



**af** Arbo-France  
Réseau Français d'étude des arboviroses

October 11, 2023

# Update on the epidemiological situation and surveillance of WNV in Italy

Luisa Barzon



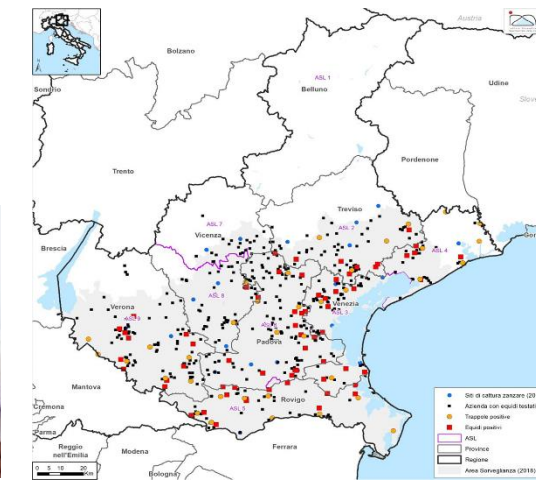
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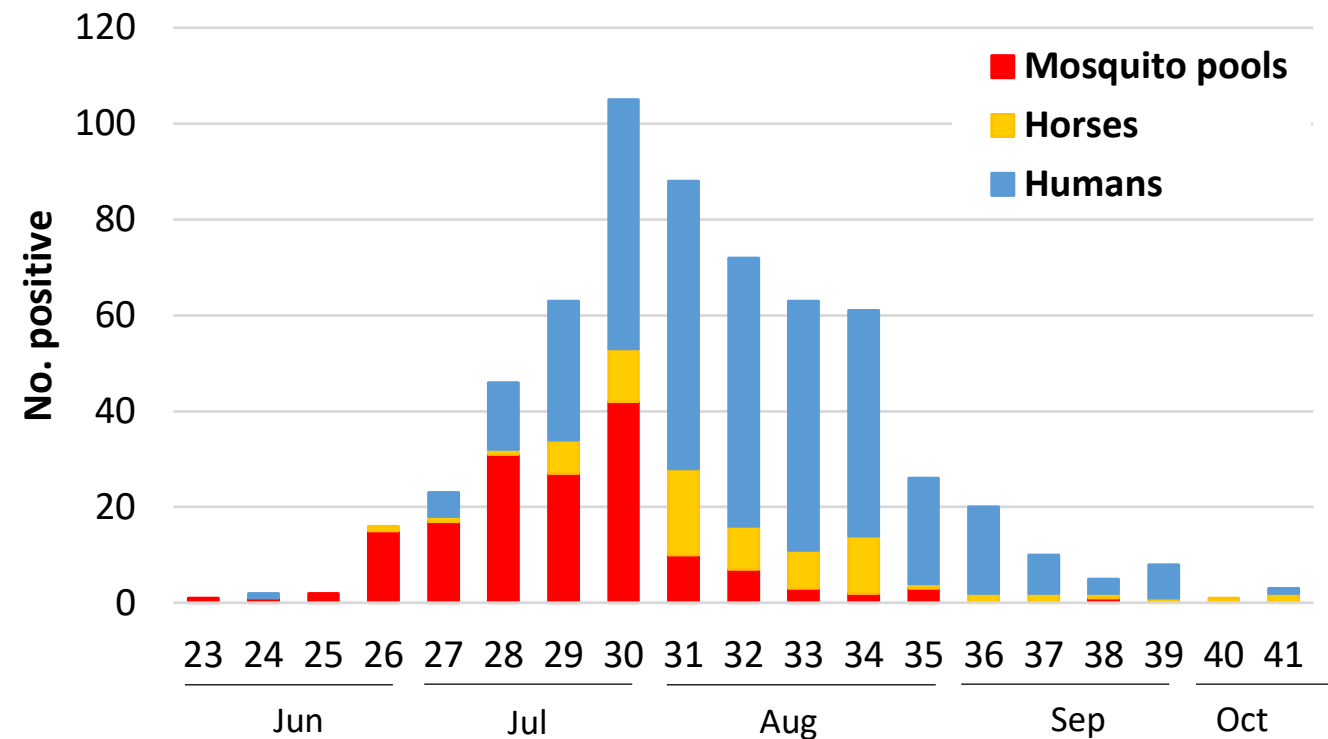
DIPARTIMENTO DI  
MEDICINA MOLECOLARE

# One Health approach for integrated WNV/USUV surveillance in Italy

- **Entomological monitoring** based on active mosquito collection in selected sites (May-October);
- **Animal surveillance** targeting migratory and resident wild birds, equids and poultry; active surveillance in target species (corvids); syndromic surveillance in equids (March-November)
- **Human surveillance system** active requesting clinicians to report all possible, probable and confirmed WNV/USUV cases (all year).



WNV surveillance, Veneto Region, Italy, 2018





# Entomological surveillance of WNV and USUV

## Sites of mosquito sampling

### Veneto, Italy

57 sites

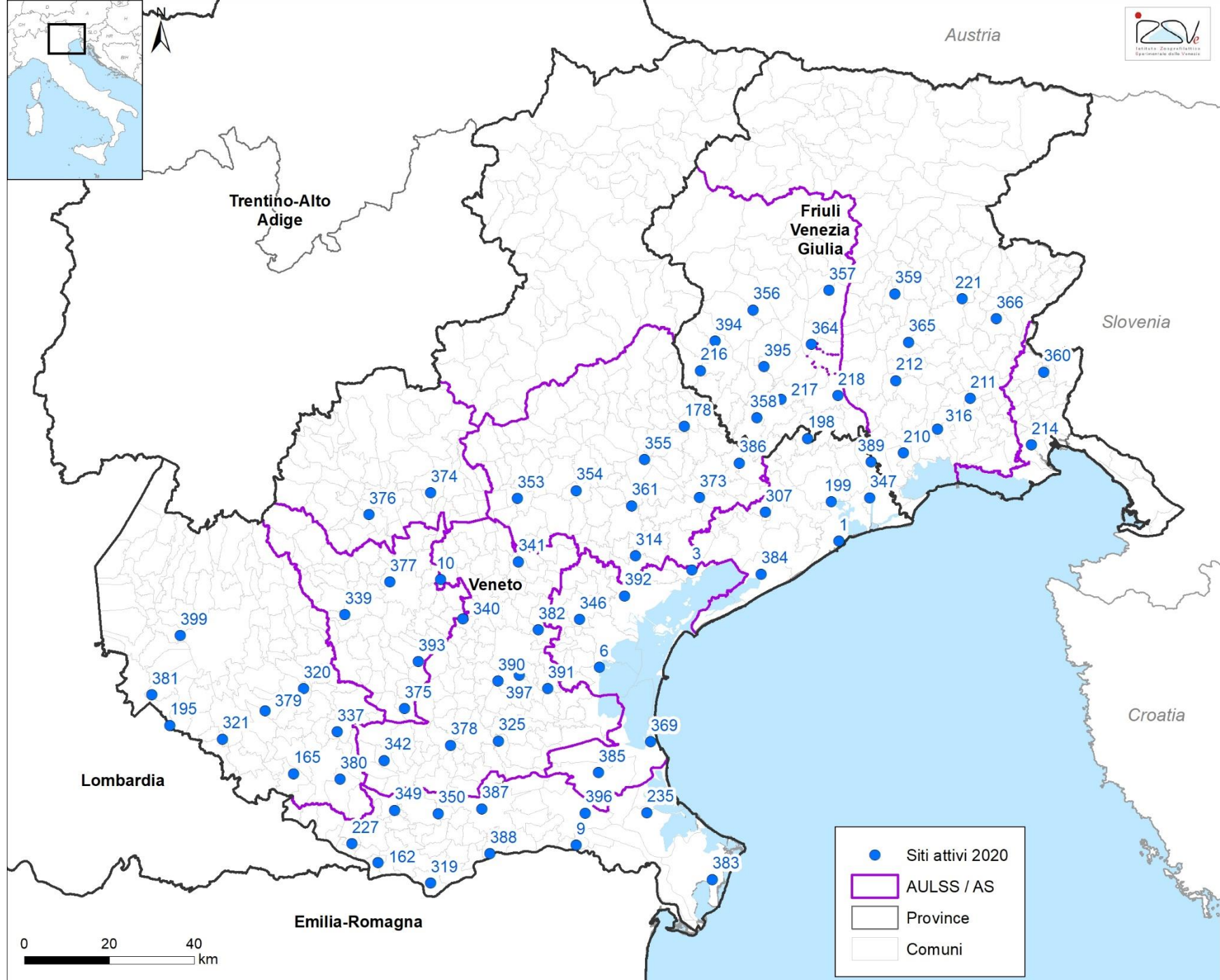
57 CDC-CO<sub>2</sub> + 8 Gravidtrap

### Friuli Venezia Giulia, Italy

19 sites

19 CDC-CO<sub>2</sub> + 1 Gravidtrap

**Period:** from mid May to mid  
October, biweekly overnight capture



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# Laboratory diagnosis of WNV/USUV infection in humans

## CASE DEFINITION: WEST NILE VIRUS (WNV) AND USUTU VIRUS (USUV)

### Probable

**Serum/plasma IgM antibodies** anti-WNV/USUV (by EIA, IFA, CLIA) and symptoms or epidemiological link

### Confirmed

At least one of the following laboratory criteria for a confirmed case:

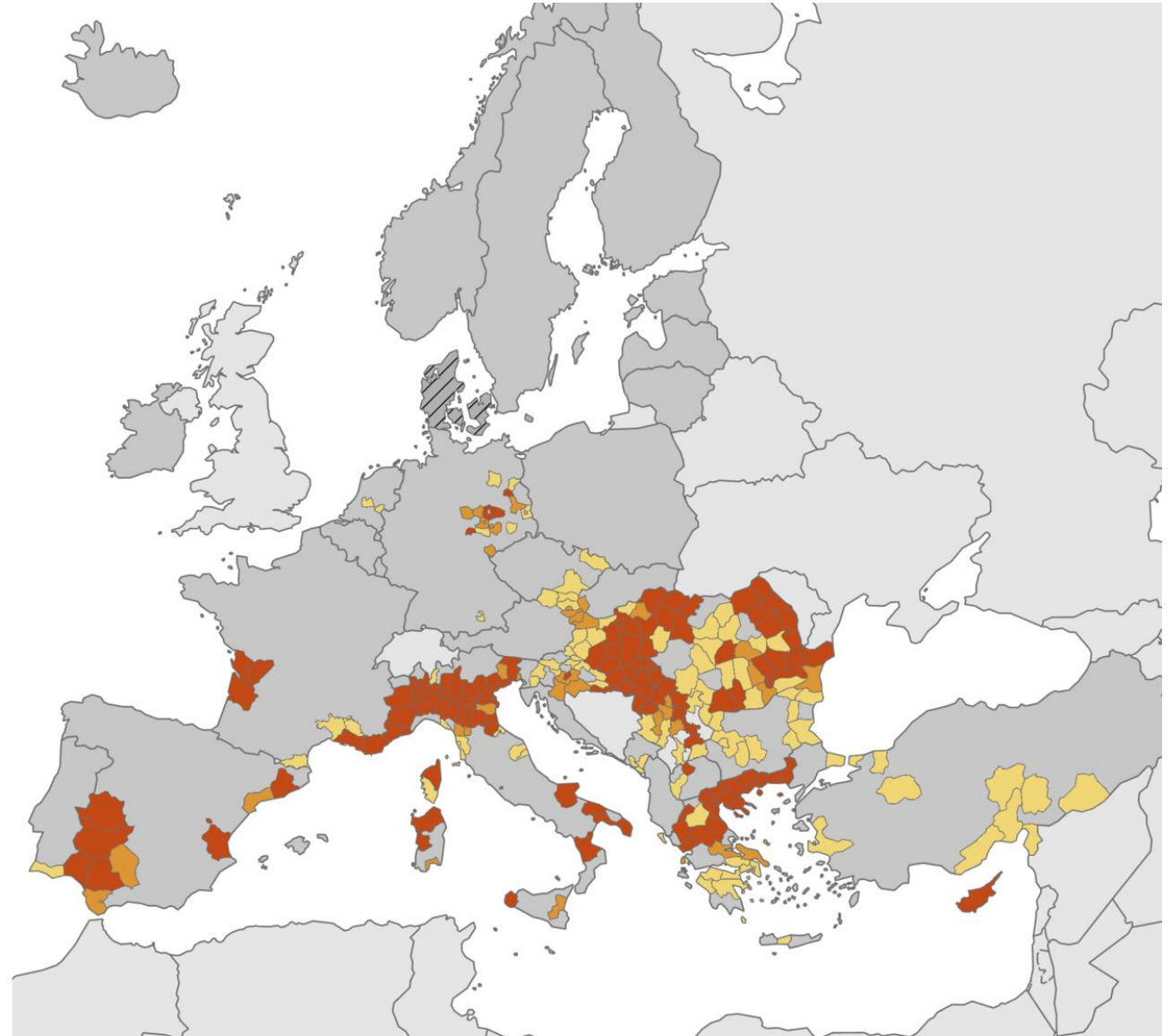
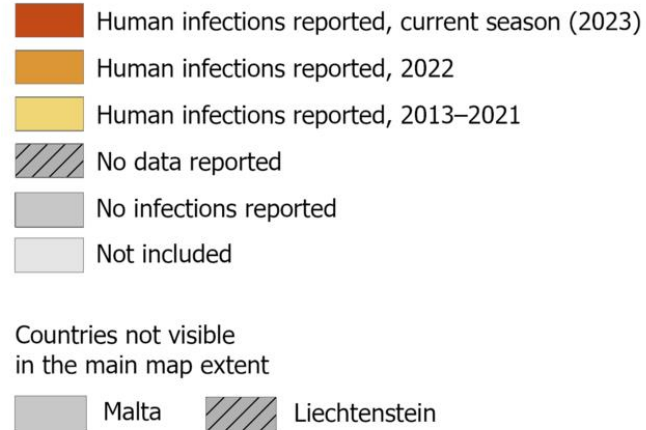
- **Isolation in cell culture** of WNV/USUV from serum and other biological samples
- Detection of **WNV/USUV RNA** in blood, urine and/or other biological specimens
- Detection of WNV/USUV-specific **IgM antibodies in CSF**
- High titer of anti-WNV/USUV IgM antibodies AND anti-WNV/USUV IgG antibodies is serum AND confirmation by a **neutralisation test**



# West Nile virus in Europe, human infections, 2023



Distribution of human West Nile virus infections in NUTS 3 or GAUL 1 regions of the EU/EEA and neighbouring countries during 2013–2022, as of 04 of October 2023



**EU/EEA countries, n = 599**

Italy	295
Greece	153
Romania	68
France	33
Hungary	28

Administrative boundaries: © EuroGeographics ©  
The boundaries and names shown on this map do not imply official endorsement or acceptance by the European Union. Map produced by ECDC on 5 October 2023



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# Human cases of WNV infection in European countries, 2012-2022

Distribution of human West Nile virus infections in NUTS 3 or GAUL 1 regions of the EU/EEA and neighbouring countries during 2012–2022, as of 31 May 2023.

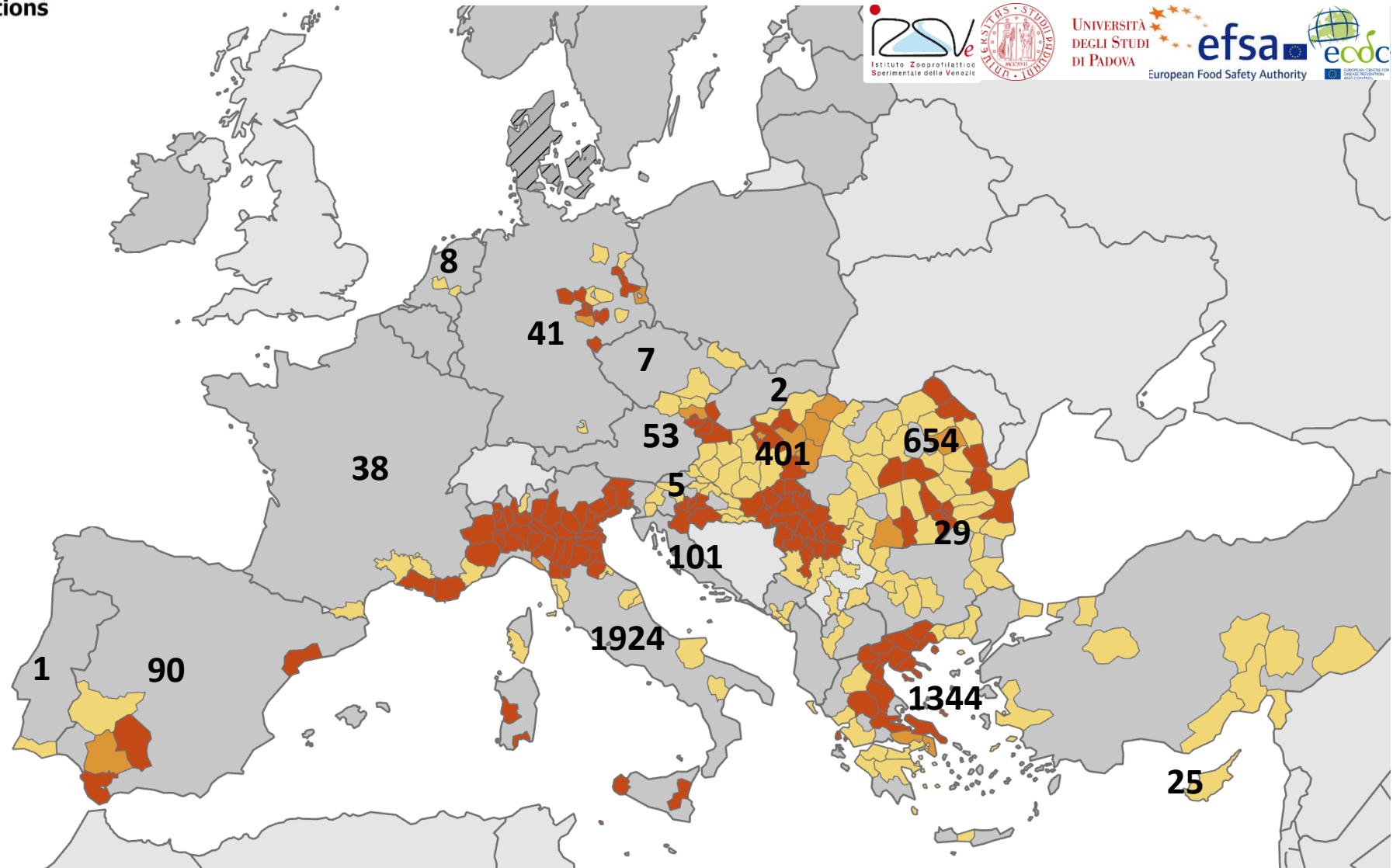
- Human infections reported, 2022
- Human infections reported, 2021
- Human infections reported, 2012–2020
- No data reported
- No infections reported
- Not included

Countries not visible in the main map extent

- Malta
- Liechtenstein

**EU/EEA countries, n = 4,723**

- Italy 41%**
- Greece 28%**
- Romania 14%**
- Hungary 8%**



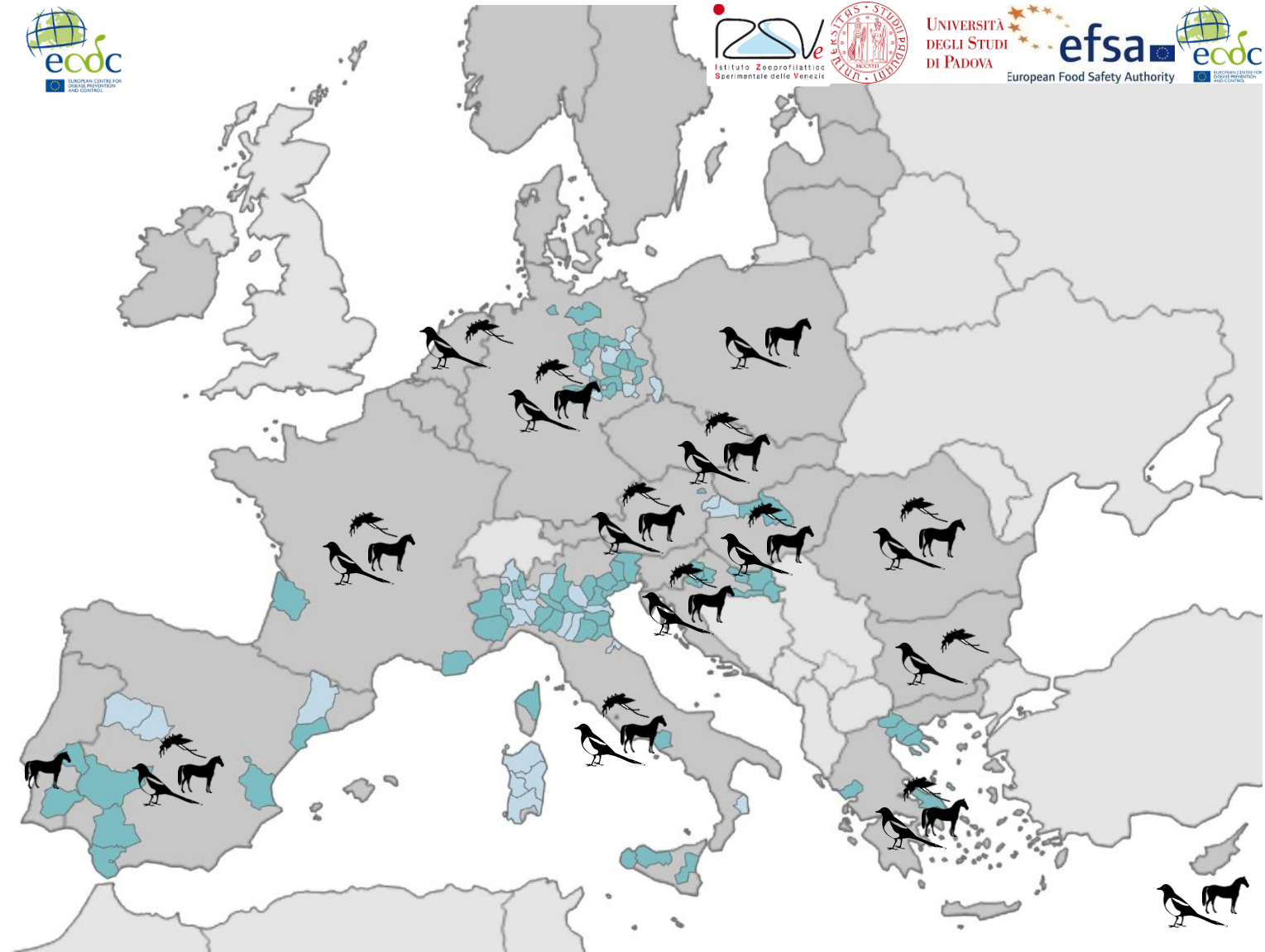
# Detection of WNV in animals in European countries, 2012-2022

Distribution of human West Nile virus infections in NUTS 3 or GAUL 1 regions of the EU/EEA and neighbouring countries during the 2022 season, as of 31 May 2023.

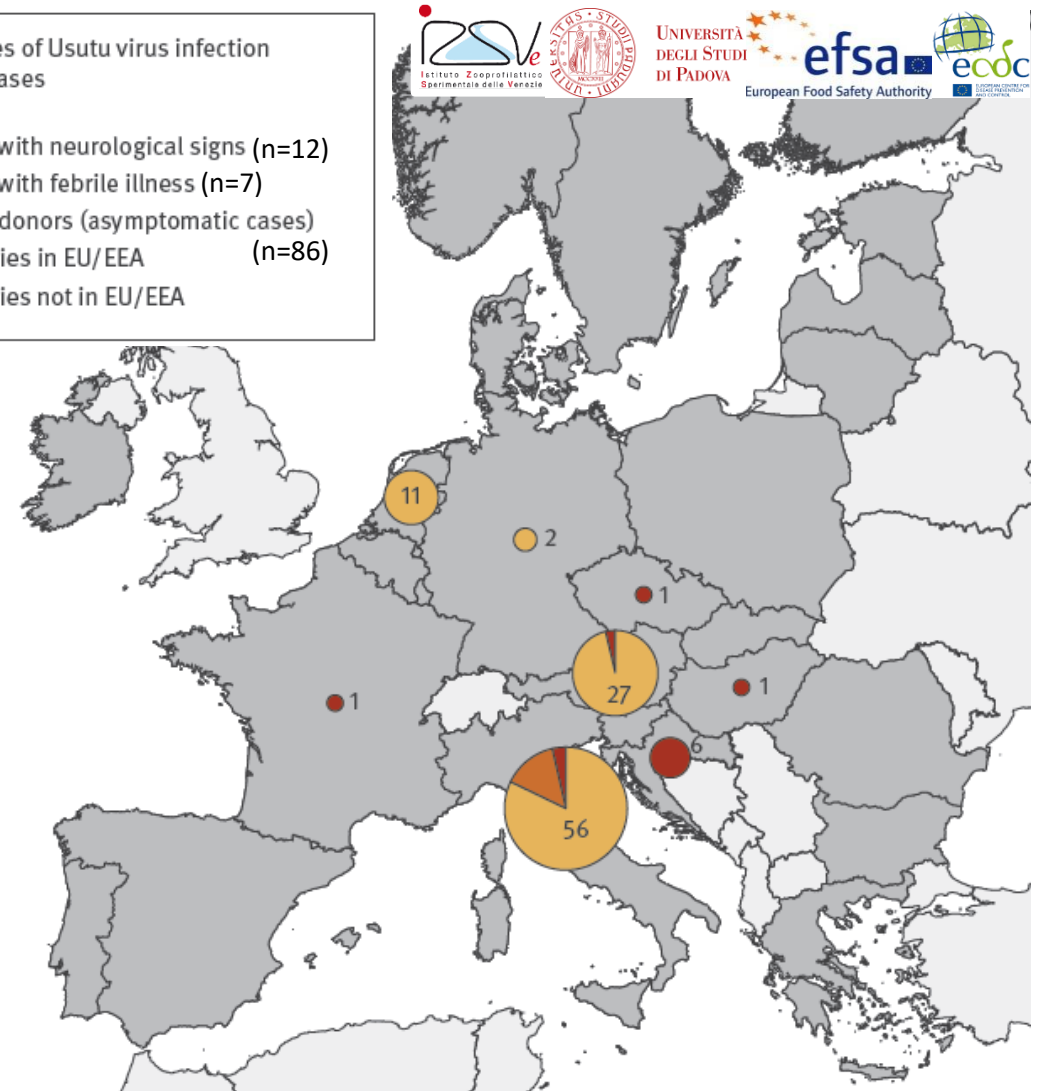
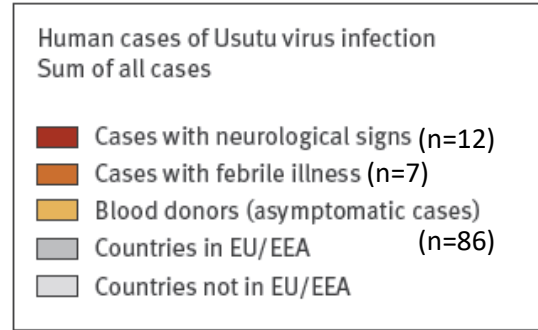
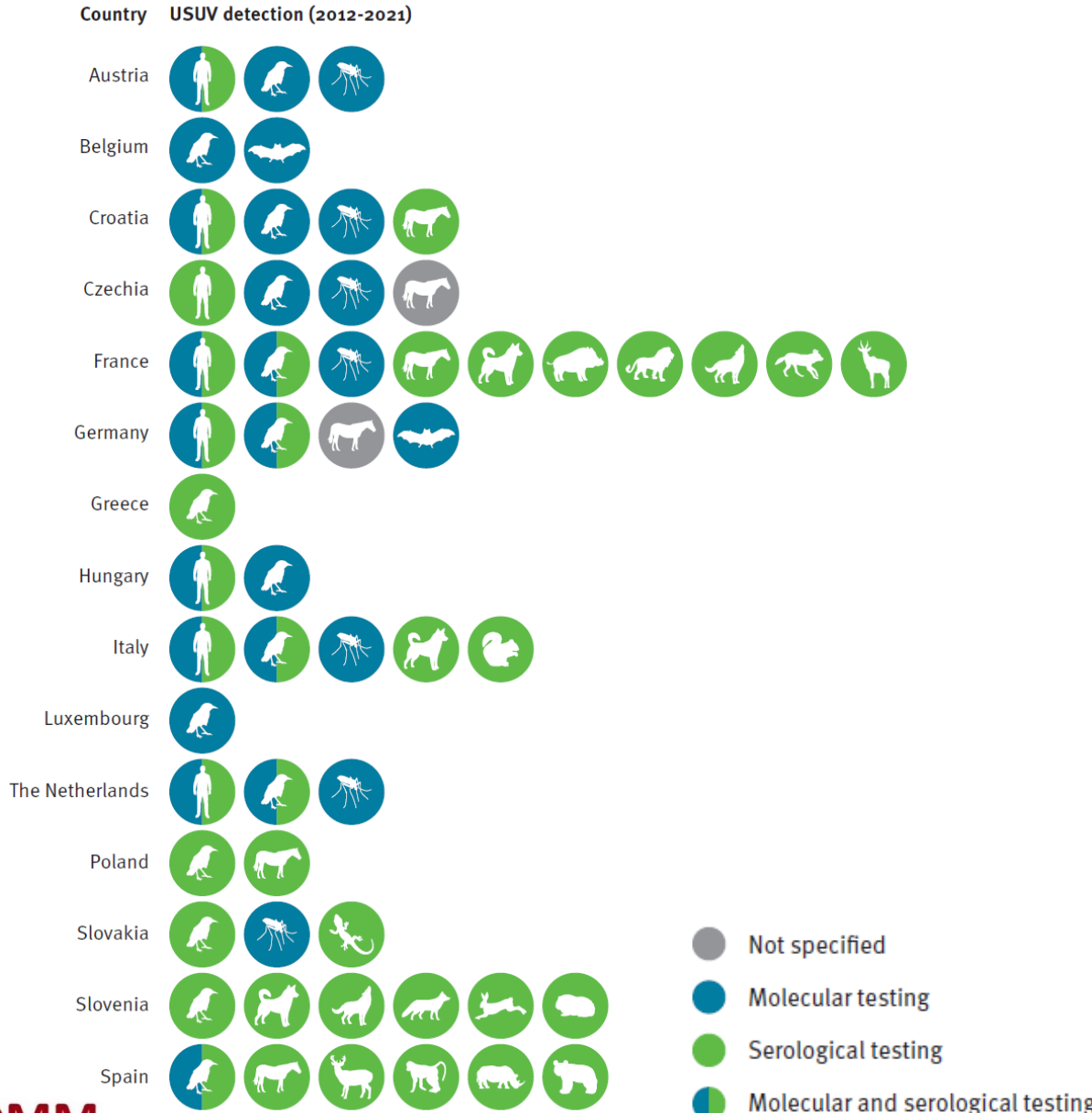
- Outbreaks among equids and birds
- Outbreaks among equids
- Outbreaks among birds
- No outbreaks reported
- Not included

## WNV detected in animals, EU/EEA, 2012-2022

- mosquitoes
- wild birds
- equids



# Usutu virus detection in EU/EEA countries, 2012-2021



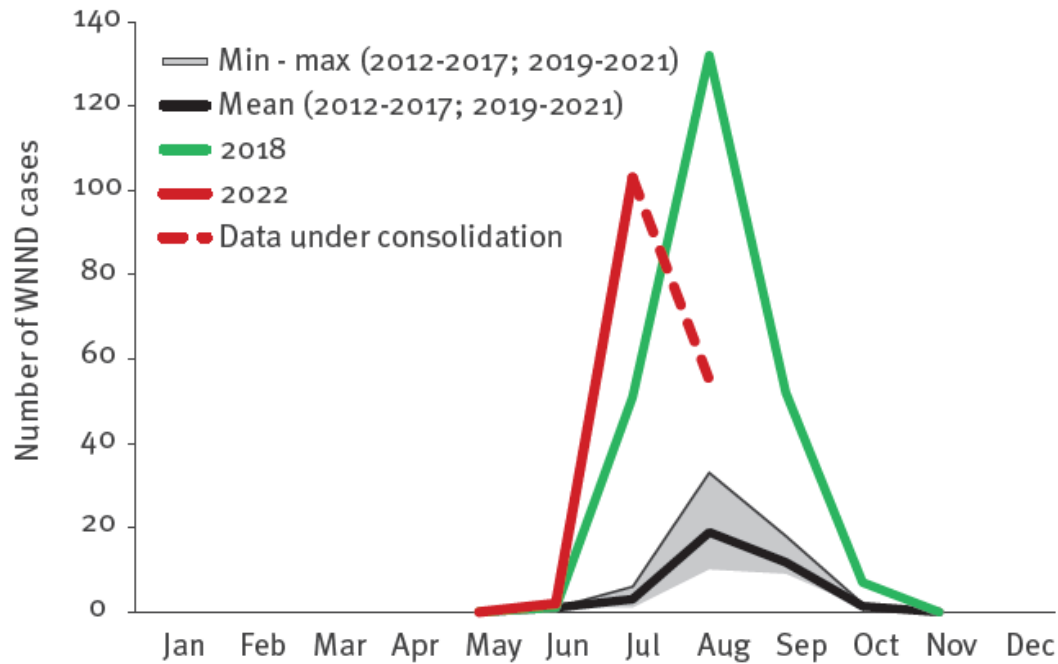


# Rapid increase in neuroinvasive West Nile virus infections in humans, Italy, July 2022

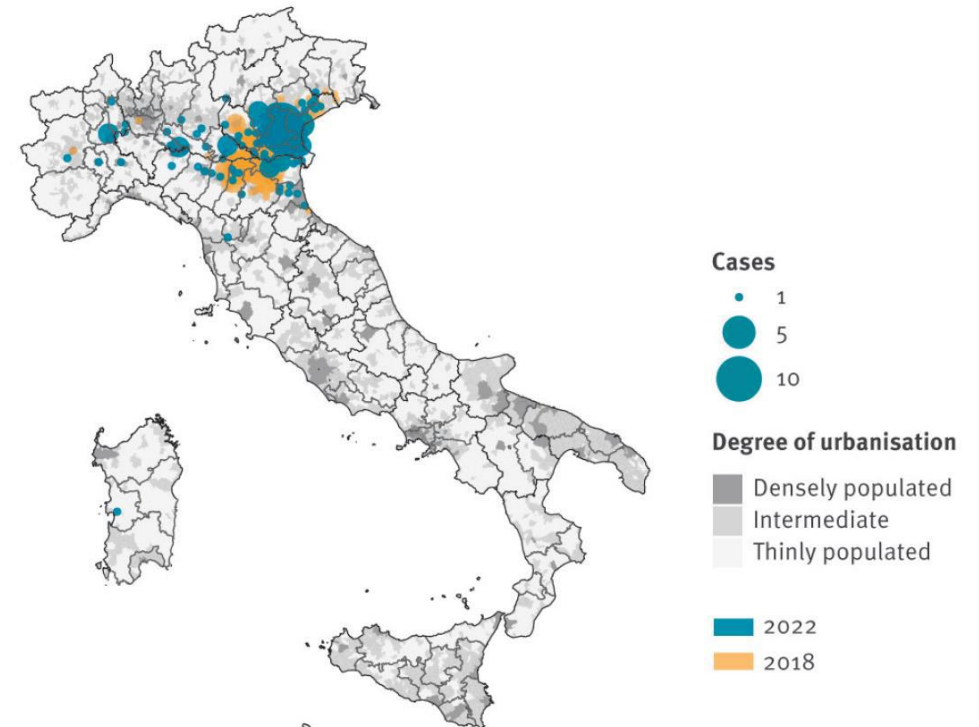
Flavia Riccardo<sup>1,\*</sup>, Antonino Bella<sup>1,\*</sup>, Federica Monaco<sup>2</sup>, Federica Ferraro<sup>3</sup>, Daniele Petrone<sup>1</sup>, Alberto Mateo-Urdiales<sup>1</sup>, Xanthi D Andrianou<sup>4</sup>, Martina Del Manso<sup>1</sup>, Giulietta Venturi<sup>1</sup>, Claudia Fortuna<sup>1</sup>, Marco Di Luca<sup>1</sup>, Francesco Severini<sup>1</sup>, Maria Grazia Caporali<sup>1</sup>, Daniela Morelli<sup>2</sup>, Federica Iapaolo<sup>2</sup>, Ilaria Pati<sup>1</sup>, Letizia Lombardini<sup>1</sup>, Tamas Bakonyi<sup>4</sup>, Olivia Alexandra<sup>4</sup>, Patrizio Pezzotti<sup>1</sup>, Maria Gabriella Perrotta<sup>3</sup>, Francesco Maraglino<sup>3</sup>, Giovanni Rezza<sup>3</sup>, Anna Teresa Palamara<sup>1</sup>, Italian Arbovirus Surveillance network<sup>5</sup>

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2. Istituto Zooprofilattico Sperimentale dell'Abruzzo e del Molise, Teramo, Italy
3. Italian Ministry of Health, Rome, Italy
4. European Centre for Disease Prevention and Control (ECDC), Stockholm, Sweden
5. The members of the Italian Arbovirus Surveillance network are listed under Collaborators

## B. WNND by month



Geographical distribution of West Nile virus human infections in regions with at least one human case with onset or diagnosis up to 31 July, by affected municipality and degree of urbanisation, Italy, 2018 vs 2022



Riccardo et al. Euro Surveill 2022

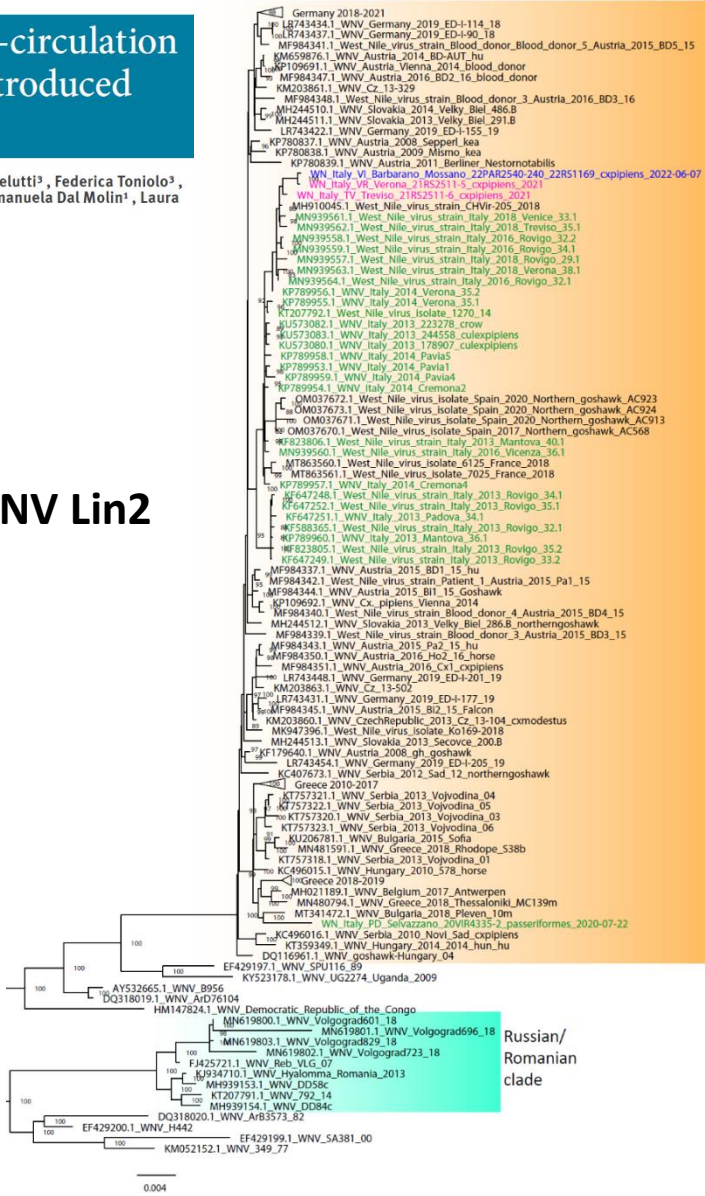
Data updated 24 August 2022.

# Early start of seasonal transmission and co-circulation of West Nile virus lineage 2 and a newly introduced lineage 1 strain, northern Italy, June 2022

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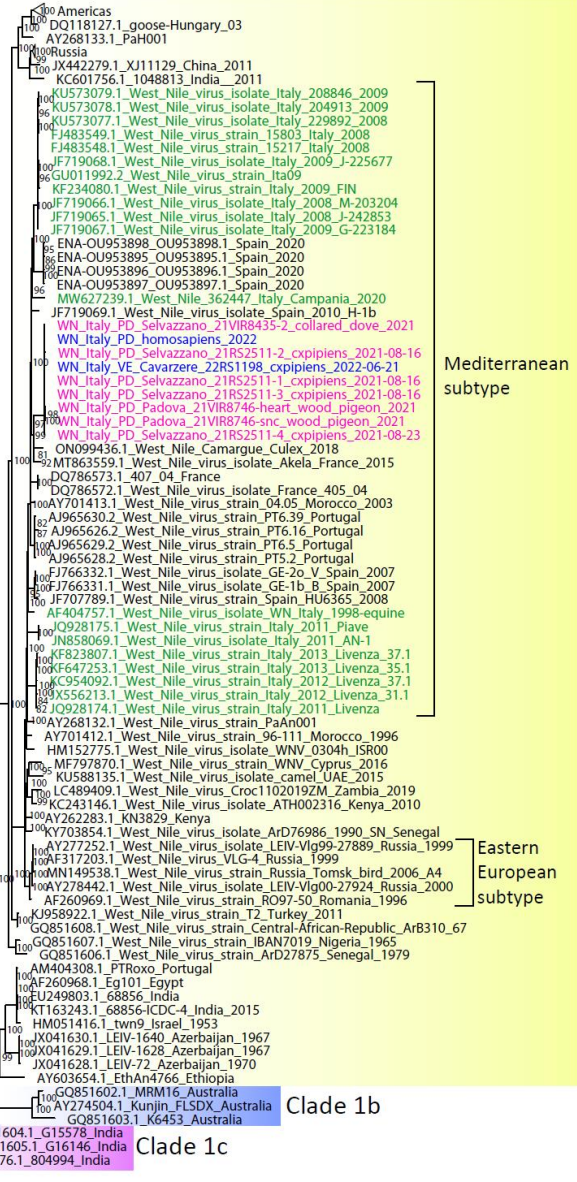
- 1. Department of Molecular Medicine, University of Padova, Padua, Italy
- 2. Microbiology and Virology Unit, Padova University Hospital, Padua, Italy
- 3. Istituto Zooprofilattico Sperimentale delle Venezie, Legnaro, Padua, Italy
- 4. Direzione Prevenzione, Sicurezza Alimentare, Veterinaria, Regione del Veneto, Venice, Italy

## WNV Lin2



Central-southern European clade

## WNV Lin1



Mediterranean subtype

Clade 1a

European subtype

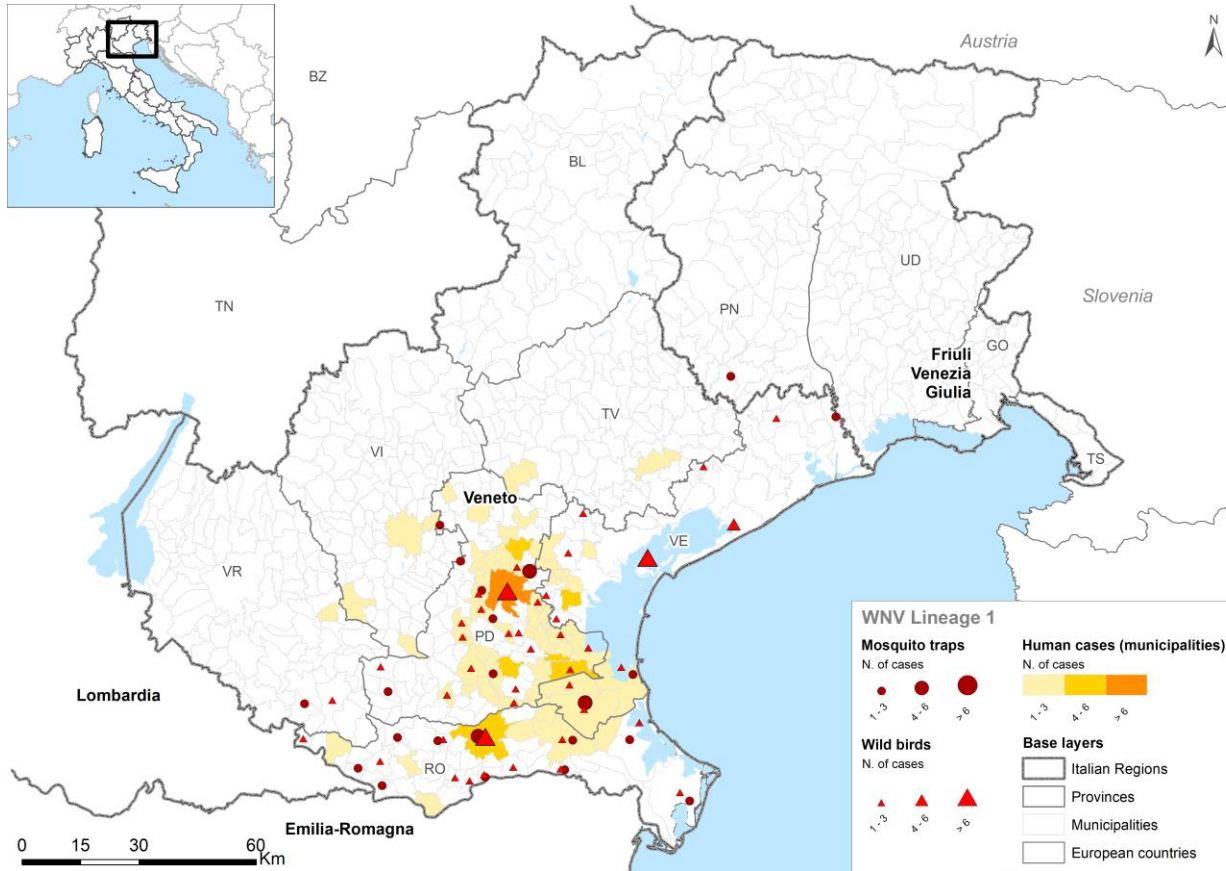
Clade 1b

Clade 1c

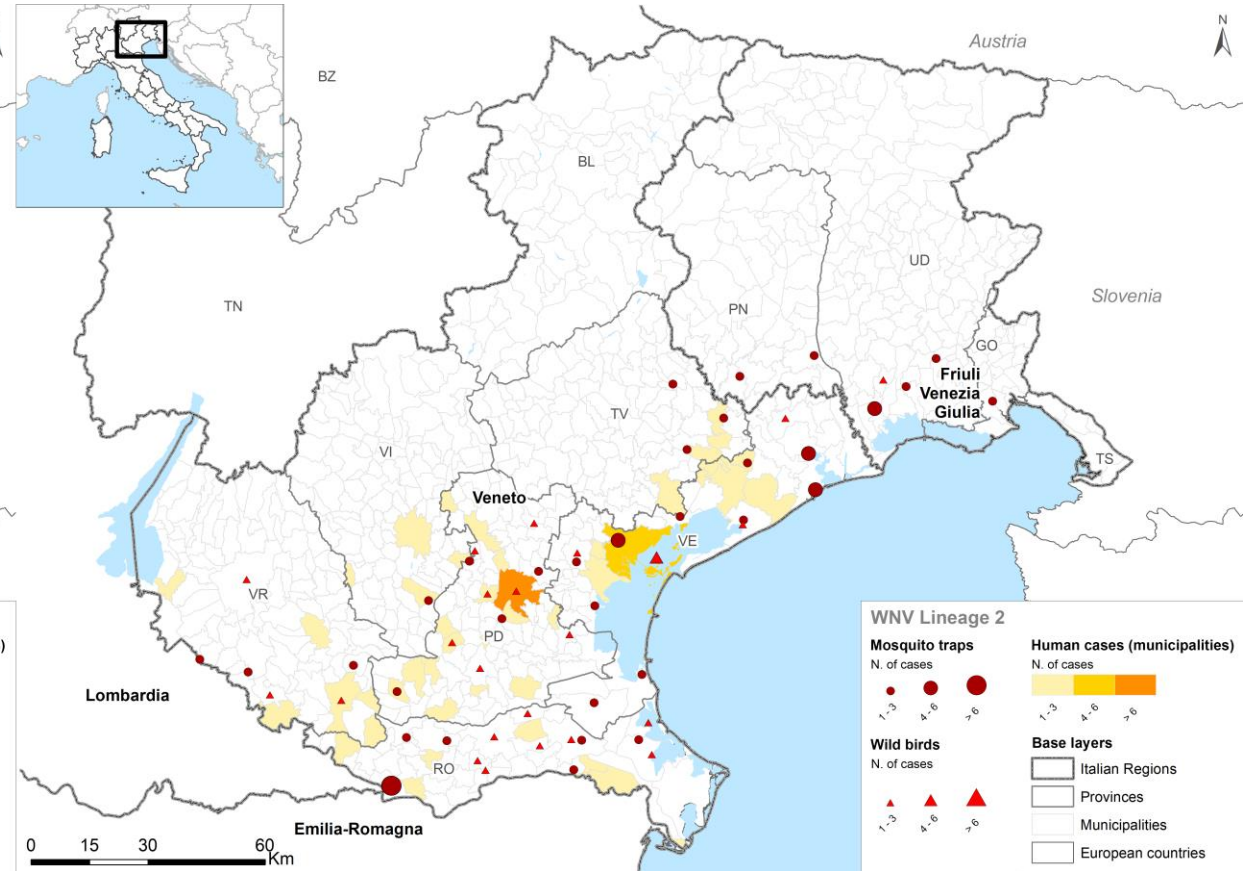
Barzon et al. Euro Surveill 2022

# WNV lineage 1 and 2, Veneto Region, as of August 12, 2022

## WNV Lineage 1

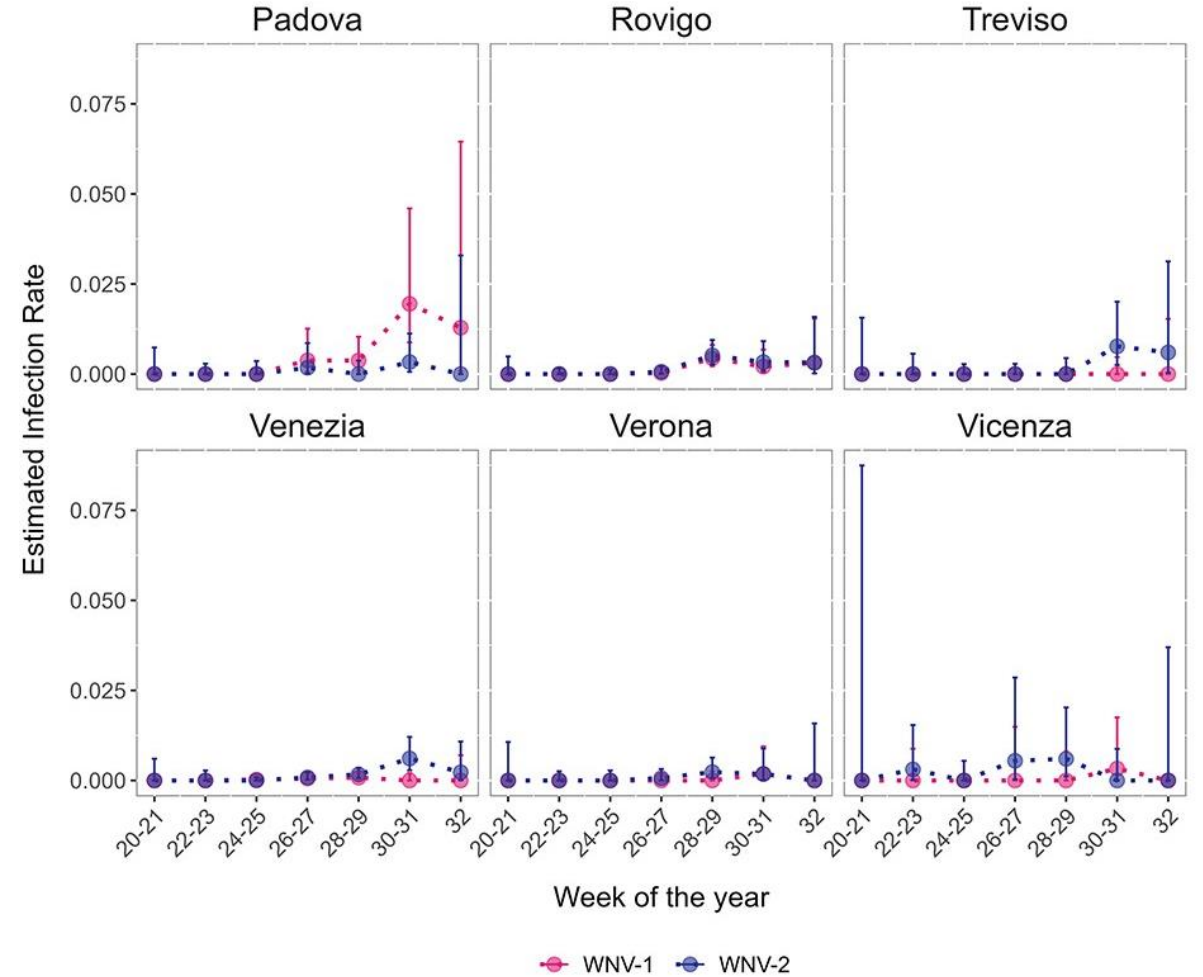
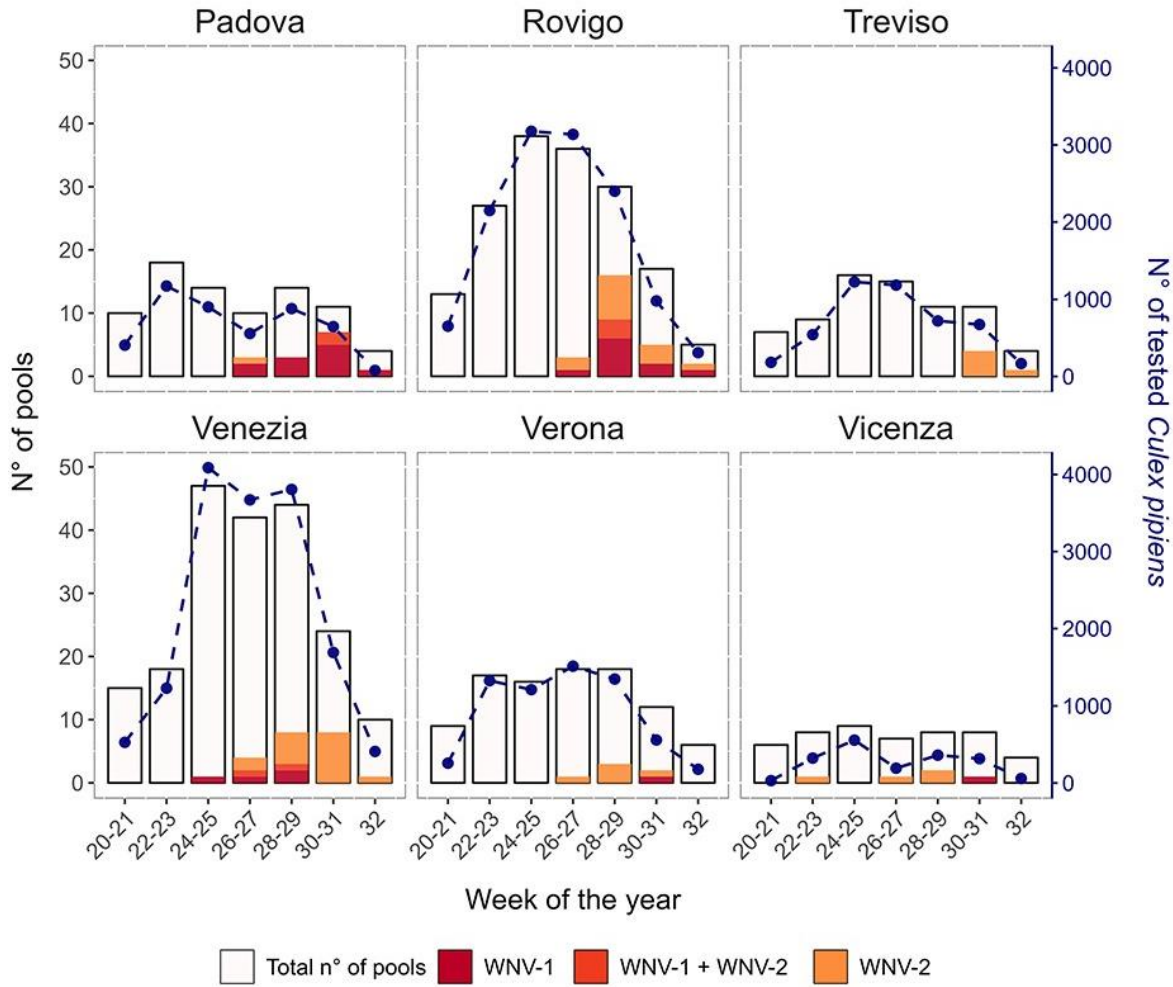


## WNV Lineage 2



Barzon et al. J Travel Med 2022

# WNV in mosquitoes, Veneto Region, 2022\*



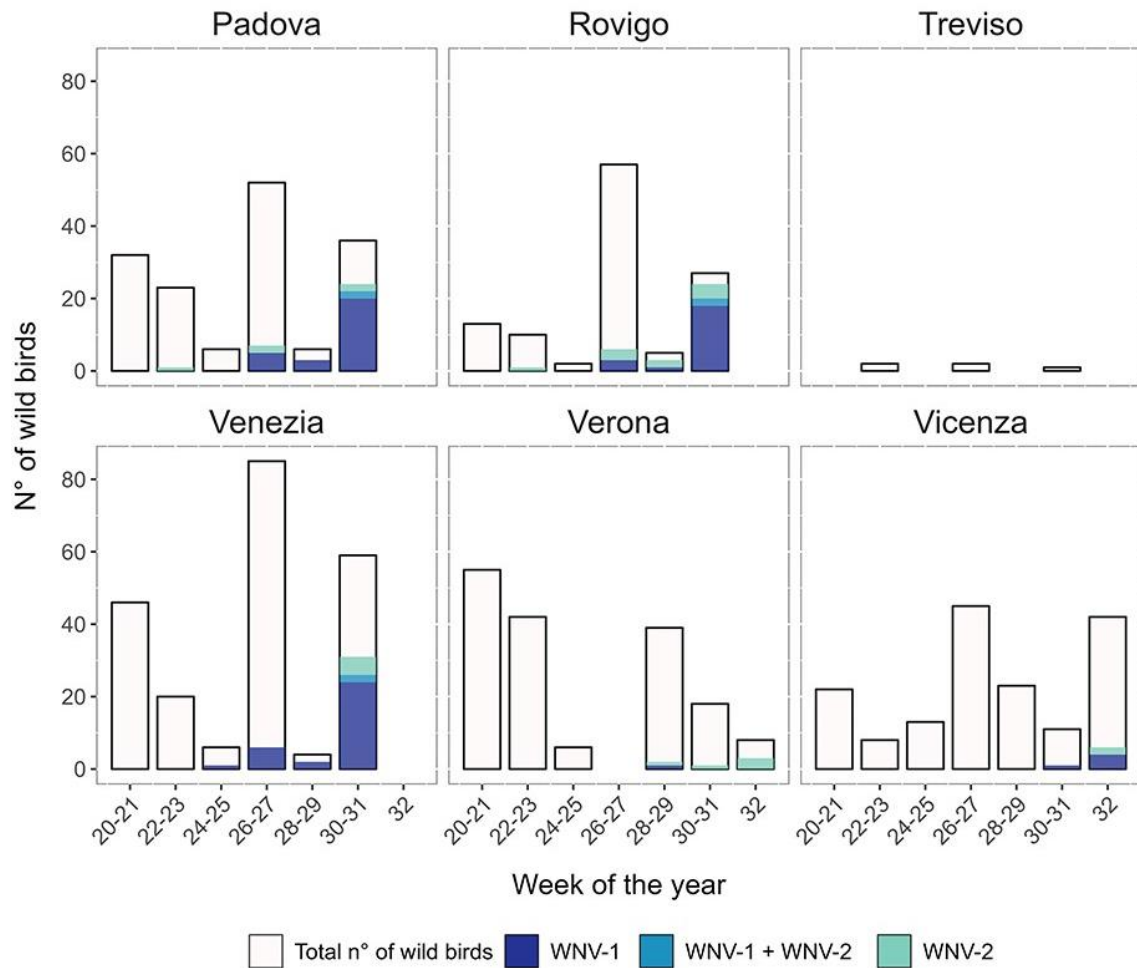
Number of tested and WNV-positive *Cx. pipiens* pools per province on a bi-weekly basis; the dashed line indicates the total number of tested mosquitoes (right axis)

Bi-weekly MLE for WNV-1, and WNV-2 mosquito infection rate per province; vertical lines represent 95% CI.

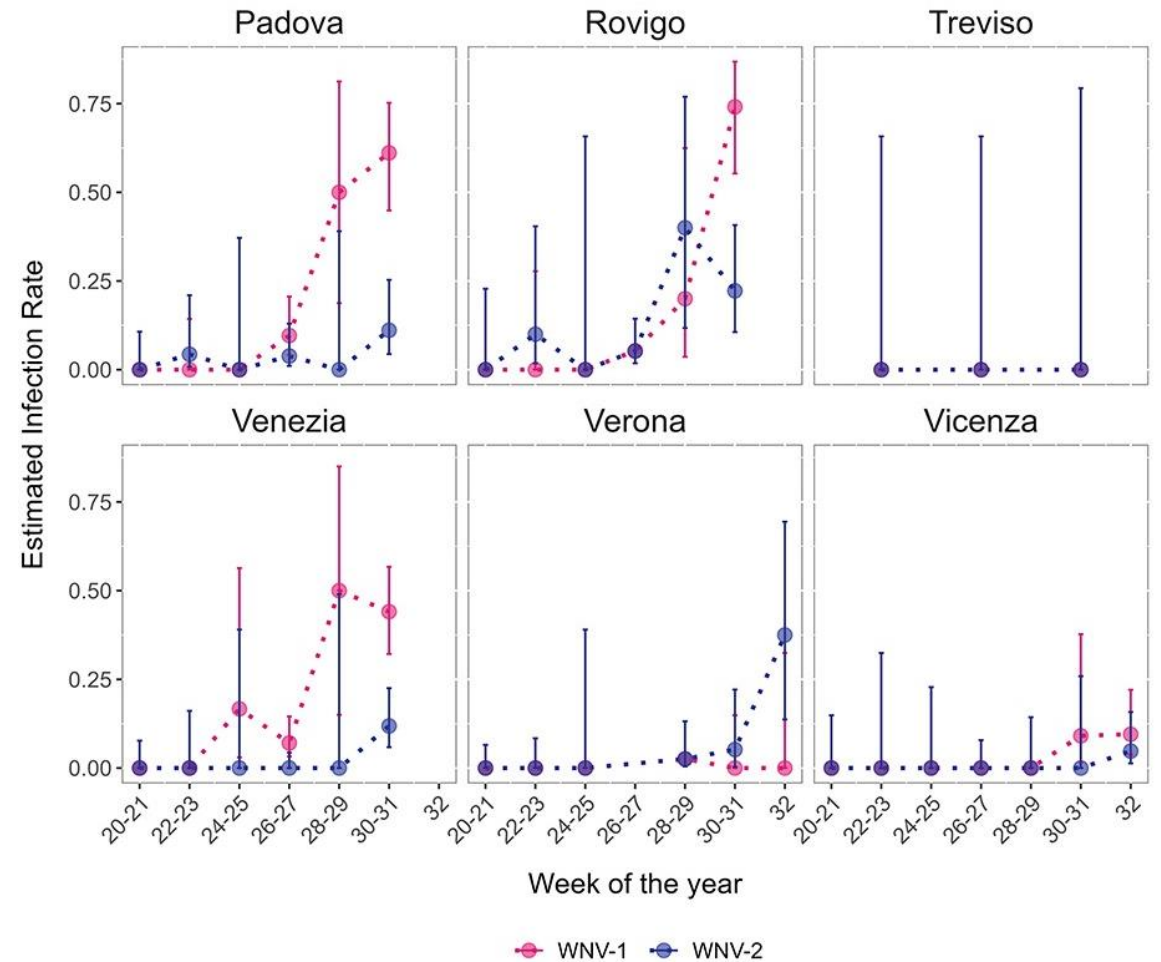
Barzon et al. *J Travel Med* 2022

\*as of August 12, 2022

# WNV in wild birds, Veneto Region, 2022\*



Number of tested and WNV-positive wild birds per province on a bi-weekly basis

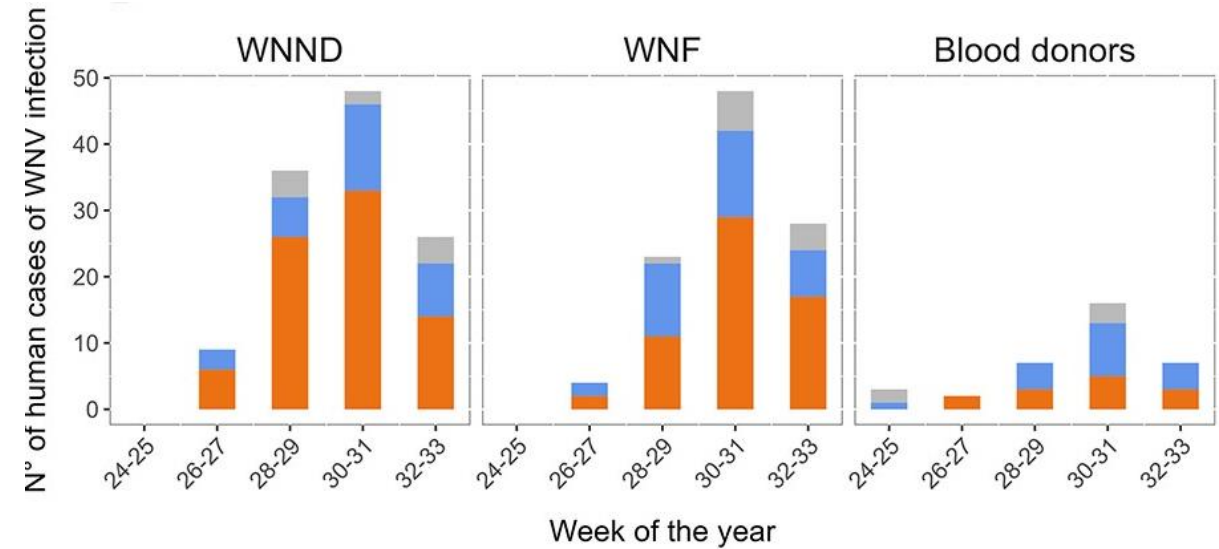
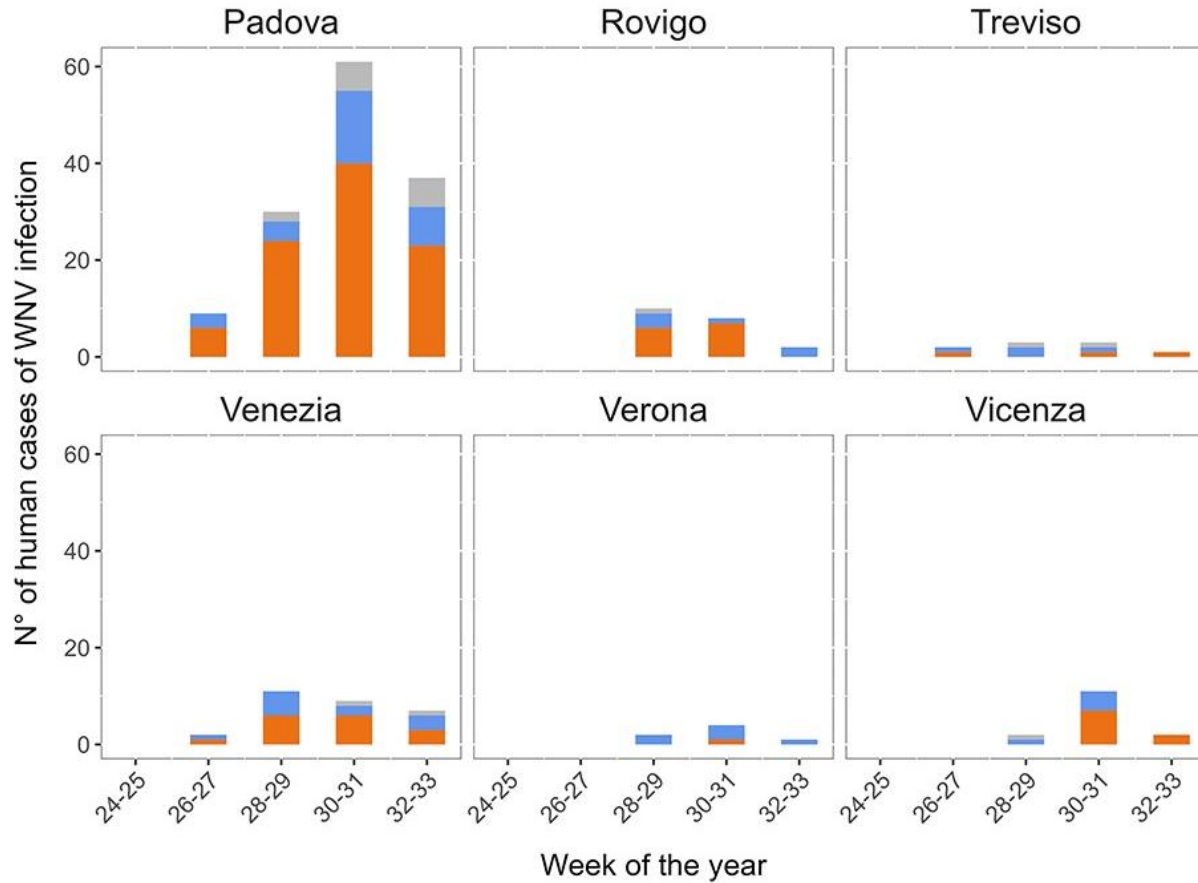


Bi-weekly MLE for WNV-1 and WNV-2 bird infection rate per province; vertical lines represent 95% CI

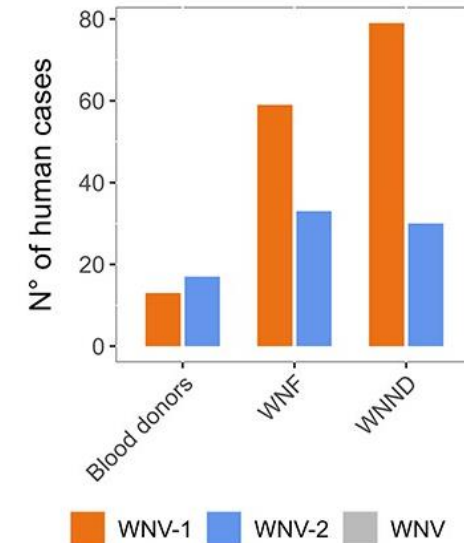
\*as of August 12, 2022

Barzon et al. J Travel Med 2022

# WNV in humans, Veneto Region, 2022\*



WNV lineages according to diagnosis



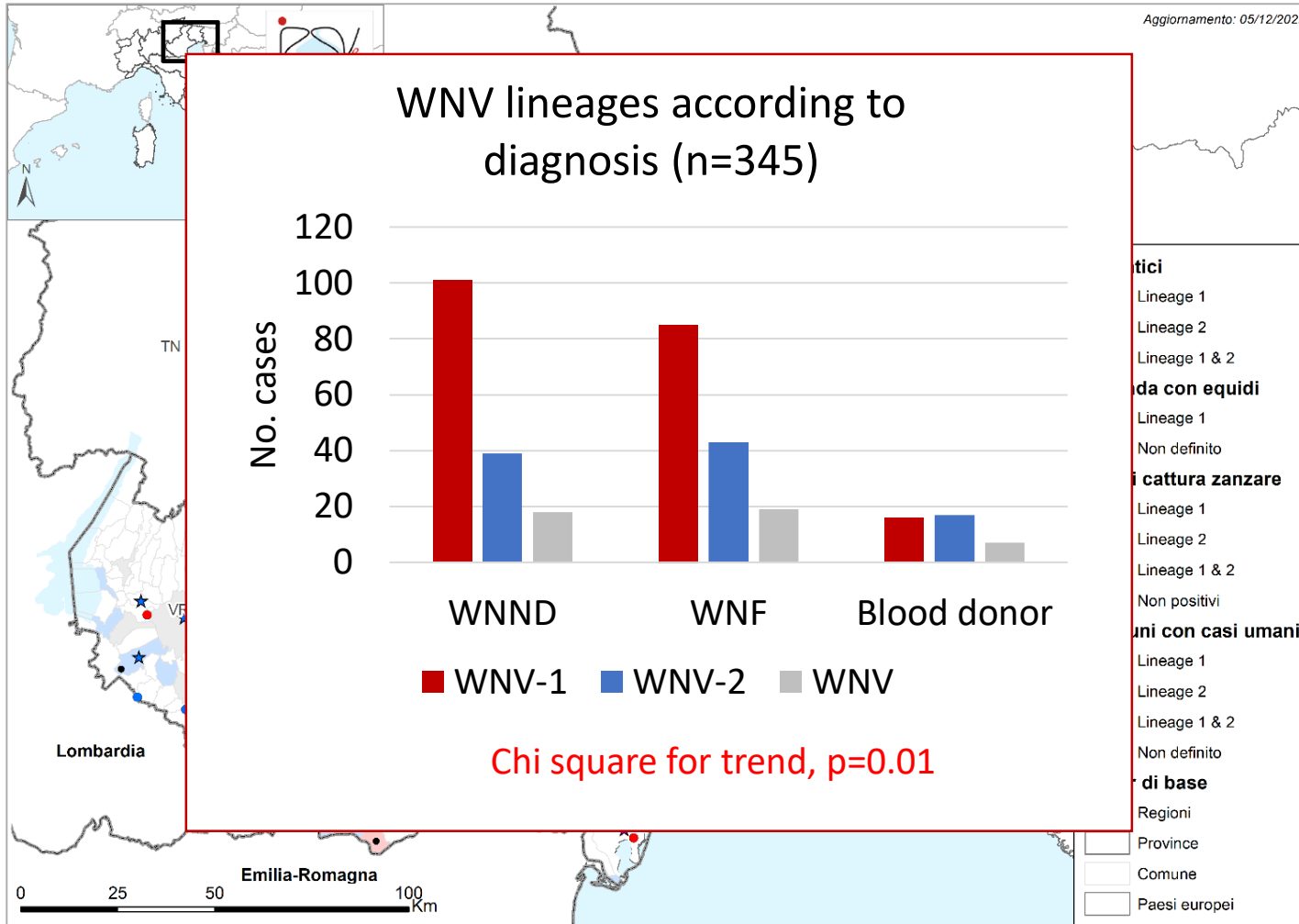
\*  $p=0.0043$ , Chi-square test for trend.

Temporal distribution of human cases of WNV infection according to WNV lineage, province, week (aggregated on a biweekly basis) of symptom onset and diagnosis (WNND, WNF, blood donors).

\*as of August 12, 2022

Barzon et al. J Travel Med 2022

# Results of WNV surveillance, Veneto Region, 2022



**Mosquitoes** (n = 103,611 tested)

WNV-1 = 51 pools (43%)

WNV-2 = 68 pools (57%)

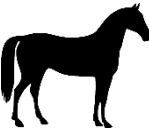
USUV = 18 pools



**Equids**

WNV-1 = 3 horses (1 death), 1 donkey (100%)

WNV IgM = 8 horses, 1 donkey



**Wild birds** (n = 2,149 tested)

WNV-1 = 127 (68%)

WNV-2 = 59 (32%)

WNV-1/2 = 4

USUV = 22



**Humans** (n = 1,949 tested)

WNV-1 = 181 (69%)

WNV-2 = 82 (31%)

WNV (serology) = 133

USUV (serology) = 1

**Blood donors** (n = 100,000)

WNV-1 = 18 (54.5%)

WNV-2 = 15 (45.5%)

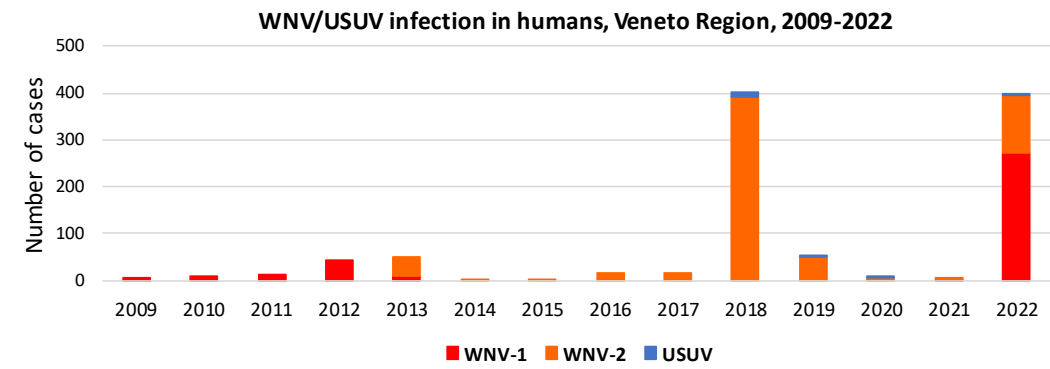
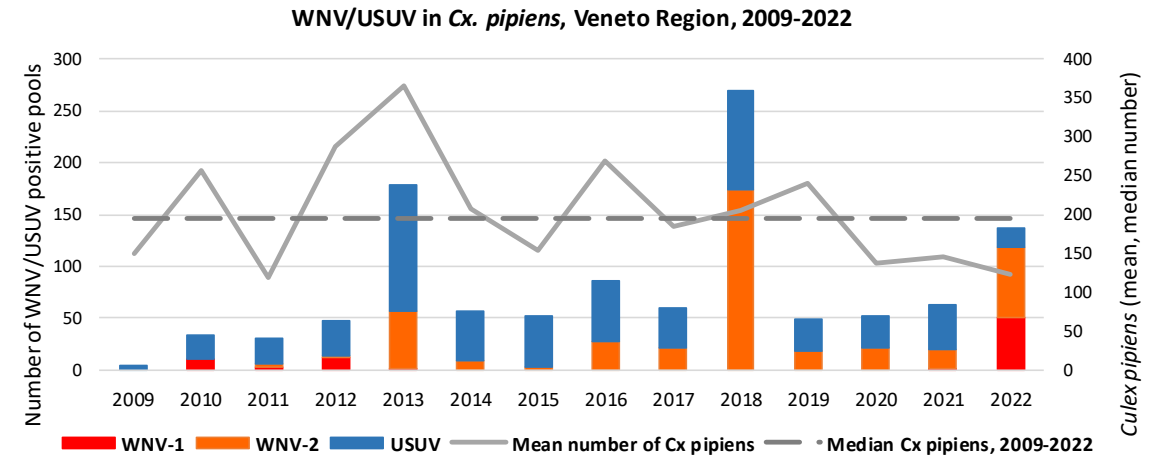
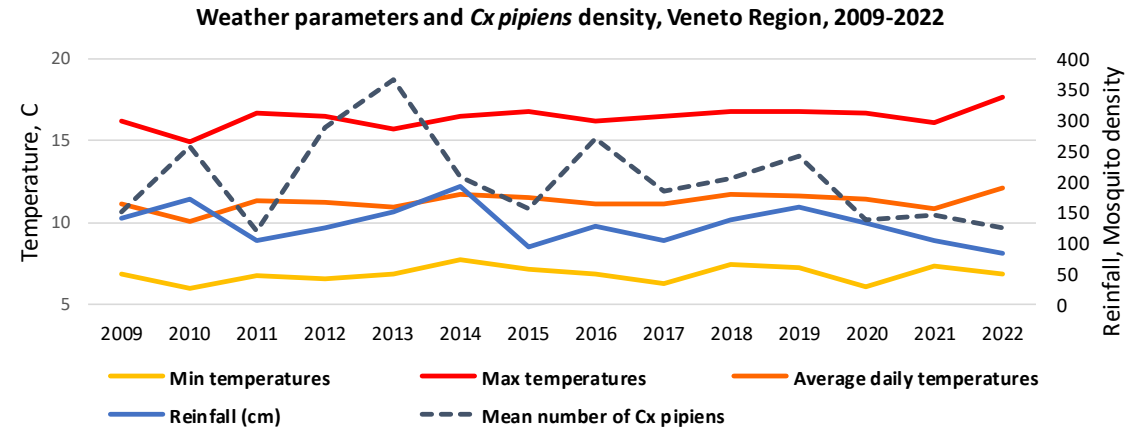
WNV (serology) = 9

USUV (serology) = 0



# Climate change and the emergence of vector-borne viral infections

Climate parameters, mosquito density and WNV/USUV outbreaks, Veneto Region, Italy, 2009-2022





# WNV infection in humans and animals, Veneto Region, 2023

**First positive mosquito pool:** July 13, 2023

Trigger for SoHO donor screening

**First human case:** Symptom onset July 13; WNND, WNV-2, Verona.

**WNV lineage 1**

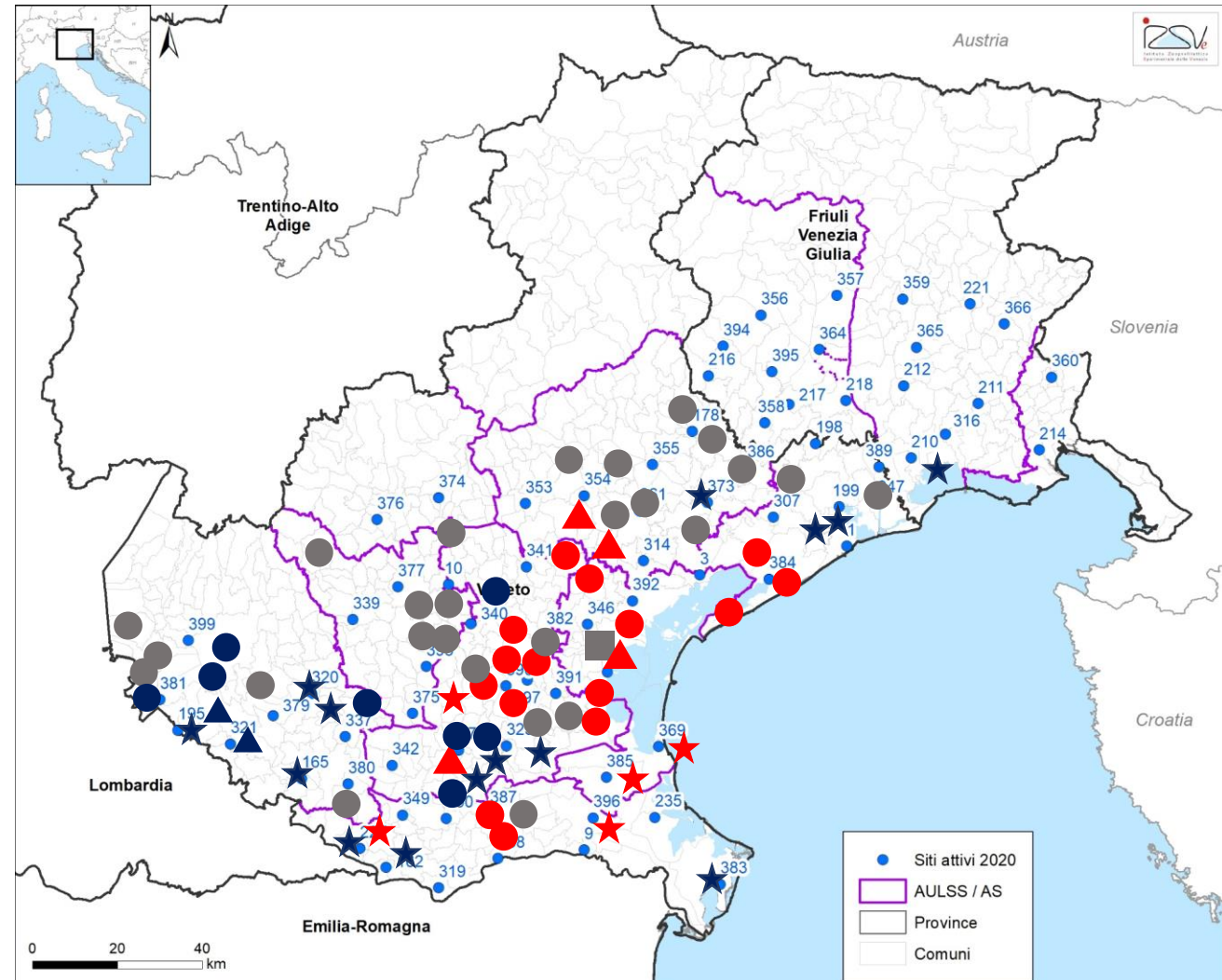
**WNV lineage 2**

WNV lineage not defined

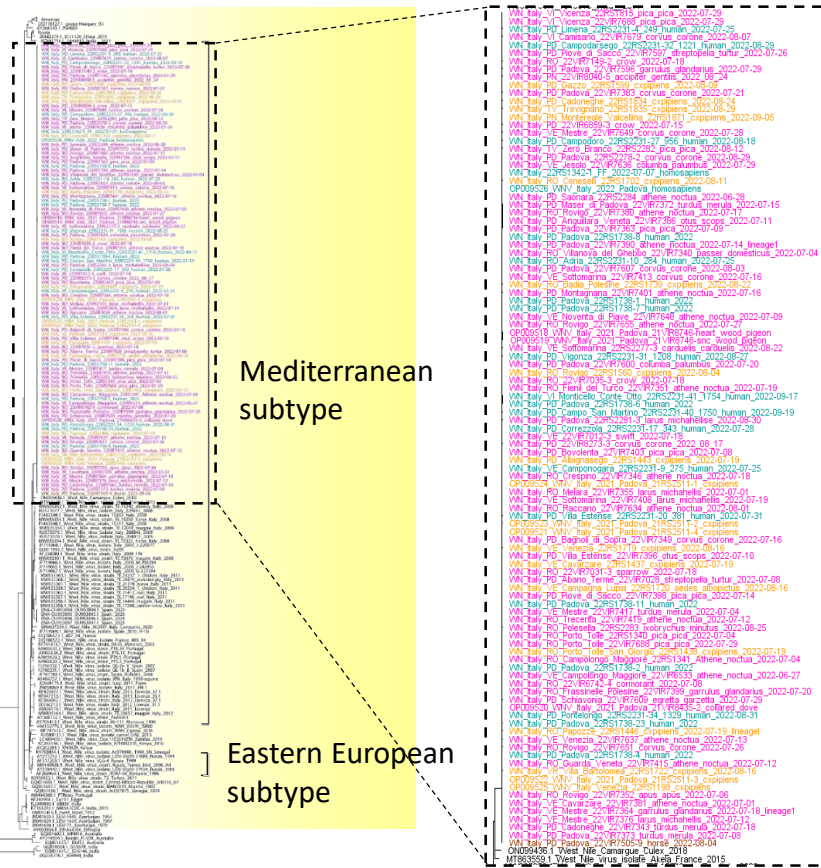
- human
- ▲ bird
- equids
- ★ mosquito

Human cases: 19 WNND, 32 WNF, 4 blood donors

**In Italy**, n = 298 human cases (172 with WNND, 61 with WNF, 65 blood donors); **WNV-1 detected in Veneto, Emilia-Romagna, Sicilia, and Campania**



# Phylogenetic and phylogeographic analysis of WNV lineage 1, Veneto Region, 2021-2023



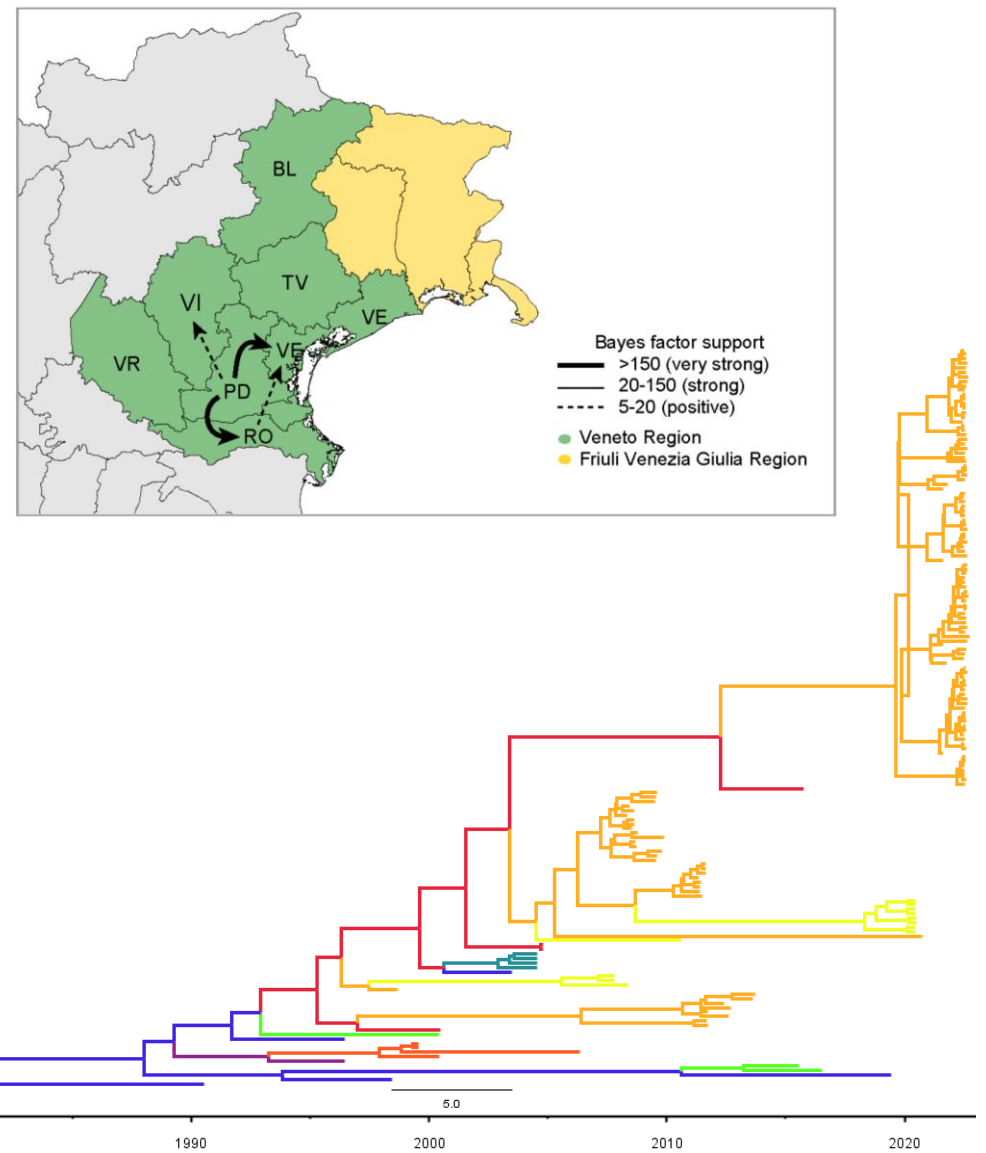
- avian
  - human
  - mosquito
  - horse
- Clade 1a

N=107 full genomes

No clustering according to species or geographical area

Diversity <99.89%

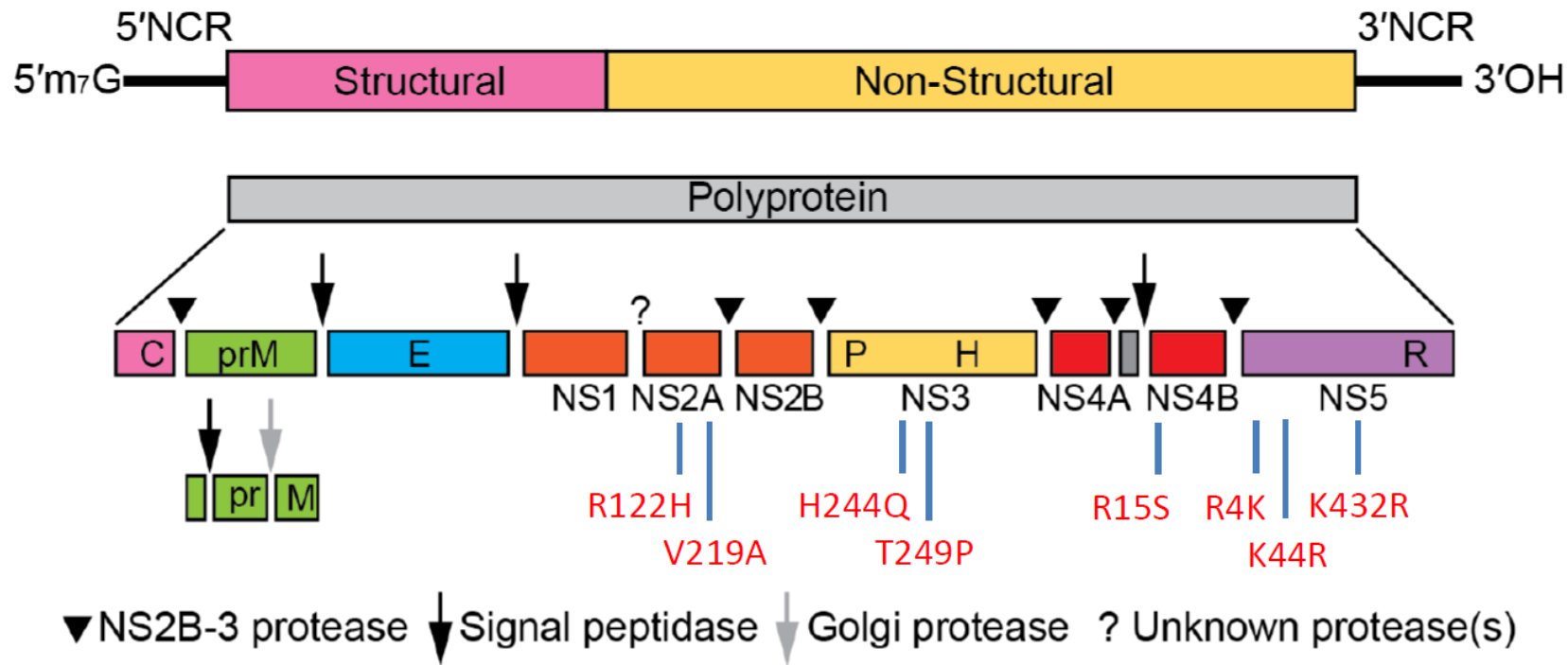
- Location
- Africa
  - France
  - Italy
  - MiddleEast
  - Portugal
  - Romania
  - Russia
  - Spain



I Monne, E Quaranta, A Fusaro, B Zecchin, C Terregino, G Capelli, 2022

# Amino acid changes in WNV-1 IT2022 vs France/2015-1A

vs. West Nile virus strain Akela/France/2015-1A



▼ NS2B-3 protease    ↓ Signal peptidase    ↓ Golgi protease    ? Unknown protease(s)

	prM	NS1	NS2A			NS2B				NS3		NS4A	NS4B		NS5			
	22	138	122	149	219	97	100	103	107	244	249	61	15	245	4	44	202	432
MT863559.1_Akela/France/2015	V	P	R	T	V	I	L	A	I	H	T	S	R	I	R	K	Y	K
Veneto e FVG 2021-2022	A (4%)	L (2%)	H (100%)	A (7%)	A (94%)	M (6%)	I (2%)	V (5%)	V (5%)	Q (100%)	P (99%) L (1%)	G (6%)	S (100%)	M (4%)	K (100%)	R (100%)	H (2%)	R (100%)

# Acknowledgements



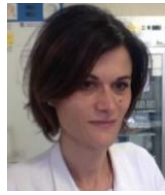
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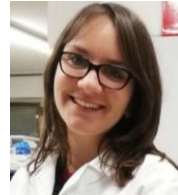
**M Pacenti**



**A Sinigaglia**



**M Trevisan**



**S Vogiatzis**



**E Dal Molin**



**C Lucca**



**A Volpe**



**G Capelli**



**F Montarsi**



**F Gobbo**



**M Bertola**



**I Monne**



**A Fusaro**



**C Terregino**



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infectious disease  
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Horizon2020, project no. 874735



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