Oamaru																																														
	Queenstown																																														
	Wanaka																																														
Southland	Bluff																																														
	Gore																																														
	Invercargill																																														

Acknowledgements

Notes

Sites and frequency of sample collection: The catchment population sites selected for the surveillance range from approximately 400 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 2023, the wastewater catchment areas cover over 75% 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.

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.

Wastewater Data Modelling

COVID-19 surveillance in Aotearoa, based on self-reported tests, can be problematic due to decreased testing and reporting. This difficulty is further amplified by increasing numbers of asymptomatic infections and reinfections. Accordingly, there is a need to use additional tools to monitor the rates/trends of infection within the community and to explore what information, predictive potential, and uncertainty, lies within the wastewater data. To address this, ESR has partnered with Auckland, Massey and Canterbury Universities (including the COVID-19 Modelling Aotearoa group; CMA) to address these issues. Modelling infection dynamics using wastewater data has challenges. There are many confounding factors that can influence the levels of SARS-CoV-2 in a wastewater catchment - from rainfall effects and shedding rates through to differences in RNA concentrations between variants. Current modelling reports on two key metrics (i) an estimate of the instantaneous reproduction number 'R' based on both case data and wastewater quantitation and (ii) an estimate of the case ascertainment rate (CAR).

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:
- 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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