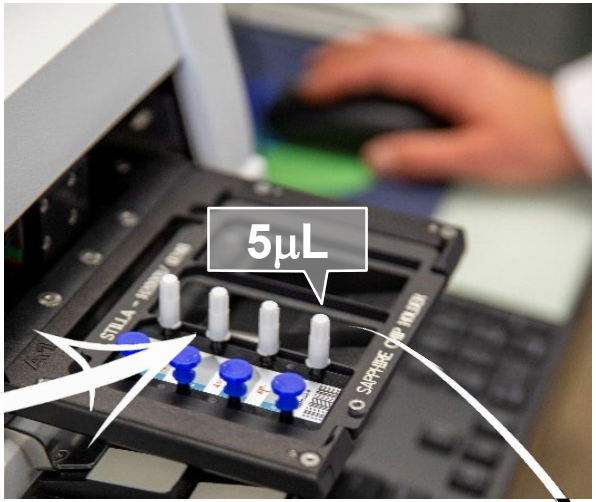
COWWID-19 | Surveillance of SARS-**Co**V-2 in **W**aste**w**ater - an Early Warning System to Track the Spatio-temporal Development of COV**ID-19**



Acknowledgements

Eawag

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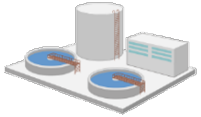


Staff of 23, now 6 WWTPs

eawag aquatic research

EPFL

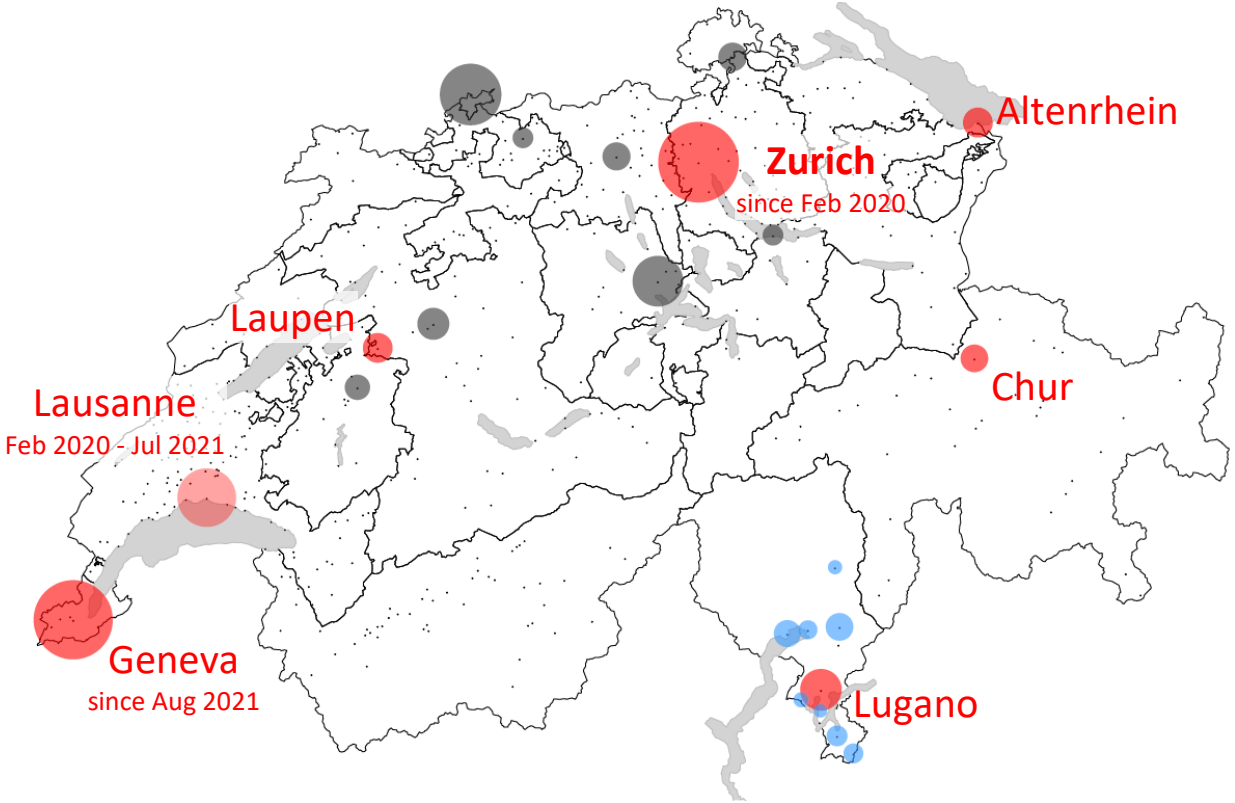
FNSNF Special Call on Coronaviruses
Fonds national suisse
Schweizerischer Nationalfonds
Fondo nazionale svizzero
Swiss National Science Foundation

Schweizerische Eidgenossenschaft
Confédération suisse
Confederazione Svizzera
Confederaziun svizra
Federal Office for the Environment (FOEN)

Schweizerische Eidgenossenschaft
Confédération suisse
Confederazione Svizzera
Confederaziun svizra
Federal Office of Public Health (FOPH)

SIB Swiss Institute of Bioinformatics

Sampling since 25 February 2020



First wave: 9 WWTPs Ticino

Feb 2020 – May 2020

Second wave: 9 WWTPs + 4 WWTPs + 1 WWTP

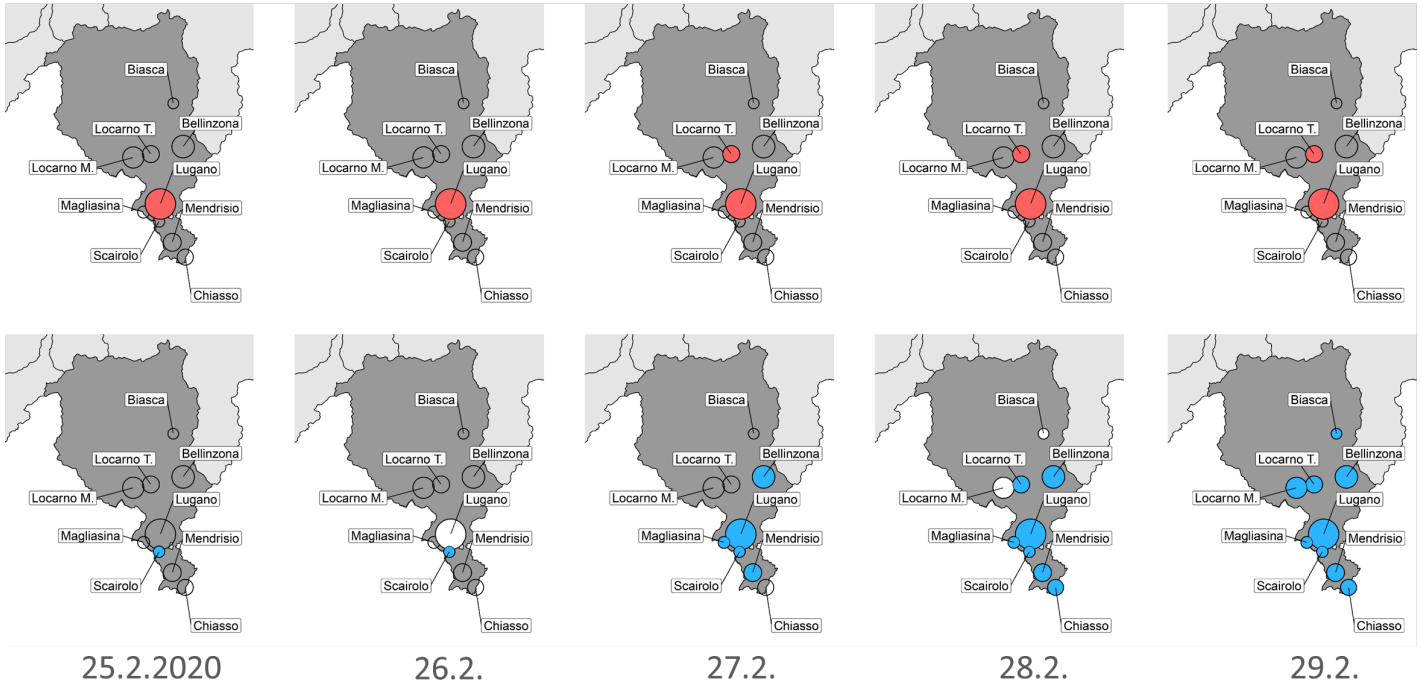
Oct/Nov 2020

Core data set: 6 WWTPs

Feb 2021 – Dec 2022

- **>1.2 mio. people** (>14% nat. pop.)
- **daily** samples (24h composites)
- **dPCR** (gene count N1)
- **NGS** (VoC)
- **Re** (effective reproductive number)
- **dPCR** (VoC, only twice per week)

Qualitatitve, retrospective analysis of TI samples



size of circles proportional to population in WWTP catchment empty circle = no sample white fill = not detected

Reported cases

by 29 Feb: a total of 4

Detections in wastewater

by 29 Feb: in all 9 catchments (total population ~300’000p)

Our data

Team EPFL / Eawag
T. Kohn / T. Julian, C. Ort

Team ETHZ
N. Beerenwinkel

Team ETHZ
T. Stadler

Number of gene copies

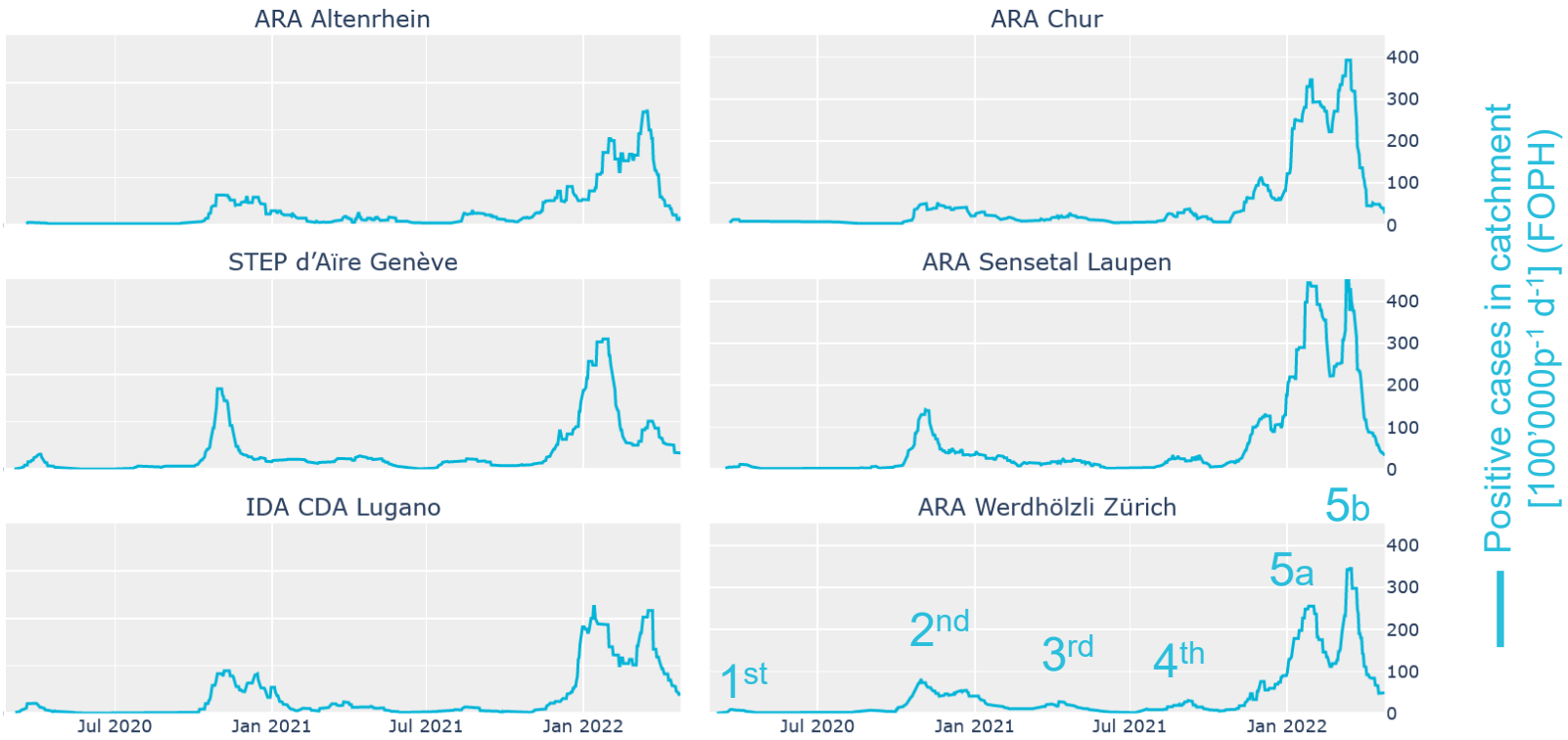
Mutations

Reproductive number Re

www.eawag.ch/covid19_sewage

Catchment-specific case data

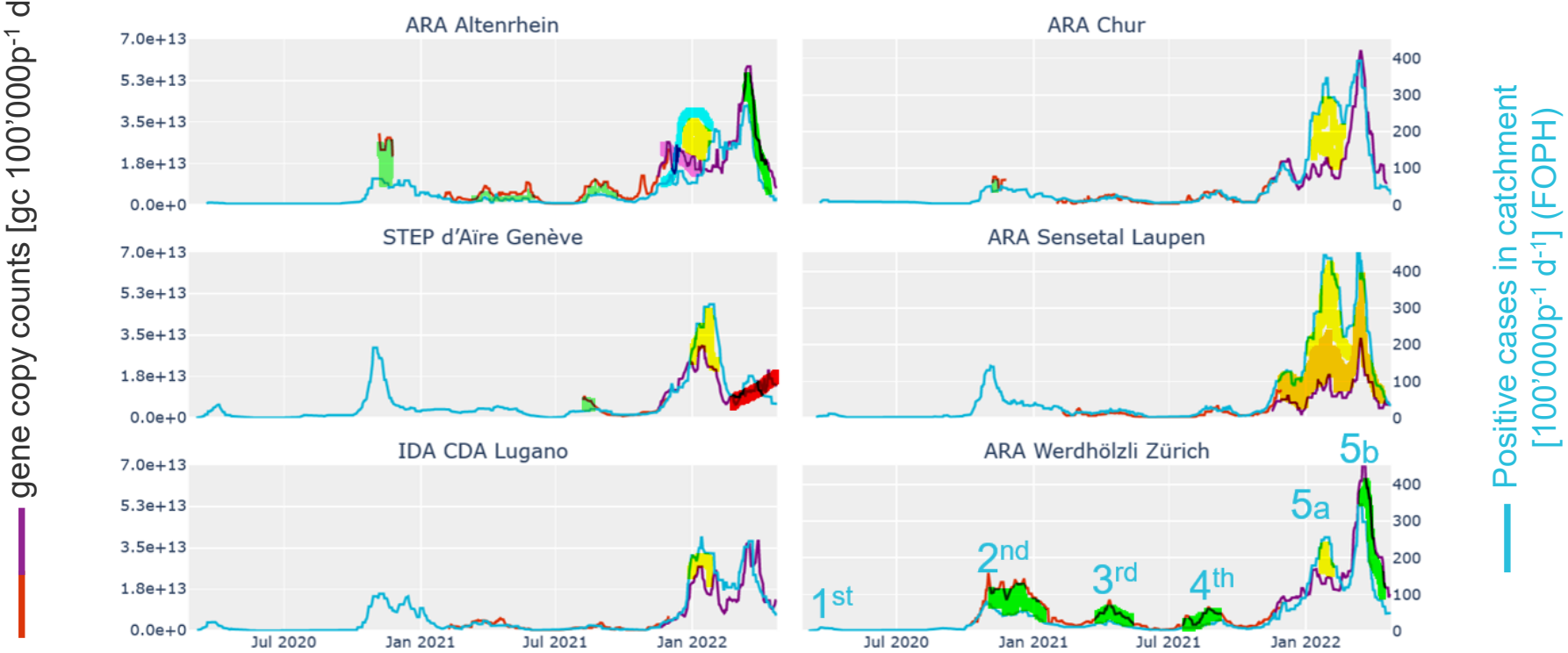
>1.63mio tests (Feb 2021 – 22 April 2022; ~325'000 positive)



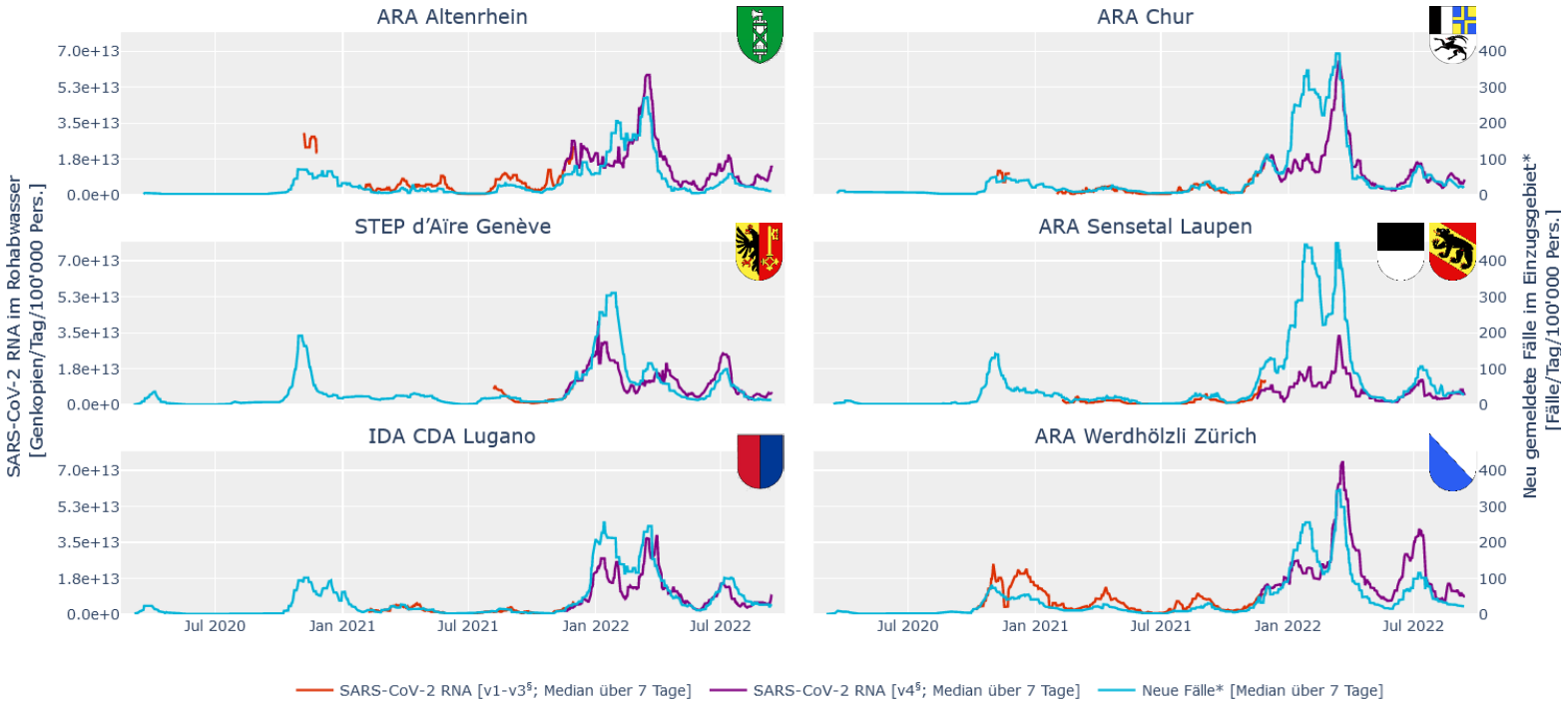
Gene copy counts

>1.63mio tests (Feb 2021 – 22 April 2022; ~325'000 positive)

~2600 ww samples



Gene copy counts



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Number of gene copies

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Mutations

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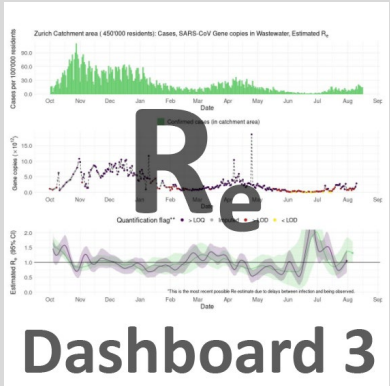
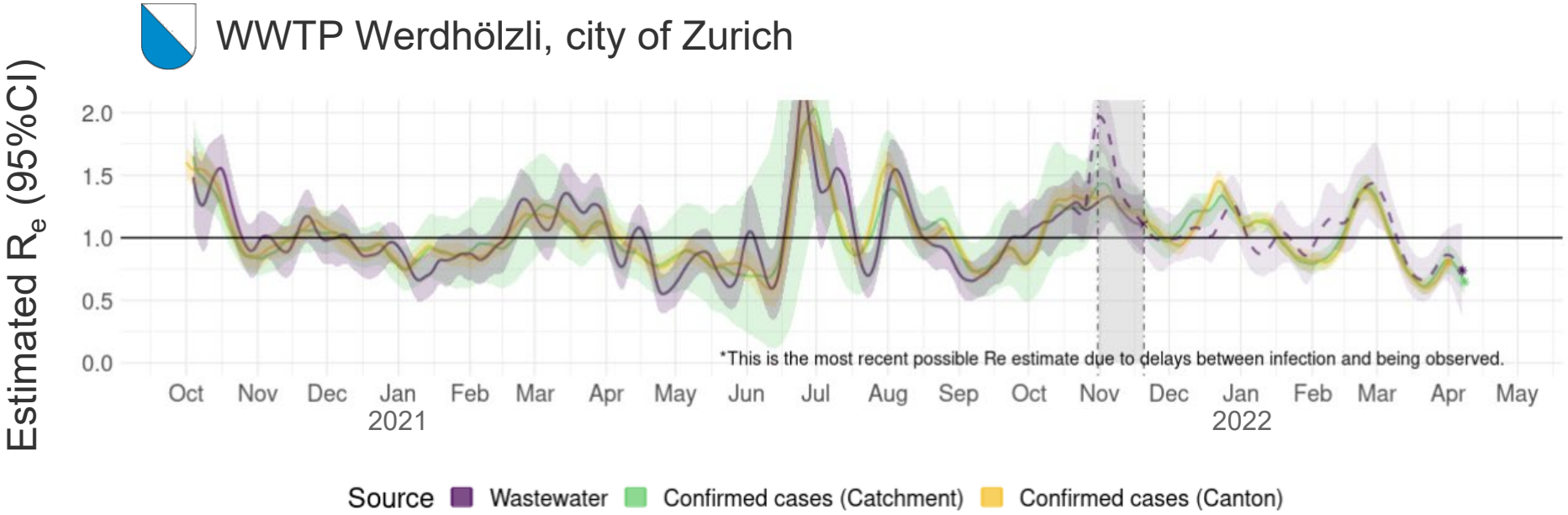
T. Stadler



Reproductive number Re

www.eawag.ch/covid19_sewage

Effective reproductive number R_e



Shaded area = period of method change for ww analysis

Our data

eawag aquatic research

EPFL

ETH zürich

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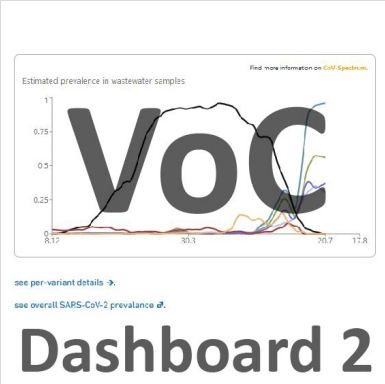
Team ETHZ
N. Beerenwinkel

Team ETHZ
T. Stadler

Number of gene copies

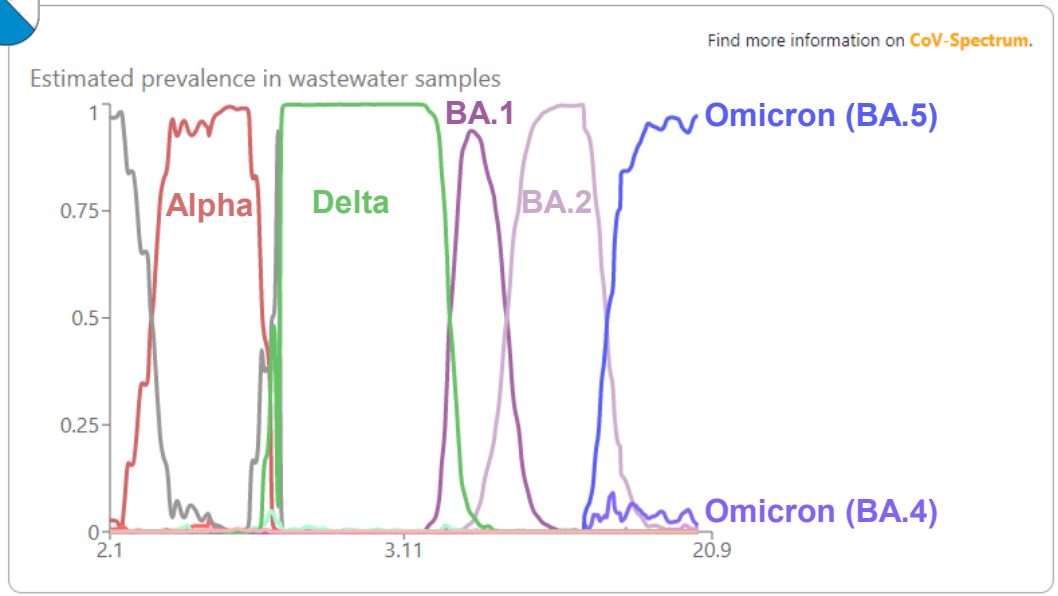


Mutations

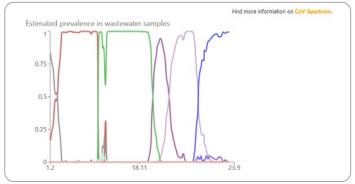
Reproductive number Re

www.eawag.ch/covid19_sewage

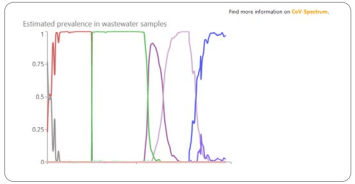
Variants of concern (NGS)



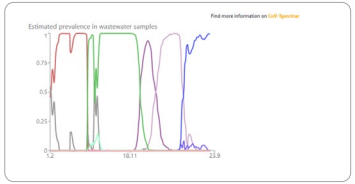
Altenrhein (SG)



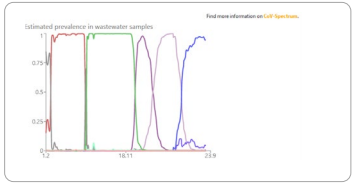
Chur (GR)



Laupen (BE)



Lugano (TI)



Take home messages: wastewater …

- ✓ **follow trends / dynamics**
- ✓ **estimate effective reproductive number**
- ✓ **detect (known) variants of concern**
- ✓ independent of reported cases
- ✓ cost effective (small number of samples, no extra infrastructure)
- ✓ nearly 100% compliance
- ✓ sensitivity: 1 reported case in 10’000 (empirical July 2021)
- ~ difficult to estimate absolute nr. of incidences
- × no information on individual
- × no information on severity

More details: publications, poster and online

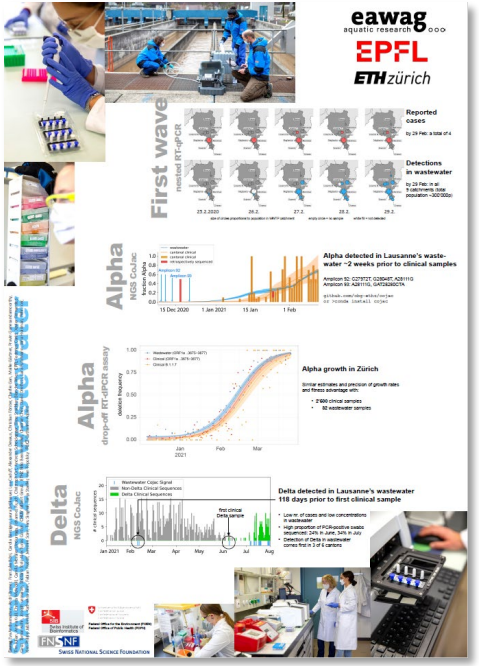
Fernandez-Cassi et al. (2021) Wastewater monitoring outperforms case numbers as a tool to track COVID-19 incidence dynamics when test positivity rates are high. ***Water Research*** *10.1016/j.watres.2021.117252*

Caduff et al. (2022) Inferring transmission fitness advantage of SARSCoV- 2 variants of concern from wastewater samples using digital PCR, Switzerland, December 2020 through March 2021. ***Eurosurveillance*** *10.2807/1560-7917.ES.2022.27.10.2100806*

Huisman et al. (2022) Wastewater-based estimation of the effective reproductive number of SARS-CoV-2. ***Environmental Health Perspective*** *10.1289/EHP10050*

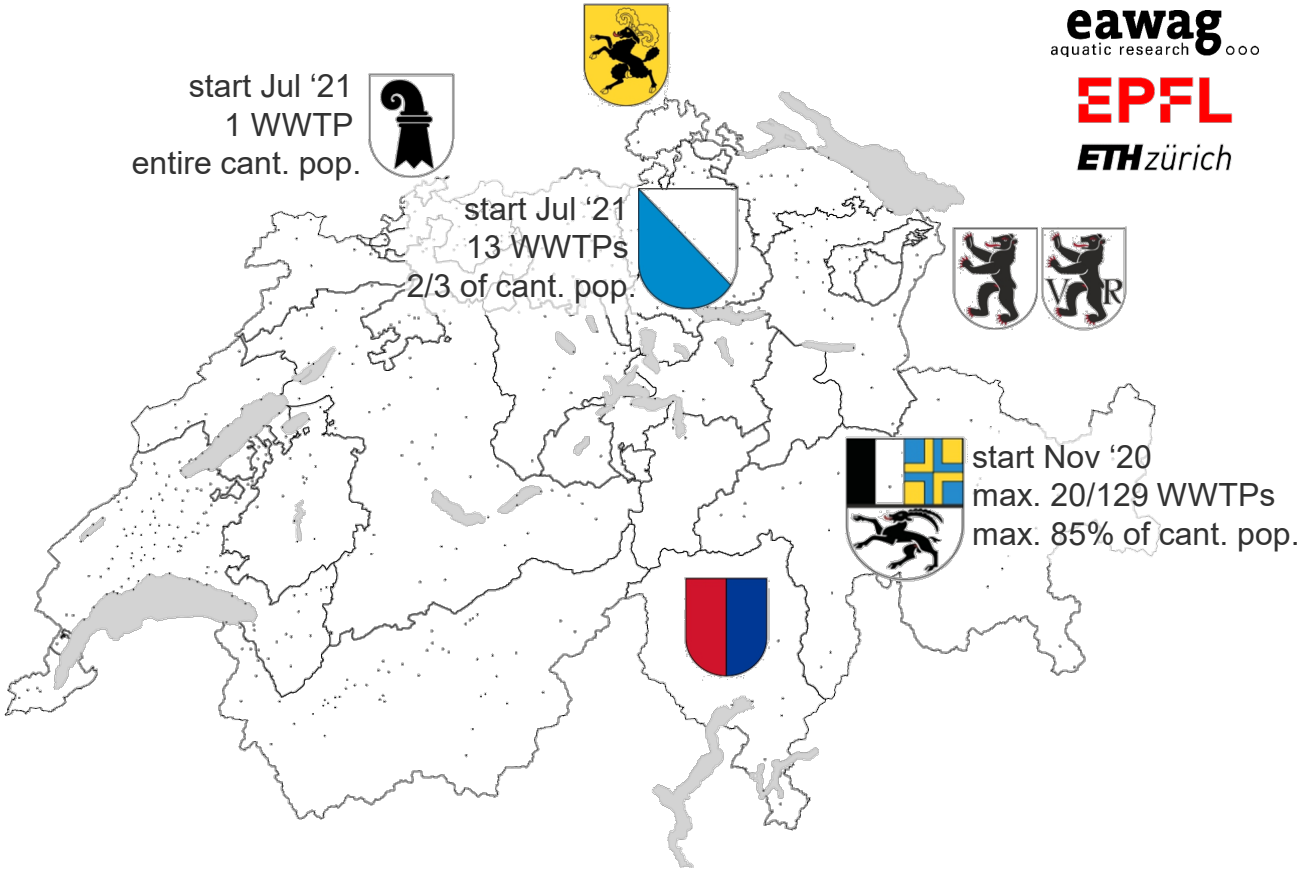
Jahn et al. (2022) Wastewater-based genomic epidemiology of SARS-CoV-2 variants: early detection, surveillance, and fitness estimation. ***Nature Microbiology*** *10.1038/s41564-022-01185-x*

Cariti et al. (2022) Wastewater reveals the spatio-temporal spread of SARS-CoV-2 in the Canton of Ticino (Switzerland) during the onset of the COVID-19 pandemic. ***ES&T Water*** *10.1021/acsestwater.2c00082*



www.eawag.ch/covid19_sewage

Early adopters



Planned national monitoring (FOPH)

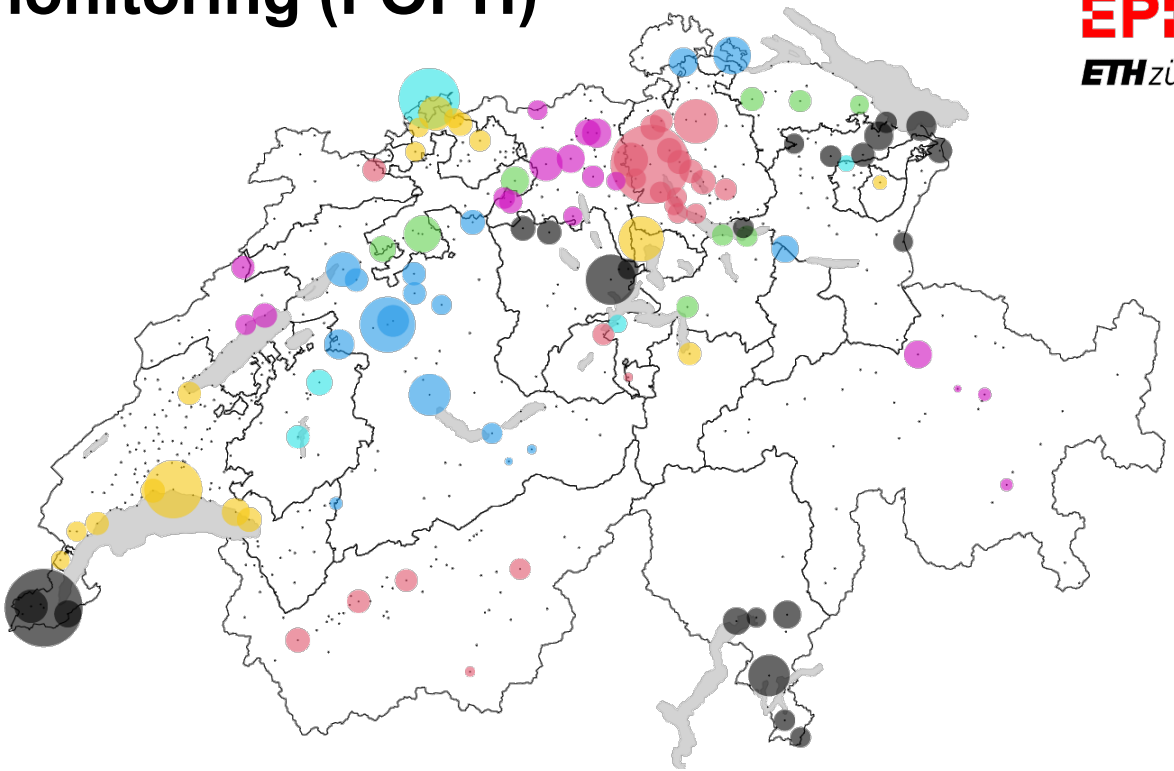
Coverage

- 100 largest WWTPs
- at least one per canton
- biggest tourist areas
- ⇒ 70% CH population

Sampling

- 3-6x per week
- Feb - Dec 2022

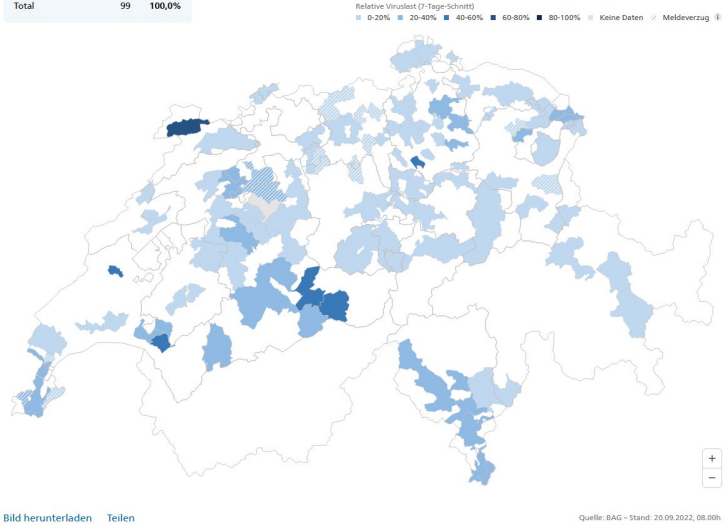
Data available soon!



National monitoring (FOPH)

Schweiz und Liechtenstein

Relative Viruslast	Anzahl ARAs	Anteil ARAs
0-20%	73	73,7%
20-40%	19	19,2%
40-60%	5	5,1%
60-80%	1	1,0%
80-100%	0	0,0%
Keine Daten	1	1,0%
Total	99	100,0%



Relative Viruslast | Absolute Viruslast

Lenzburg

Lenzburg, AG
Wohnbevölkerung: 54 568

7-Tage-Schnitt vom 10.09.2022

Relative Viruslast	1,7%
Absolute Viruslast	5.6e+10
Differenz zur Vorwoche	–3,9pp

Bild herunterladen Teilen

Quelle: BAG – Stand: 20.09.2022, 08.00h

https://www.covid19.admin.ch/en/epidemiologic/waste-water

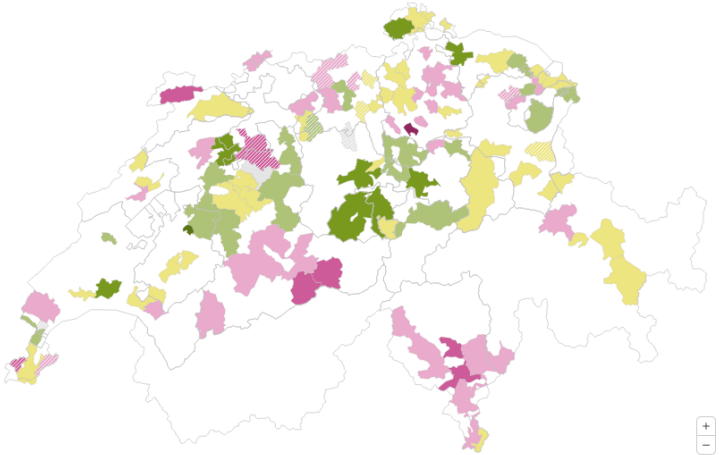
National monitoring (FOPH)

Switzerland and Liechtenstein

Difference of 7-day average compared with the previous week	Number of WWTP	Proportion of WWTP
-20pp or less	1	1,0%
-10pp to -20pp	8	8,1%
-3 to -10pp	15	15,2%
-3 to +3pp	34	34,3%
+3pp to +10pp	32	32,3%
+10pp to +20pp	5	5,1%
+20pp or more	1	1,0%
No reference value	3	3,0%
Total	99	100,0%

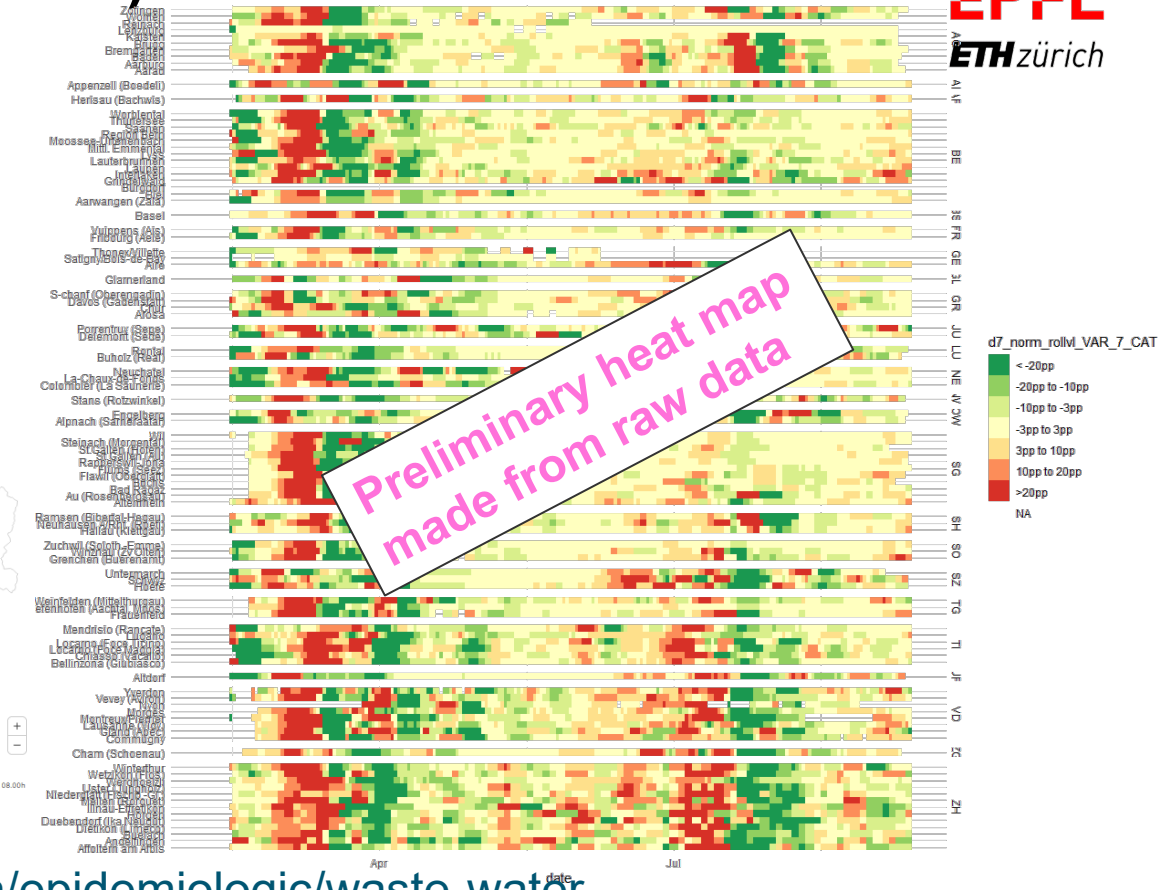
Difference of 7-day average compared with the previous week

-20pp or less · -10pp to -20pp · -3 to -10pp · -3 to +3pp · +3pp to +10pp · +10pp to +20pp · +20pp or more · No reference value · Reporting delay



Download image Share

Source: FOPH – Status: 20.09.2022, 08.00h



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