National Wastewater Surveillance Programme - COVID-19

Week 25, 2022 (Week ending 26 June 2022)

Report prepared on 29 June 2022

Overview

SARS-CoV-2, the virus that causes COVID-19 disease, is shed in the faeces of people that are infected and so the viral RNA can be detected in wastewater. As such, testing wastewater for SARS-CoV-2 RNA is an efficient population-based COVID-19 surveillance tool. Based on national and international data, this method has been shown to be an indicator of increasing and decreasing cases (i.e., early warning system) and complements other surveillance tools. A national wastewater COVID-19 surveillance programme was established in 2021 by the Institute of Environmental Science and Research (ESR). This work is funded by the New Zealand Ministry of Health and is part of New Zealand's COVID-19 response.

Wastewater samples are collected from wastewater treatment plants across both the North and South Island of New Zealand. Most sites are sampled at least weekly between Monday and Thursday of any given week. The number of sites and frequency of collection varies over time. Grab or 24 hr composite samples are collected.

Approach

Samples are sent from each wastewater treatment plant to ESR. Processing involves the concentration of virus and extraction of viral RNA. The presence of SARS-CoV-2 RNA in the sample is then determined using RT-qPCR.

A result of not detected means that SARS-CoV-2 RNA is either absent from the sample, or at a level too low to be detected. When SARS-CoV-2 RNA is detected, the concentration in the sample can be calculated. Low amounts of SARS-CoV-2 RNA in a sample may not be able to be accurately quantified and are recorded as less than the limit of quantitation. For quantitation, the raw concentration data (i.e., genome copies per L) is converted to a viral load of genome copies per day per person. This calculation considers the flow rate of wastewater entering the wastewater treatment plant and the population in the catchment. This is the population-normalised viral load.

Key Points & Limitations

- SARS-CoV-2 RNA concentrations should not be compared between wastewater catchments.
- Day to day variability in SARS-CoV-2 RNA concentrations, especially in smaller catchments, is to be expected. Greater variability is expected with grab samples.
- Generally, increasing viral loads are associated with increasing numbers of people with SARS-CoV-2 infection and vice versa (decreasing concentrations indicating decreasing cases). However, there are a number of factors that affect the amount of viral RNA detected and so data from wastewater surveillance cannot indicate the exact number of COVID-19 cases in the catchment area.
- The number of COVID-19 cases reported via individual testing are reported for each region to provide a comparison to the wastewater results. The cases in each catchment area are an estimate of the number of people in that wastewater catchment area that have reported a positive test. However, because the wastewater catchments do not exactly align with regional boundaries, the number of cases estimated by region and by water catchment area may be different.
- Data are provisional and may be subject to change by location.
- As septic tank systems are not connected to wastewater treatment plants, the wastewater from these households will not be represented in the data.

Results For Week 25, 2022

In the week ending 26 June 2022, 147 samples were collected from 105 locations in New Zealand.

SAR-CoV-2 was detected in every sample from all sites tested except for the sample from Reefton collected on 20 June 2022 where SARS-CoV-2 was not detected.

Figure 1 below gives the proportion of sites with positive results for this and previous weeks.
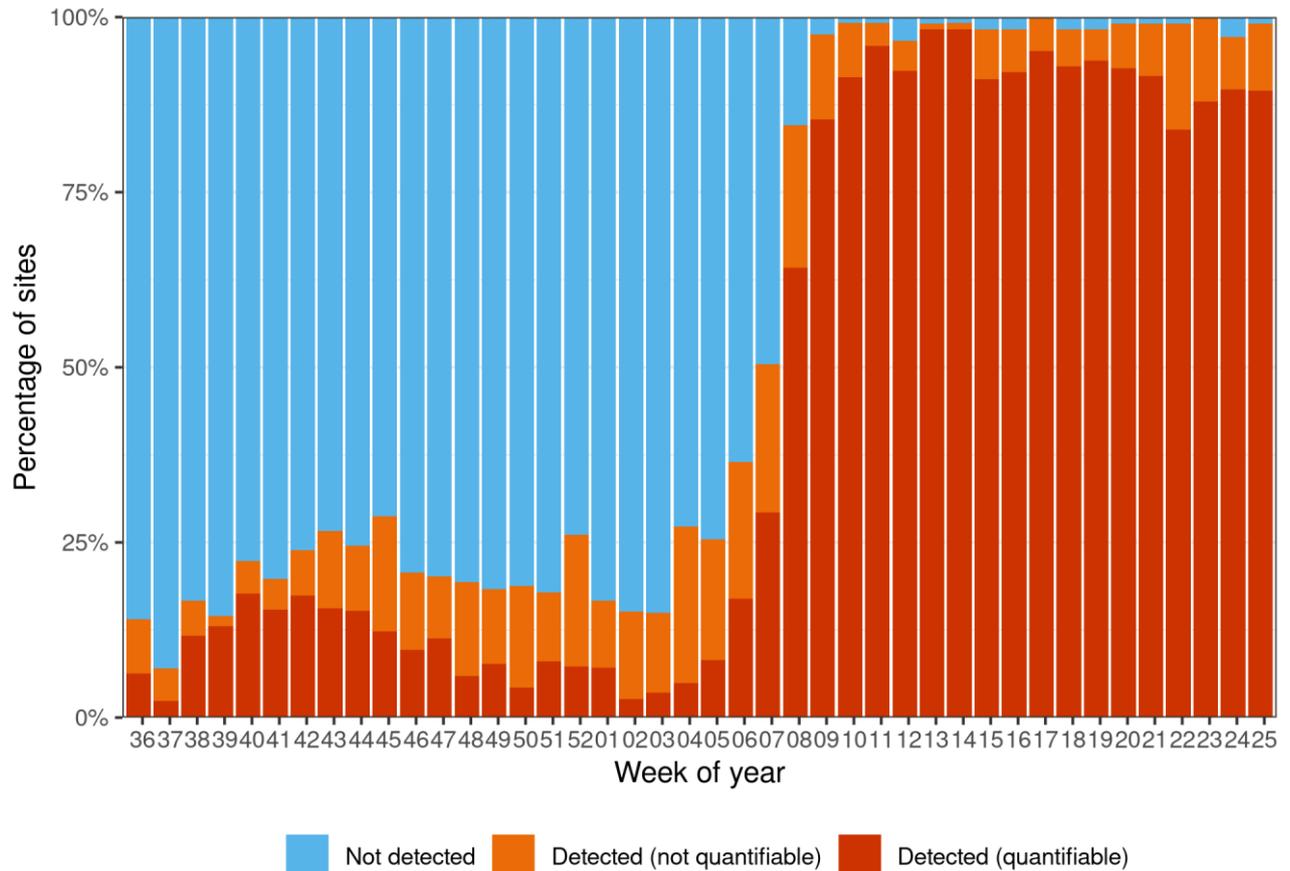
Figure 1. Results for SARS-CoV-2 RNA in wastewater collected across New Zealand.

Figure 2 shows the location of sampling sites and latest results in the two weeks ending 26 June 2022.

In the last 2 weeks, wastewater variant analysis indicates that BA.2 is the dominant Omicron subvariant being detected in all sentinel sites. Variants BA.4/5 and BA.2.12.1 have also been detected in samples collected from a number of sites.

Figure 2. Location of sampling sites and latest results in the two weeks ending 26 June 2022. Interactive map of weekly results available publicly at https://www.esr.cri.nz/our-expertise/covid-19-response/wastewater-testing-results

Interpreting site graphs (NOTE: THESE GRAPHS ARE PRESENTED DIFFERENTLY TO PREVIOUS REPORTS)

Site, sample collection method and population. Results based on autosampler may be more representative than grab sample-based results.

Hastings *Autosampler 80.0K*

SARS-CoV-2 genome copies/day/person

Rolling 7-day average of new cases
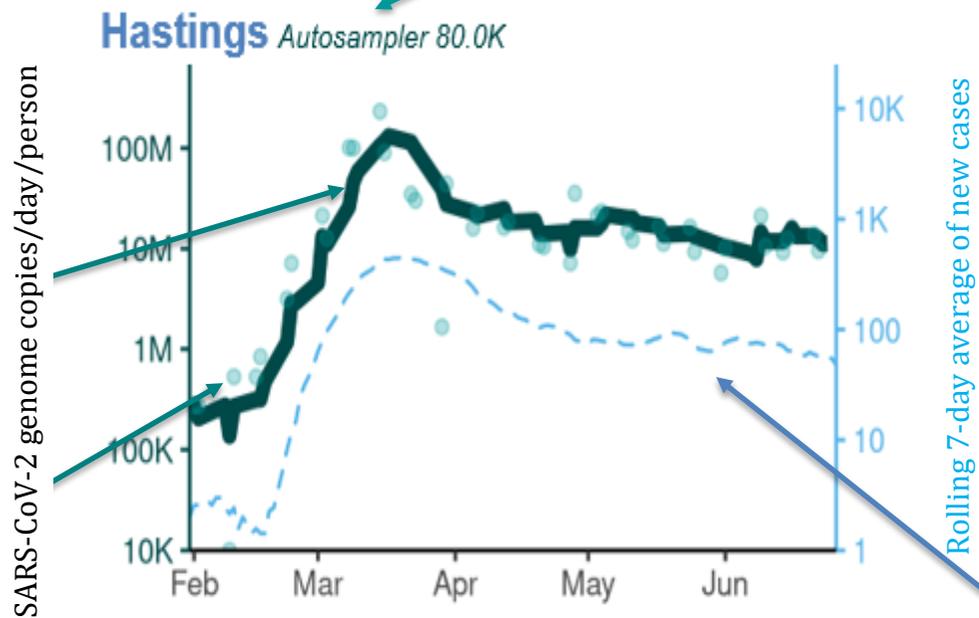
Wastewater Results

Rolling 14-day average of genome copies/day/person **shown as solid line**

Individual wastewater sample results are shown as **circles**

Log$_{10}$ **scale**

Rolling 7-day average **new cases** in the catchment based on **reported date** of illness

Dotted line

Log$_{10}$ **scale**

This data is not available for all sites, and subject to change

Both wastewater and cases data are on a **log$_{10}$ scale.**

The scales on all of the graphs have been normalised to cover the same scale on every graph.

Care should be taken when interpreting the data.

Northland

Whangarei *Autosampler 65.0K*

SARS-CoV-2 genome copies / day / person

Dargaville *Grab 5.0K*

Ruakaka *Grab 4.5K*

Cases - 7 day rolling average

Hikurangi
Whangar
Ruakak
Dargaville
Maungaturoto
Manga
Kaiwaka

Status ● Detected ● Not detected

6
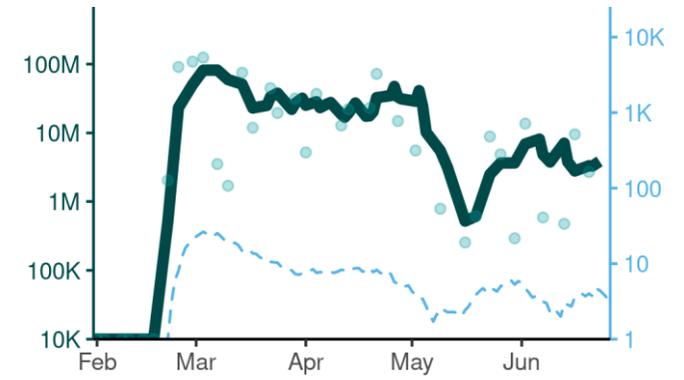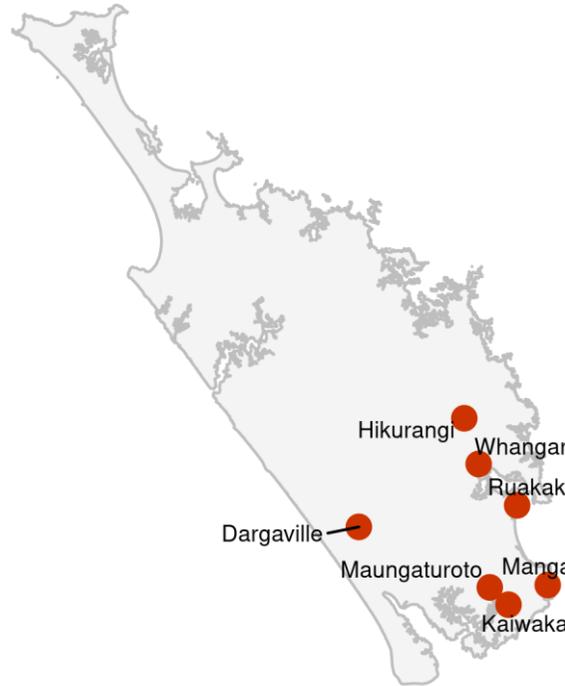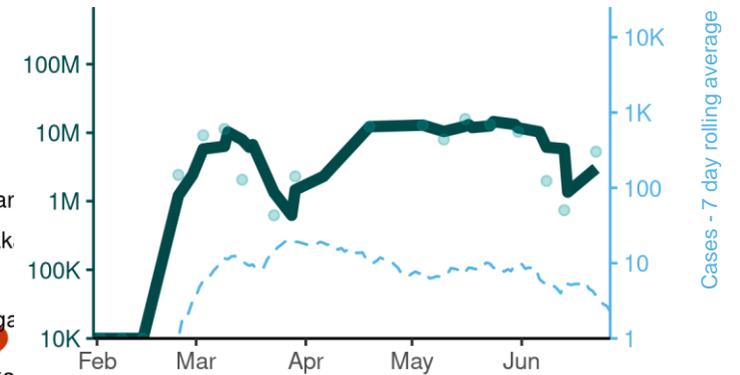
Hikurangi *Grab 1.7K*

Mangawhai *Grab 1.1K*

SARS-CoV-2 genome copies / day / person
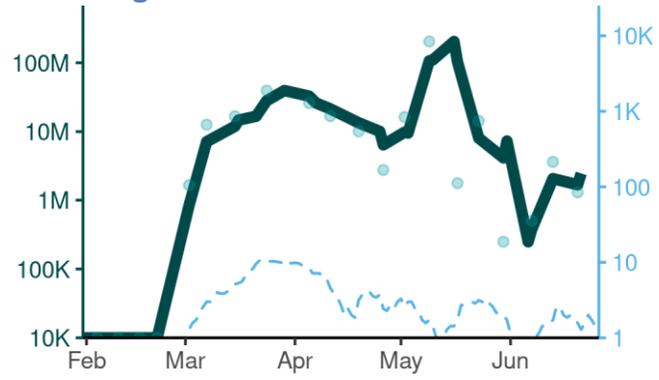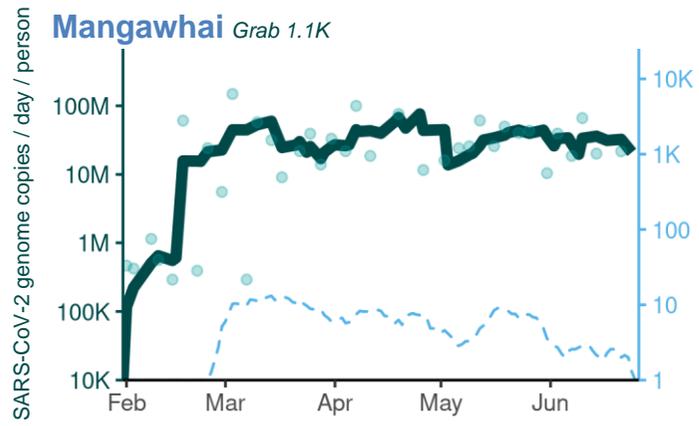
Auckland

Auckland (Combined) *Autosampler 1.1M*
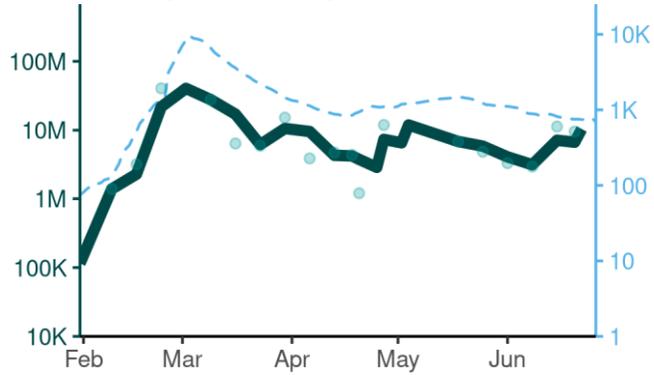
North Shore *Autosampler 240.0K*
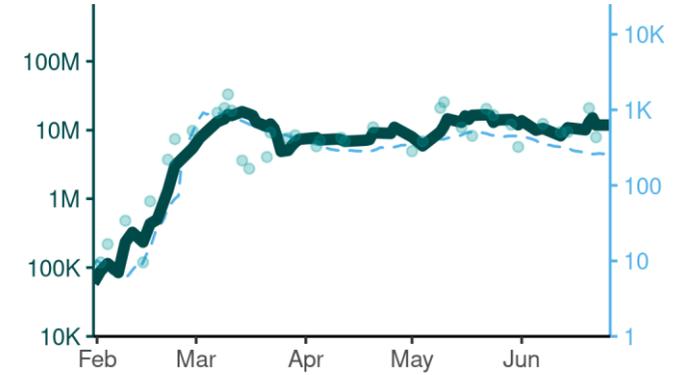
Auckland East *Autosampler 680.0K*
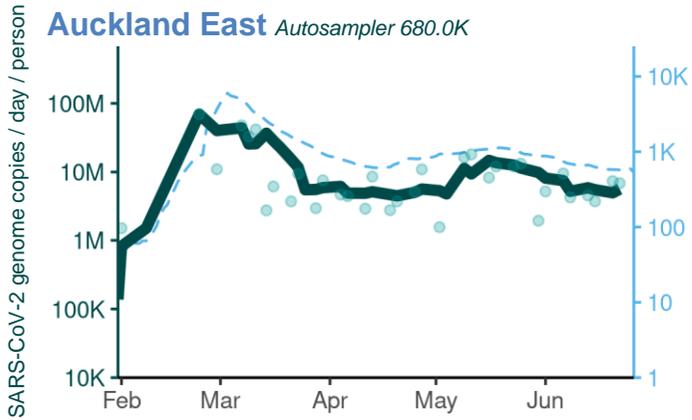
Auckland Southwest *Autosampler 120.0K*
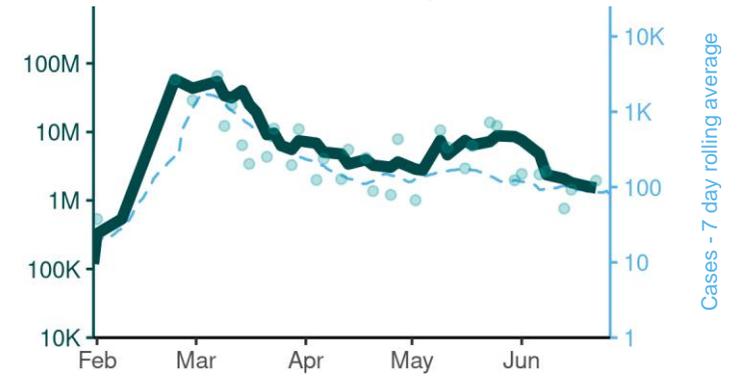
Auckland West *Autosampler 315.0K*
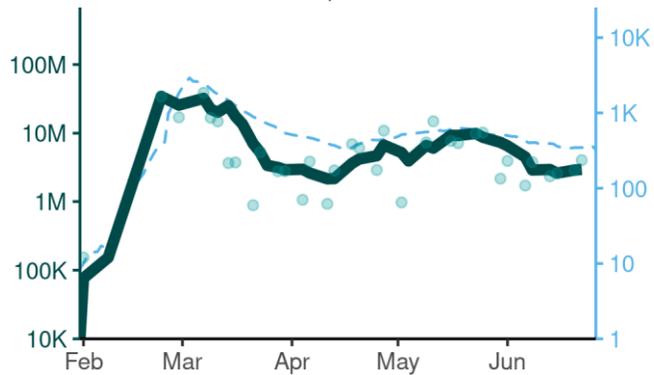
Army Bay *Autosampler 42.0K (missing samples)*
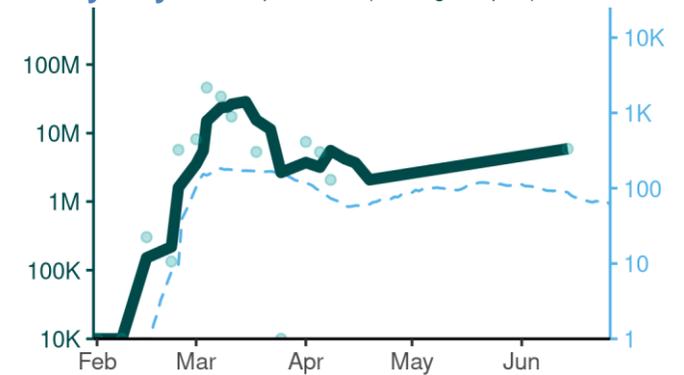
SARS-CoV-2 genome copies / day / person
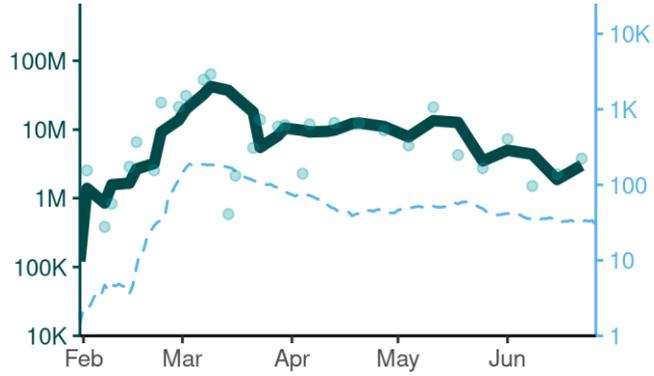
Cases - 7 day rolling average

Map locations: Wellsford, Omaha, Warkworth, Snells/Algies, Helensville, Army Bay, North Shore, Auckland West, Beachlands, Auckland East, Auckland (Combined), Auckland Southwest, Kawakawa Bay, Kingseat, Clarks Beach, Waiuku, Pukekohe

Status ● Detected ● Not detected

8
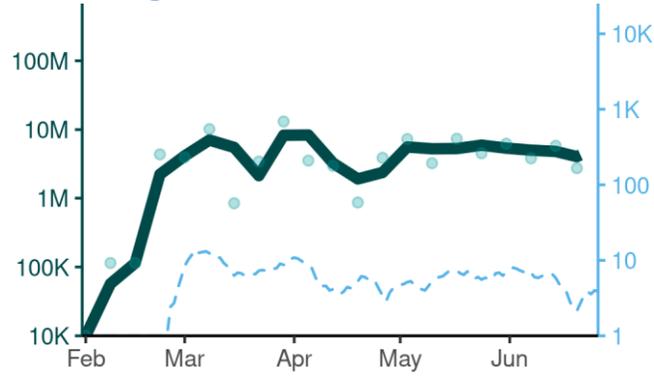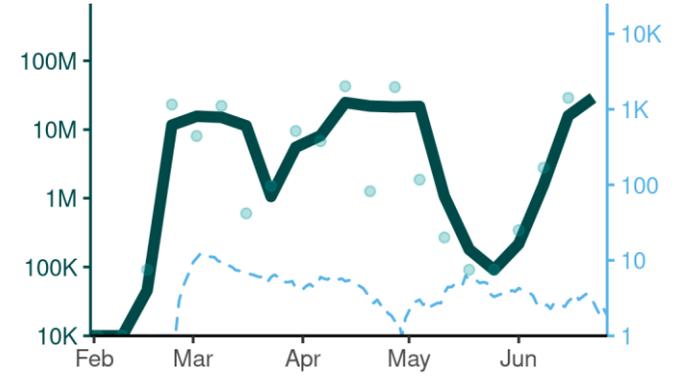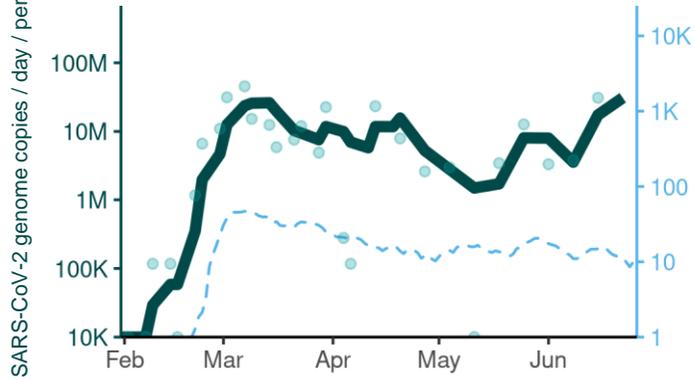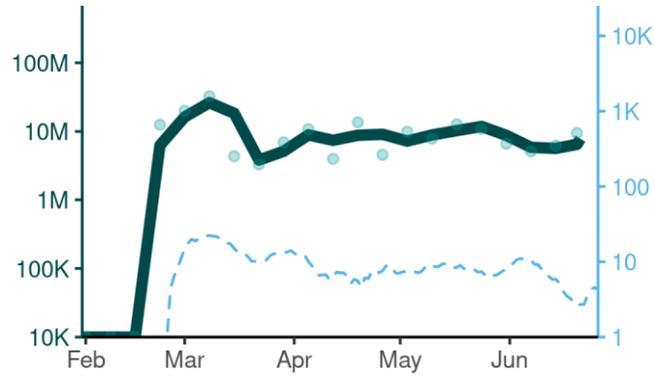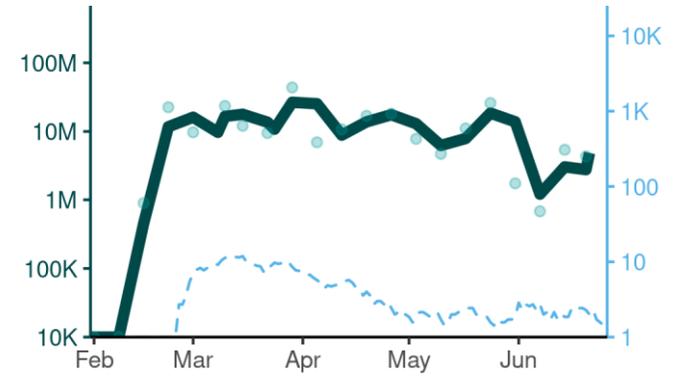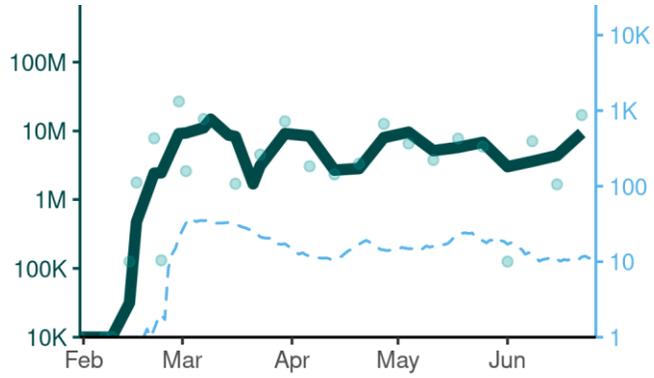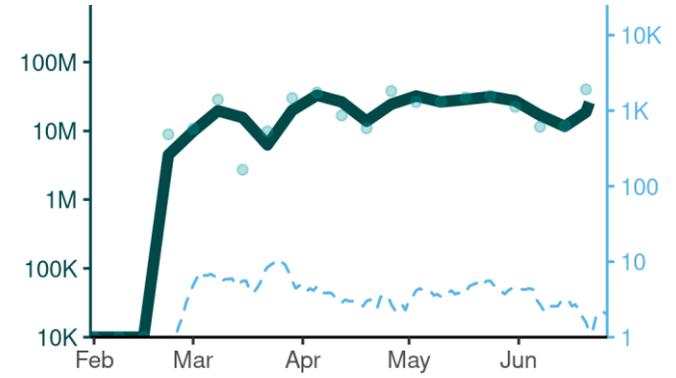
Waikato

Hamilton *Autosampler 169.0K*
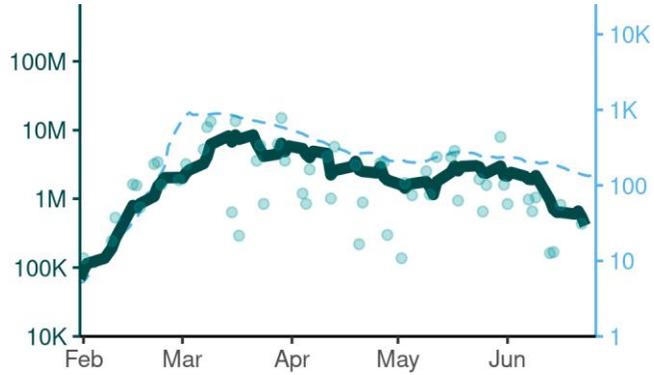
Taupo *Autosampler/Grab 23.0K*

SARS-CoV-2 genome copies / day / person
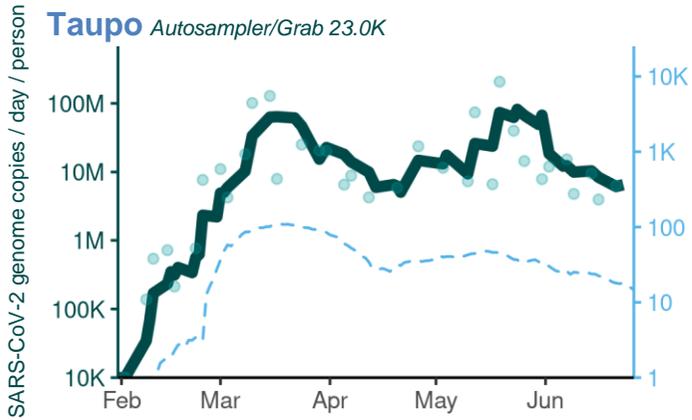
Cambridge *Autosampler 20.1K*
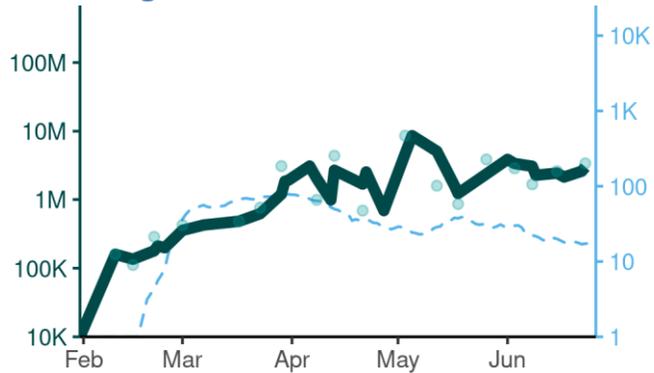
Te Awamutu *Autosampler 13.1K*
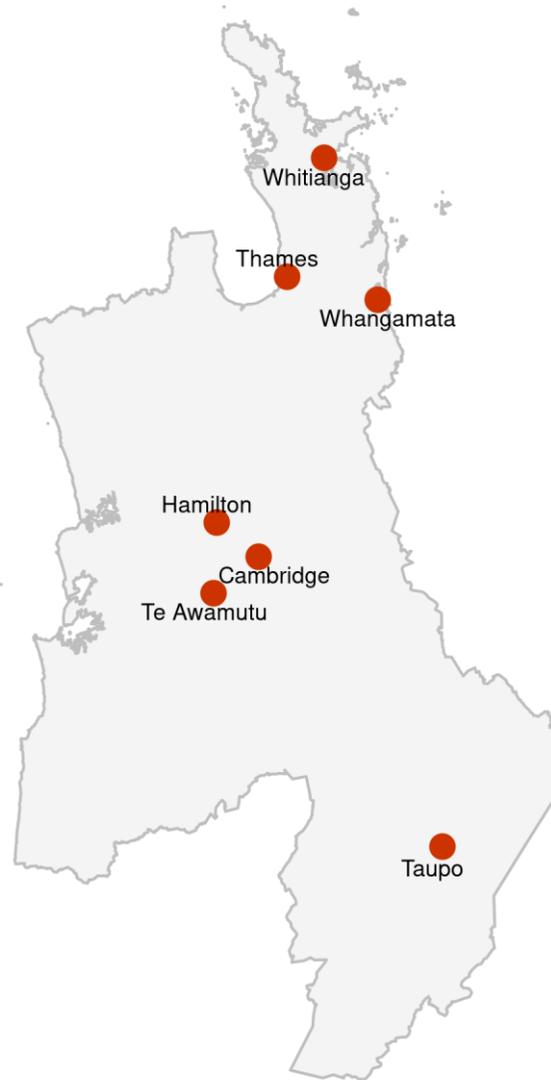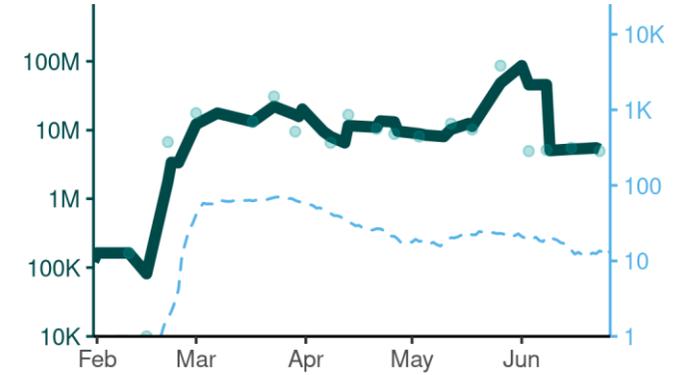
Whitianga

Thames

Whangamata

Hamilton

Cambridge

Te Awamutu

Taupo

Cases - 7 day rolling average
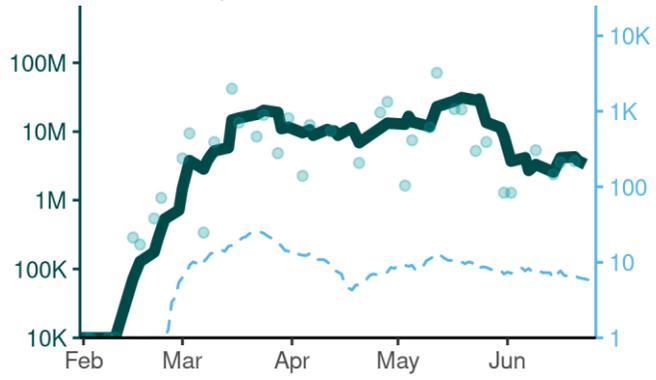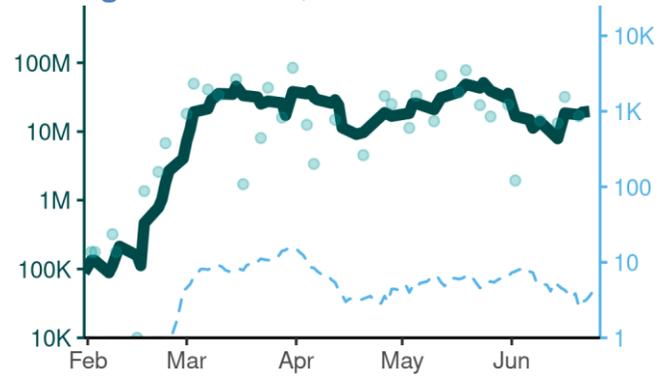
Status   ● Detected   ● Not detected
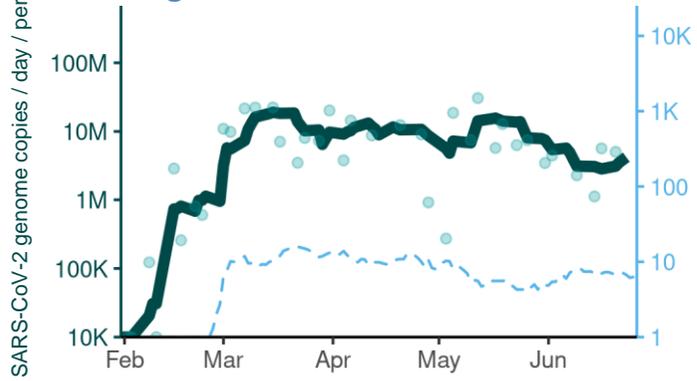
Bay of Plenty and Gisborne

Mt Maunganaui *Autosampler 65.0K*
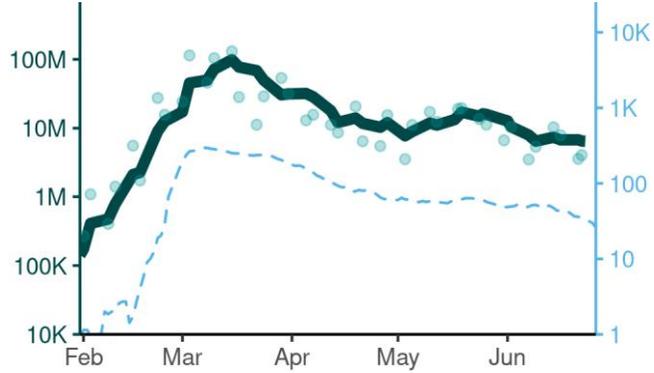
Gisborne *Autosampler 37.0K*
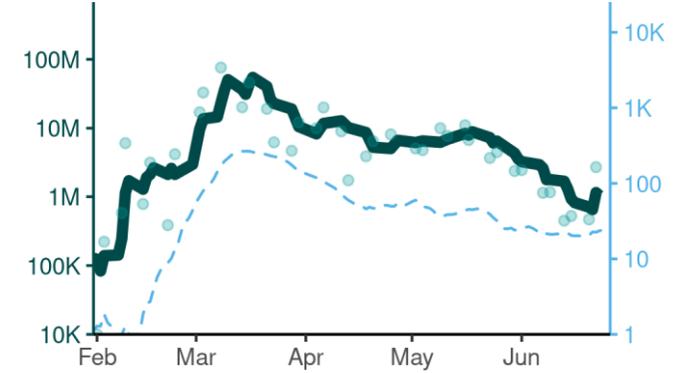
Rotorua *Autosampler 59.0K*
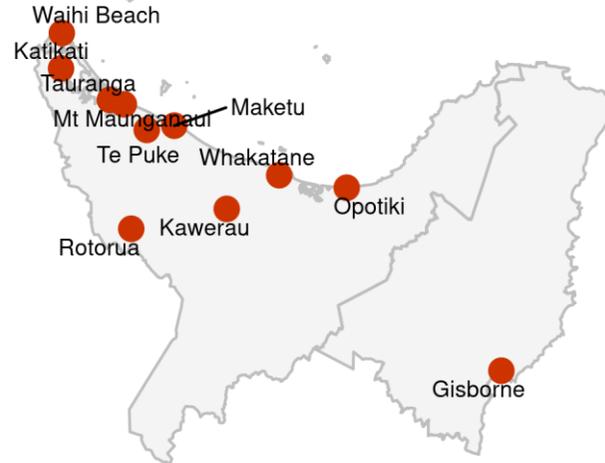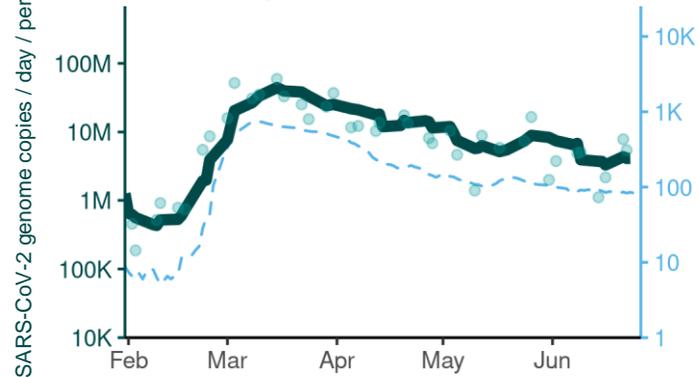
Whakatane *Autosampler 21.0K*
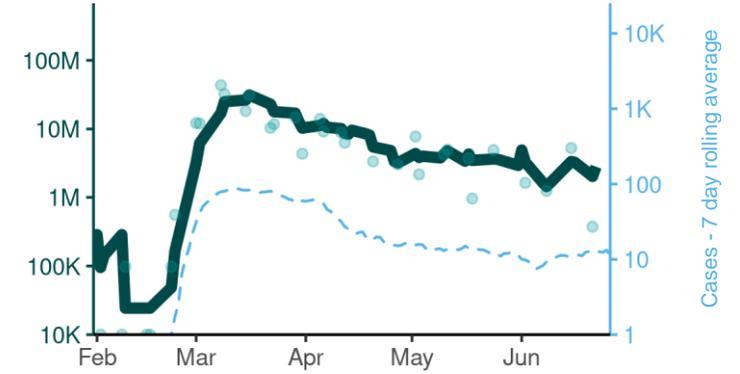
Tauranga *Autosampler 50.0K*

Te Puke *Autosampler 9.7K*

Map locations: Waihi Beach, Katikati, Tauranga, Mt Maunganaui, Maketu, Te Puke, Whakatane, Opotiki, Rotorua, Kawerau, Gisborne

Status ● Detected ● Not detected

Y-axis (left): SARS-CoV-2 genome copies / day / person
Y-axis (right): Cases - 7 day rolling average
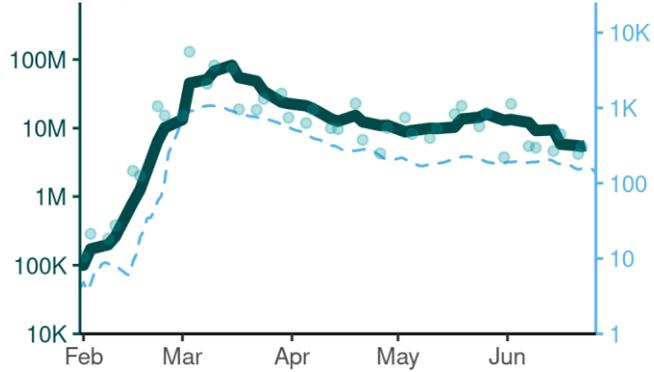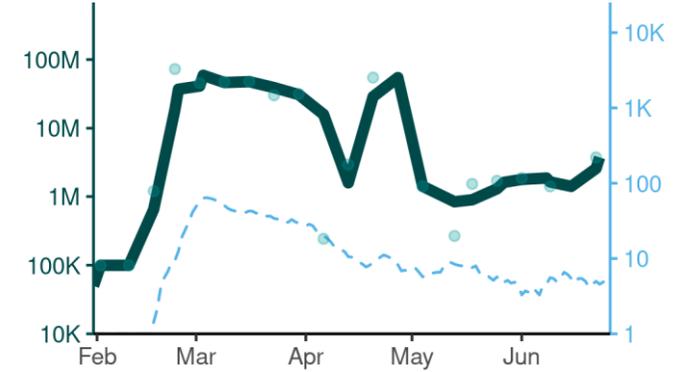
Kawerau *Autosampler 7.0K*
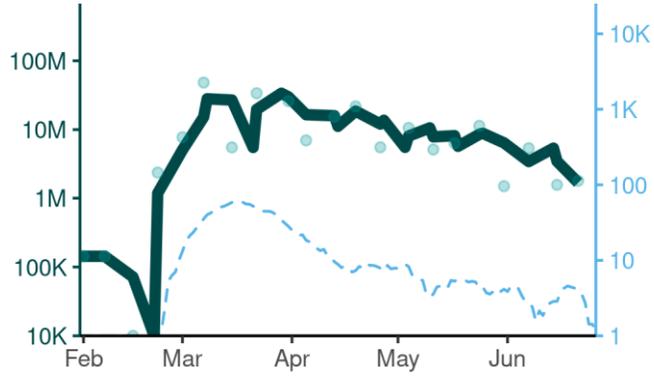
Waihi Beach *Autosampler 3.6K*
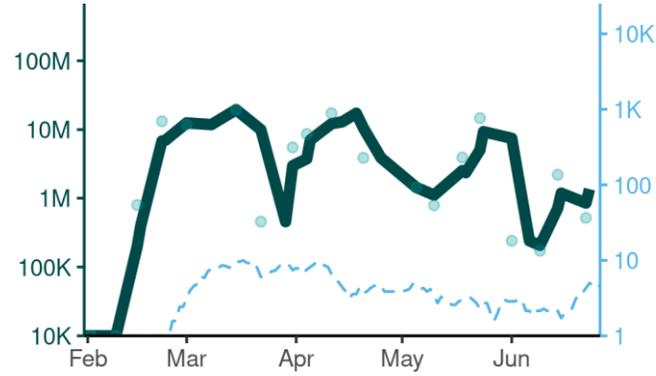
Katikati *Autosampler 5.5K*
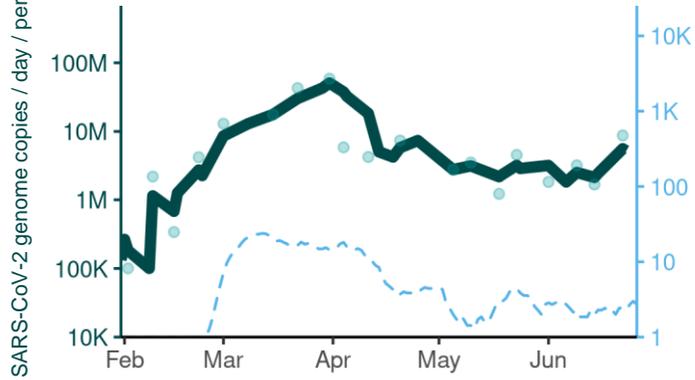
Maketu *Autosampler 1.3K*

Opotiki *Grab 3.8K*

SARS-CoV-2 genome copies / day / person

13
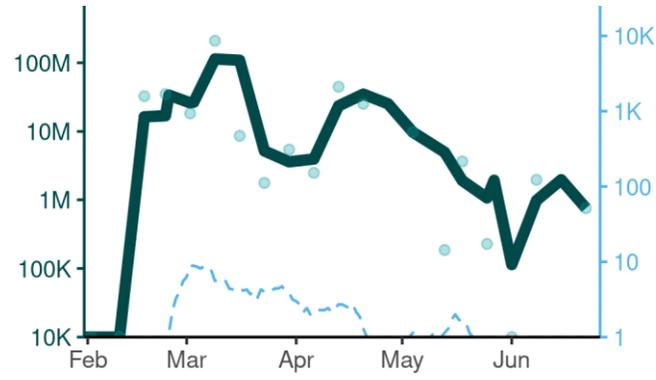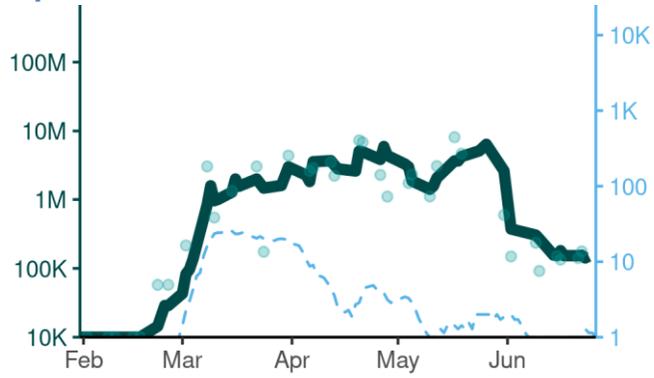
Hawke's Bay

Hastings *Autosampler 80.0K*
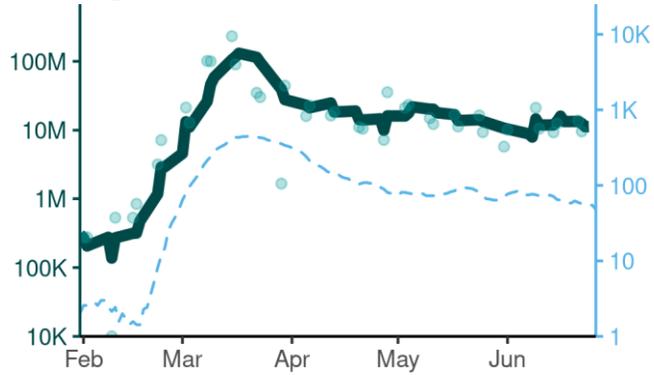
Napier *Autosampler 55.0K*
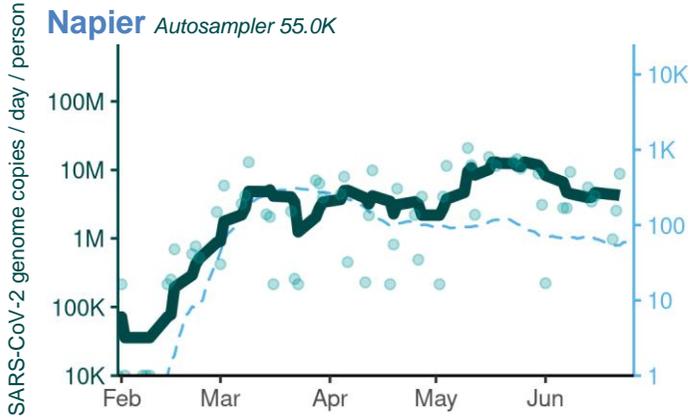
Waipukurau *Autosampler 4.6K*
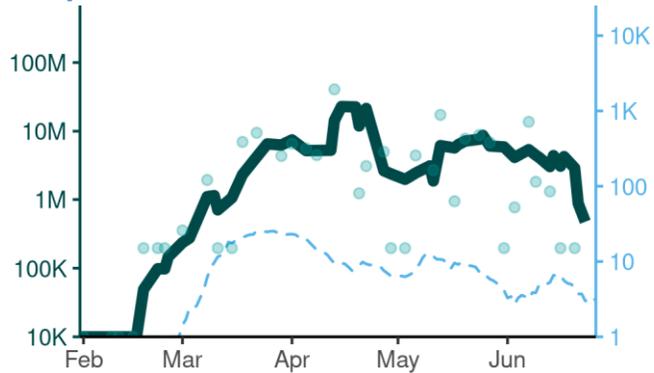
Wairoa *Grab 4.4K*
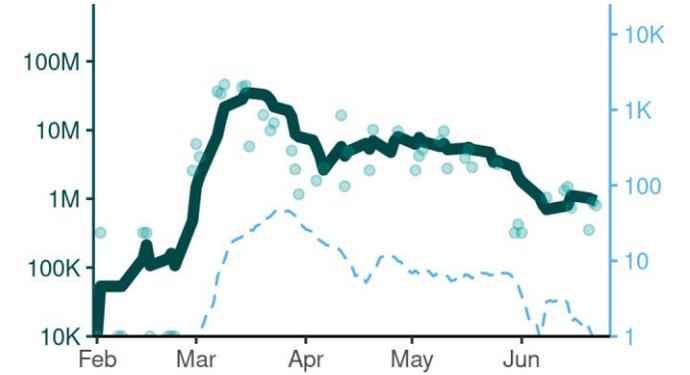
Waipawa *Autosampler 2.2K*

SARS-CoV-2 genome copies / day / person

Cases - 7 day rolling average

Map labels: Wairoa, Napier, Hastings, Otane, Waipawa, Takapau, Waipukurau, Te Paerahi, Porangahau
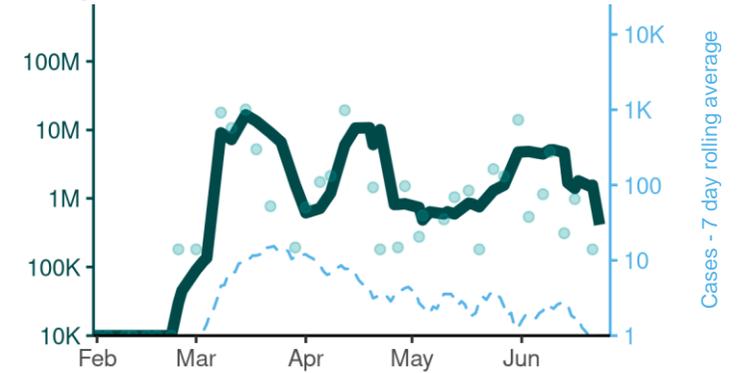
Status ● Detected ● Not detected

Taranaki

New Plymouth *Autosampler 88.0K*
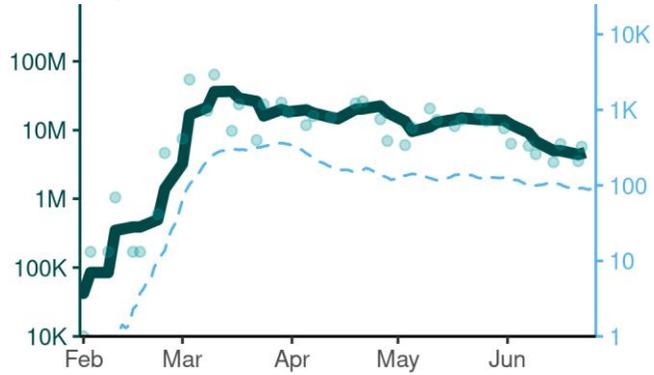
Eltham *Autosampler 2.0K*
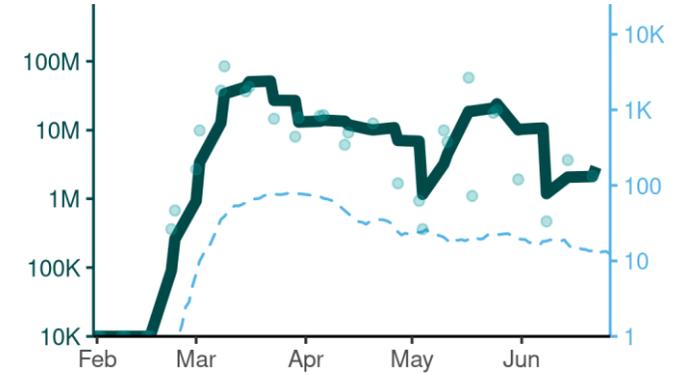
Hawera *Autosampler 12.0K*
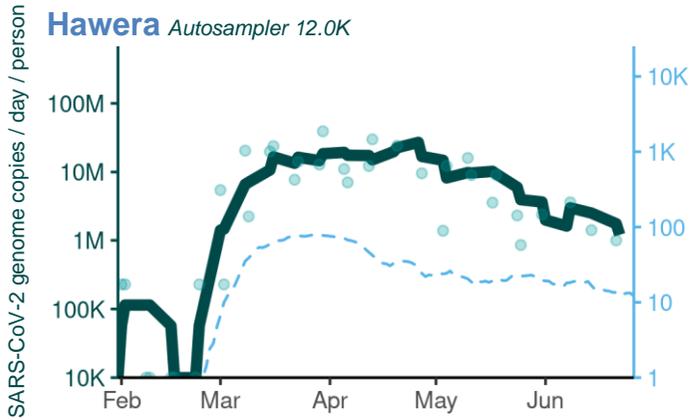
Opunake *Autosampler 1.4K*

SARS-CoV-2 genome copies / day / person

Cases - 7 day rolling average
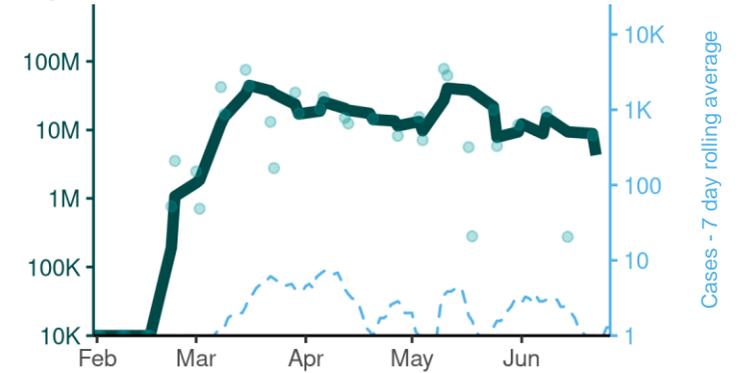
Stratford *Autosampler 9.9K*

Patea *Autosampler 1.2K*

Map labels: New Plymouth, Opunake, Kaponga, Stratford, Eltham, Manaia, Hawera, Patea, Waverley
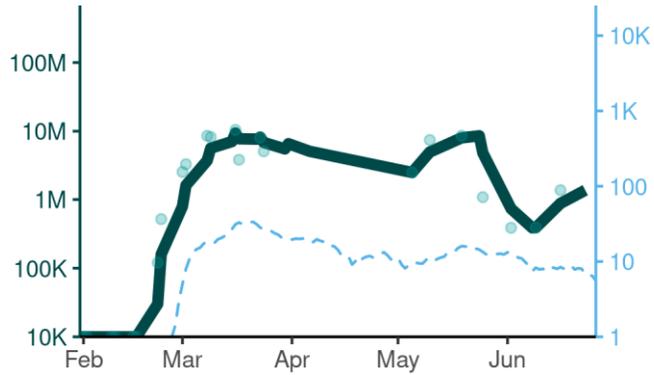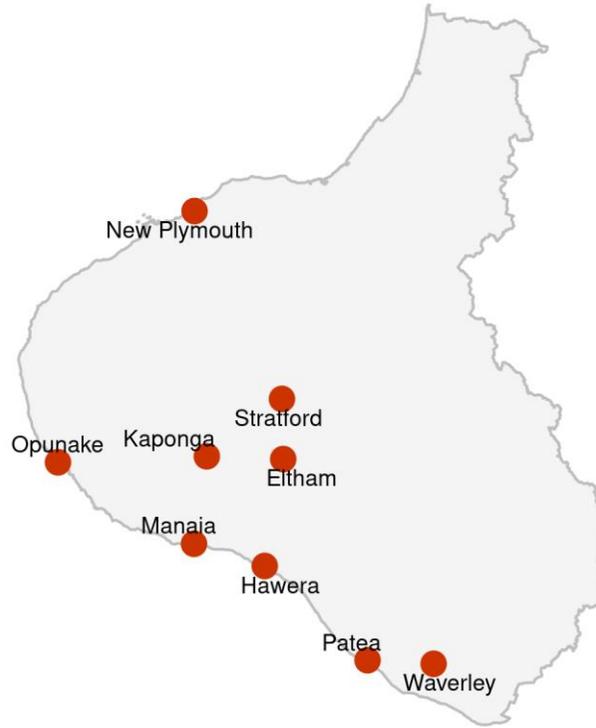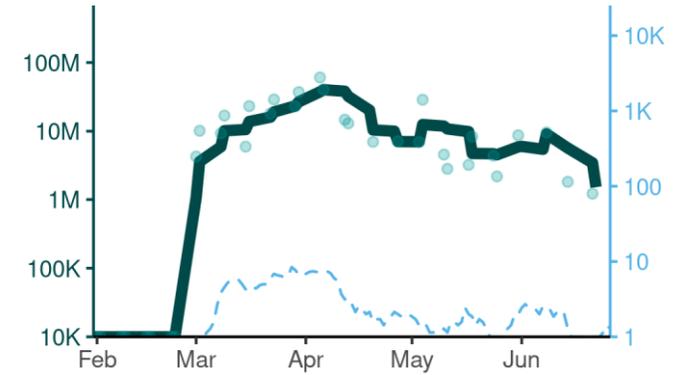
Status ● Detected ● Not detected

Manawatu-Whanganui

Palmerston North *Autosampler 90.0K*
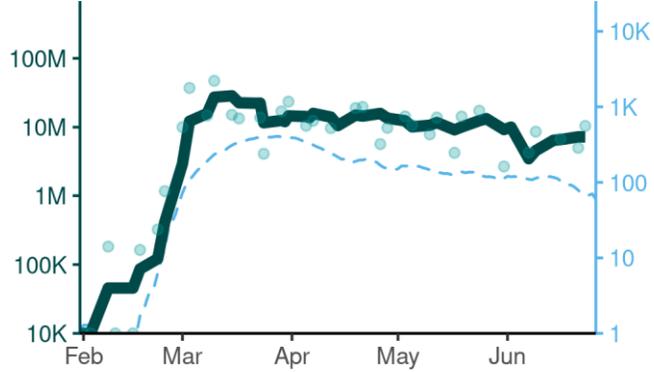
Whanganui Urban *Autosampler 44.5K*
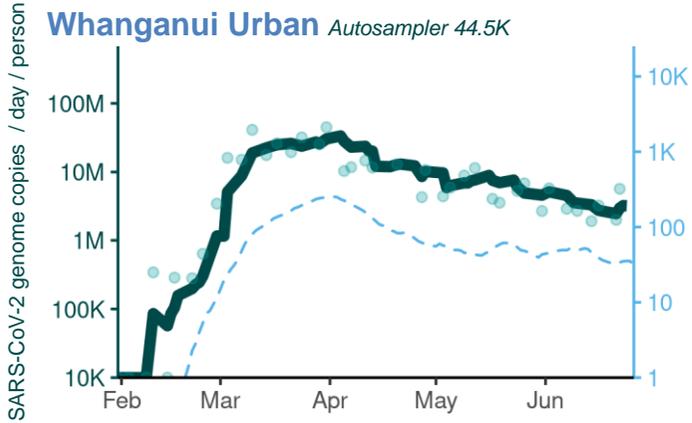
Levin *Autosampler 21.2K*
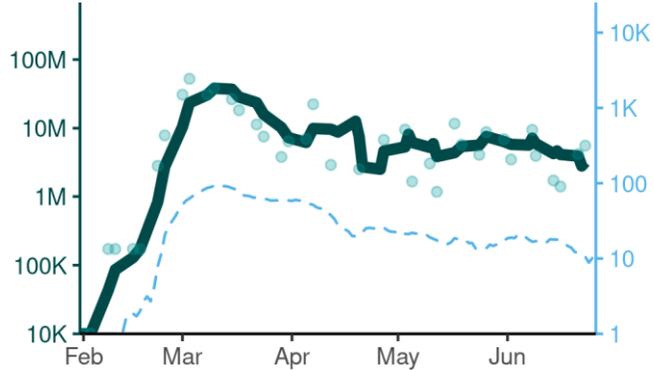
Dannevirke *Grab 5.7K*

Taumarunui *Grab 4.0K*

SARS-CoV-2 genome copies / day / person

Cases - 7 day rolling average

Taumarunui

Whanganui Urban

Palmerston North

Levin

Woodville

Dannevirke
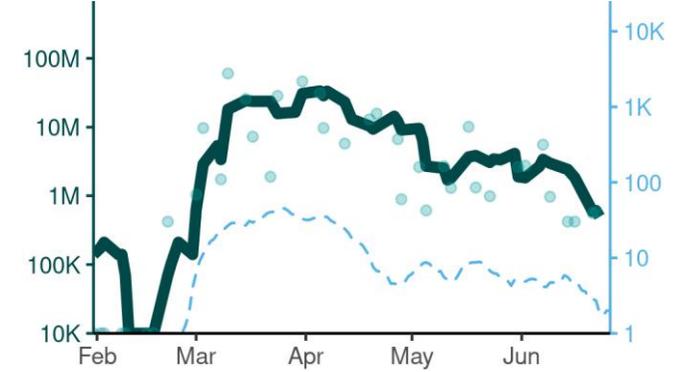
Pahiatua
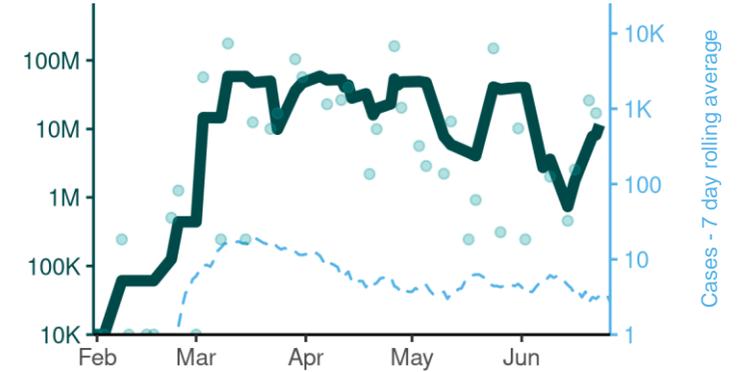
Eketahuna

Status ● Detected ● Not detected

Pahiatua *Grab 2.8K*
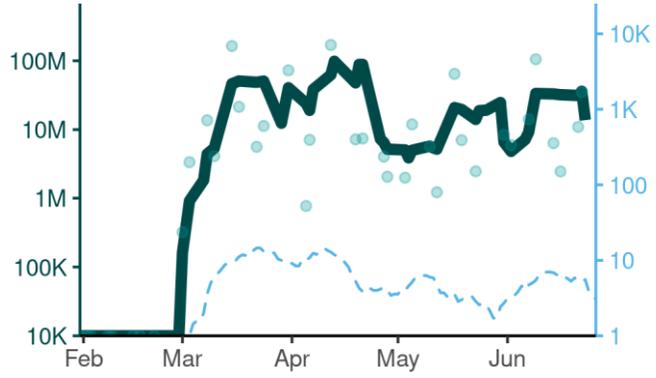
Woodville *Grab 1.7K*
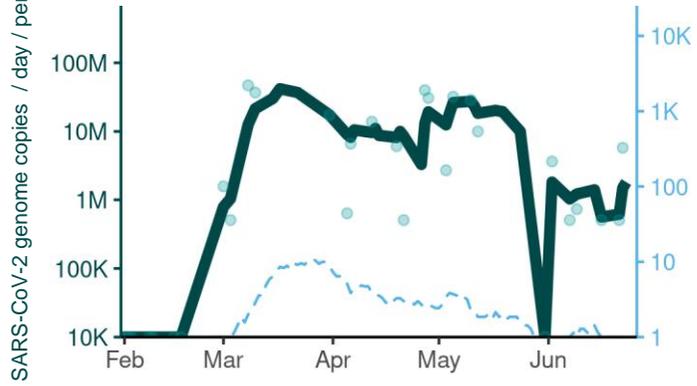
Eketahuna *Grab 1.6K*

SARS-CoV-2 genome copies / day / person
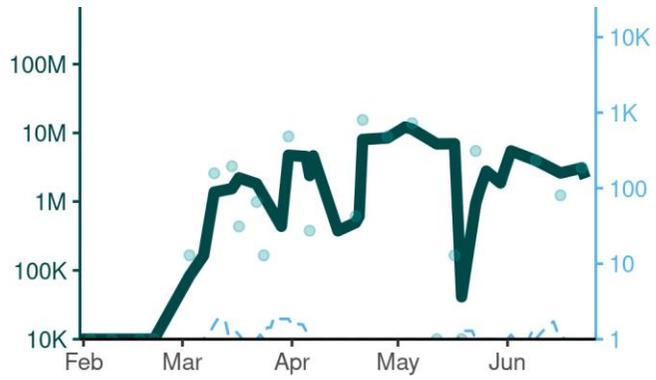
Wellington

Wellington (Moa Point) *Autosampler 168.0K*

Hutt Valley *Autosampler 133.0K*
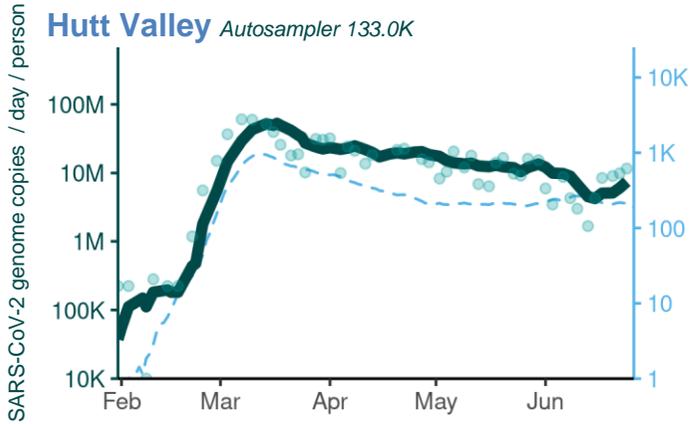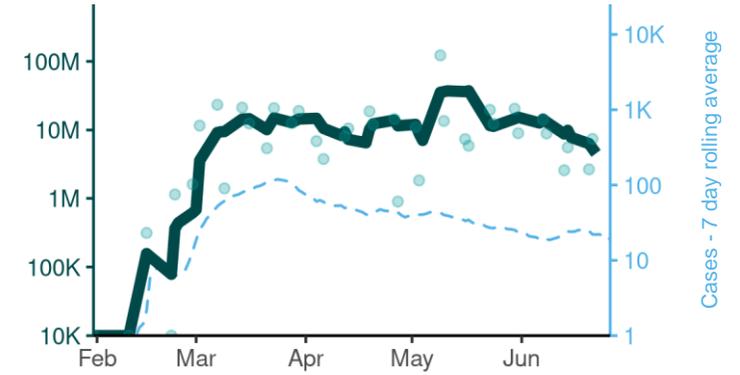
Porirua *Autosampler 85.0K*

Paraparaumu *Autosampler 49.0K*

Masterton *Grab 20.7K*
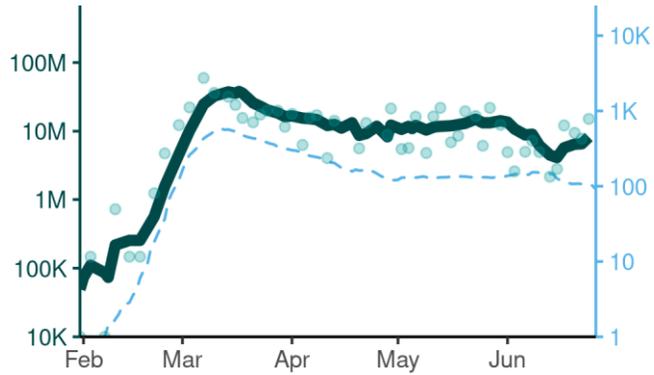
Wellington (Western) *Autosampler 14.0K*

SARS-CoV-2 genome copies / day / person

Cases - 7 day rolling average

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

Status   Detected   Not detected

SARS-CoV-2 genome copies / day / person
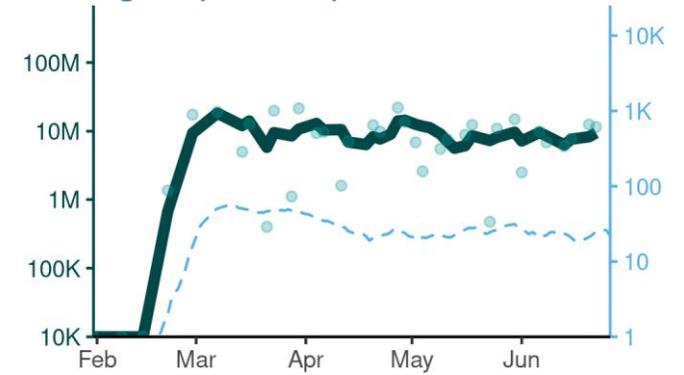
Carterton *Grab 5.8K*
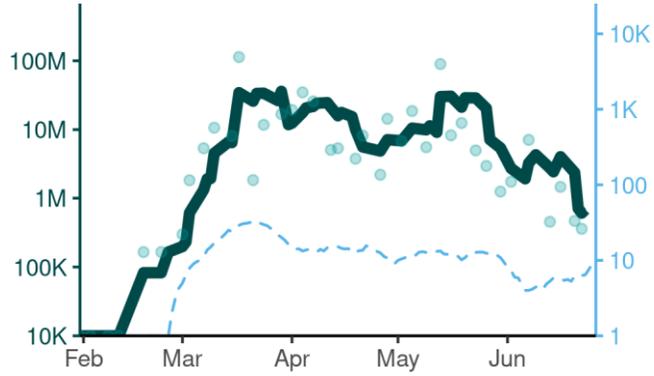
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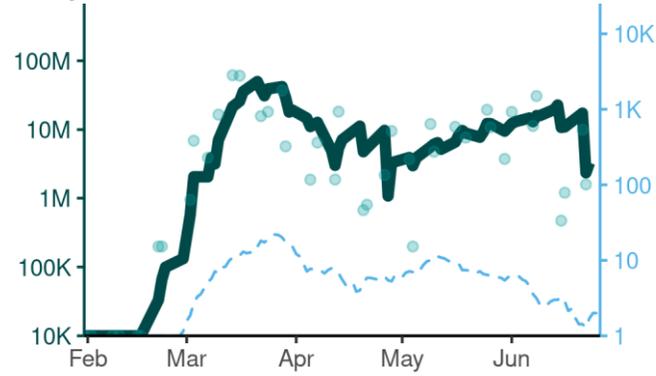
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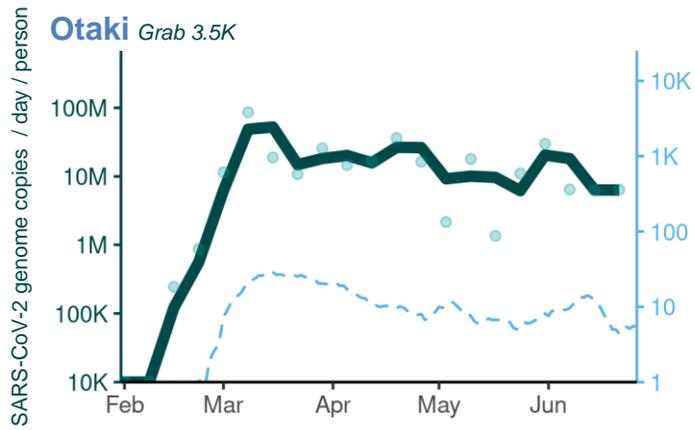
Martinborough *Autosampler/grab 1.6K*
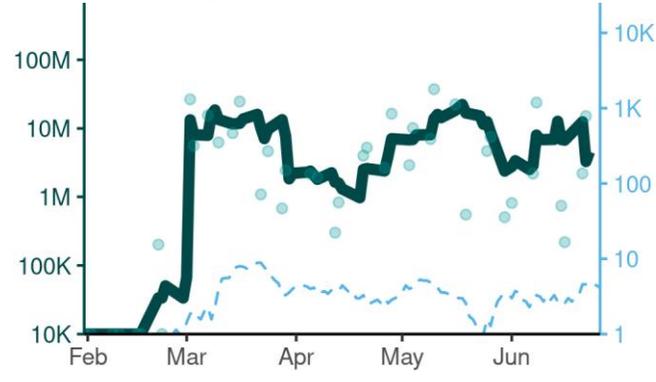
Featherston *Grab 2.5K*
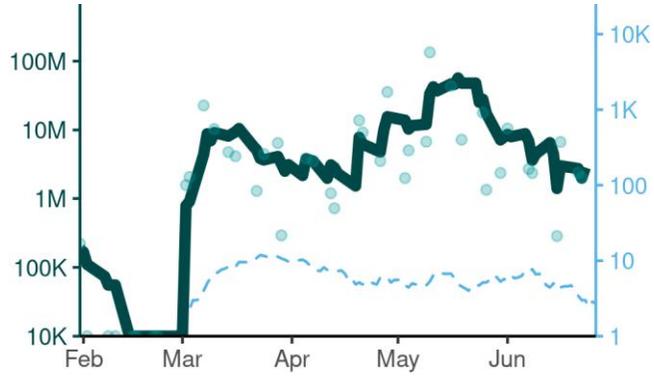
Tasman, Nelson, and Marlborough

Richmond/Nelson South *Autosampler 60.0K*
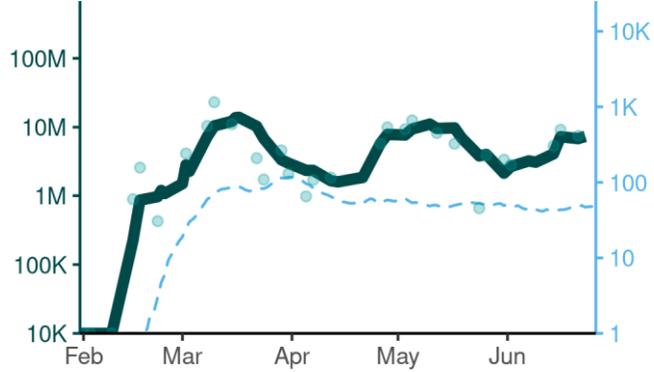
Motueka *Autosampler 8.3K (no case data)*
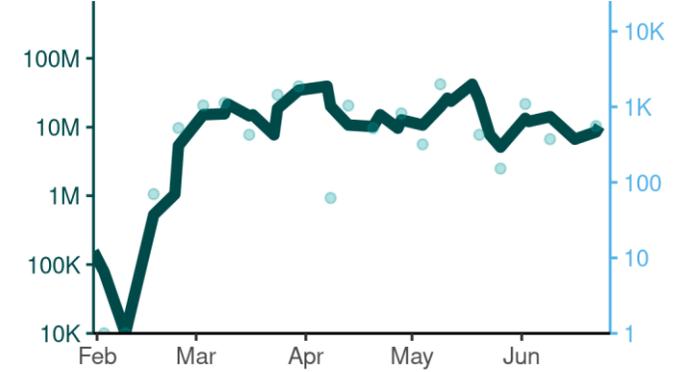
Blenheim *Autosampler 31.0K*

Nelson Central/North *Autosampler 26.0K*
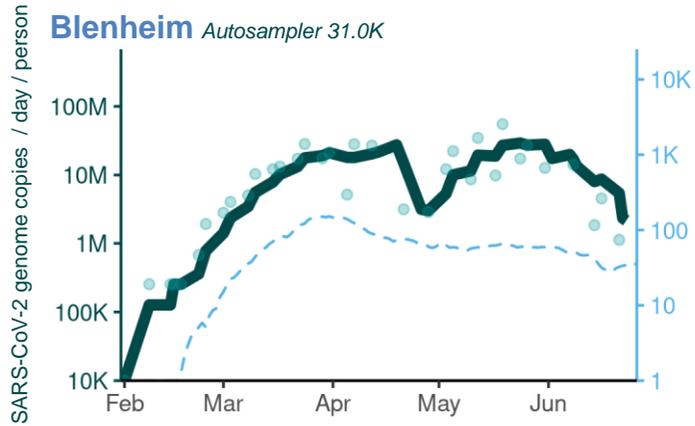
Picton *Autosampler 5.0K*
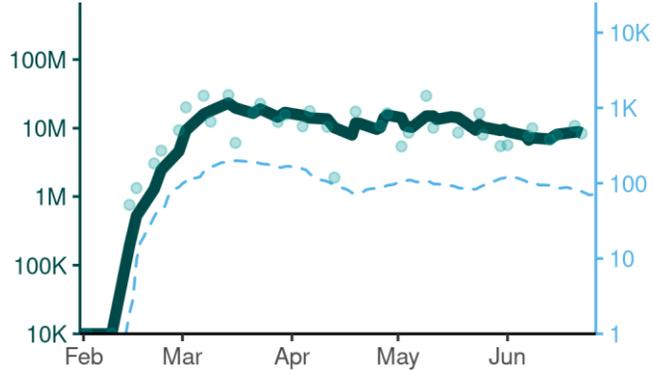
Status ● Detected ● Not detected

West Coast and Canterbury

Christchurch *Autosampler 368.0K*
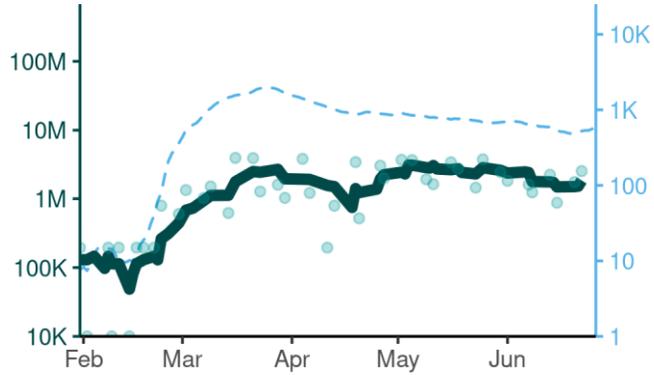
Rangiora *Grab 19.0K*
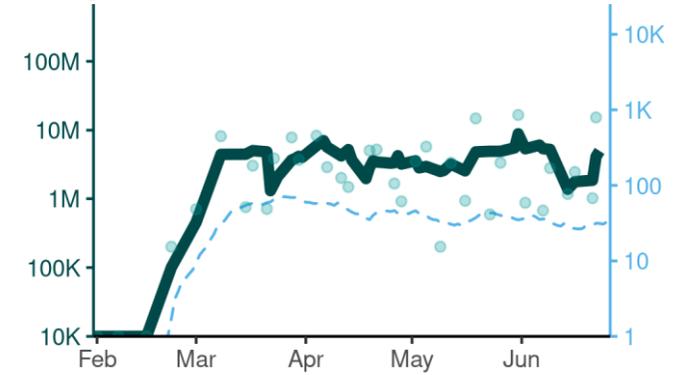
Rolleston & Eastern Selwyn *Autosampler 35.0K*
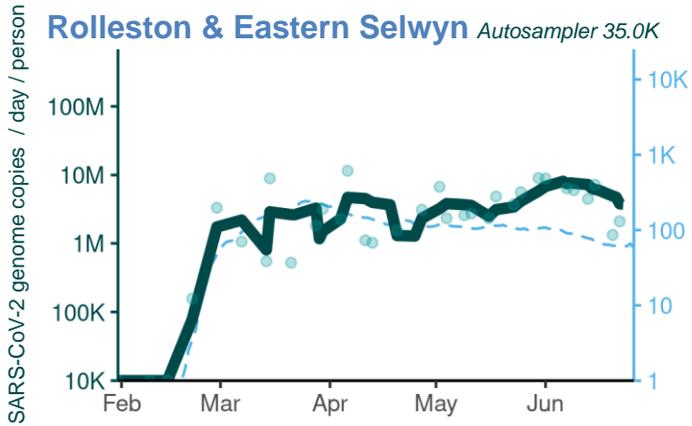
Ashburton *Autosampler 18.0K*
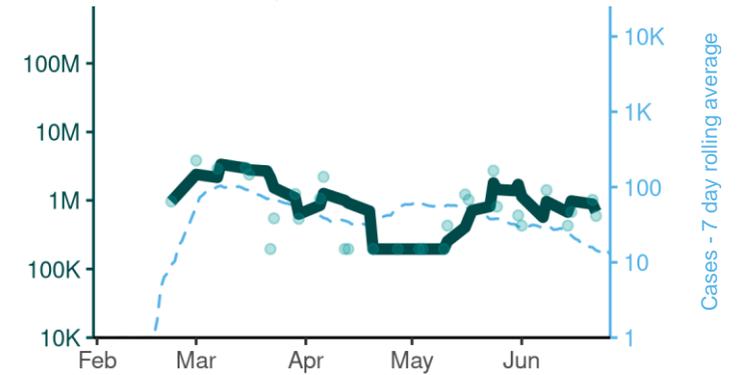
Timaru *Autosampler 28.0K*
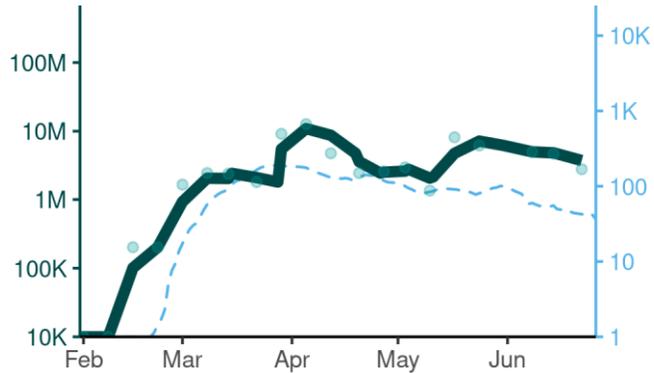
Kaiapoi *Grab 12.5K*
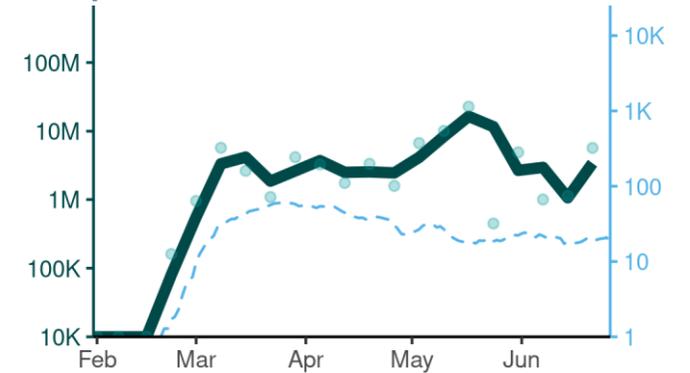
SARS-CoV-2 genome copies / day / person
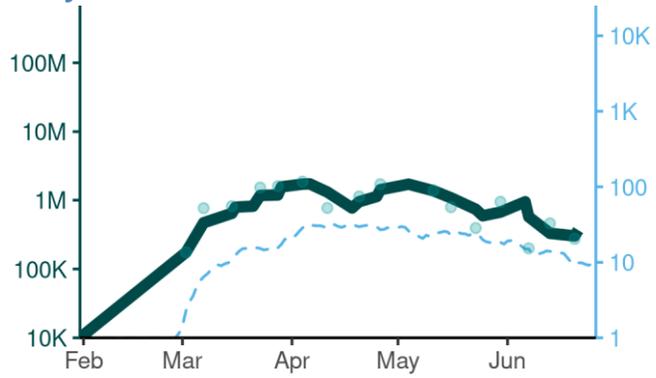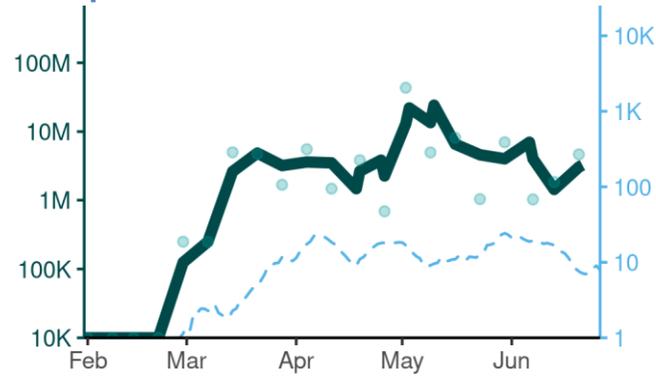
Cases - 7 day rolling average

Westport
Reefton
Greymouth
Hokitika
Kaikoura
Hanmer Springs
Amberley
Rangiora
Kaiapoi
Woodend
Christchurch
Rolleston & Eastern Selwyn
Leeston
Ashburton
Timaru

Status ● Detected ● Not detected
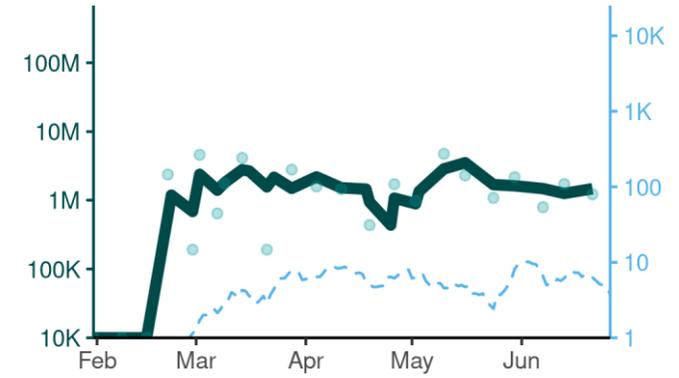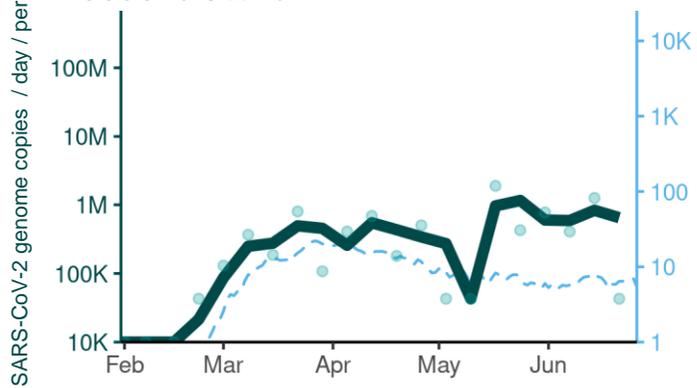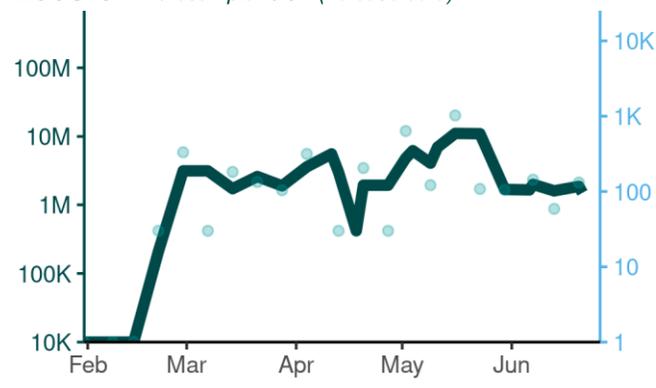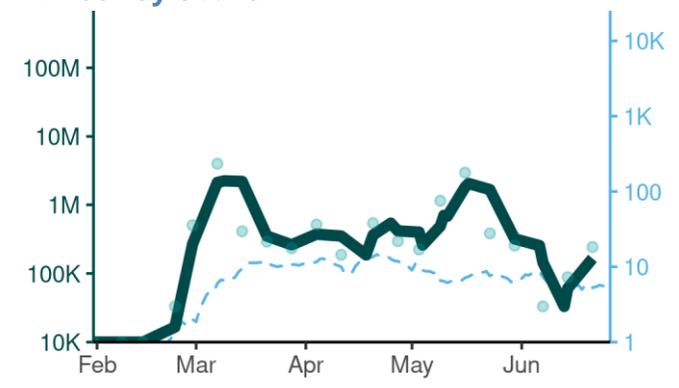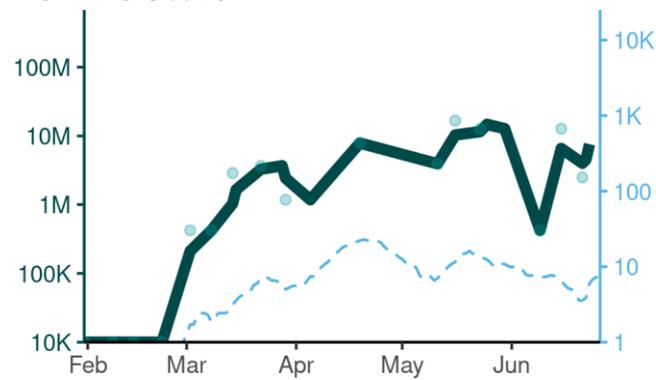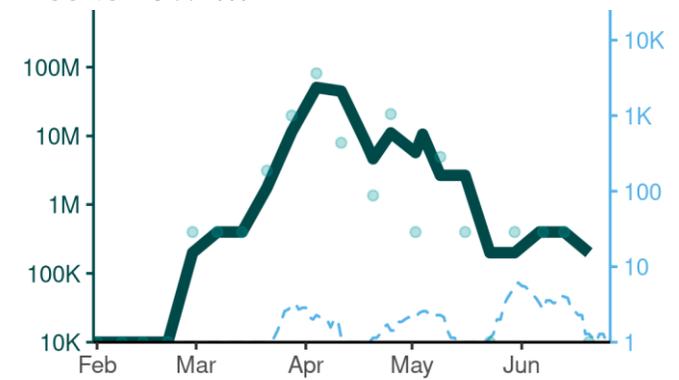
Otago and Southland

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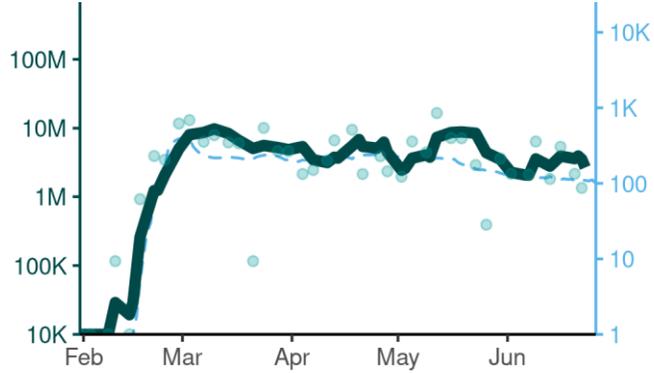
Dunedin (Green Island) *Autosampler 22.9K*
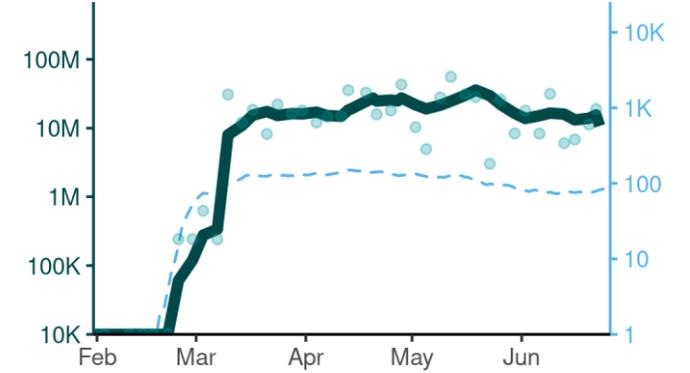
Invercargill *Autosampler 50.0K*
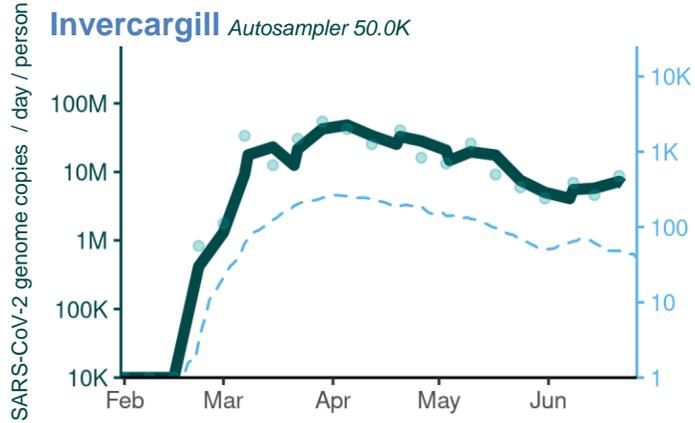
Dunedin (Mosgiel) *Autosampler 14.6K*
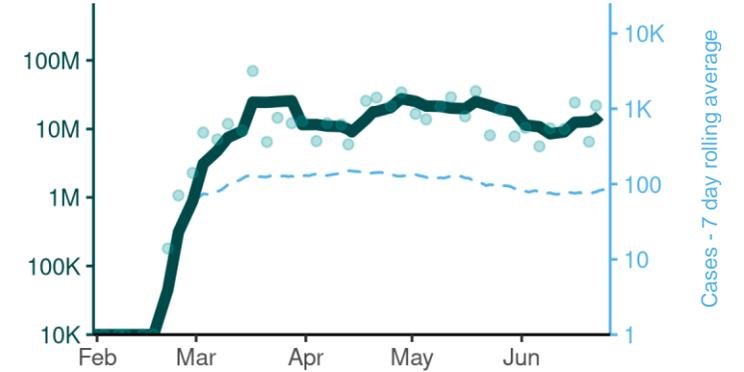
Queenstown *Autosampler 40.0K*

Wanaka *Grab 14.5K*

SARS-CoV-2 genome copies / day / person

Cases - 7 day rolling average

Wanaka

Queenstown
Cromwell
Alexandra

Dunedin (Mosgiel)
Dunedin (Tahuna)
Dunedin (Green Island)

Gore
Invercargill
Balclutha

Bluff

Status ● Detected ● Not detected

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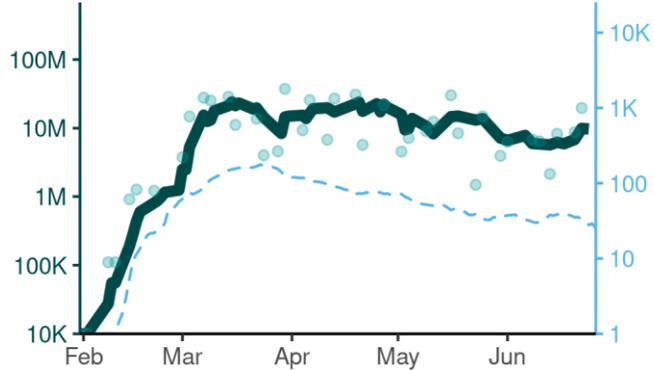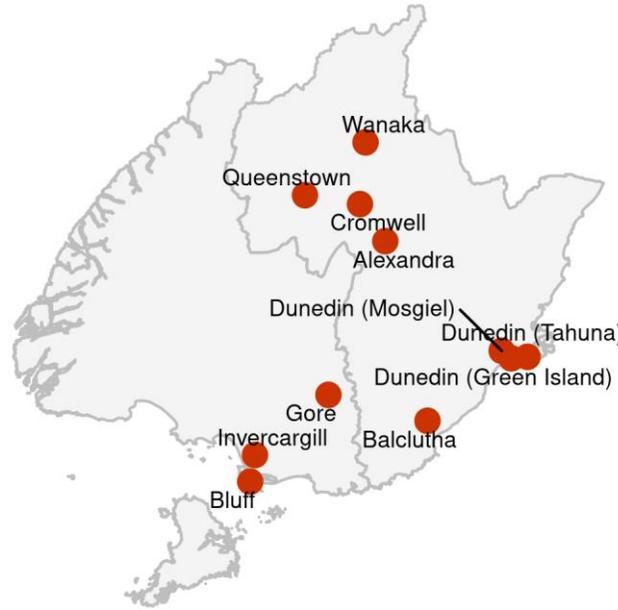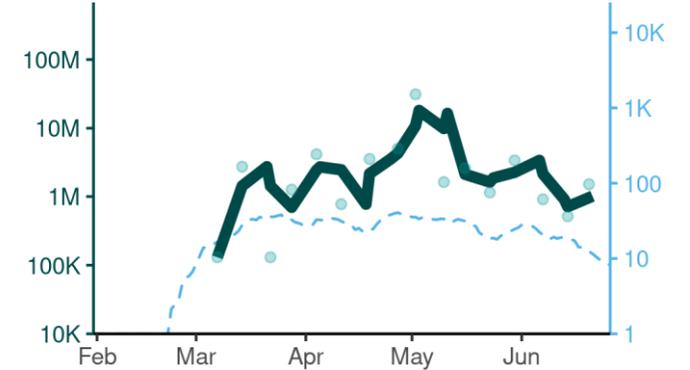
Gore *Autosampler 8.0K*
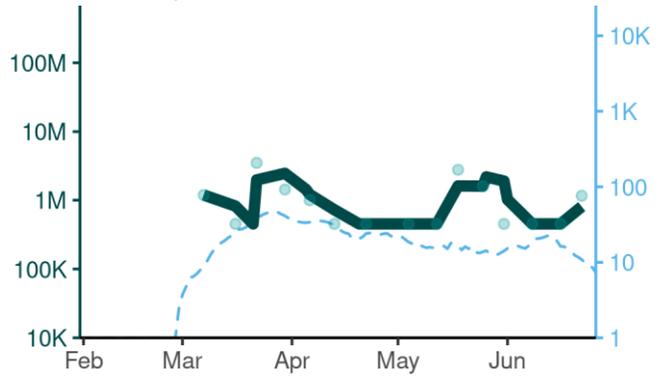
Balclutha *Grab 4.1K*
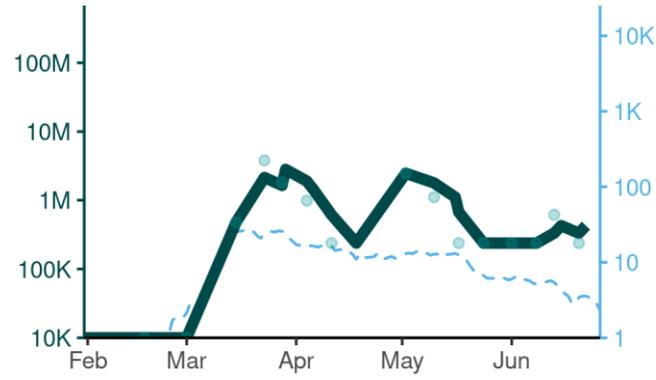
Cromwell *Autosampler 7.1K*
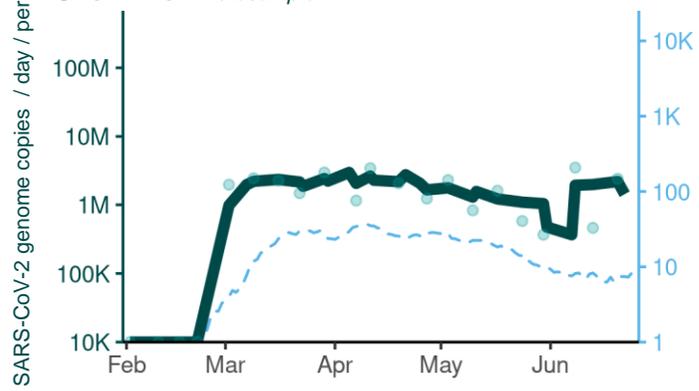
Bluff *Autosampler 2.0K*
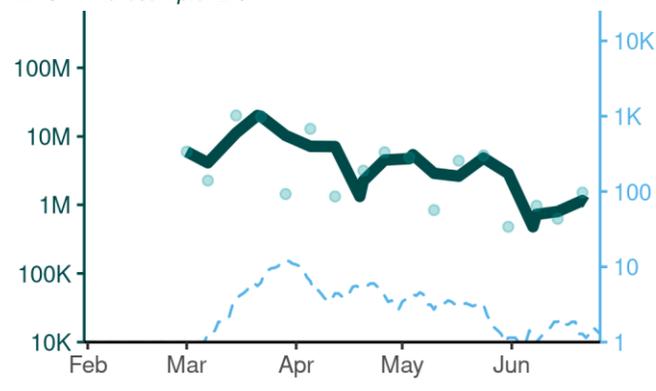
Alexandra *Autosampler 6.2K*

SARS-CoV-2 genome copies / day / person

Weekly summary

Key: Not Detected | Detected (below limit of quantification) | Detected (quantifiable) | Not sampled.

Site	2021 36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	2022 01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25

Northland
- Ahipara
- Awanui
- Dargaville
- Haruru
- Hihi
- Hikurangi
- Kaeo
- Kaikohe
- Kaitaia
- Kaiwaka
- Kawakawa
- Kerikeri
- Kohukohu
- Mangawhai
- Maungaturoto
- Opononi
- Paihia
- Rangiputa
- Rawene
- Ruakaka
- Russell
- Taipa
- Waipu
- Whangarei
- Whatuwhiwhi

Auckland
- Army Bay
- Auckland (Combined)
- Auckland East
- Auckland Southwest
- Auckland West
- Beachlands
- Clarks Beach
- Helensville
- Kawakawa Bay
- Kingseat
- North Shore
- Omaha
- Pukekohe
- Snells/Algies
- Waiheke Island
- Waiuku
- Warkworth
- Wellsford

Waikato
- Cambridge
- Coromandel
- Hamilton
- Huntly
- Kihikihi
- Kinloch
- Mangakino
- Maramarua
- Matamata
- Matangi
- Meremere
- Morrinsville
- Motuoapa
- Ngaruawahia
- Ngatea
- Omori
- Otorohanga
- Paeroa
- Pauanui
- Putaruru
- Raglan
- Taupo

Site	2021																	2022																							
	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
Tauwhare																																										
Te Awamutu																																										
Te Kauwhata																																										
Te Kowhai																																										
Te Kuiti																																										
Thames																																										
Tokoroa																																										
Turangi																																										
Waihi																																										
Waitakaruru																																										
Whangamata																																										
Whitianga																																										
Bay of Plenty																																										
Edgecumbe																																										
Katikati																																										
Kawerau																																										
Maketu																																										
Mt Maunganaui																																										
Murupara																																										
Ohope																																										
Opotiki																																										
Rotorua																																										
Taneatua																																										
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																																										
Feilding																																										
Hunterville																																										
Levin																																										
Pahiatua																																										
Palmerston North																																										
Taumarunui																																										
Whanganui Urban																																										
Woodville																																										
Wellington																																										
Carterton																																										
Featherston																																										
Greytown																																										
Hutt Valley																																										
Martinborough																																										
Masterton																																										
Otaki																																										
Paraparaumu																																										
Porirua																																										

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Site	2021																		2022																									
	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52		01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
Wellington (Moa Point)																																											
Wellington (Western)																																											
Tasman																																											
Motueka																																											
Nelson																																											
Nelson Central/North																																											
Richmond/Nelson South																																											
Marlborough																																											
Blenheim																																											
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Hokitika																																											
Reefton																																											
Westport																																											
Canterbury																																											
Amberley																																											
Ashburton																																											
Christchurch																																											
Hanmer Springs																																											
Kaiapoi																																											
Kaikoura																																											
Leeston																																											
Methven																																											
Oamaru																																											
Oxford																																											
Rangiora																																											
Rolleston & Eastern Selwyn																																											
Timaru																																											
Waimate																																											
Woodend																																											
Otago																																											
Alexandra																																											
Balclutha																																											
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Dunedin (Green Island)																																											
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Milton																																											
Queenstown																																											
Wanaka																																											
Southland																																											
Bluff																																											
Gore																																											
Invercargill																																											

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Acknowledgements

Notes

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

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

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

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

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

SARS-CoV-2 RNA detected (positive result): A positive detection in the wastewater indicates that at least one person has been shedding SARS-CoV-2 into the wastewater at some point during the time period that the sample was being collected. In some cases, detections could also be due to the shedding of low levels of SARS-CoV-2 RNA by a recently recovered case. The detection of SARS-CoV-2 RNA does not indicate that infectious virus is present.

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

Viral loads and normalisation: When detected, the SARS-CoV-2 RNA concentration is calculated as genome copies per L of wastewater. This is then converted to a viral load of **genome copies/day/person**. This conversion takes into account the flow rate of wastewater entering the treatment plant (the influent) and the population in the catchment. The **flow rate** is the total volume (m^3 per day) recorded at the inlet of the wastewater treatment plant over 24 hours. This is a **population-normalised viral load**. Currently, the flow rate is the average annual flow rate, but will be replaced with daily flow rate when available (note that rainfall may significantly increase the flow rate at the inlet, diluting the sample, and may result in lower concentrations and a false negative result).

In future, SARS-CoV-2 RNA concentrations will also be normalised by testing for the presence of pepper mild mottled virus (PMMoV). PMMoV is a virus that infects peppers but not humans. Consumption of peppers or pepper products 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).

<u>For further information please contact:</u>

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END OF REPORT