New Zealand Wastewater Surveillance Programme COVID-19

Monthly Report February 2024

Weeks ending 11 February to 03 March 2024
Report prepared 11 March 2024

Key Trends & Insights

In February 2024, SARS-CoV-2 levels in wastewater averaged 5.17 million genome copies per person per day (GC/p/d) compared to 5.97 GC/p/d in January. During this period, SARS-CoV-2 levels were highest in the week ending 18 February at 6.44 million GC/p/d.

100%	**64%**	**JN.1**
Sites (44/44) where SARS-CoV-2 was detected.	NZ population covered by wastewater testing	Most prevalent variant detected (97%)

- In February 2024, 257 samples were collected across Aotearoa. SARS-CoV-2 RNA was detected in 255/257 (99%) of samples from 44/44 sites (100%).
- Following a sustained increase in SARS-CoV-2 RNA quantities in wastewater since August 2023 through to December 2023, while variations have been observed, the overall trend from January through to February 2024 was downward, followed by a recent flattening out.
- The estimated national percentage of the JN.1 family (includes JN.1, JN.1.4 and XDK) remained steady at a high level (95-97%) through February.

National Results

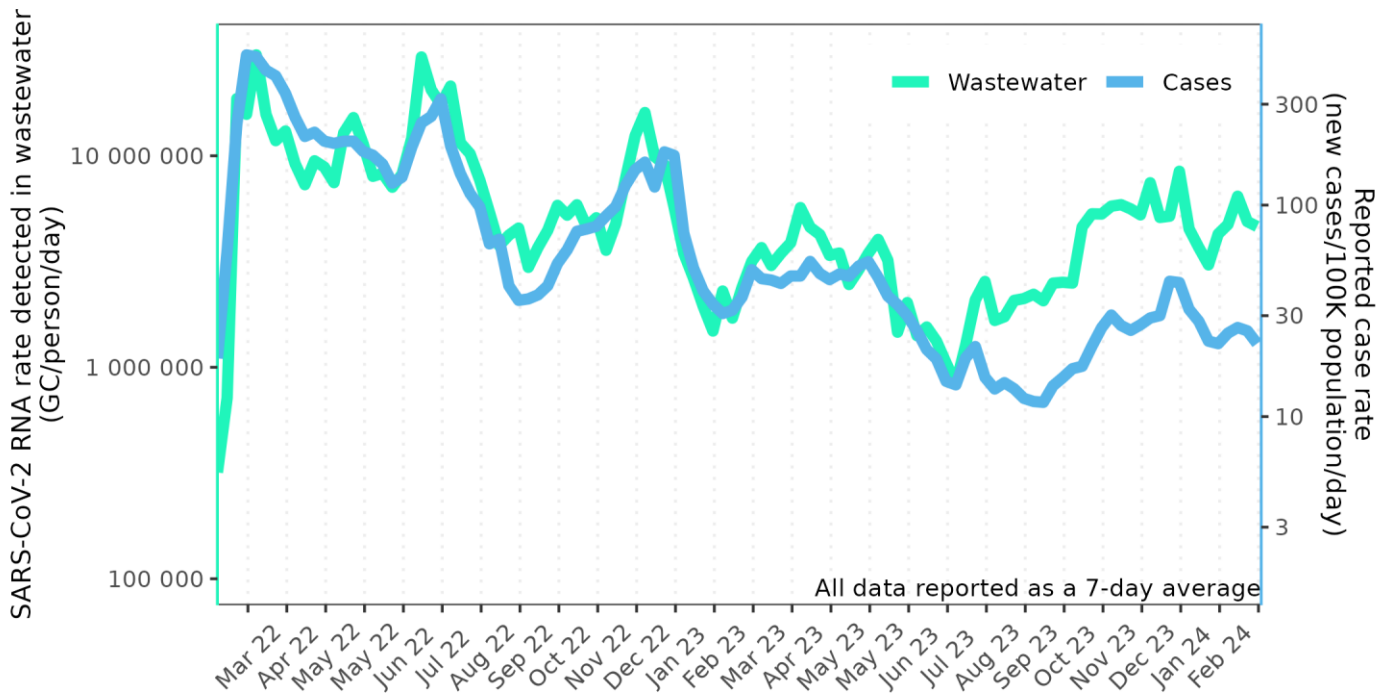## National SARS-CoV-2 levels in wastewater and reported cases

Figure 1. National timeseries of estimated SARS-CoV-2 wastewater rate (GC/person/day, green line) and reported case rate (new cases/100,000 population/day, blue line) on a log_{10} scale.
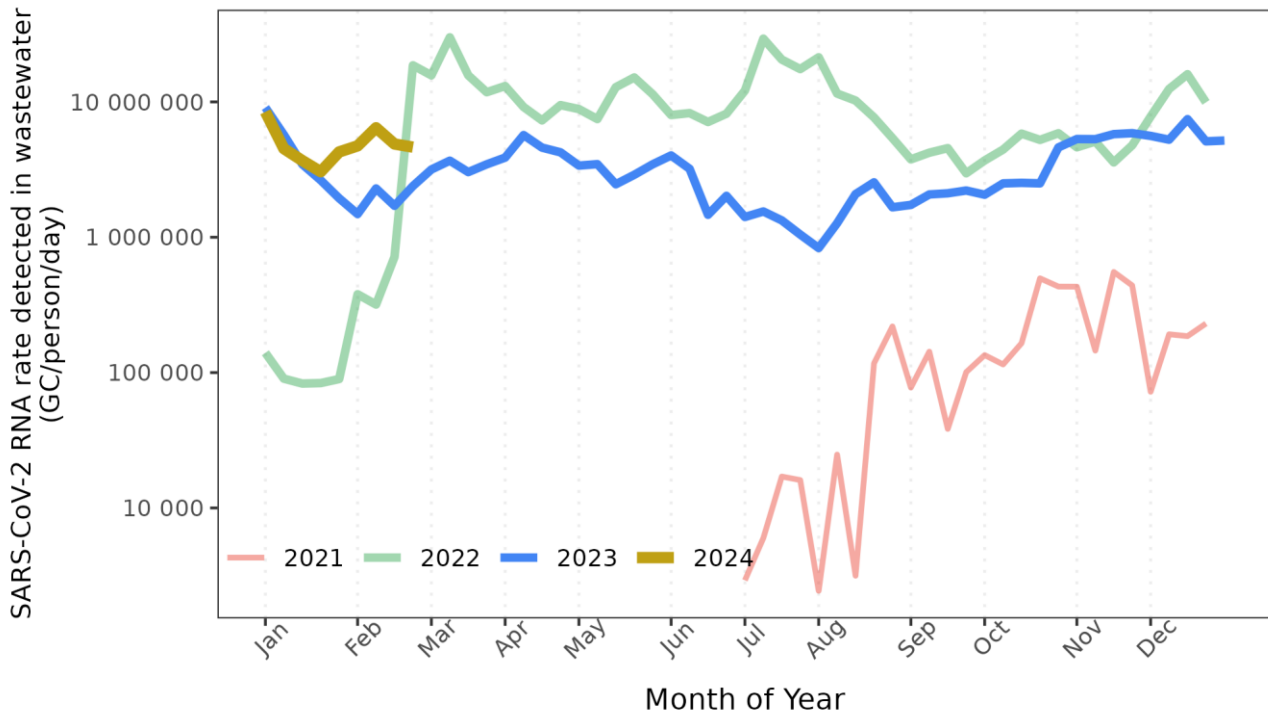

Figure 2. National timeseries of estimated SARS-CoV-2 wastewater rate (GC/person/day).
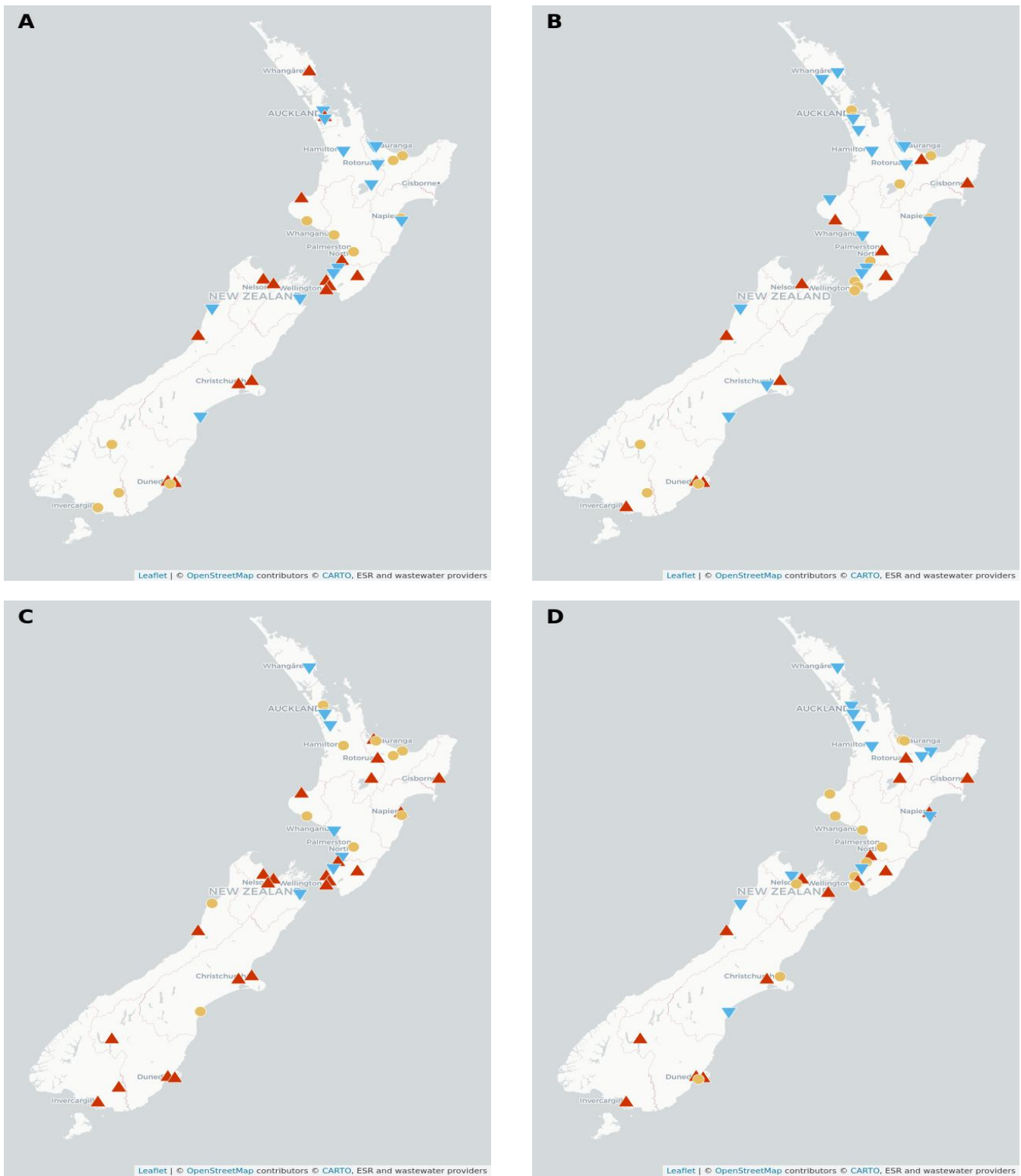
Figure 3. Comparison of SARS-CoV-2 levels for the week ending 3 March 2024, compared to levels measured: A) 1 week ago; B) 2 weeks ago; C) 4 weeks ago; D) 12 weeks ago. Only sites with results for both time points are included. When the viral quantity is 30% or more higher this is labelled as increased (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/

Variant Analysis

Results from the four weeks of sampling up to week 8 from twenty sentinel wastewater sites (Table 1) across New Zealand show that the JN.1 family of lineages (includes JN.1, JN.1.4 and XDK) were dominant (estimated percentage between 95% and 97%) across this period (Figures 4 and 5, Table 1).

BA.2.86, the parental lineage to JN.1, continued to be detected but at low levels in February (3-5% nationally, Figures 4 and 5). EG.5 was intermittently detected at low amounts in some North Island locations in February (Table 1), only reaching a 1% national level in week 8 (Figures 4 and 5).
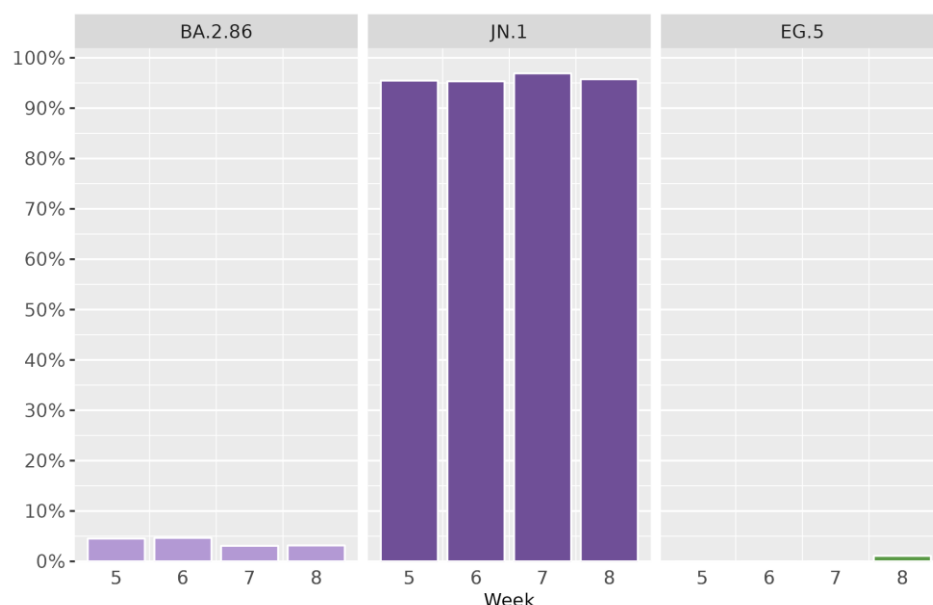
Figure 4. National percentage of each variant for week 5 (ending 4 February 2024) to week 8 (ending 25 February 2024).

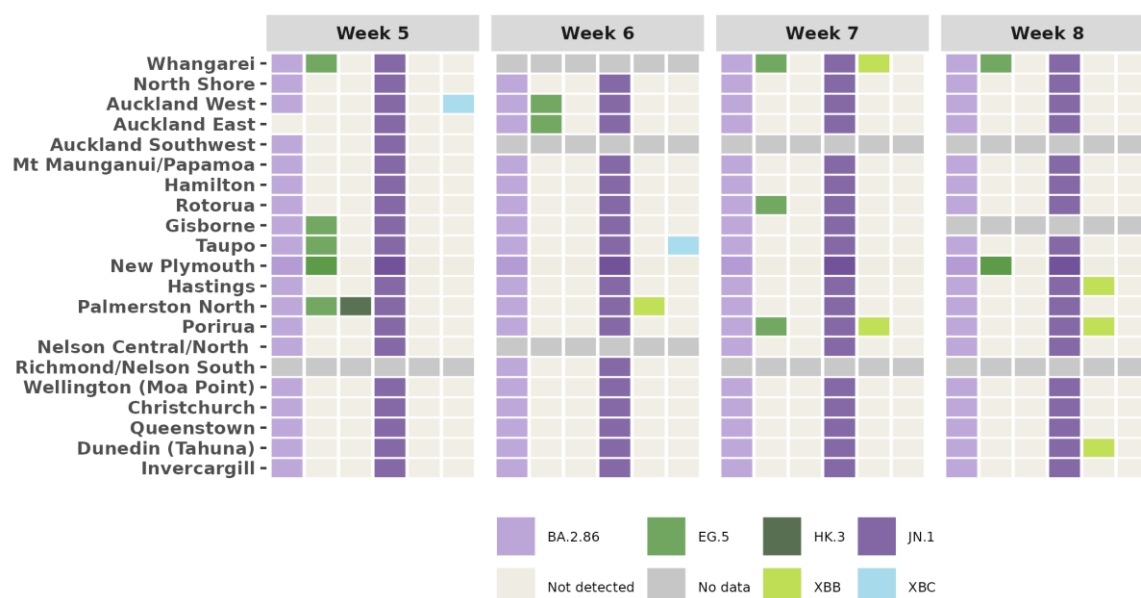**Table 1.** Data from 20 wastewater sentinel sites sampled in week 5 (ending 4 February 2024) to week 8 (ending 25 February 2024). The cream coloured box denotes that the variant was not detected and grey box denotes site was not sampled that week.
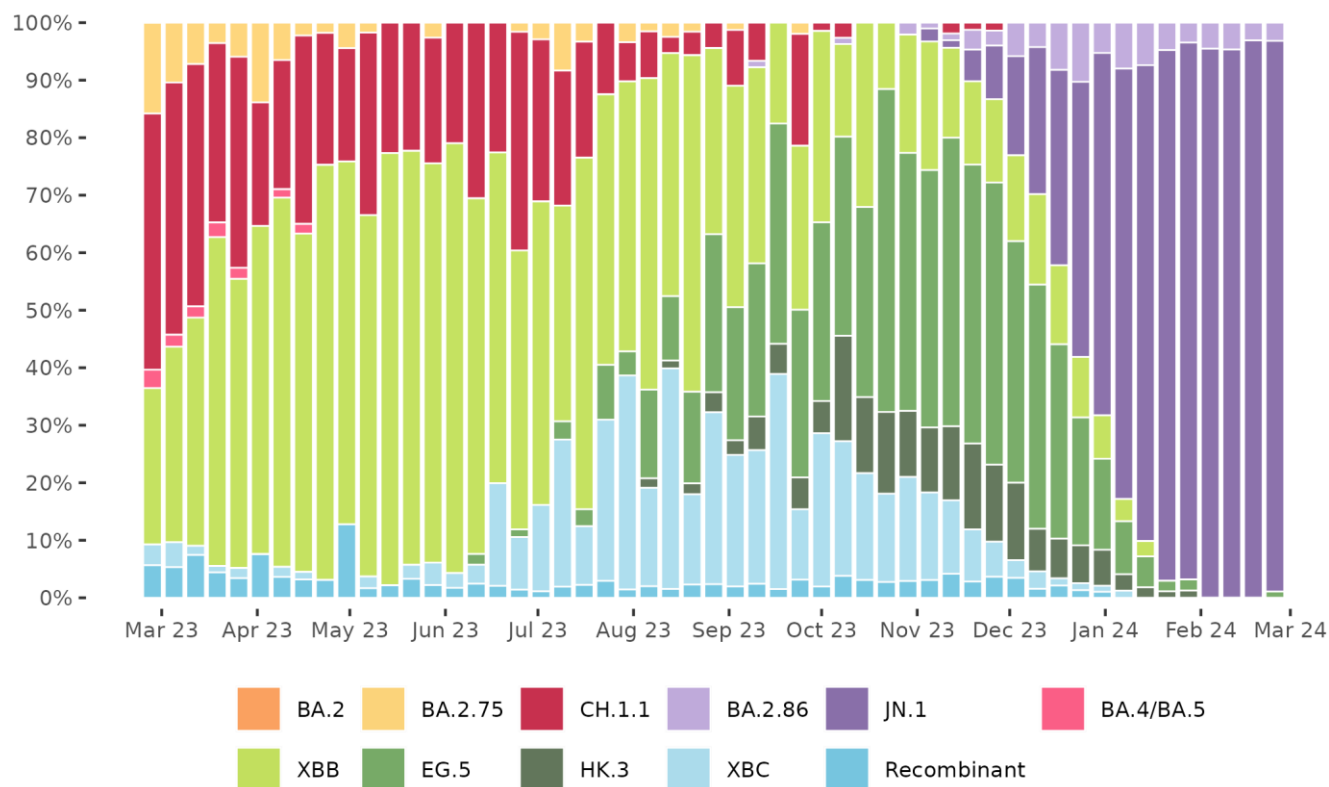
Figure 5. Estimated percentage over time at a national scale (average). Data are collected from up to 20 sentinel sites each week.

Instantaneous Reproduction Number

Daily wastewater and case data up to 1 March 2024 was used for the modelling. The uncertainty in these measures is denoted with 95% credible intervals (shown in green in Figure 6).

Instantaneous reproduction number: The estimate of the instantaneous reproduction number for 1 March 2024 (in week 9) was 0.98 (95% credible interval 0.67 - 1.4, Figure 6).
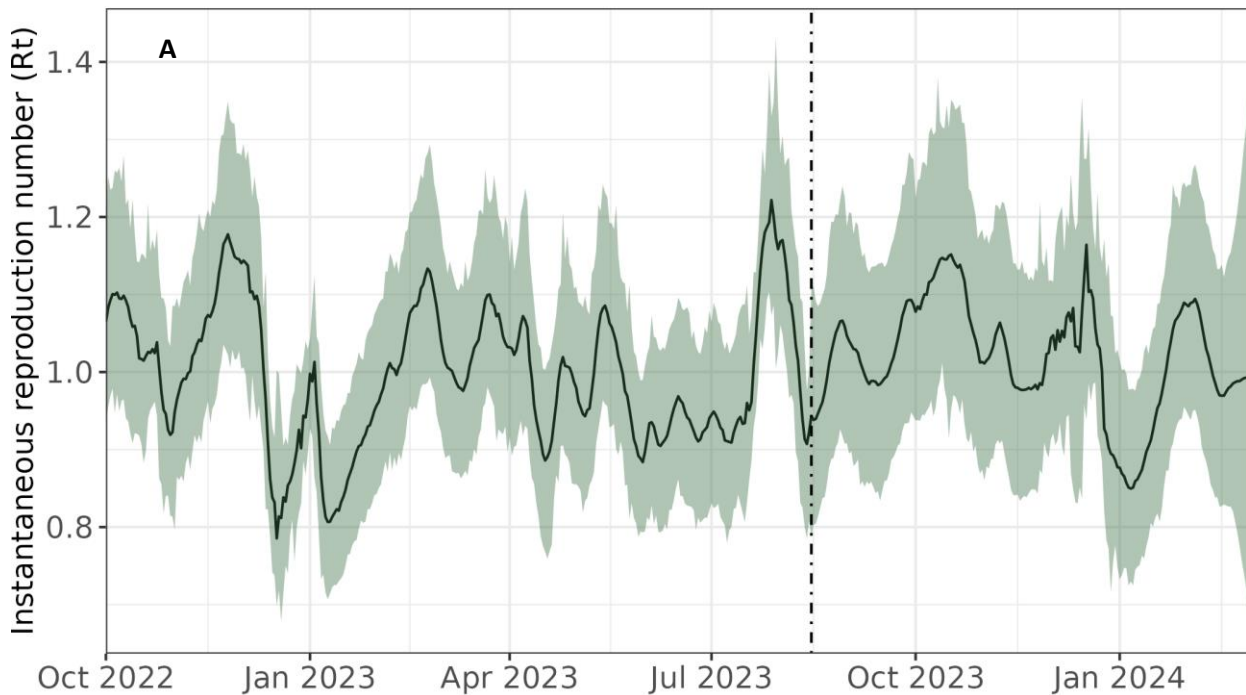
Figure 6. Estimates of instantaneous reproduction number. Black vertical lines represent when COVID-19 restrictions were lifted on 15 August 2023. Black solid lines represent central estimates. Shaded regions show 95% credible intervals on the value of the hidden states.

Trends in Ministry of Health Regions

Regional analysis of the wastewater data is shown in Figure 7.
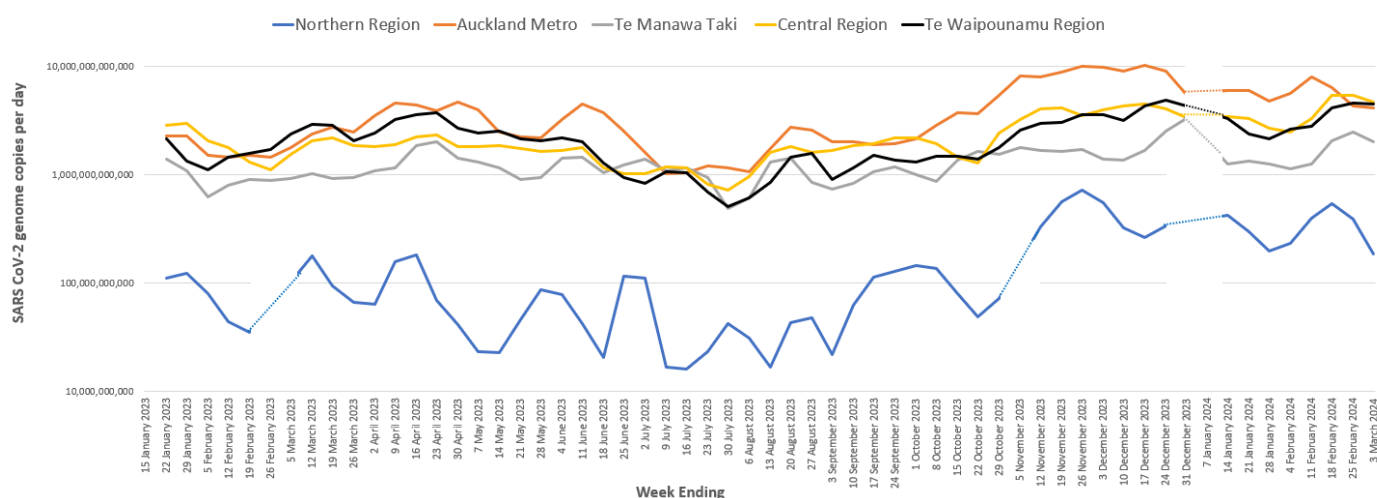
Figure 7. Two week rolling average of total SARS-CoV-2 genome copies detected per day in the five Ministry of Health regions for 2023 and 2024. Dashed lines are inferred levels during periods when samples were either not collected (Christmas period) or insufficient numbers collected (for example, due to weather impacts) for the region.

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 considers 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: *Instantaneous reproduction number (R_t):* The instantaneous reproduction number (R_t) represents the average number of secondary cases that will arise per primary infectious case. The effective reproduction (R_{eff}) number can be measured as either the instantaneous reproduction number (R_t), which measures transmission at a specific point in time; or the case reproductive number, which measures transmission for a specific cohort of individuals. The models described measure the instantaneous reproduction number (R_t). In general terms, an R_t above 1 would typically indicate an increasing number of infections in the population. The instantaneous reproduction number is calculated using a semi-mechanistic model that is fitted to (i) case numbers and (ii) wastewater quantitation, and incorporates information about shedding rates, infection generation times, and case ascertainment. Instantaneous reproduction number is estimated take into account any delays in self-reporting of cases. It should be noted that there is uncertainty in this measure, which is denoted with the 95% credible intervals.

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 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).

For further information please contact:

Joanne Hewitt
Science Leader
Joanne.hewitt@esr.cri.nz

Jo Chapman
Senior Scientist
Joanne.chapman@esr.cri.nz

Appendix A. National Results

Time series plotted on linear scale

Appendix B. Site Results Weekly Summary

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

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

region	Site	population	sample_type
Northland	Dargaville	5,000	Grab
Northland	Whangarei	65,000	Autosample
Auckland	Auckland East	680,000	Autosample
Auckland	Auckland Southwest	120,000	Autosample
Auckland	Auckland West	315,000	Autosample
Auckland	North Shore	240,000	Autosample
Auckland	Pukekohe	20,900	Autosample
Waikato	Cambridge	20,100	Autosample
Waikato	Hamilton	169,000	Autosample
Waikato	Taupo	23,000	Auto/grab
Waikato	Whitianga	6,600	Autosample
Bay of Plenty	Katikati	5,500	Autosample
Bay of Plenty	Kawerau	7,000	Autosample
Bay of Plenty	Mt Maunganui/Papamoa	65,000	Autosample
Bay of Plenty	Rotorua	59,000	Autosample
Bay of Plenty	Tauranga	50,000	Autosample
Bay of Plenty	Whakatāne	21,020	Autosample
Gisborne	Gisborne	37,000	Autosample
Hawke's Bay	Hastings	80,000	Autosample
Hawke's Bay	Napier	55,000	Autosample
Hawke's Bay	Hawera	12,000	Autosample
Manawatu-Whanganui	New Plymouth	88,000	Autosample
Manawatu-Whanganui	Levin	21,200	Autosample
Manawatu-Whanganui	Palmerston North	90,000	Autosample
Manawatu-Whanganui	Whanganui	44,500	Autosample
Wellington	Carterton	5,800	Grab
Wellington	Hutt Valley	133,000	Autosample
Wellington	Masterton	20,700	Auto/grab
Wellington	Otaki	3,500	Autosample
Wellington	Paraparaumu	49,000	Autosample

Columns span weeks 21–52 of 2023 and weeks 1–9 of 2024.

region	Site	population	sample_type	2023																												2024								
				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	52	1	2	3	4	5	6	7	8	9
	Porirua	85,000	Autosample																																									
	Wellington (Moa Point)	168,000	Autosample																																									
Tasman	Motueka	8,300	Autosample																																									
Nelson	Nelson Central/North	26,000	Autosample																																									
	Richmond/Nelson South	60,000	Autosample																																									
Marlborough	Blenheim	31,000	Autosample																																									
West Coast	Greymouth	10,000	Grab																																									
	Westport	5,000	Grab																																									
	Ashburton	18,000	Autosample																																									
Canterbury	Christchurch	368,000	Autosample																																									
	Rolleston & Eastern Selwyn	35,000	Autosample																																									
	Timaru	28,000	Autosample																																									
	Alexandra	6,200	Autosample																																									
	Cromwell	7,100	Autosample																																									
	Dunedin (Green Island)	22,900	Autosample																																									
Otago	Dunedin (Mosgiel)	14,600	Autosample																																									
	Dunedin (Tahuna)	84,000	Autosample																																									
	Queenstown	40,000	Autosample																																									
	Wanaka	14,500	Grab																																									
Southland	Gore	8,000	Autosample																																									
	Invercargill	50,000	Autosample																																									

E/S/R