National SARS-CoV-2 Wastewater Surveillance Programme

Week 14 2022 (03/04/2022—09/04/2022)

Report prepared on 14/04/2022

Programme overview

People infected with SARS-CoV-2, the virus that causes COVID-19 disease, can shed the virus in their stool, which can then be detected in wastewater. This means that wastewater surveillance can be used to monitor the circulation of SARS-CoV-2 in the population.

The National SARS-CoV-2 Wastewater Surveillance Programme (NWSP) has been established through a partnership with Irish Water, the National Virus Reference Laboratory (NVRL), University College Dublin (UCD), the HSE Health Protection Surveillance Centre (HPSC) and the HSE Health Intelligence Unit (HIU). Samples from 68 wastewater catchment areas across Ireland are taken on a weekly basis and analysed for the presence of SARS-CoV-2, with the exception of Ringsend in Dublin which is sampled twice a week. These 68 wastewater catchment areas (see Figure 3) cover 80% of the population connected to public wastewater treatment facilities and are spread throughout every region of Ireland.

The NWSP is an additional tool in Ireland's response to COVID-19. The NWSP aims to complement our case-based surveillance systems (i.e. our monitoring of the number of people testing positive or presenting to a healthcare provider with symptoms) through acting as an early warning system for the circulation, or a notable increase in the circulation, of SARS-CoV-2 in a wastewater catchment area.

Please note that stool and wastewater are not recognised sources of transmission for SARS-CoV-2. Standard hygiene measures should be used after using the toilet. Guidance from the WHO for water and sanitation providers recommends standard best practices, including PPE for those working in proximity to wastewater, be followed.

Methods

Wastewater samples are analysed using reverse transcriptase quantitative PCR to determine the concentration of the virus in wastewater sample. Samples are classified as unavailable when a sample was not received or could not be fully analysed; as undetected when the concentration was below the detection limit (BDL); as a weak positive when SARS-CoV-2 RNA was detected but the concentration was below the quantification limit (BQL); and as a positive when SARS-CoV-2 RNA was detected and the concentration could be quantified.

The amount of SARS-CoV-2 genetic material (the viral load, reported as gc/day) entering a wastewater treatment plant is then calculated from the viral concentration and the flow rate for the plant. Finally, population-normalised viral loads are reported as gc/day per person residing in the catchment area.

Please see the glossary and technical notes for further explanations.

Results from Week 14, 2022

In week 14, 2022 (week beginning 03/04/2022), samples were received and analysed from 68/68 catchment areas. SARS-CoV-2 RNA was detected in 68 of these (100%). Figure 1 below gives the proportion of samples (including the two samples from Ringsend) with positive results for this and previous weeks, while Figure 2 summarises the catchment-specific classification of sample results for each week of the programme.

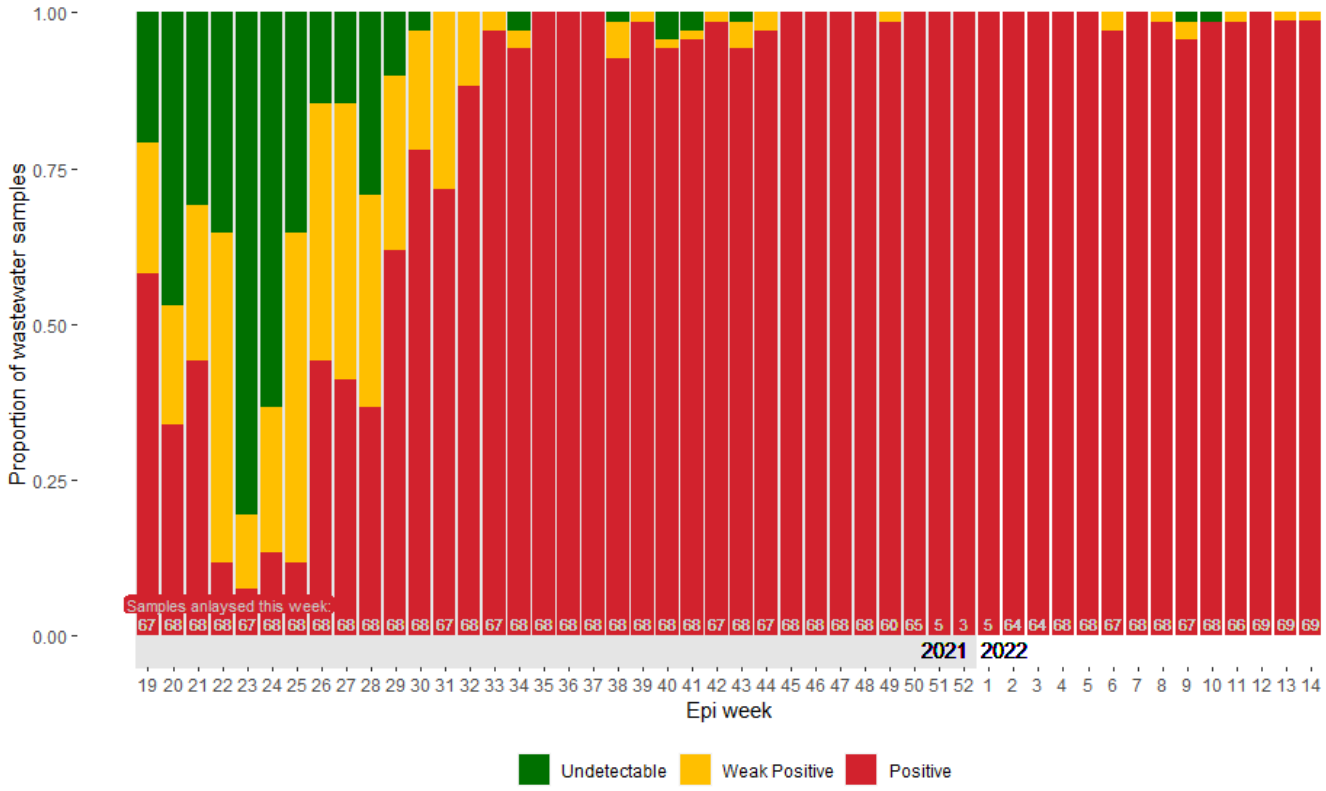
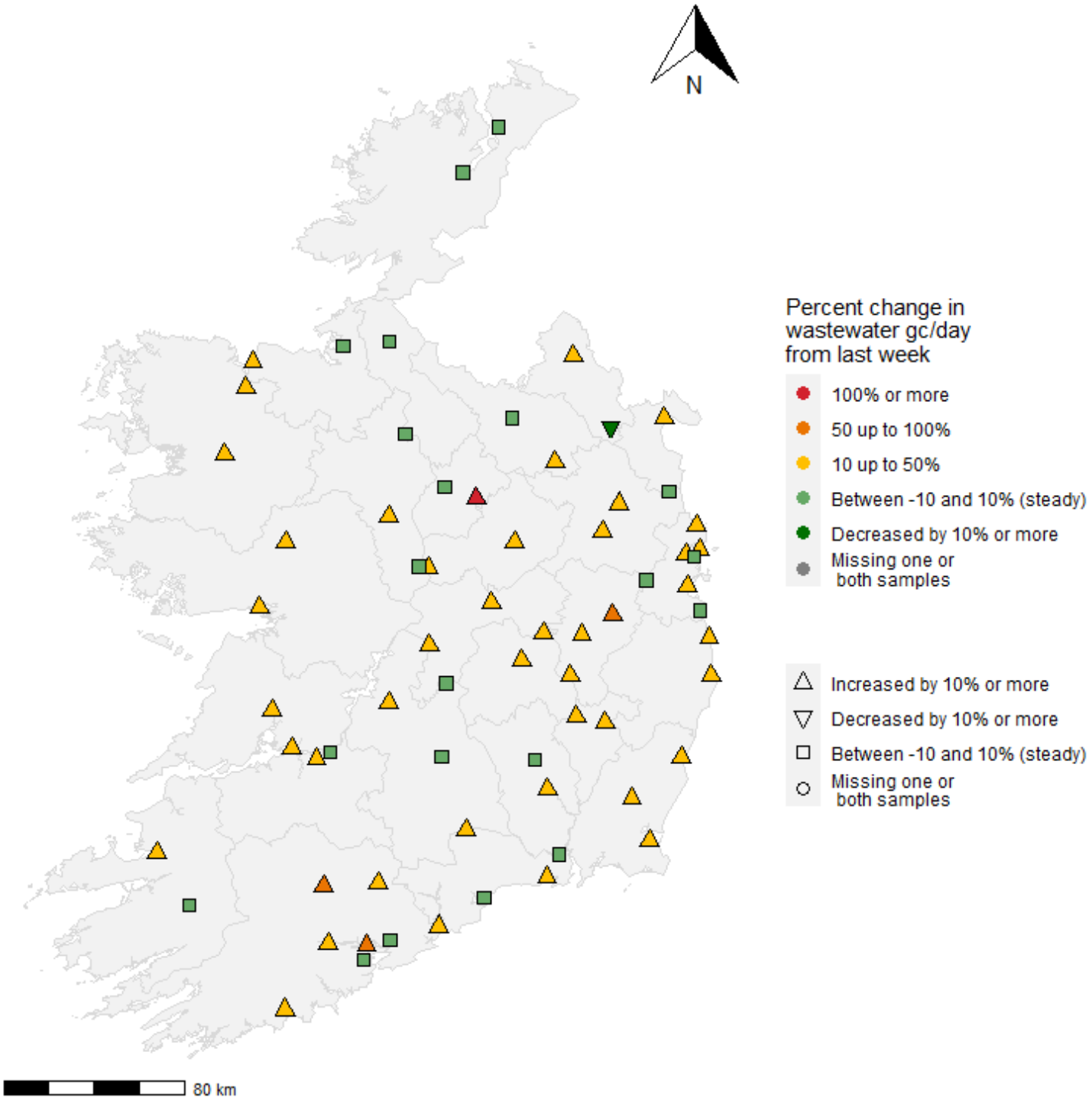


Figure 1. **Wastewater SARS-CoV-2 detections in Ireland by week, National Wastewater Surveillance Programme, week 19, 2021 to week 14, 2022**

Note: There are 69 possible samples from 68 catchment areas because Ringsend is sampled twice weekly. Samples with an undetected result may have SARS-CoV-2 present but the amount was too low to be detected by the test. It does not mean that SARS-CoV-2 is not circulating in the wastewater catchment area of the Wastewater treatment plant (WWTP).

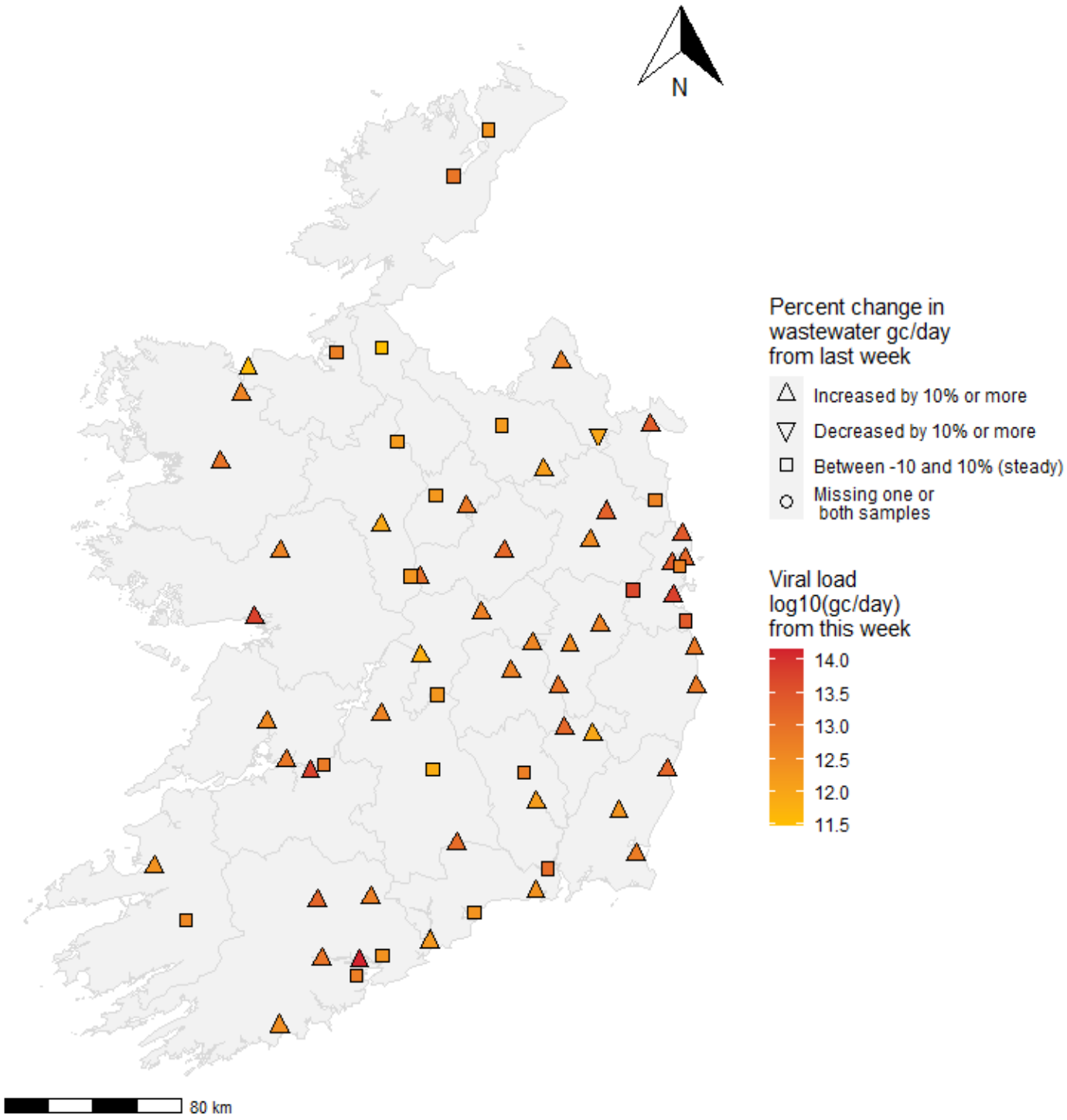
Figure 2. **Weekly SARS-CoV-2 sample classification by wastewater catchment area, National Wastewater Surveillance Programme, week 19, 2021, to week 14, 2022**

Of the 68 catchment areas for which a change from the previous week could be calculated, the viral load remained stable (within +/- 10%) in 21 of them, while 1 experienced decreases of 10% or more, and 46 saw increases of at least 10%. Of these, 42 had an increase from 10 to 50%, and 4 had an increase of more than 50%. Figure 3a below shows the locations of each catchment area and these relative changes in viral load from the previous week, while Figure 3b displays the absolute viral load for each catchment areas in week 14, 2022. Figure 4 displays the SARS-CoV-2 viral loads (gc/day) by wastewater catchment area each week since the start of the NWSP in week 19, 2021.



Note: Viral load values based on GAM-smoothed estimates. See Techincal notes.

Figure 3a. **Approximate location of wastewater catchment areas and percent change in SARS-CoV-2 viral loads between weeks 13 and 14, 2022, National Wastewater Surveillance Programme**



Note: Viral load values based on GAM-smoothed estimates. See Techincal notes.

Figure 3b. **Approximate location of wastewater catchment areas and SARS-CoV-2 viral loads (gc/day) in wastewater and percentage change compared to previous week, National Wastewater Surveillance Programme, week 14, 2022.**

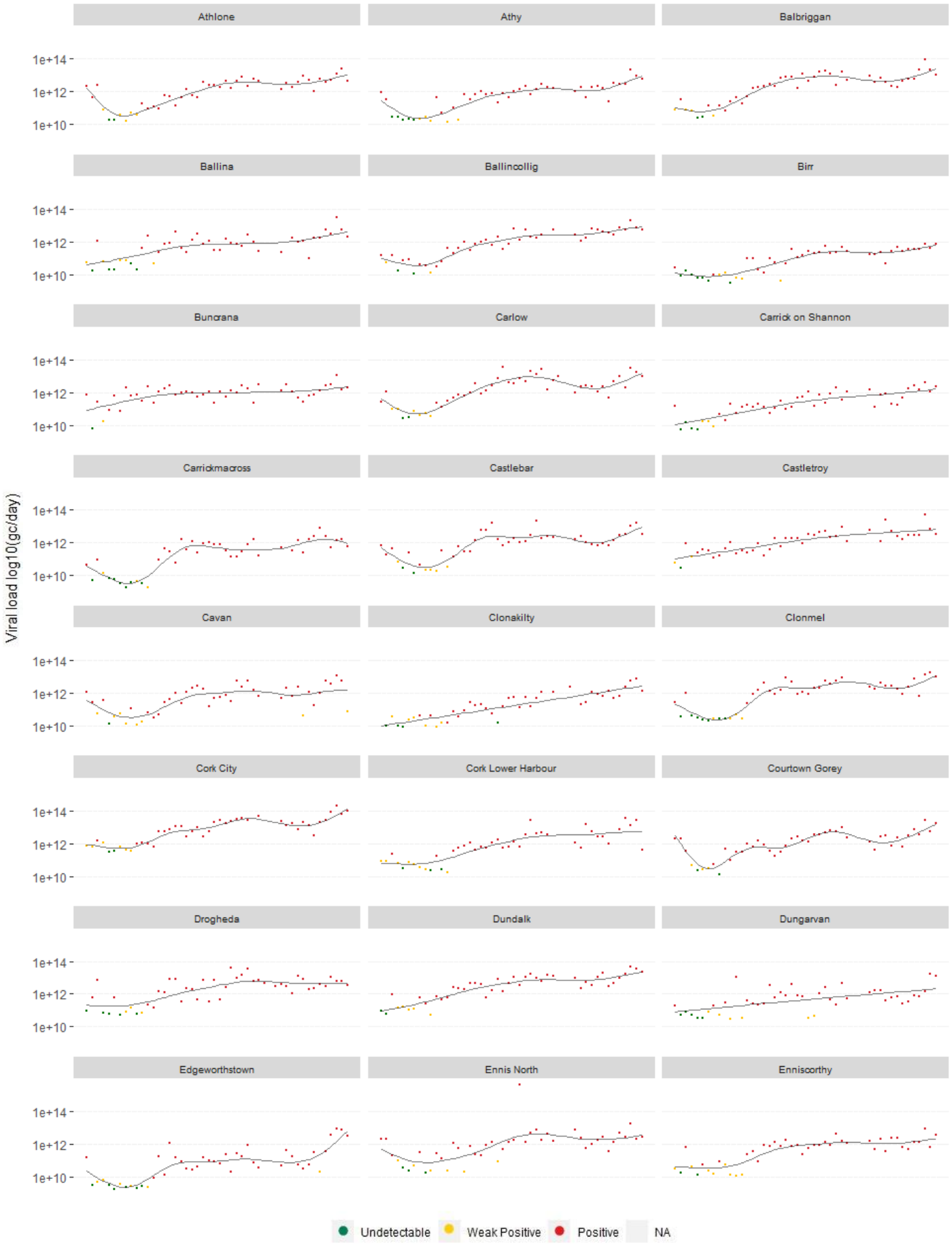


Figure 4a. **Weekly SARS-CoV-2 viral load (gc/day) in wastewater, and GAM smoothed trend, by wastewater catchment area, National Wastewater Surveillance Programme, week 19, 2021 to week 14, 2022**

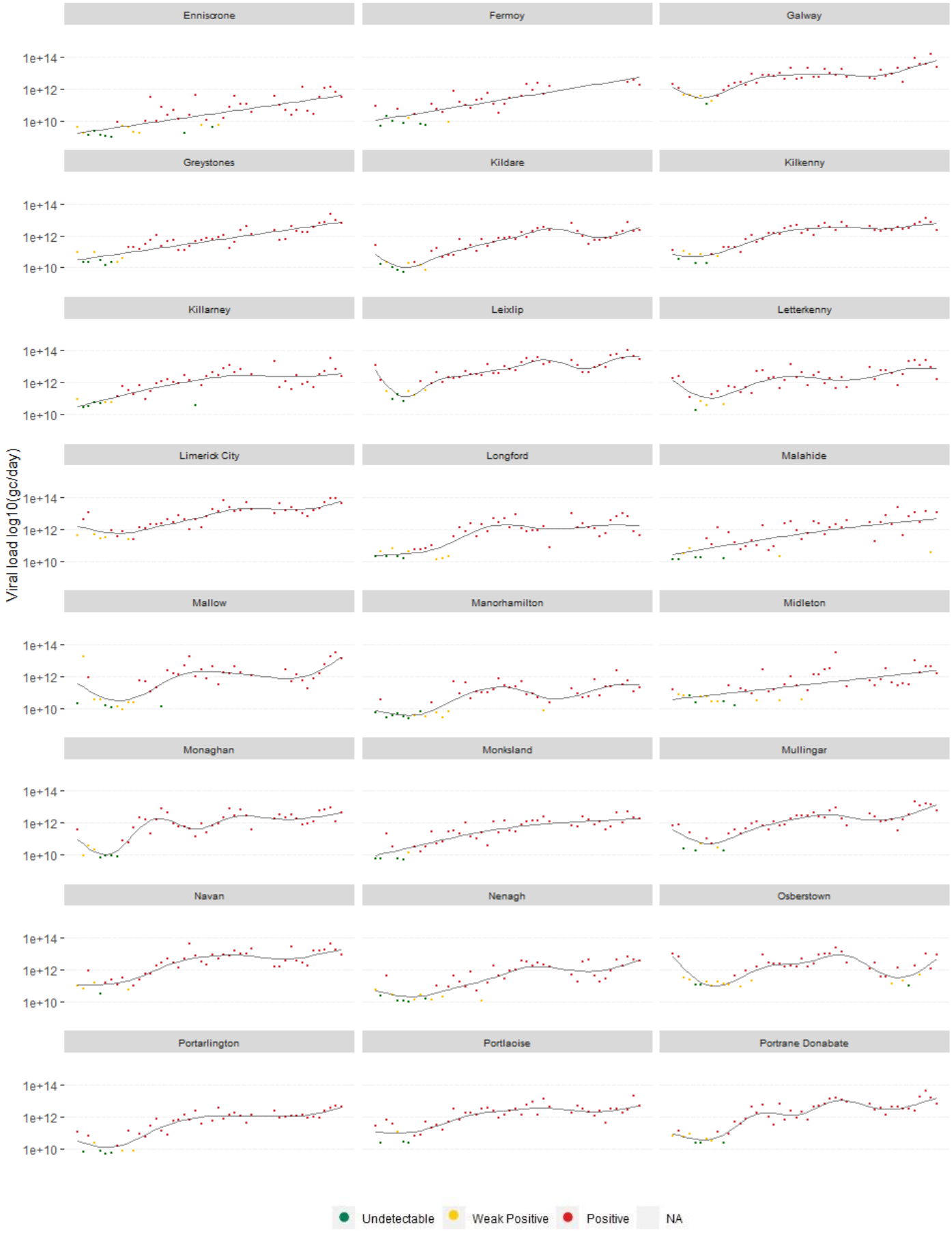


Figure 4b. **Weekly SARS-CoV-2 viral load (gc/day) in wastewater, and GAM smoothed trend, by wastewater catchment area, National Wastewater Surveillance Programme, week 19, 2021 to week 14, 2022**

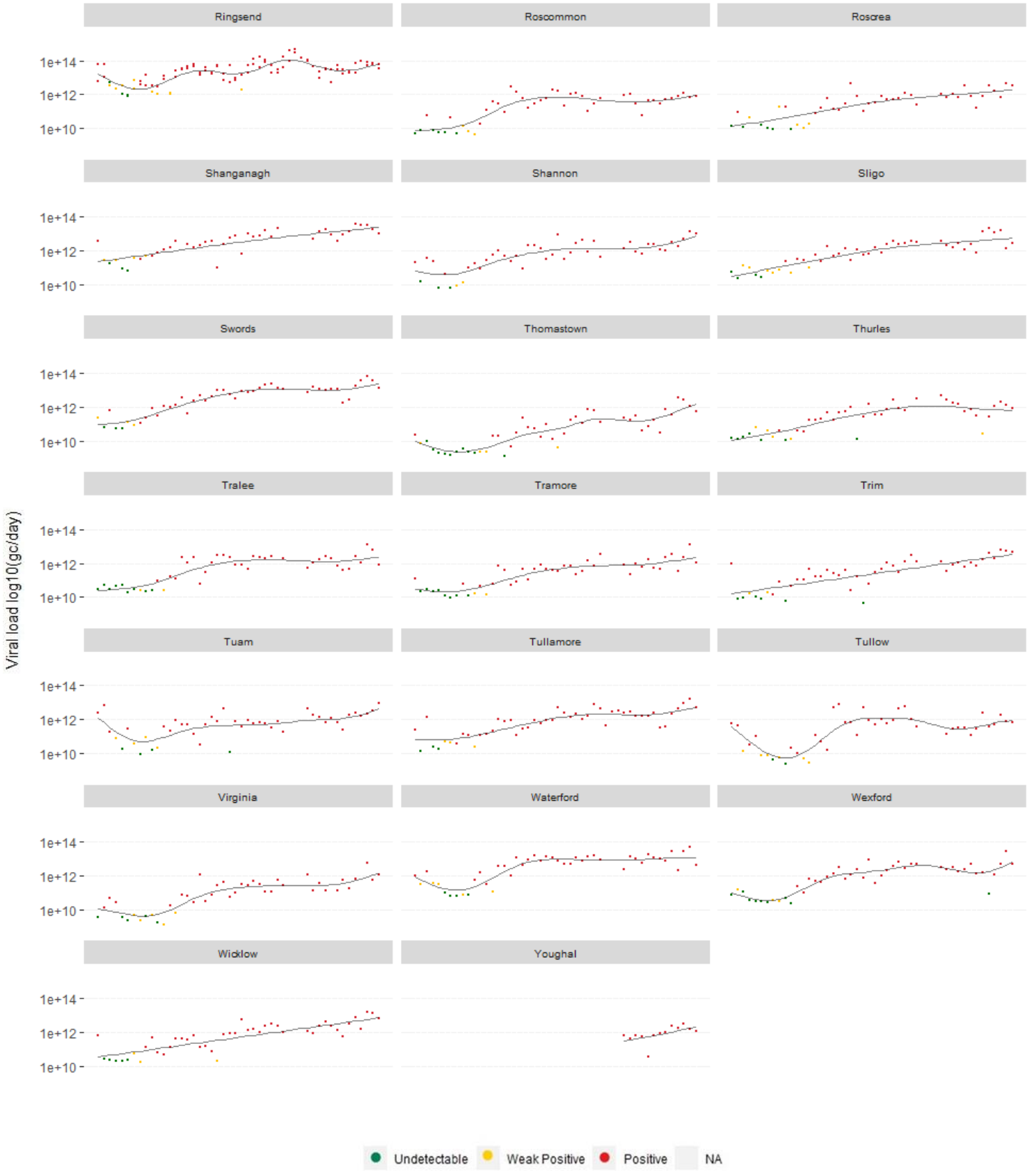


Figure 4c. **Weekly SARS-CoV-2 viral load (gc/day) in wastewater, and GAM smoothed trend, by wastewater catchment area, National Wastewater Surveillance Programme, week 19, 2021 to week 14, 2022**

Additional results

As shown in Figures 5, population-normalised viral loads were still high in week 14, 2022, relative to previous weeks.

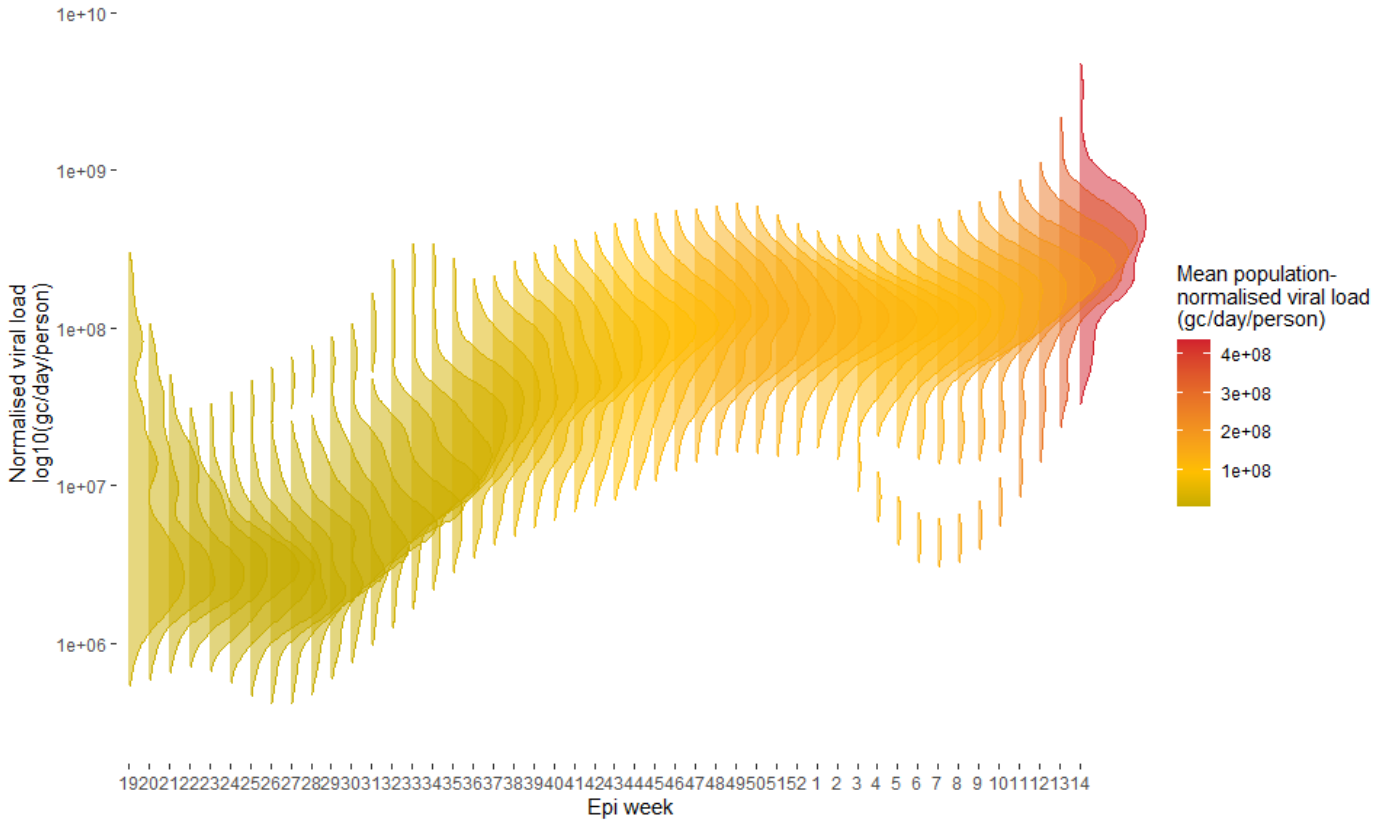


Figure 5. **Weekly distribution of population-normalised SARS-CoV-2 viral load (gc/day/person), National Wastewater Surveillance Programme, week 19, 2021 to week 14, 2022**

Figure 6 below is a phase plot that traces each catchment area forward in time in terms of the population-normalised viral load each week and the percent change from the previous week. This allows us to more easily identify catchment areas where the recent change in viral load has been noteworthy, and compare that to the history of such changes over the duration of the programme.

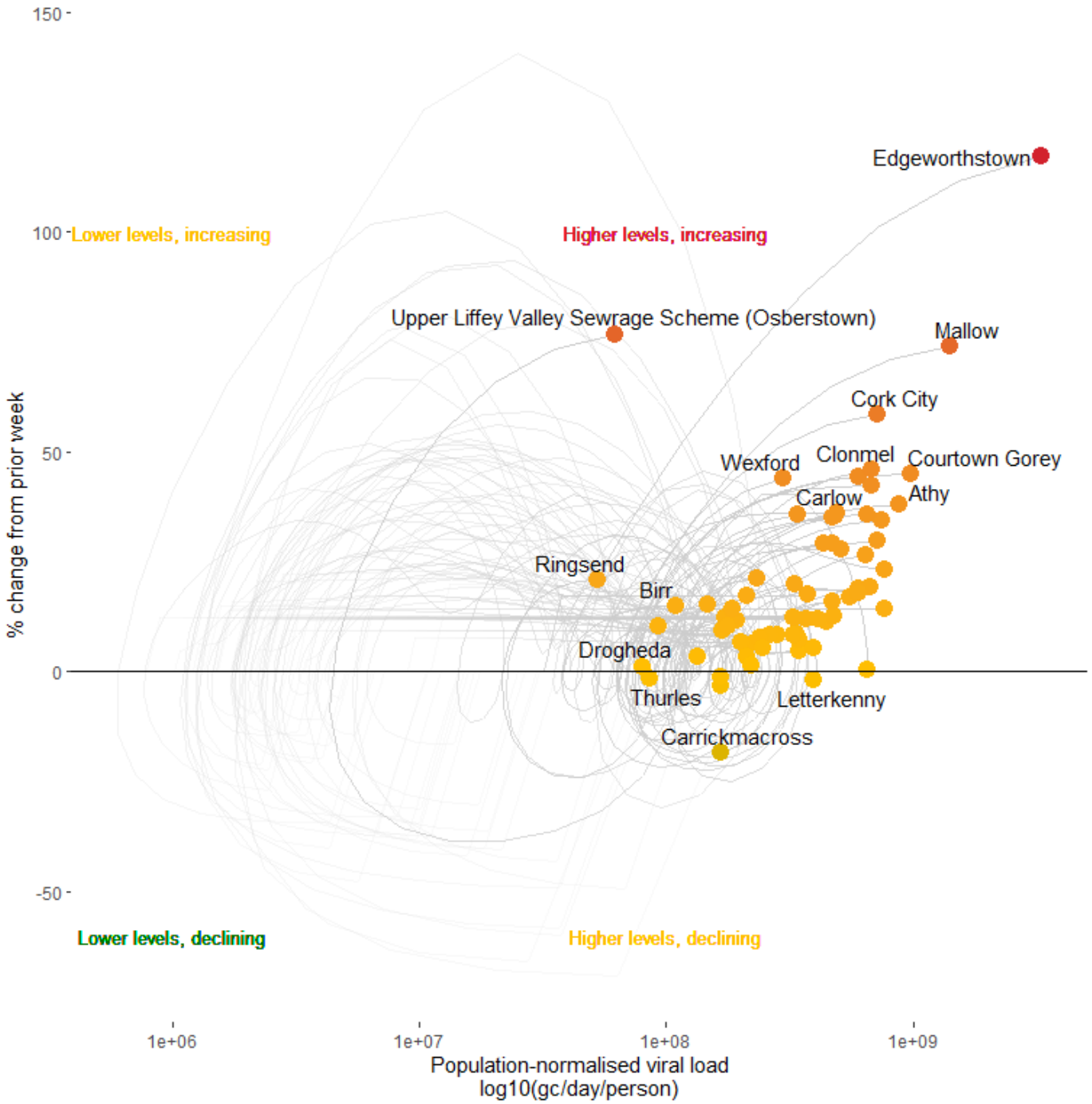


Figure 6. **SARS-CoV-2 viral load phase plot by wastewater catchment area, National Wastewater Surveillance Programme, week 19, 2021 to week 14, 2022**

Acknowledgements

Sincere thanks are extended to all those who are participating in the collection and processing of Report prepared by COVID-19 Epidemiology Team, HPSC samples, processing data and reporting of data used in this report. This includes the staff at participating wastewater treatment plants, Irish Water, laboratory staff (UCD and NVRL), HSE COVID-19 Contact Management Programme (CMP), Health Intelligence Unit (HIU), surveillance scientists, microbiologists and administrative staff.

Glossary

Below detection limit (BDL): The limit of detection is the lowest concentration of viral material that can be detected in a wastewater sample. If the concentration of viral material in a sample is below the limit of detection, it does not mean that there is no virus present. Viral material may be present, but it cannot be detected by the test due to its very low concentration.

Below Quantifiable Limits (BQL): The limit of quantification is the lowest concentration of viral genetic material that can be reliably quantified. A result which is BQL means that viral RNA was detected but the concentration cannot be accurately determined.

Composite Samples: Wastewater sample consists of numerous individual discrete samples taken at regular intervals over a period of 24 hours.

Grab sample: A wastewater sample collected at a particular time and place can represent only the composition of the source at that time and place.

Flow rate: The total volume arising from the wastewater catchment area in the 24hours the sample is taken (m3 per day) as measured at the inlet of the wastewater treatment plant.

Technical notes

Wastewater sample collection: Staff of the participating wastewater treatment plants collect 24-hour composite samples on specified days. In some instances, incomplete composites, or grab samples, are used instead.

Laboratory analysis of wastewater samples: Carried out by UCD. Following arrival of the wastewater samples in the laboratory, the virus is concentrated and the genetic material is extracted. The genetic material (RNA) is quantified using reverse transcriptase quantitative PCR which is used to determine the concentration of the virus in wastewater. The amount of viral genetic material per day entering a wastewater treatment plant can be calculated based on the concentration of the virus and the flow rate.

Selection of wastewater catchment areas for inclusion in the NWSP: Catchment areas were selected to provide the greatest coverage of the population and to represent catchment areas in all counties. Two catchment areas from each county have been included in the NWSP. In addition, we included all wastewater catchment areas greater than 10,000 population equivalent (PE) in size. The 68 wastewater catchment areas included in the NWSP cover 80% of the population connected to public wastewater treatment plants, and are shown in Figure 1.

Smoothing: Smoothed trends were fit to observed data with generalised additive models using restricted maximum likelihood estimates of smoothing parameters with interpolation for weeks with missing sample data. The resulting trend lines should only be viewed as one reasonable, visual summary of the observed data.

Population data: Population normalised results use 2020 estimates of the residential population of the wastewater catchment area provided by Irish Water.

Dates of epidemiological weeks are available here.

Data uses

Since the onset of the Covid-19 pandemic, analysis of wastewater for the presence of SARS-CoV-2 has been taking place in many European countries and elsewhere as recommended by the European Union. The NWSP will work with Departments of Public Health and other stakeholders on how the data can best support the public health response to SARS-CoV-2/COVID-19 in Ireland. At the current stage of the pandemic, circulation is widespread with high incidence rates across Ireland. The NWSP will likely be of greatest value when the circulation of SARS-CoV-2 and testing rates are lower, when a detection of SARS-CoV-2 in wastewater may be the first indication of circulation in a catchment area.

The NWSP will also be of value in monitoring for the presence of new variants of SARS-CoV-2 as they emerge.

Data limitations and uncertainties

In general, higher levels of SARS-CoV-2 in wastewater suggests more people with SARS-CoV-2 infection in the wastewater catchment area. However, people shed different amounts of virus during the period that they are infected which declines are as they are clearing the virus. For this and other reasons it is therefore difficult to reliably estimate the number of people with SARS-CoV-2 infection in the catchment area based on analysis of SARS-CoV-2 RNA in wastewater.

Aside from the number of people with SARS-CoV-2 infection, and the amount of virus they shed, there are other factors which influence the amount of SARS-CoV-2 detected in wastewater. For example, wastewater treatment plants also take in surface waters from rainfall, which alters the flow rate of influent entering the treatment plant. The concentration of SARS-CoV-2 is therefore adjusted to take the daily flow rate of the plant into account. When a flow rate is not available for the day the composite sample was taken, the average annual flow rate is used instead. Composite samples are the preferred sample type as the reflect wastewater passing through the sampling point for a 24-hour period. However, composite samples are not always possible. The NWSP will continue to monitor its methodology as part of its quality improvement process.

NWSP data should be reviewed in conjunction with data from other case-based surveillance systems.

Further information

A technical report by the Joint Research Centre (JRC) and the Directorate-General for Environment (DG-ENV) of the European Commission on wastewater surveillance for SARS-CoV-2 is available here.

Links to dashboards of other SARS-CoV-2 wastewater surveillance programmes are available here.

Appendices

Supplemental Table 1. National Wastewater Surveillance Programme sampling results by wastewater catchment area, week 14, 2022

County	Wastewater catchment area	Sample type	Sample date	Result category
Carlow	Carlow	24 hour composite	05/04/2022	Positive
	Tullow	Unknown	05/04/2022	Positive
Cavan	Cavan	24 hour composite	04/04/2022	Weak Positive
	Virginia	24 hour composite	04/04/2022	Positive
Clare	Ennis North	24 hour composite	03/04/2022	Positive
	Shannon	24 hour composite	03/04/2022	Positive
Cork	Ballincollig	24 hour composite	04/04/2022	Positive
	Clonakilty	24 hour composite	04/04/2022	Positive
	Cork City	24 hour composite	04/04/2022	Positive
	Cork Lower Harbour	Incomplete composite	04/04/2022	Positive
	Fermoy	Unknown	04/04/2022	Positive
	Mallow	24 hour composite	04/04/2022	Positive
	Midleton	Grab	05/04/2022	Positive
	Youghal	24 hour composite	03/04/2022	Positive
Donegal	Buncrana	24 hour composite	05/04/2022	Positive
	Letterkenny	24 hour composite	05/04/2022	Positive
Dublin	Balbriggan	24 hour composite	04/04/2022	Positive
	Malahide	Grab	05/04/2022	Positive
	Portrane Donabate	24 hour composite	04/04/2022	Positive
	Ringsend 1	24 hour composite	03/04/2022	Positive
	Ringsend 2	24 hour composite	06/04/2022	Positive
	Shanganagh	Unknown	05/04/2022	Positive
	Swords	24 hour composite	04/04/2022	Positive
Galway	Galway	Unknown	03/04/2022	Positive
	Tuam	24 hour composite	03/04/2022	Positive
Kerry	Killarney	24 hour composite	04/04/2022	Positive
	Tralee	24 hour composite	04/04/2022	Positive
Kildare	Athy	24 hour composite	05/04/2022	Positive
	Kildare	24 hour composite	05/04/2022	Positive
	Lower Liffey Valley Regional Sewerage Scheme (Leixlip)	24 hour composite	05/04/2022	Positive
	Upper Liffey Valley Sewerage Scheme (Osberstown)	24 hour composite	05/04/2022	Positive
Kilkenny	Kilkenny	24 hour composite	03/04/2022	Positive
	Thomastown	24 hour composite	03/04/2022	Positive
Laois	Portarlington	24 hour composite	03/04/2022	Positive
	Portlaoise	24 hour composite	03/04/2022	Positive

County	Wastewater catchment area	Sample type	Sample date	Result category
Leitrim	Carrick on Shannon	24 hour composite	05/04/2022	Positive
	Manorhamilton	24 hour composite	05/04/2022	Positive
Limerick	Castletroy	24 hour composite	04/04/2022	Positive
	Limerick City	24 hour composite	04/04/2022	Positive
Longford	Edgeworthstown	24 hour composite	05/04/2022	Positive
	Longford	24 hour composite	05/04/2022	Positive
Louth	Drogheda	24 hour composite	04/04/2022	Positive
	Dundalk	24 hour composite	04/04/2022	Positive
Mayo	Ballina	24 hour composite	04/04/2022	Positive
	Castlebar	24 hour composite	03/04/2022	Positive
Meath	Navan	Incomplete composite	04/04/2022	Positive
	Trim	24 hour composite	05/04/2022	Positive
Monaghan	Carrickmacross	24 hour composite	04/04/2022	Positive
	Monaghan	24 hour composite	04/04/2022	Positive
Offaly	Birr	24 hour composite	03/04/2022	Positive
	Tullamore	24 hour composite	03/04/2022	Positive
Roscommon	Monksland	24 hour composite	04/04/2022	Positive
	Roscommon	24 hour composite	04/04/2022	Positive
Sligo	Enniscrone	24 hour composite	03/04/2022	Positive
	Sligo	24 hour composite	05/04/2022	Positive
Tipperary	Clonmel	24 hour composite	04/04/2022	Positive
	Nenagh	Unknown	04/04/2022	Positive
	Roscrea	24 hour composite	04/04/2022	Positive
	Thurles	24 hour composite	04/04/2022	Positive
Waterford	Dungarvan	24 hour composite	03/04/2022	Positive
	Tramore	24 hour composite	03/04/2022	Positive
	Waterford	24 hour composite	03/04/2022	Positive
Westmeath	Athlone	24 hour composite	03/04/2022	Positive
	Mullingar	24 hour composite	05/04/2022	Positive
Wexford	Courtown Gorey	24 hour composite	05/04/2022	Positive
	Enniscorthy	24 hour composite	03/04/2022	Positive
	Wexford	24 hour composite	03/04/2022	Positive
Wicklow	Greystones	24 hour composite	05/04/2022	Positive
	Wicklow	24 hour composite	05/04/2022	Positive