



# Headline events from global FMD surveillance activities (2023)

*Andrew Shaw*

**Acknowledgements:** Donald King, Valerie Mioulet, Nick Knowles, Anna Ludi, Britta Wood, Ginette Wilsden, Krupali Parekh, Antonello Di Nardo, Jemma Wadsworth, Clare Browning, Mark Henstock, Hayley Hicks, Victoria Chantler, David Paton, Dexter Wiseman, Jozhel Baguisi, Harry Bull, Amy McCarron, Bryony Armson, Sarah Belgrave, Sarah Belton



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## Summary of 295 samples tested during 2023 (to date):

Country of origin	FMDV detection								
	Total	Serotype							No Virus Detected
		O	A	Asia-1	SAT1	SAT2	SAT3	FMD GD	
<b>Bahrain</b>	10					5		3	2
<b>Egypt</b>	34	3	13					16	2
<b>Iraq</b>	12					10		2	0
<b>Israel</b>	6	Pending							
<b>Jordan</b>	27					23		4	0
<b>Nepal</b>	80	35						32	13
<b>Nigeria</b>	13	10						3	0
<b>Pakistan</b>	50	11	5	12				11	11
<b>Palestine</b>	4	Pending							
<b>Qatar</b>	7				7				0
<b>Rep. Korea</b>	1	1							0
<b>Thailand</b>	24	17	7						0
<b>Uganda</b>	27	4						5	18

Additional genotyping reports issued for sequences from: Comoros, Israel, Iraq, Jordan, Libya, Malawi, Malaysia, Oman, Palestine, Republic of Korea, Tunisia, Türkiye [www.pirbright.ac.uk](http://www.pirbright.ac.uk)

# Pool 1: Status in 2023

## Characterisation of different FMD virus lineages



Based on data from WRLFMD, RRLSEA, the WOA/FAO Lab Network and reported

Country	O					A		Asia-1
	ME-SA/Ind-2001e	SEA / Mya-98	CATHAY	ME-SA / PanAsia	ME-SA/ PanAsia-2	ASIA / Sea-97	ASIA/Ind	
Cambodia	2019	2016		2019		2016		
Laos	2020	2017		2018		2018		
Malaysia	2022	2016	2005	2020	2009	2022*		
Myanmar	2021	2021				2021	2010	2017
Thailand	2021	2018	2012	2019		2022*		
Vietnam	2022	2019	2018	2018		2017		2006
Indonesia	2023							
PR China	2021	2020	2022	2019		2019		2009
Mongolia	2022	2018		2017		2016		

Is this the true picture of FMD in SEACFMD countries?

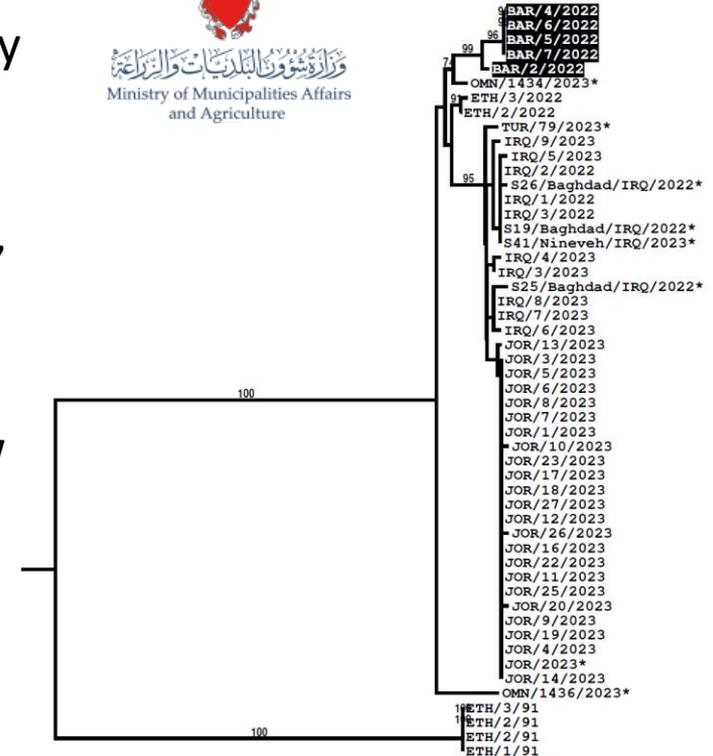
\* Not sequenced @ WRLFMD

..... or does under-sampling bias our understanding of the epidemiology?

[www.pirbright.ac.uk](http://www.pirbright.ac.uk)

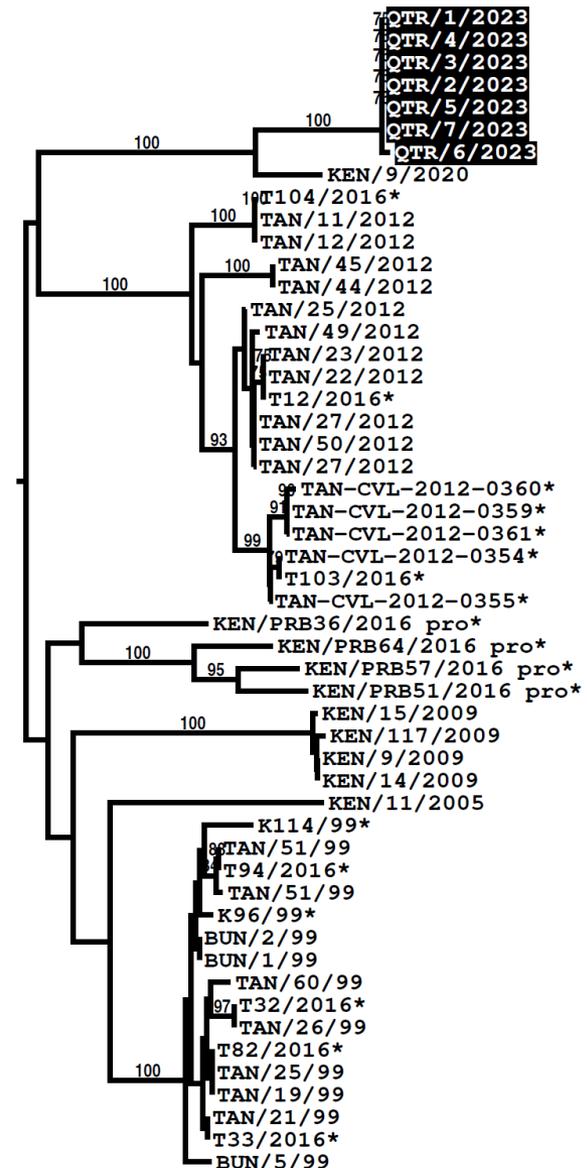
# Update on outbreaks due to the SAT2/XIV topotype

- VP1 sequence data and samples:  
kindly shared by colleagues at: Central Veterinary laboratory and Researches Veterinary Dept, Iraq; FMD (ŞAP) Institute, Türkiye; JUST, Jordan, Central Laboratory of Animal Health, Oman; Sultan Qaboos University, Oman; ANSES, France and AHI, Ethiopia
- Most closely related to sequences recovered from samples collected in SW Ethiopia in 2022
- To our knowledge, this is the first time that serotype SAT 2 has been detected in Iraq, Jordan or Türkiye
- Topotype XIV has been detected on only one other previous occasion – in 1991

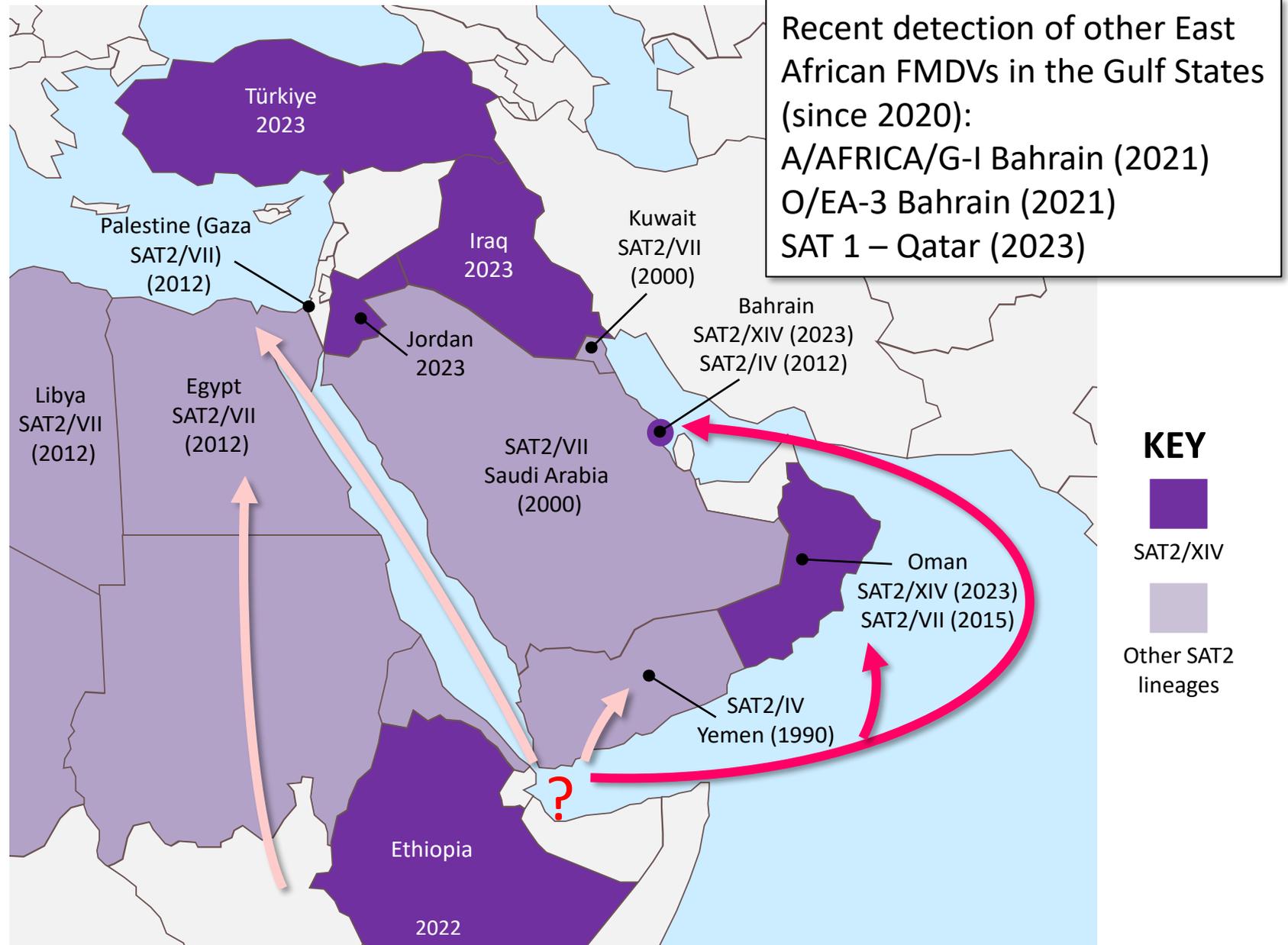


# SAT 1: further unexpected events in the Middle East

- Samples submitted from Qatar
- Cattle – sampled in April/May 2023
- **Serotype SAT 1 – topotype I**
- ~96% identical to virus from Kenya (2020)
- Vaccine matching >0.3 for the SAT1/Rho-78 vaccine from BI
- Genetically distinct to SAT1/I viruses from Comoros - where closest virus is from Tanzania from 2014
- These two incursions are not closely related but concurrence may indicate a general upsurge in SAT 1 in East Africa?

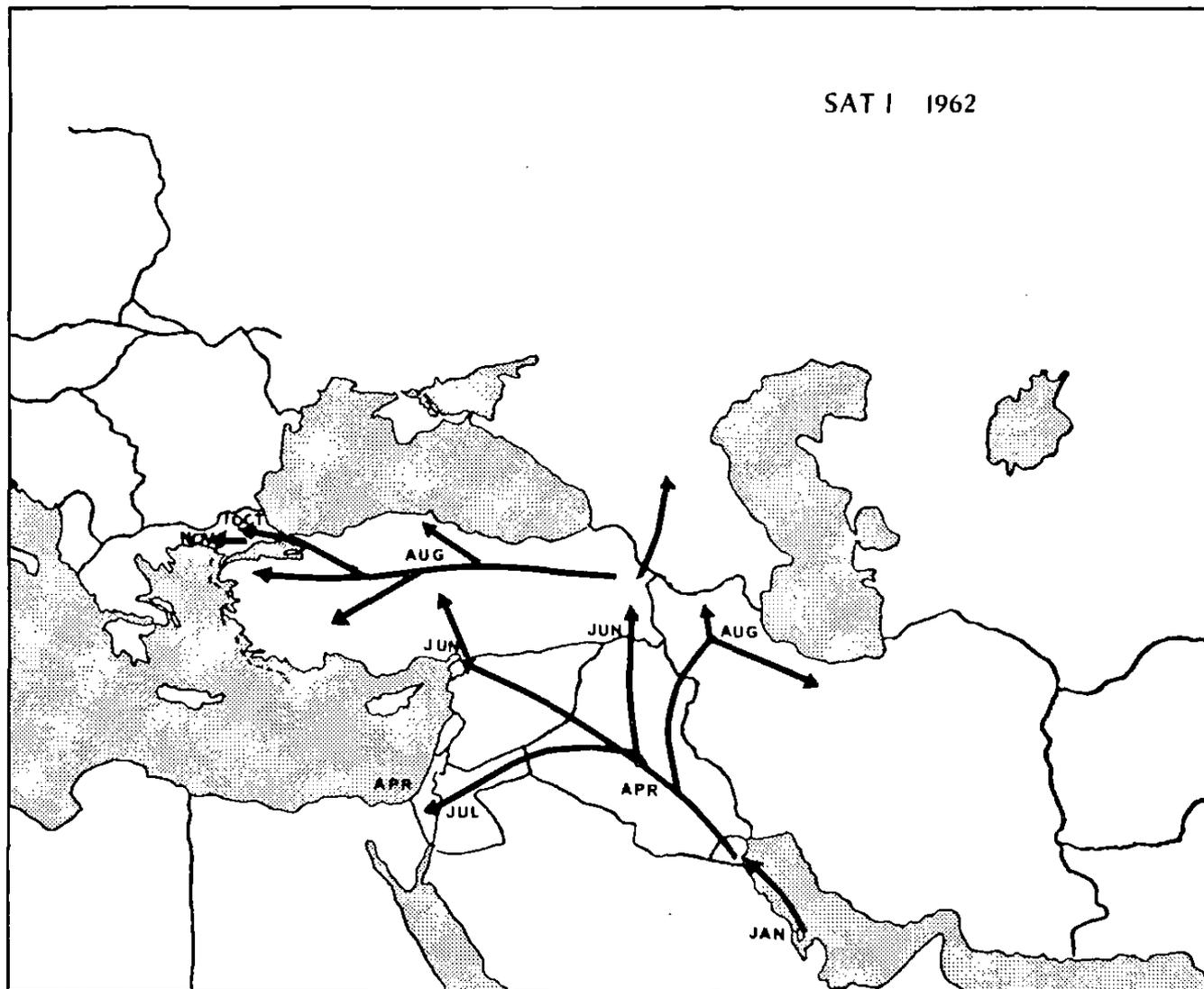


# Virus sources in North Africa/Middle East



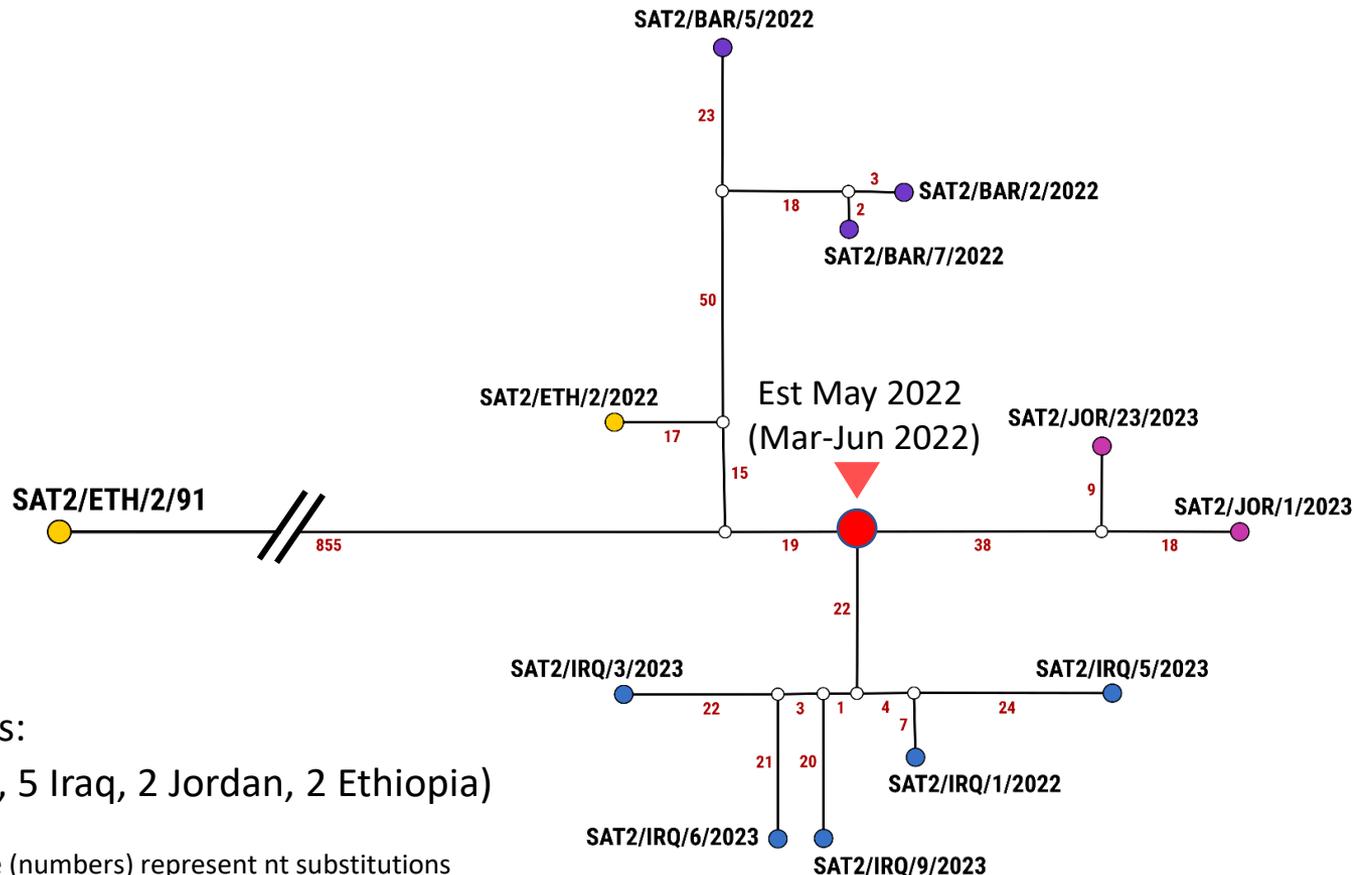
Arrows represent putative transmission pathways in the region (based on sequence relationships for previous outbreaks)

J.B. BROOKSBY (1986) Foot-and-mouth disease: an introduction  
*Rev. sei. tech. Off. int. Epiz.*, 1986, 5 (2), 257-263.



# SAT2/XIV full genome sequencing

- Multiple introductions of SAT2/XIV into the Middle East?
- Jordanian sequences are NOT interleaved with those from Iraq
- Date of IRQ/JOR ancestor (●) estimated by Bayesian analyses
- Missing (unsampled cases) from Iraq, Jordan - or elsewhere?



12 samples:  
(3 Bahrain, 5 Iraq, 2 Jordan, 2 Ethiopia)

TCS tree where (numbers) represent nt substitutions

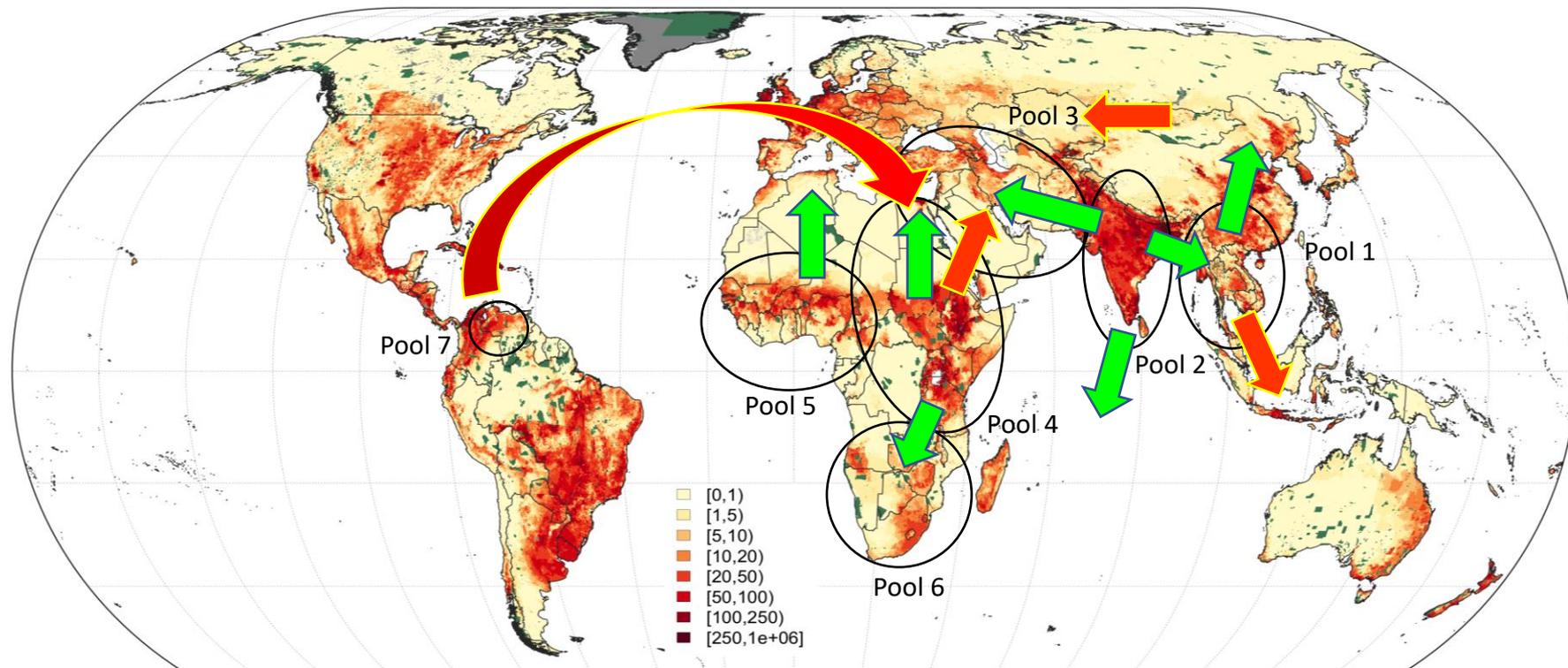
# SAT2/XIV: control via vaccination?

- SAT2 vaccines are not widely used to control FMD outbreaks in the region
- Vaccine matching results from Pirbright:

Isolate	SAT2 Eritrea 98 (BI)		SAT2 ZIM 7/83 (BI)	
	neut	$r_1$ value	neut	$r_1$ value
SAT2/ETH/2/2022	1.62	0.81	2.17	0.54
SAT2/ETH/3/2022	1.66	0.49	1.70	0.15
SAT2/IRQ/2/2022	1.75	0.73	2.04	0.38
SAT2/IRQ/5/2023	1.61	0.53	2.33	0.74
SAT2/IRQ/9/2023	1.51	0.42	1.95	0.31
SAT2/JOR/11/2023	1.69	0.58	1.74	0.20
SAT2/JOR/20/2023	1.85	0.83	1.81	0.24
SAT2/JOR/26/2023	1.86	0.66	1.94	0.32
SAT2/BAR/2/2022	1.50	0.40	1.85	0.39
SAT2/BAR/7/2022	1.62	0.53	1.99	0.53

- Pirbright will perform an *in vivo study* to support the field use of these vaccines (Oct-Dec 2023) – funded by Defra and BI

# Trans-pool movements are important



Cattle density map

Robinson et al., 2007

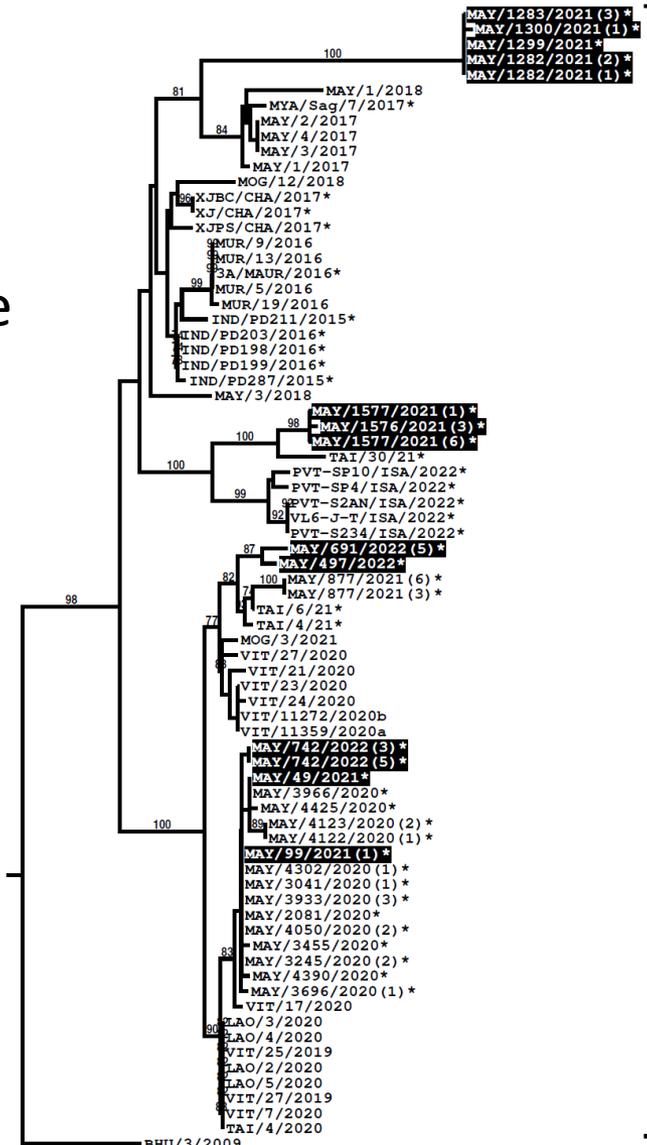
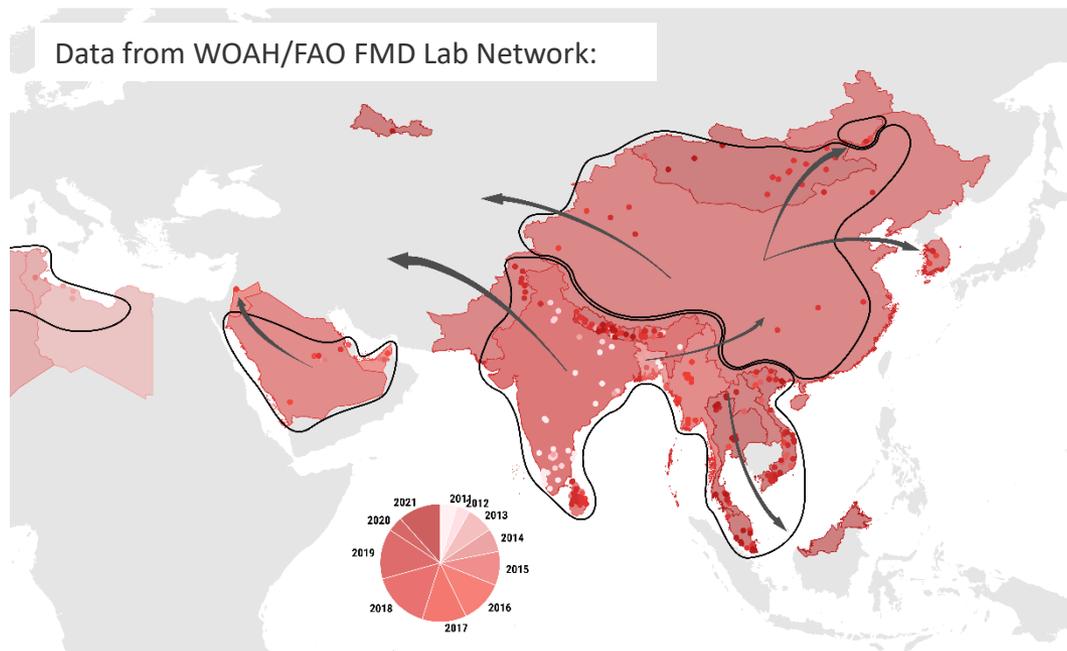
➔ New events 2021-23

Long distance (trans-pool) FMDV movements (since 2015)

- Impact/change regional FMD risks including FMD free countries
- Selection of vaccines to control outbreaks

# Conjectured distribution of O/ME-SA/Ind2001e

- O/ME-SA/Ind-2001e is the most widely-spread FMDV lineage
- Sequences are heterogenous in SEA (i.e. multiple genetic clades of this lineage are present)



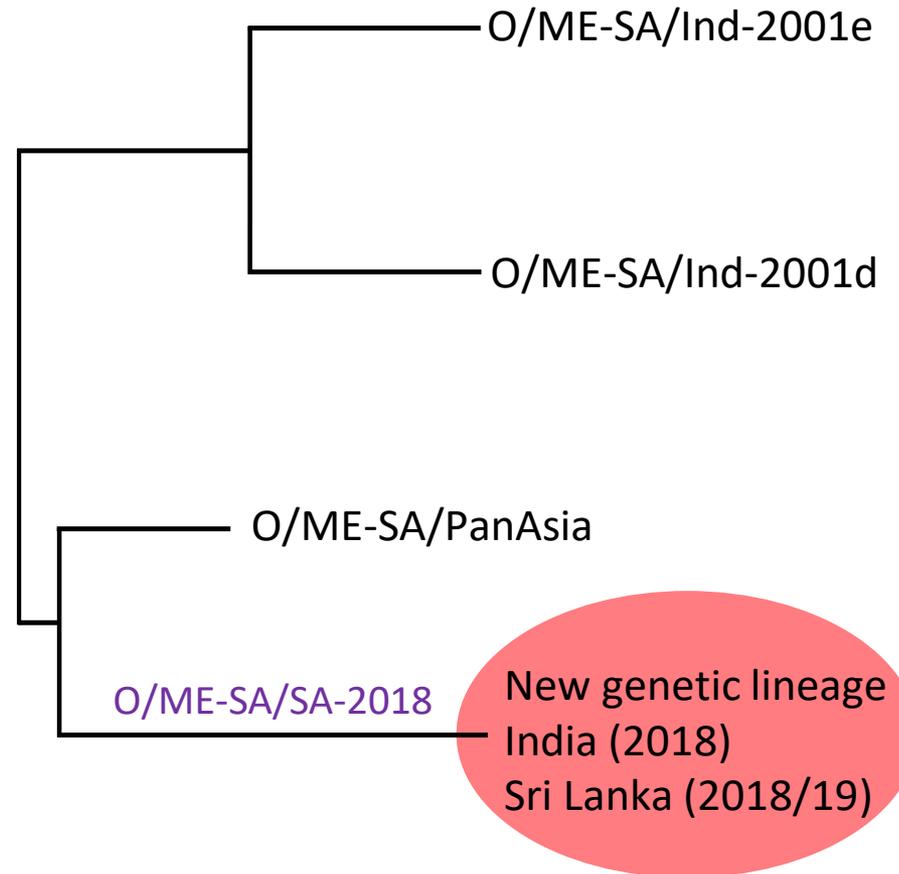
Data kindly shared by the Malaysian National Foot-and-Mouth Disease Laboratory (MNFMDL)

# Brewing up the next serotype O virus lineage

- History of pandemic serotype O lineages emerge from Pool 2

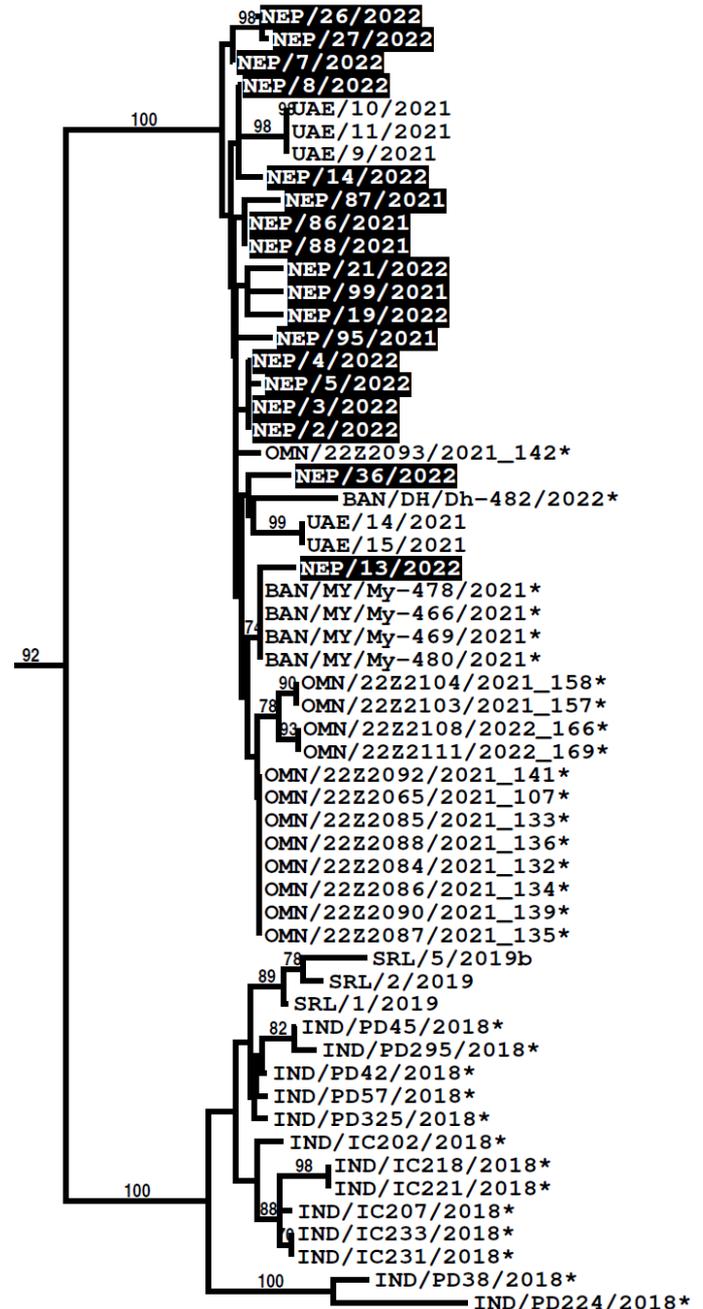


<https://www.thinglink.com/scene/451911993104793602>

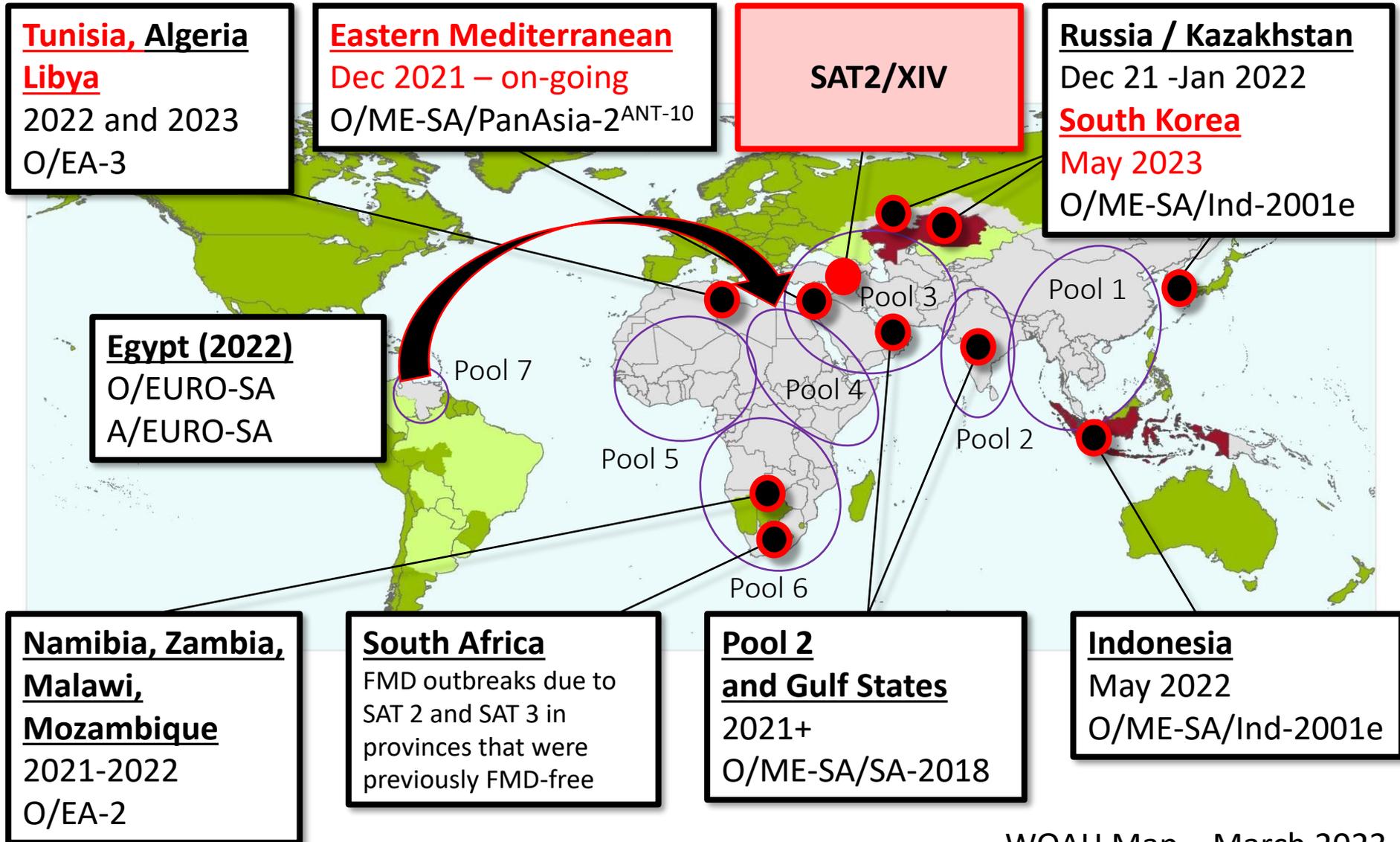


# Pool 2/3: O/ME-SA/SA-2018: an emerging lineage that threatens SEA ?

- New serotype O lineage detected in Pool 2 (India, Nepal, Bangladesh and Sri Lanka)
- Lineage estimated to represent ~ 40% of serotype O cases in India
- Detected in Pool 3 (UAE and Oman) in 2021 in small ruminants
- Scope to spread more widely – following pathways for O/ME-SA/Ind-2001 (d and e)
- Vaccine matching for this lineage appears to be similar to O/ME-SA/Ind-2001e



# Headline global events (2021/23)



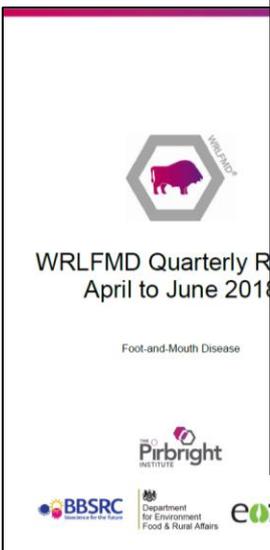
WOAH Map – March 2023

# Further information.....

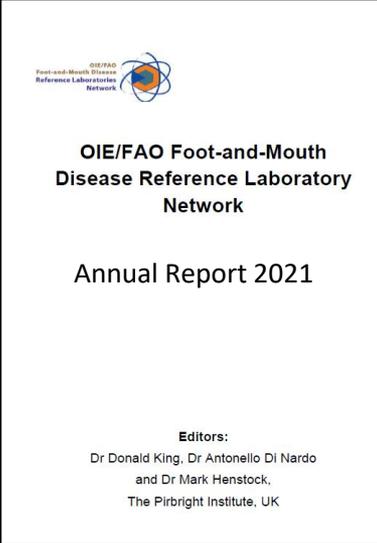
- FMD reports and lab testing (<https://www.wrlfmd.org/ref-lab-reports>)
  - *Genotyping reports, Vaccine matching and Serotyping reports*
- Other data sources:
  - Quarterly WRLFMD/EuFMD report (<https://www.wrlfmd.org/ref-lab-reports>)
  - Annual report of the WOA/FAO FMD Laboratory Network (<http://foot-and-mouth.org/>)



The screenshot shows the WRLFMD website interface. At the top, there is a navigation menu with links for WRLFMD, REPORTS, LABORATORY PROTOCOLS, NEWS, EVENTS, and RELATED SITES. Below the menu is a large, colorful world map with a text overlay that reads "FOOT-AND-MOUTH DISEASE". Underneath the map, there is a "Welcome" section featuring the WRLFMD logo (a purple bull silhouette inside a hexagon) and a paragraph stating that the Pirbright Institute is designated as the World Reference Laboratory for Foot-and-Mouth Disease by the Food and Agriculture Organization (FAO) of the United Nations and as a reference laboratory for FMD by the Office International des Epizooties (OIE). To the right of the welcome message is a "Country FMD Reports" section with a world map and a link to "Country Reports".



The cover of the WRLFMD Quarterly Report for April to June 2018. It features the WRLFMD logo at the top center. Below the logo, the text reads "WRLFMD Quarterly Report April to June 2018" and "Foot-and-Mouth Disease". At the bottom, there are logos for BBSRC (Department for the Environment, Food & Rural Affairs) and eofmd.



The cover of the OIE/FAO Foot-and-Mouth Disease Reference Laboratory Network Annual Report 2021. It features the OIE/FAO logo at the top center. Below the logo, the text reads "OIE/FAO Foot-and-Mouth Disease Reference Laboratory Network" and "Annual Report 2021". At the bottom, it lists the editors: Dr Donald King, Dr Antonello Di Nardo, and Dr Mark Henstock, The Pirbright Institute, UK.

# Acknowledgements

- Support for the WRLFMD and research projects
- Collaborating FMD Reference Laboratories and field teams
- Partners within the WOAH/FAO FMD Lab Network



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