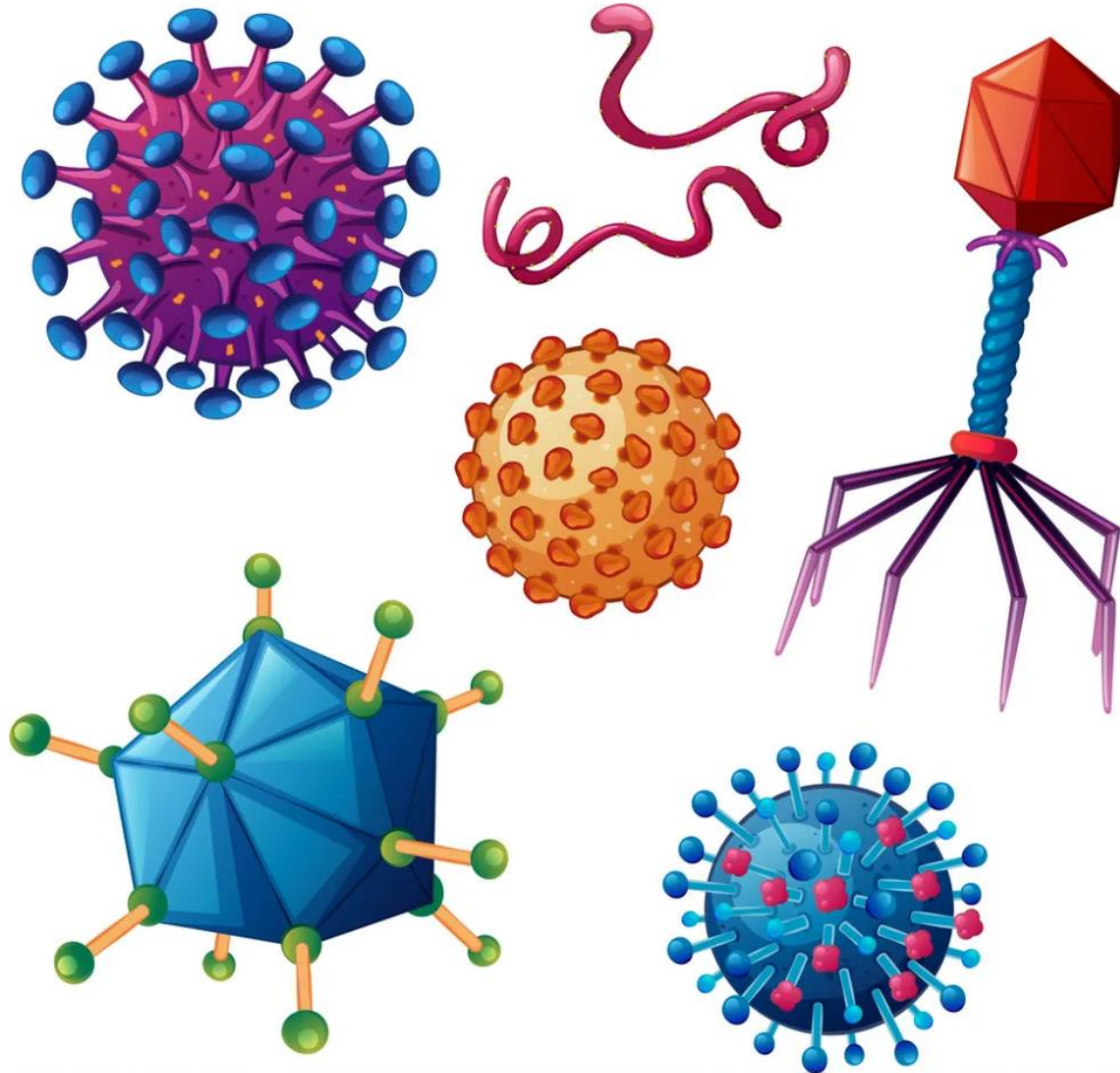


What is the biggest threat to human health?



Use of wastewater surveillance for tracking public health



PRIFYSGOL
BANGOR
UNIVERSITY



Murdoch
UNIVERSITY

Davey Jones

Environment Centre Wales, Bangor University, UK

Food Futures Institute, Murdoch University, Western Australia

Luke Hillary, Kata Farkas, Jamie Thorpe, Marco Distaso, James McDonald, Jessica Kevill,
Rachel Williams, Tony Harrington, Will Gaze, Shelagh Malham,
Andy Weightman, Isabelle Durance & Pete Kille

Wastewater hits the media

.....for all the wrong reasons

NEWS

Home | Coronavirus | Climate | UK | World | Business | Politics | Tech | Science | Health | Family & Education

Science & Environment

Sewage discharged into rivers 400,000 times in 2020

By David Brown
BBC News

31 March | Comments



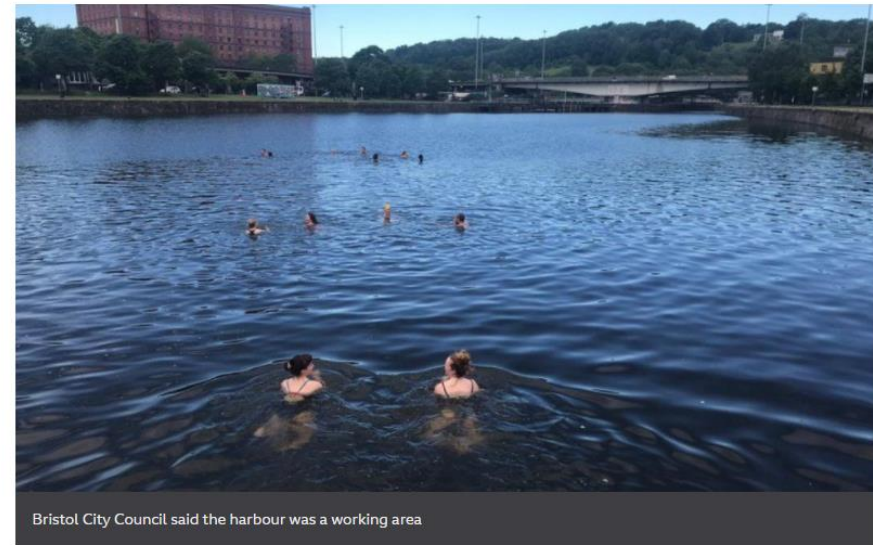
NEWS

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England | Local News | Regions | Bristol

Swimmers protest against Bristol harbour's bathing ban

4 June

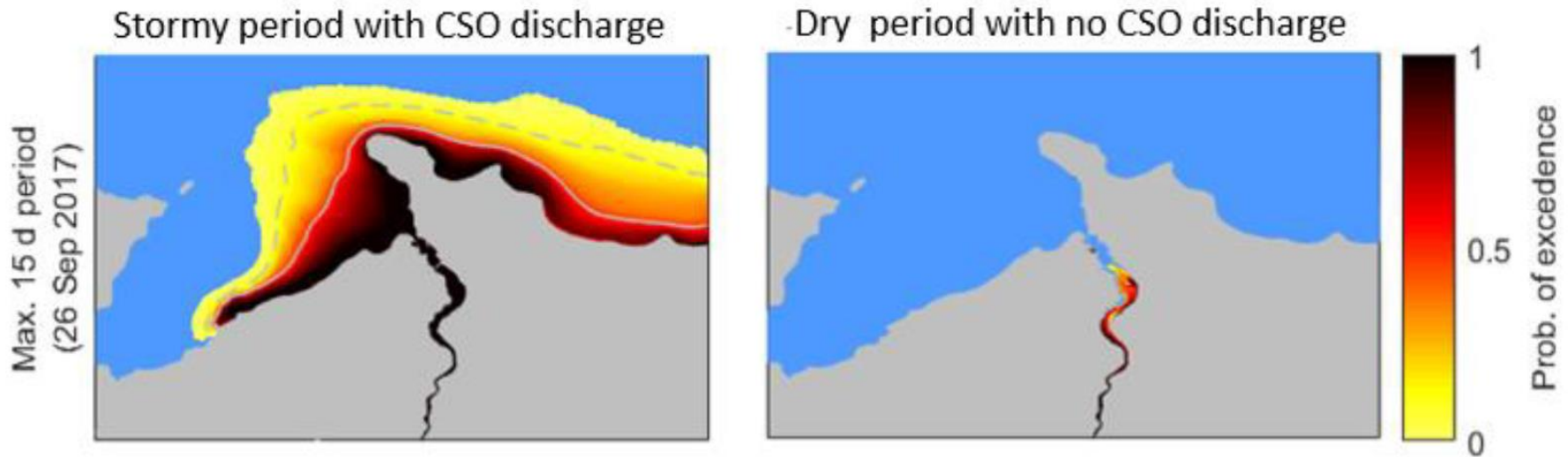


Viraaqua

Tracing the fate and infectivity of human pathogenic viruses through the environment



We now know that wastewater discharges are a major problem



Tell people when it safe to use beaches, rivers, harvest shellfish etc



Winter vomiting bug alert over UK oysters as three-quarters are found to contain the norovirus

- Bug causes symptoms such as vomiting and diarrhoea
- Cooking kills virus but oysters are eaten raw

By **DAILY MAIL REPORTER**
UPDATED: 13:55, 29 November 2011



More than three-quarters of British-grown oysters contain norovirus, known as the 'winter vomiting bug', experts have warned.

A study conducted on behalf of the Food Standards Agency found that 76 per cent of oysters tested from UK oyster growing beds had traces of the infectious bug.

Low levels of the virus, which causes symptoms such as vomiting and diarrhoea, were found in 52 per cent of the positive samples, according to the data.



sky ne
Home UK

180 hit as mussels cause outbreak of norovirus in hospital

A visitor bringing shellfish into a hospital in Northumberland has resulted in 180 people contracting the winter vomiting bug.



The outbreak has been traced back to mussels brought for an inpatient

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Canada BC

Norovirus outbreak from B.C. oysters makes dozens sick

Vancouver oyster bar owner expects his business to take a hit, as health officials issue warning

By Rafferty Baker, CBC News Posted: Jan 13, 2017 9:40 AM PT | Last Updated: Jan 13, 2017 2:20 PM PT

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The San Diego Union-Tribune

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Friday:

San Diego waterways are not being tested for hepatitis amid health crisis

By **James DeHaven** - Contact Reporter

OCTOBER 13, 2017, 5:00 PM

None is monitoring San Diego's surface water for hepatitis A, even amid a deadly, human waste-fueled outbreak of the disease that can spread through area waterways.

That's according to a letter from federal officials to U.S. Rep. Scott Peters, who last month asked the U.S. Environmental Protection Agency to take "the immediate steps necessary" to address potential waterborne transmission of the viral liver infection that has killed 18 people and sickened nearly 500 others since November.

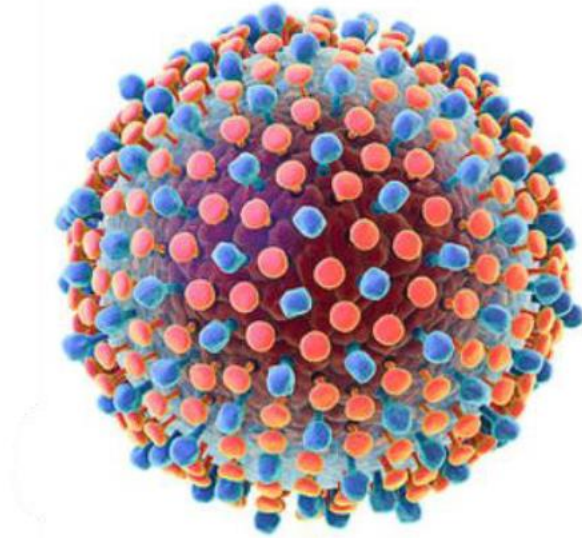
The infection is spread when someone ingests even a tiny particle of feces, raising the possibility that it could spread from homeless encampments along city waterways toward the bays and inlets.

Top Stories

Porr Dan Don

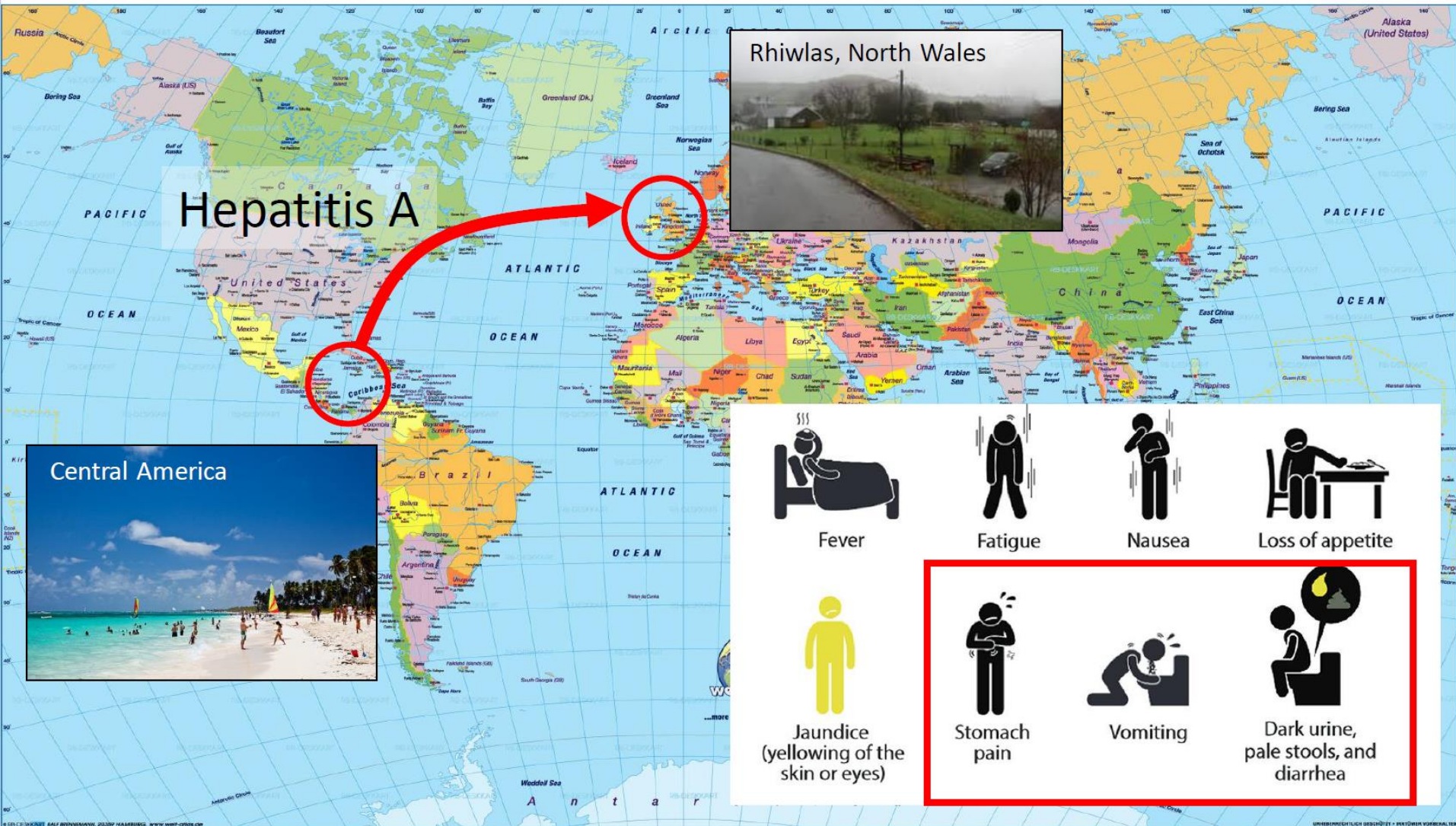
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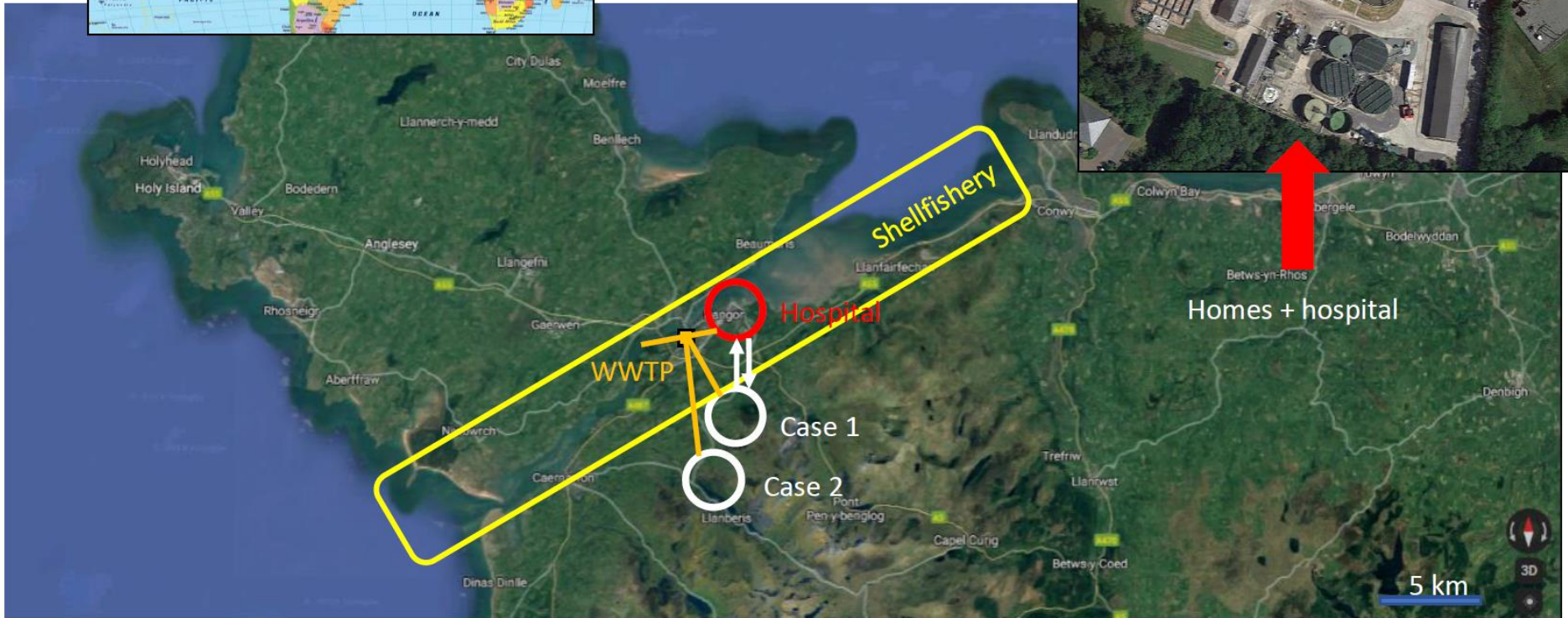
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.....a cautionary tale
of the power of viruses.....

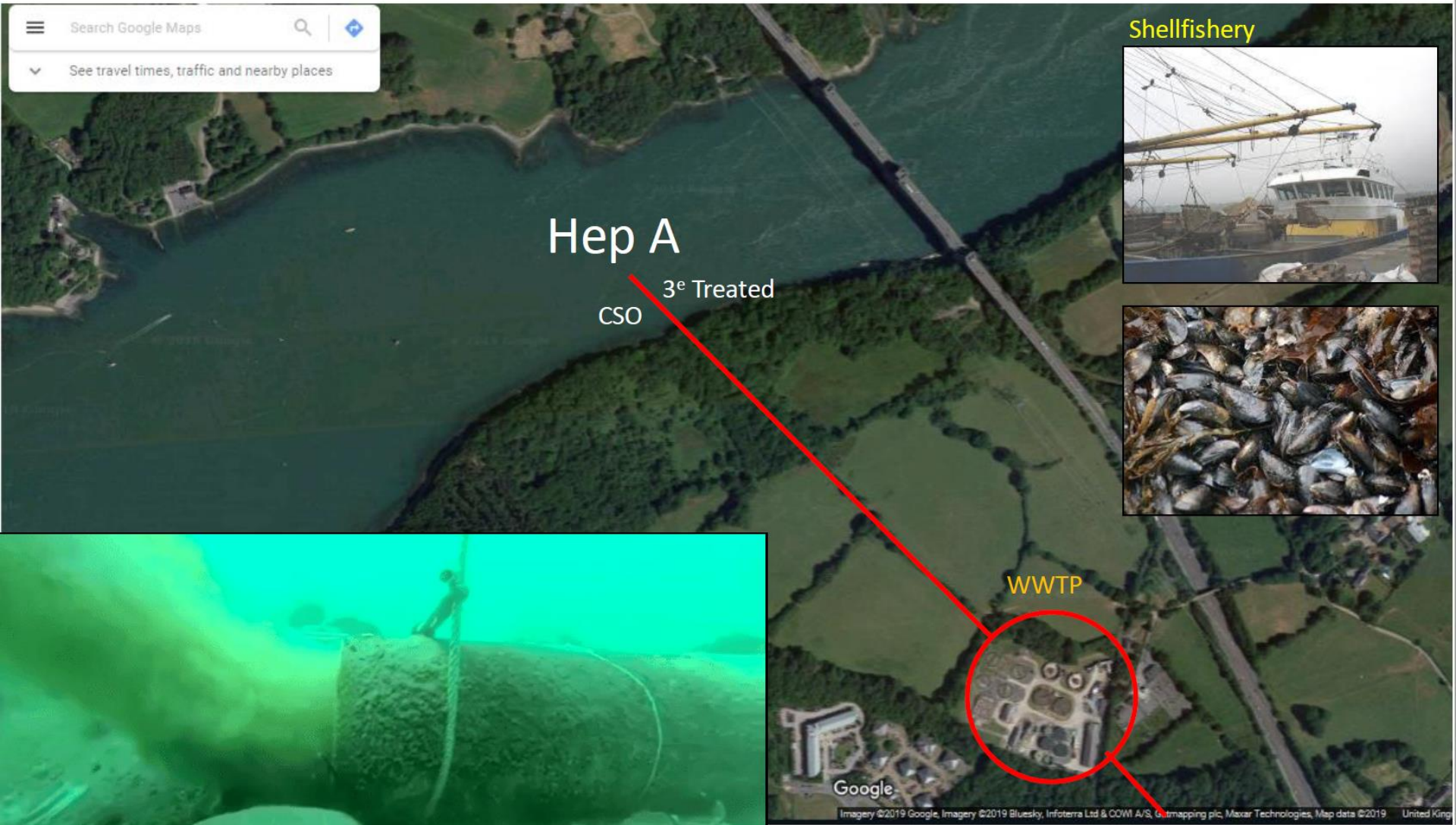
The start of the viral journey





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Hep A

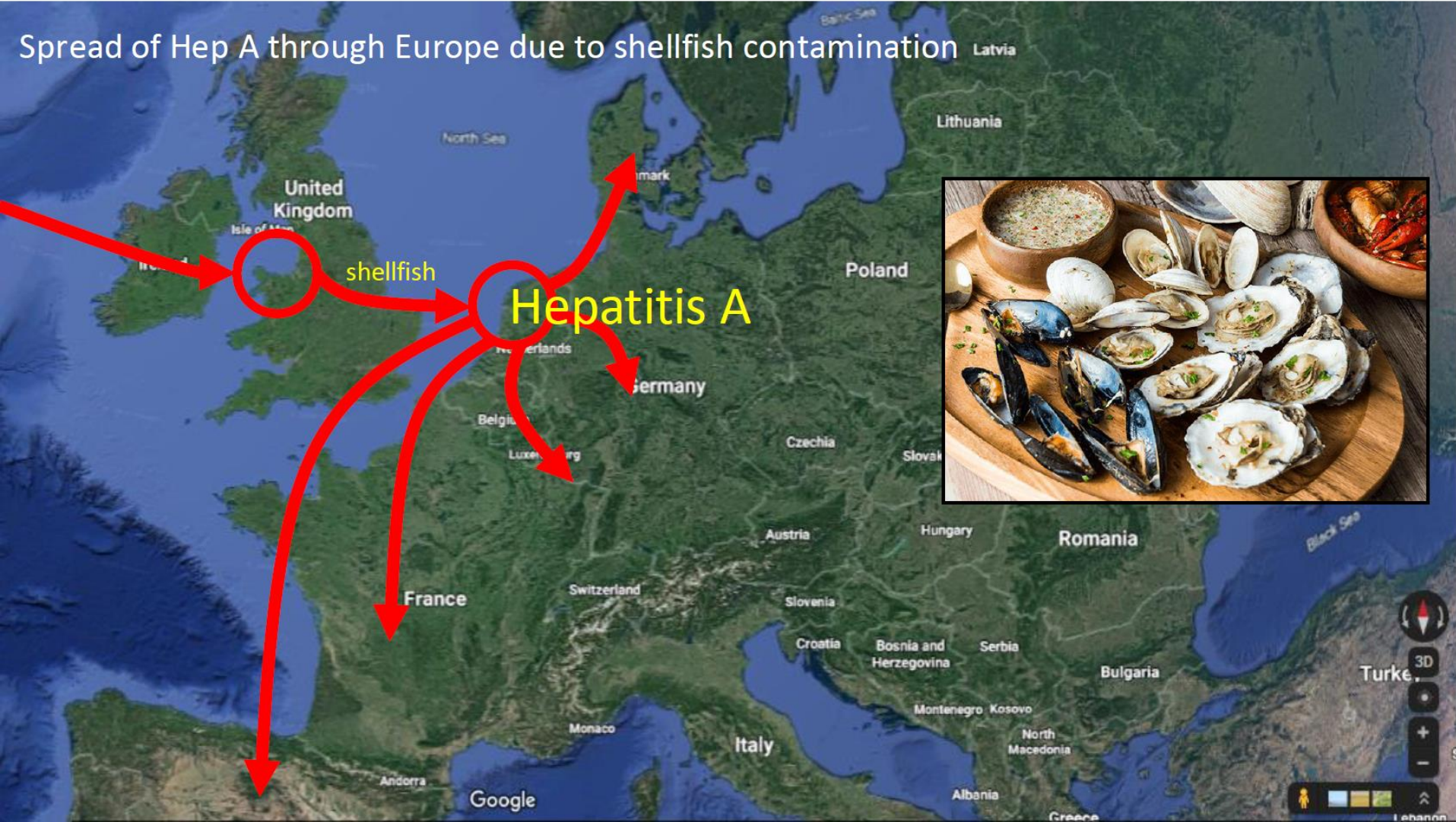
3^e Treated
CSO

WWTP

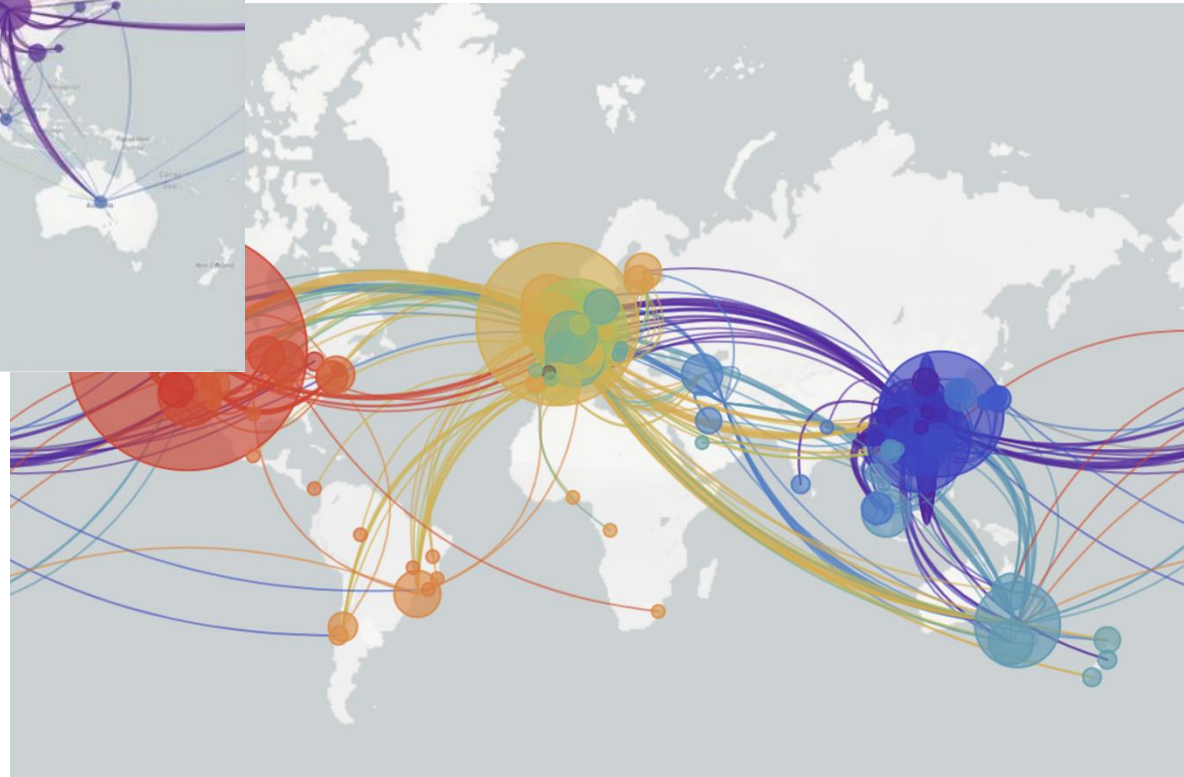
Shellfishery



The end of the viral journey



Global spread of SARS-CoV-2



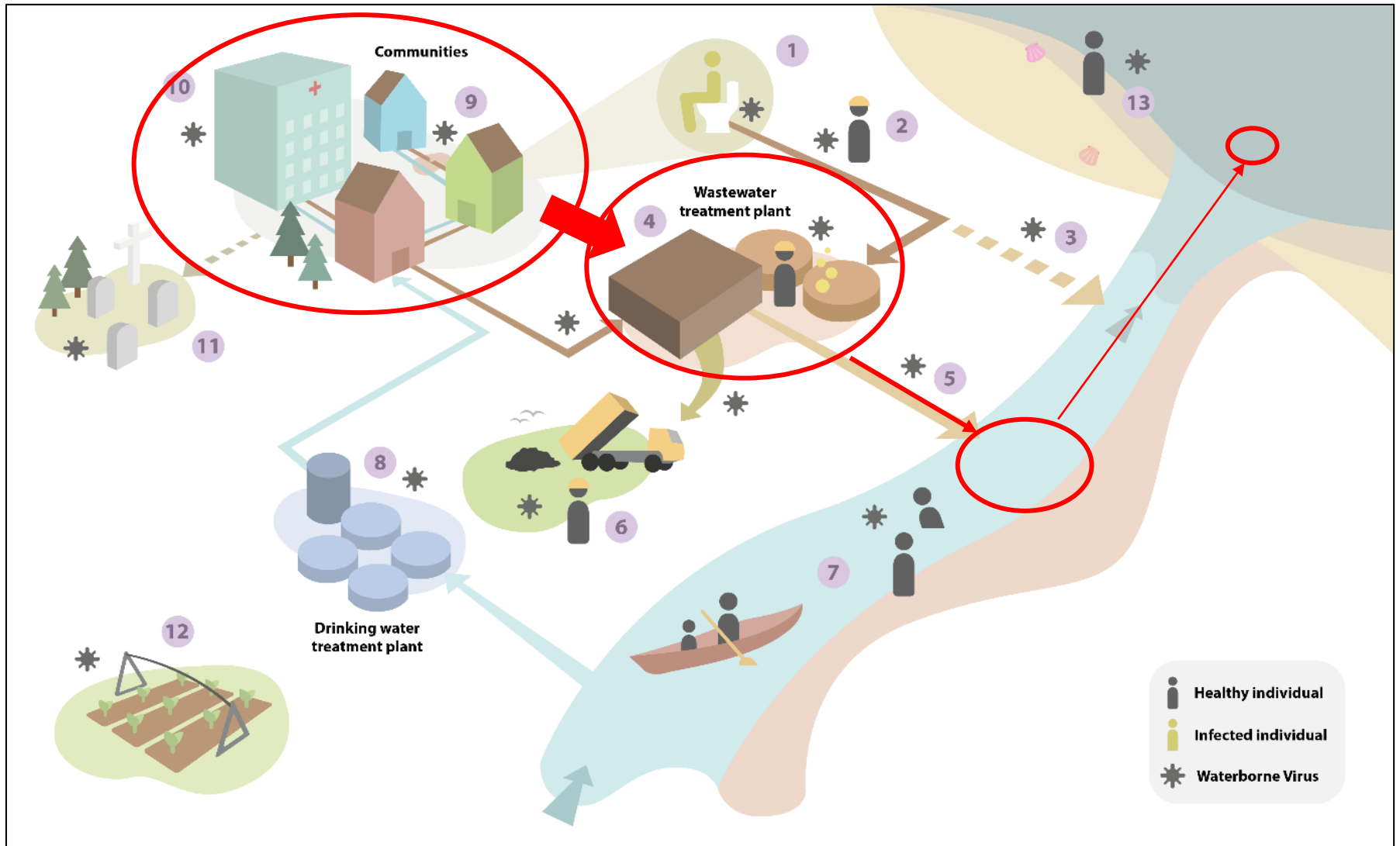
Tracking SARS-CoV-2 in the community using wastewater



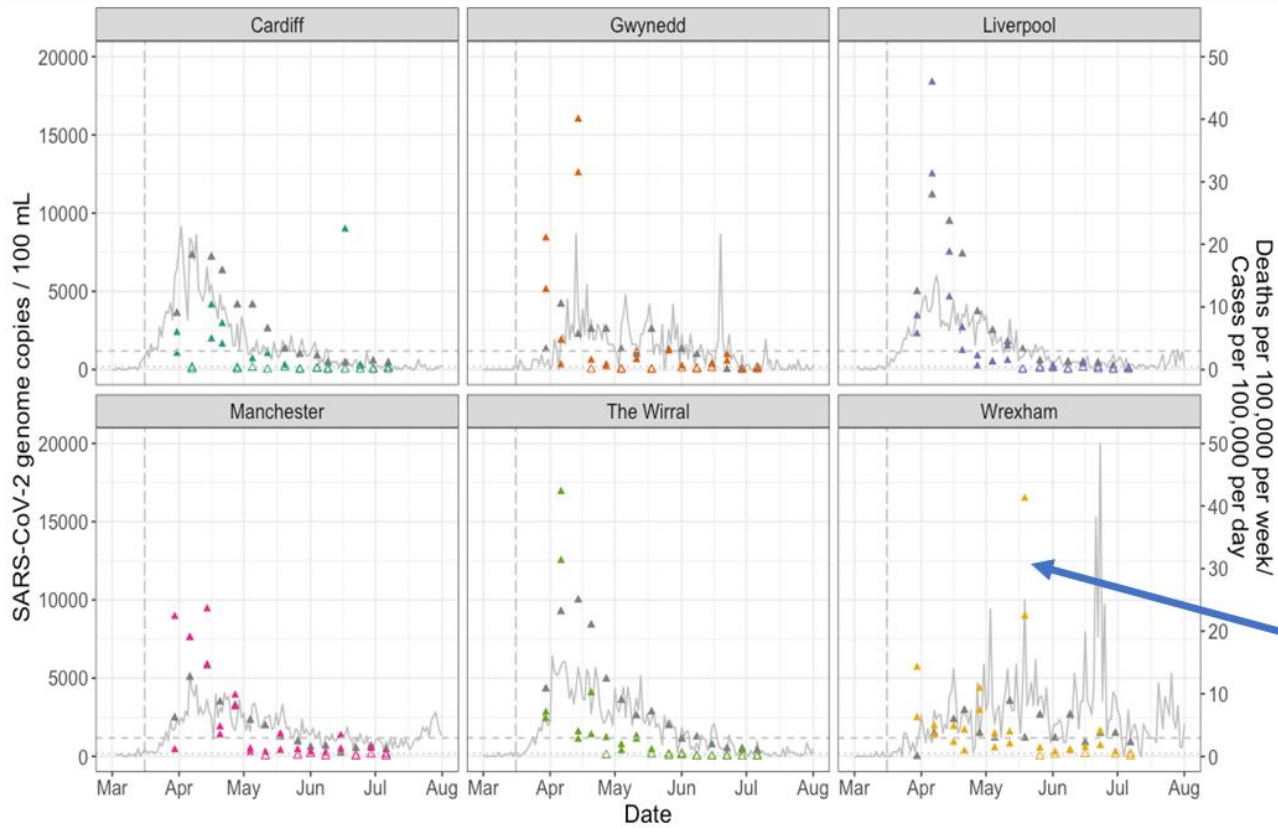
Wastewater-based epidemiology

- Measuring the waste products of society
- Prediction and status of ongoing outbreaks at a community level
- Snapshot of public health
- Inclusion of asymptomatic/presymptomatic cases
- Has been used for poliovirus epidemiology
- Data exists for enteric viruses (norovirus, enteroviruses, hepatitis A/E viruses)
- Does it work for the respiratory virus SARS-CoV-2?

The basic principle of WBE







N1 gene target

PRRS (process control)

CrAssphage
(human marker)

Localised outbreak

Amplification \triangle FALSE \blacktriangle TRUE

WWTP ● Cardiff ● Liverpool ● The Wirral
● Gwynedd ● Manchester ● Wrexham

Using wastewater testing to support surge testing (in-network surveillance)

Liverpool



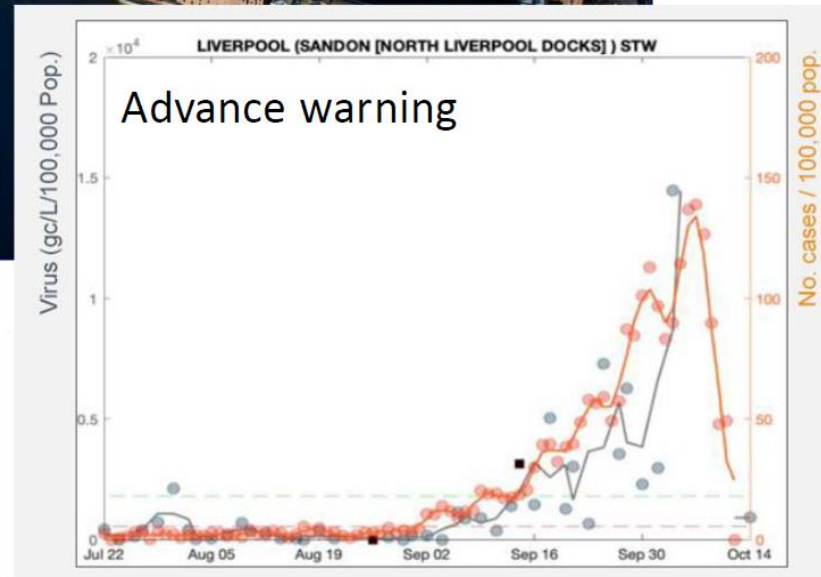
Draft document for discussion purposes
only – not government policy

NHS
Test and Trace

COVID-19 WASTEWATER
PROGRAMME

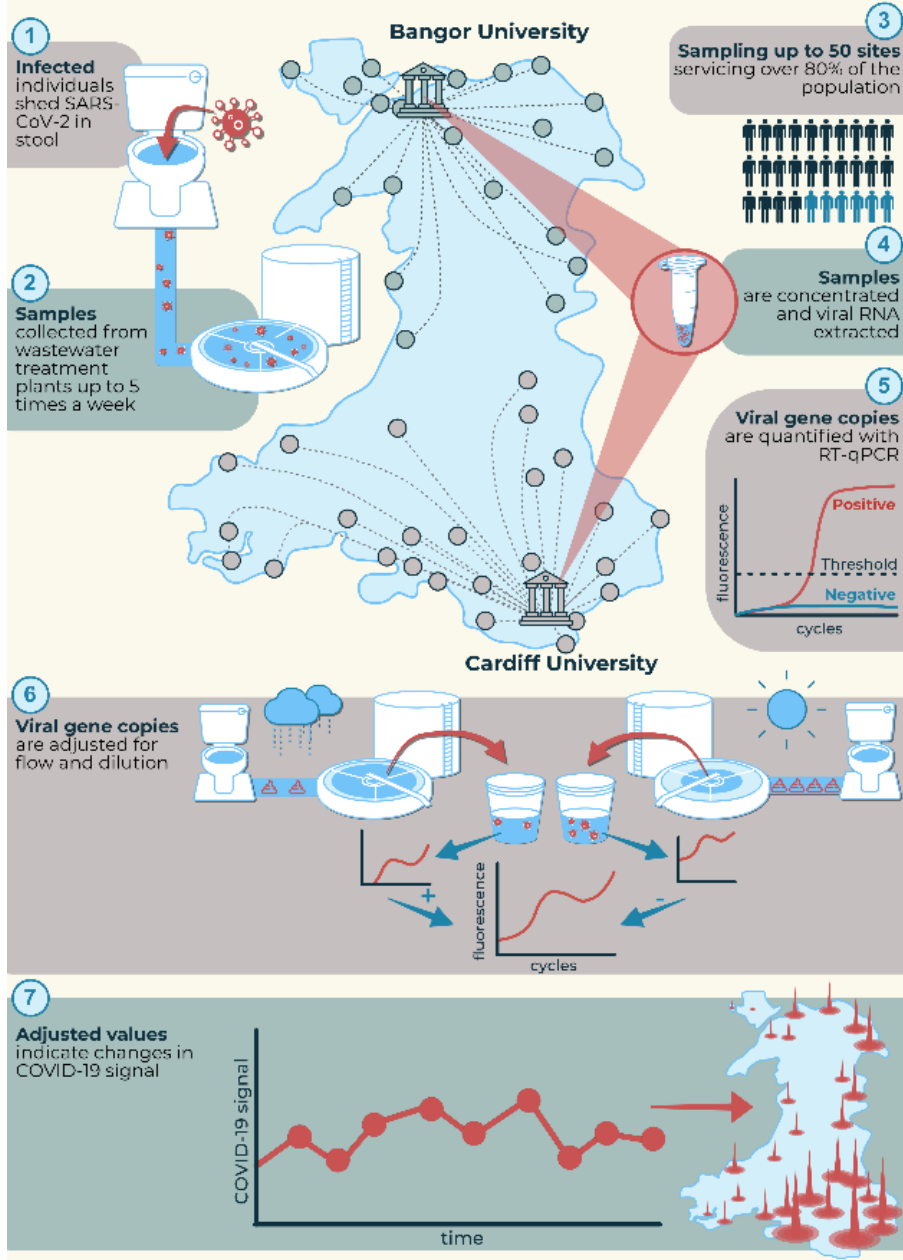
LIVERPOOL UPDATE #17

For the week commencing 11th January



National Surveillance Programme

- 50 urban sites in Wales (80% of the population)
- Several hospitals
- Monitored 5 times a week
- SARS-CoV-2 plus other public health indicators
- Flow data
- Wastewater chemistry
- Prevalence of COVID in the population
- Published weekly by Welsh Government
- Cost to date: £10 million





Llywodraeth Cymru
Welsh Government

Wastewater Monitoring in Wales

Report Date: 20 October 2022

Using samples collected up to (unless indicated otherwise): 17 October 2022



GIG
CYMRU
NHS
WALES

Iechyd Cyhoeddus
Cymru
Public Health
Wales



Dŵr Cymru
Welsh Water



Wales Situation Report

Since the last report, SARS-CoV-2 viral load has decreased across the country. The signal decreased in 8 regions, remained level in 5 regions and increased in 1 region.

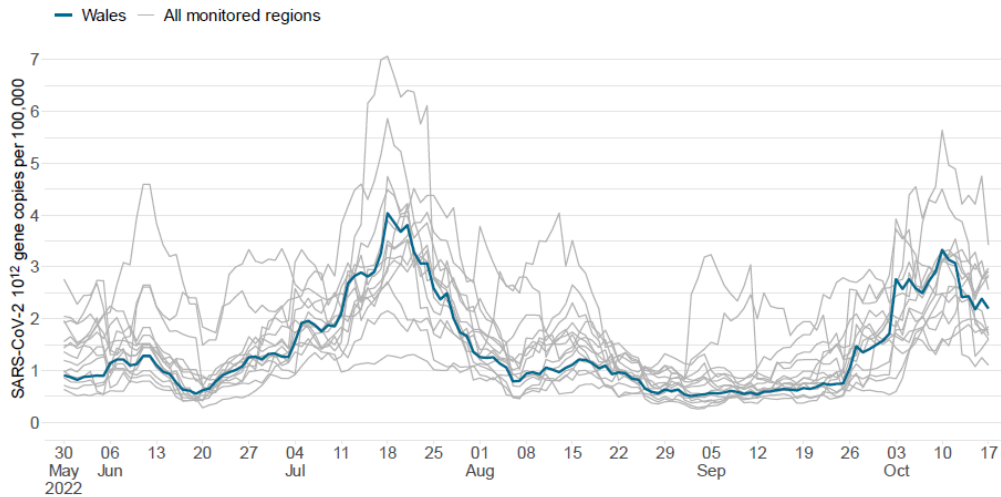


Figure 2 - National (blue lines) and Regions (grey lines) Rolling Mean SARS-CoV-2 gc/day per 100k

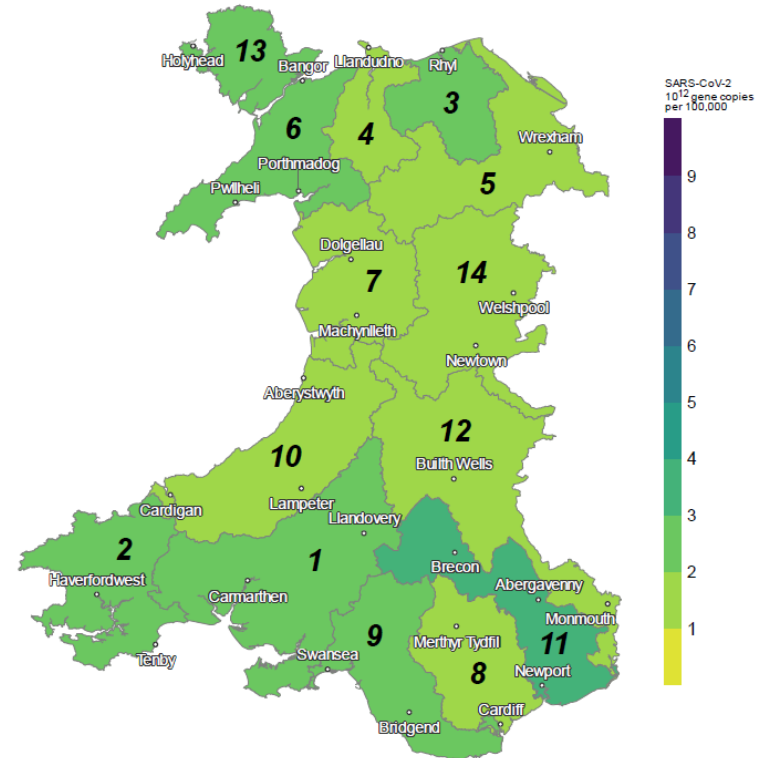


Figure 3 - National Heat Map showing Regional Mean SARS-CoV-2 gc/day per 100k

Appendix B – ONS COVID-19 Infection Survey

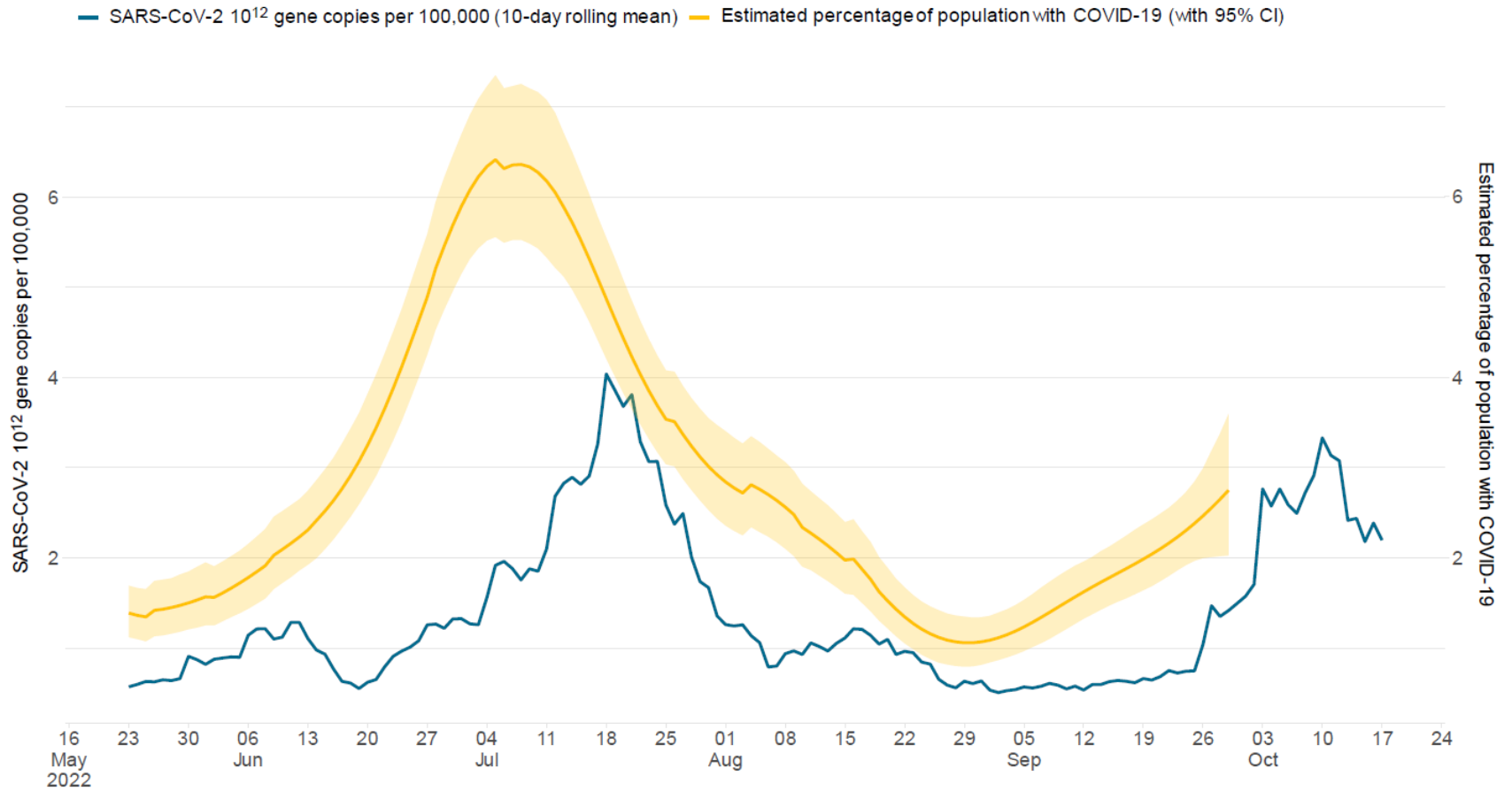


Figure 47 – ONS CIS vs Wastewater National Mean (SARS-CoV-2 gc/day per 100k)

Detection of SARS-CoV-2 Variants of Concern (VoC) via Wastewater Sequencing: 17 October 2022

Samples taken up to: 5 October 2022

Detection summary of SARS-CoV-2 Variants of Concern (VoC), including Omicron sub-lineages in Wales, via wastewater sequencing. Figures and tables summarise the occurrence of SARS-CoV-2 VOCs detected in samples from the Wales Wastewater Monitoring Programme's 47 WwTWs. All samples are sequenced together in the Bangor laboratory on a Nextseq 1000.

National Summary

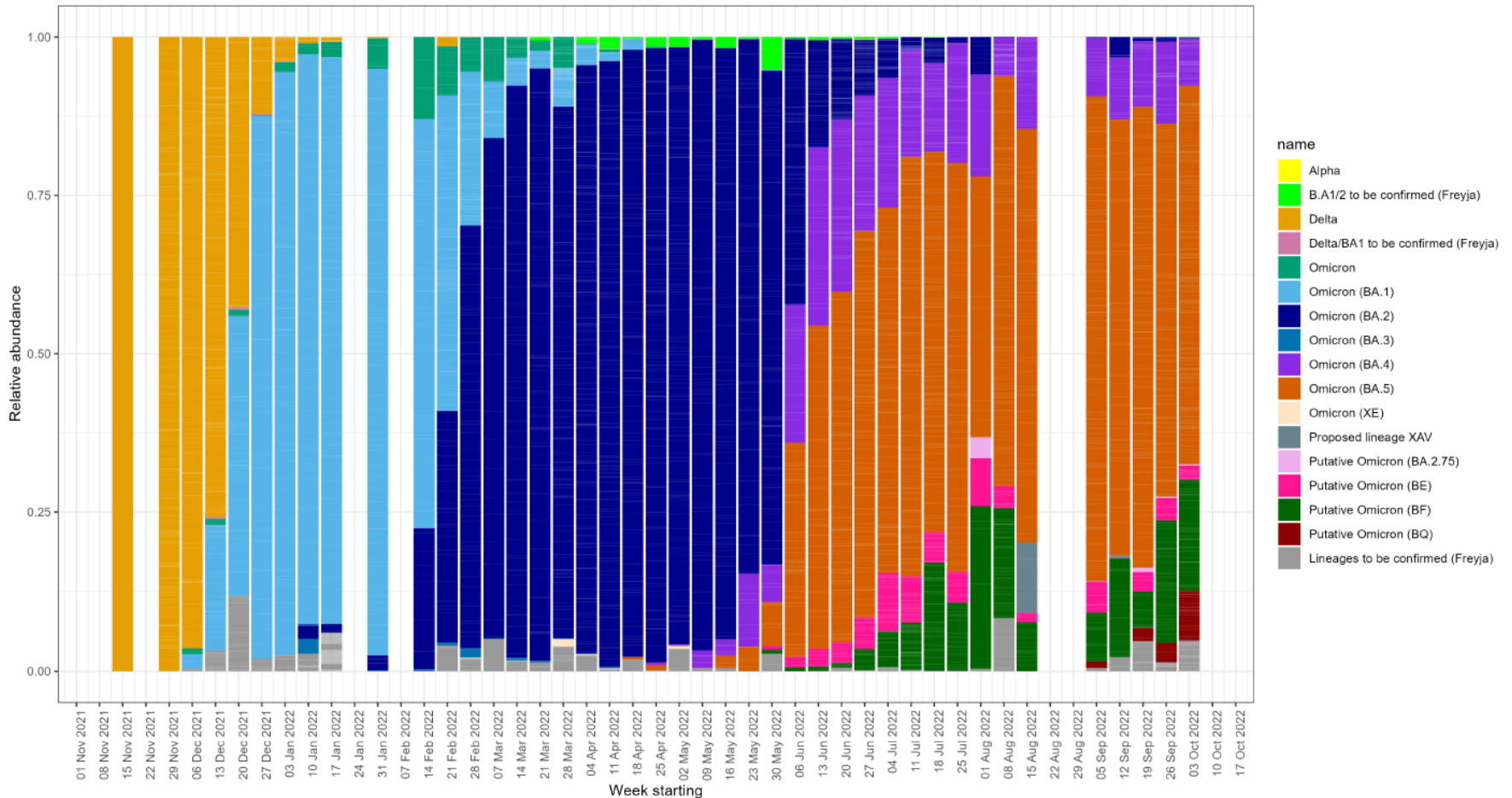


Figure 1. VOCs identified at the national level (across all 47 WwTPs covered by the Programme) since 15 November 2021 (plotting proportion of sequence reads assigned to each VOC using Freyja programme; see key). Black lines within the stacked bar plot relate to the detection of sub-lineages.

Region 6: Llŷn and Eryri

This section is relevant for:

Betsi Cadwaladr University Health Board

Gwynedd County Council

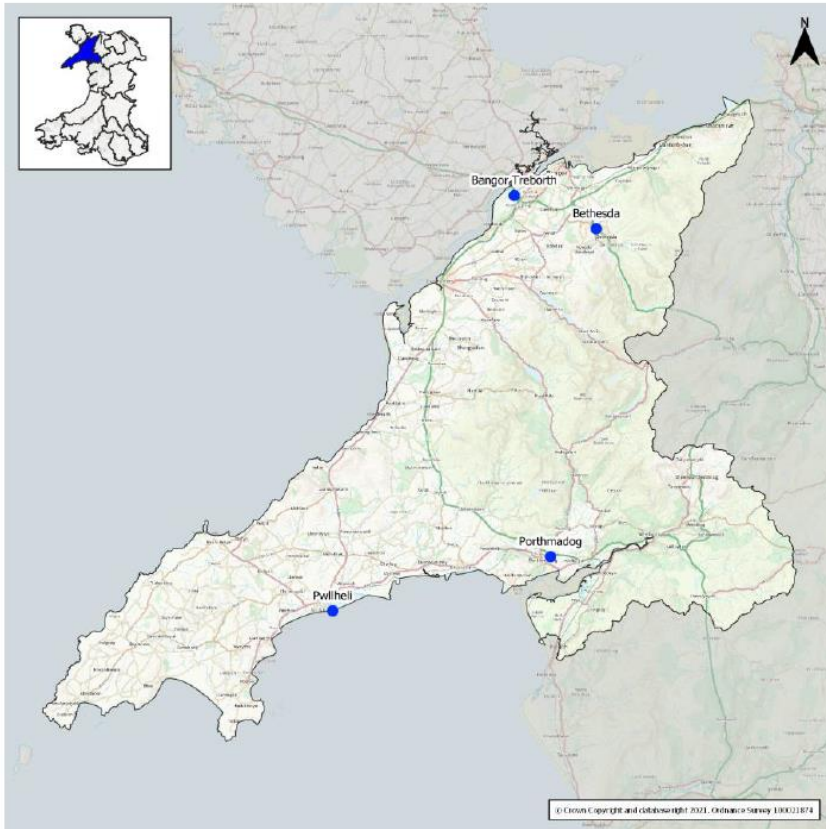


Figure 20 - Region 6 Map

Region 6 situation report:

- Wastewater signal in the region has been unstable, with both increases and decreases over the last four weeks. However, the overall signal change in that period is an increase.
- Compared with last week, the signal has decreased across the region. However, the signal increased at Bethesda and Porthmadog.
- The High Signal Level and Increasing Signal Level indicators were triggered at Porthmadog during the last reporting period.
- There was one sample missing from Bethesda, Porthmadog and Pwllheli. Access issues at Pwllheli between 23 May – 7 June resulted in some missing samples causing a break in the series for that site.

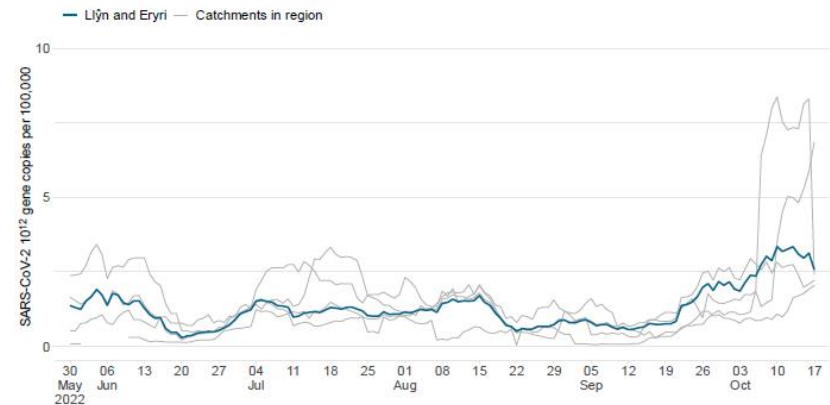
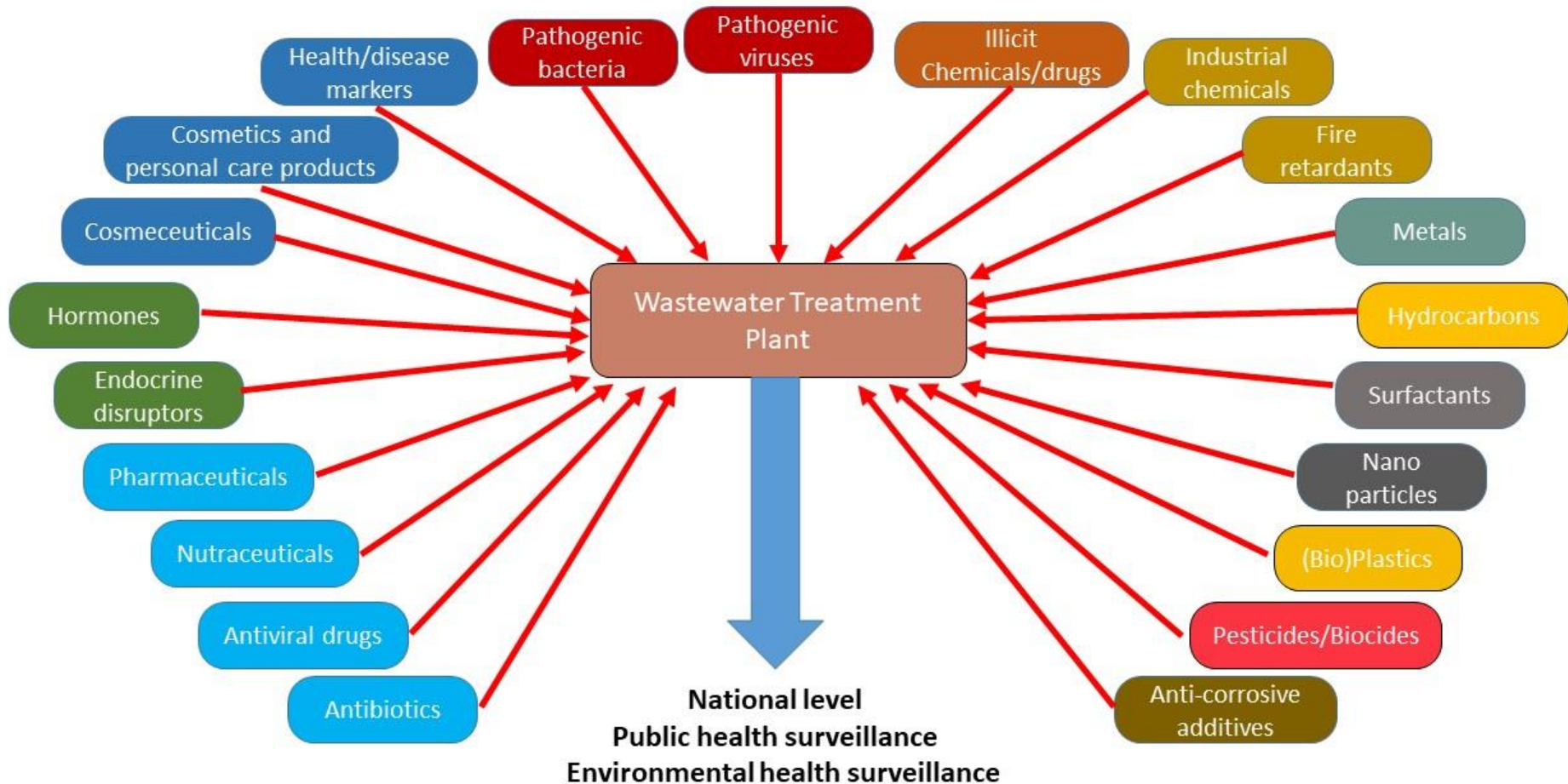


Figure 21 - Regional mean (blue lines) Site mean (grey lines) SARS-CoV-2 gc/day per 100k

What is the future of wastewater-based epidemiology?

Wastewater tells no lies about our habits



Monitoring drug use across Europe

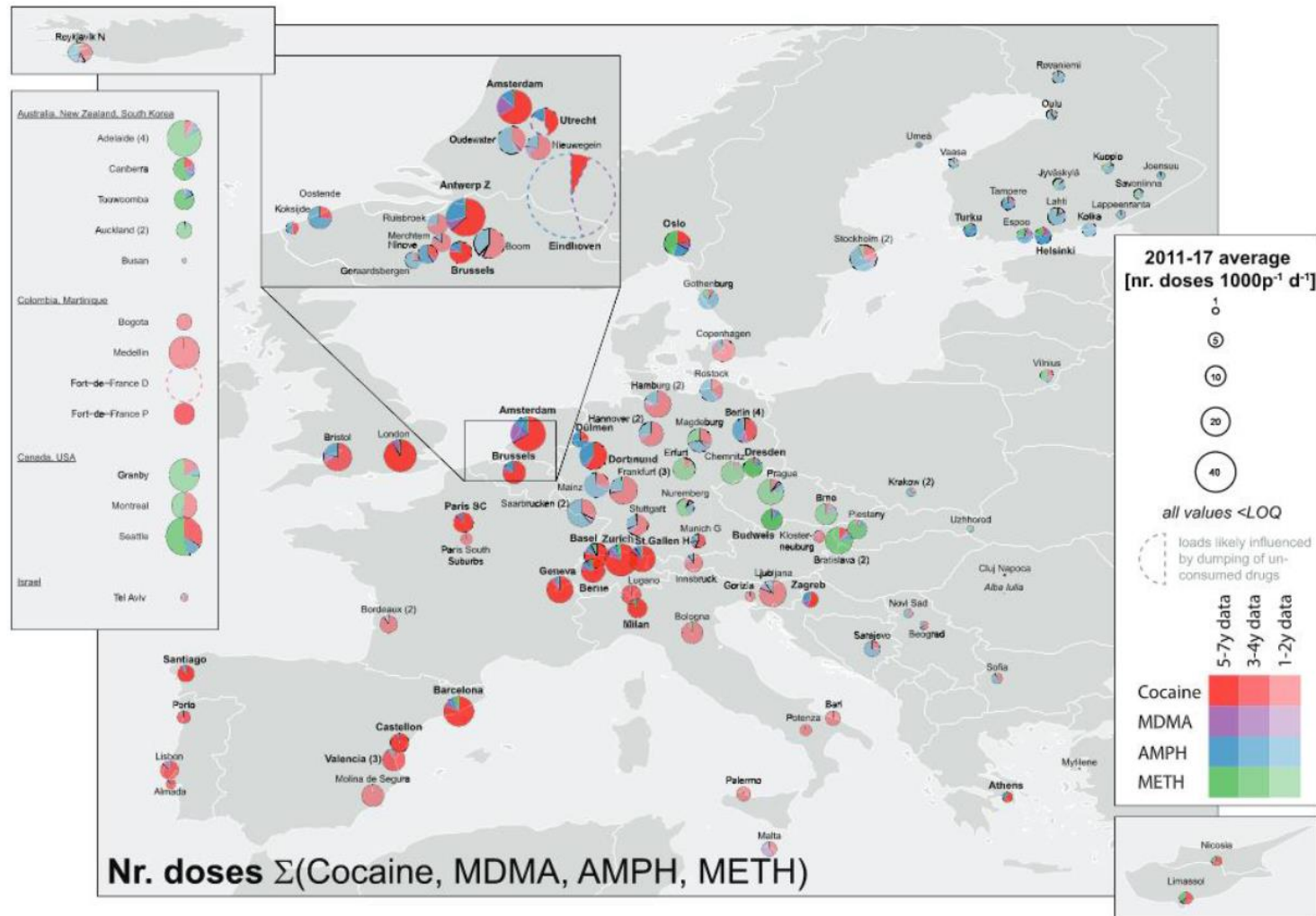
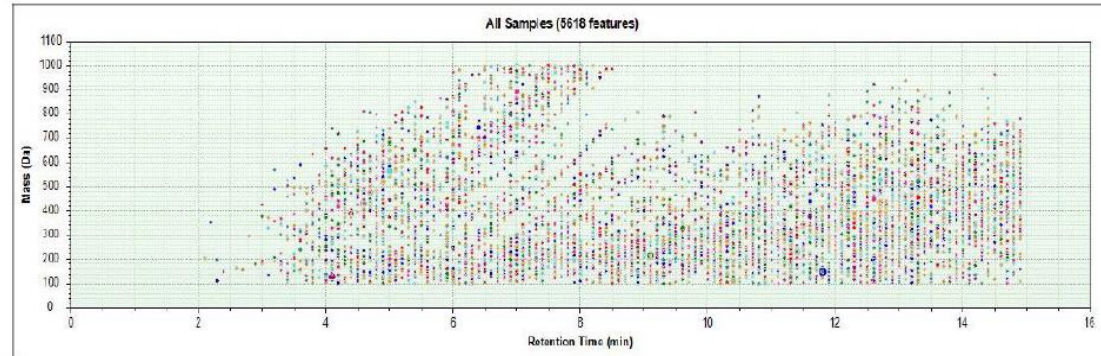


Figure 6 2011–17 total average number of doses/1000 people/day. [Colour figure can be viewed at wileyonlinelibrary.com]

Harnessing the power of analytical chemistry: pharmaceutical monitoring



Figure 3.4.1 – Sample Point 4 – Nant-Y-Ffin upstream of Nant-Y-Fendrod.



5-Aminosalicylic acid	Hydrocodone*	Venlafaxine*
Oxycodone	Cotinine	Paracetamol*
Diazepam	Phenyltoloxamine	Caffeine
Methylscopolamine	Irbesartan*	Tramadol*
Lamotrigine*	Benzoylcegonine*	N,N-Diethyl-m-toluamide. DEET*
Nicotine*	MBDB	Hydroxycotinine*
Carbamazepine-10.11-epoxid*	Lidocaine	O-Desmethylvenlafaxine. Desvenlafaxine
Oxcarbazepine	Sertraline	Benzododecinium
Carbamazepine	Naproxen*	Citalopram*
Codeine	Dihydrocodeine*	

Where
we are
now and
what is
the
vision..

- **Wastewater provides a perfect window to assess how we live**
- Wastewater-based surveillance for SARS-CoV-2 is now proven to work
- It has been used to guide national and local policy within 18 months
- We have the national infrastructure
- WBE is truly multidisciplinary
- We need to better understand the downstream impacts – it is not just about public health
- It can make a valuable contribution to the health of the nation