



The Global FMD Situation & Risks

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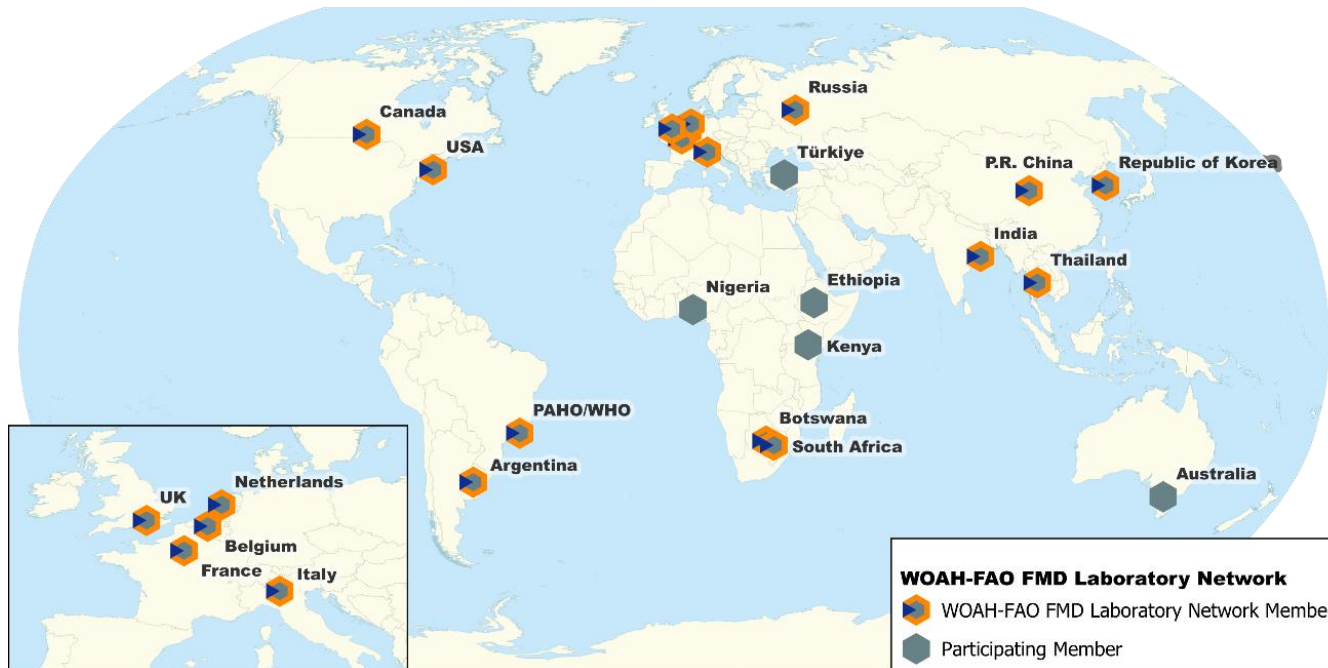
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WOAH/FAO FMD Laboratory Network

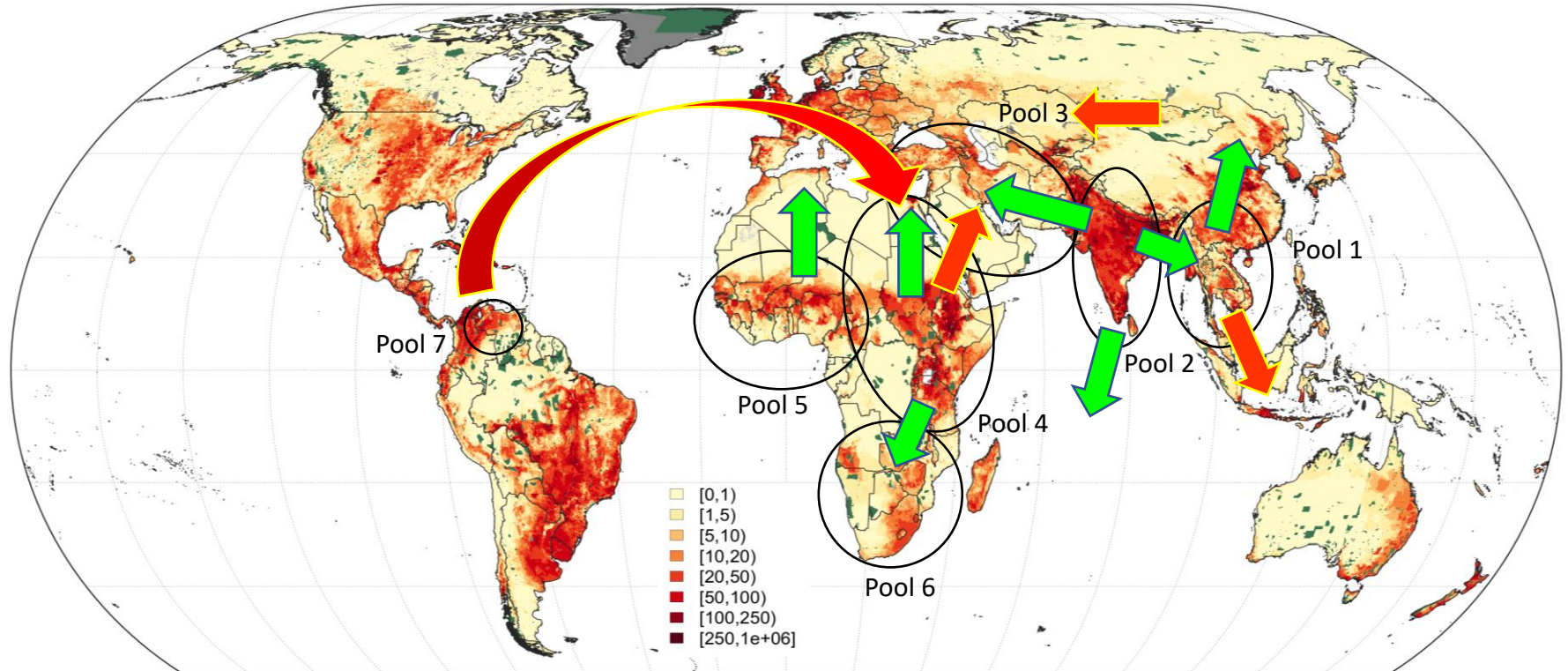
Core activities:

- Collation and exchange of data
- Test improvement & harmonisation
- Vaccine performance
- Review of FMD risks
- Support to GF-TADs regional RoadMaps

WOAH/FAO
Foot-and-Mouth Disease
Reference Laboratories
Network



Trans-pool movement



Cattle density map

Robinson et al., 2007

➡ New events 2021-24

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

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

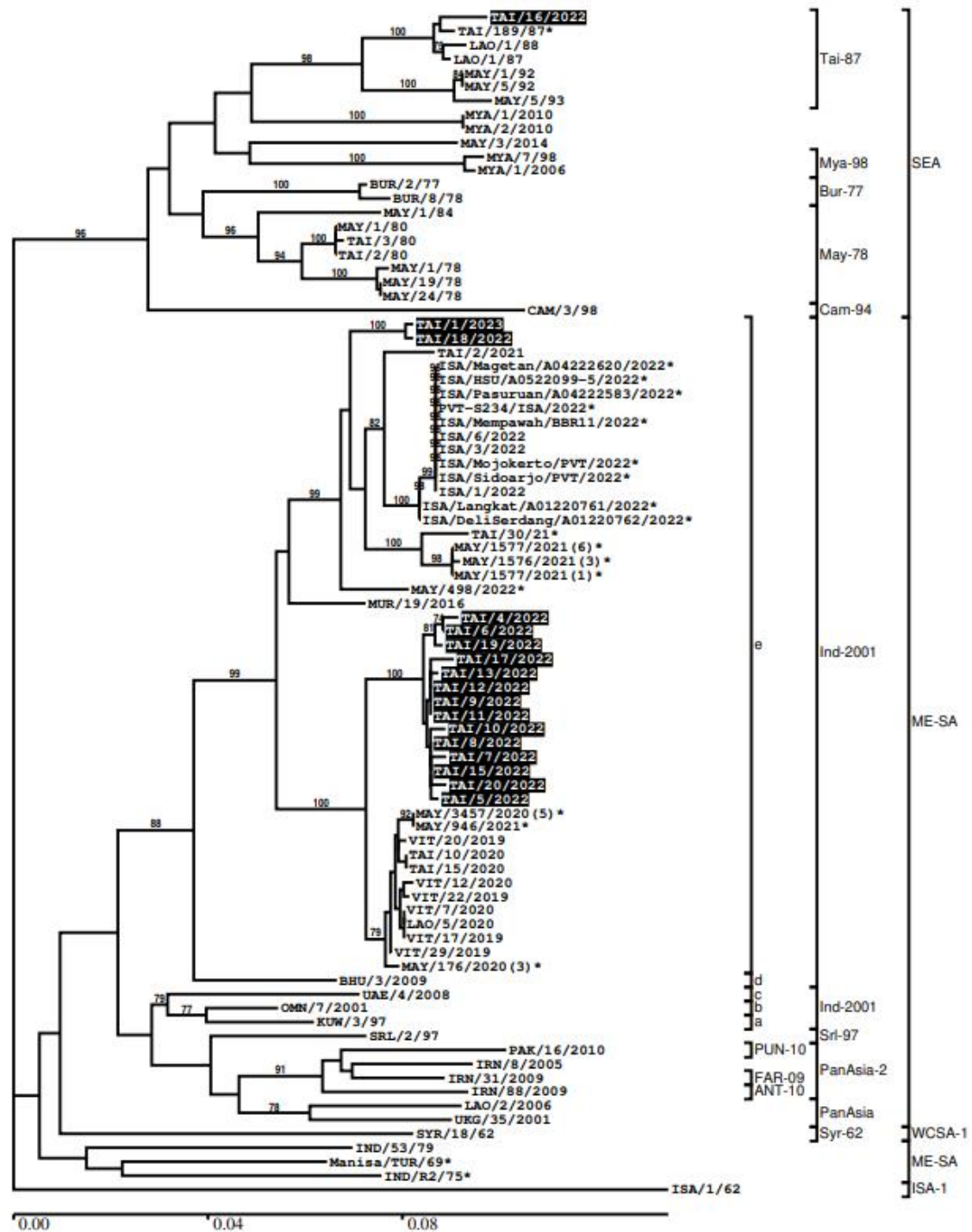
Pool 1: Status in 2024

- Characterisation of different FMD virus Lineages

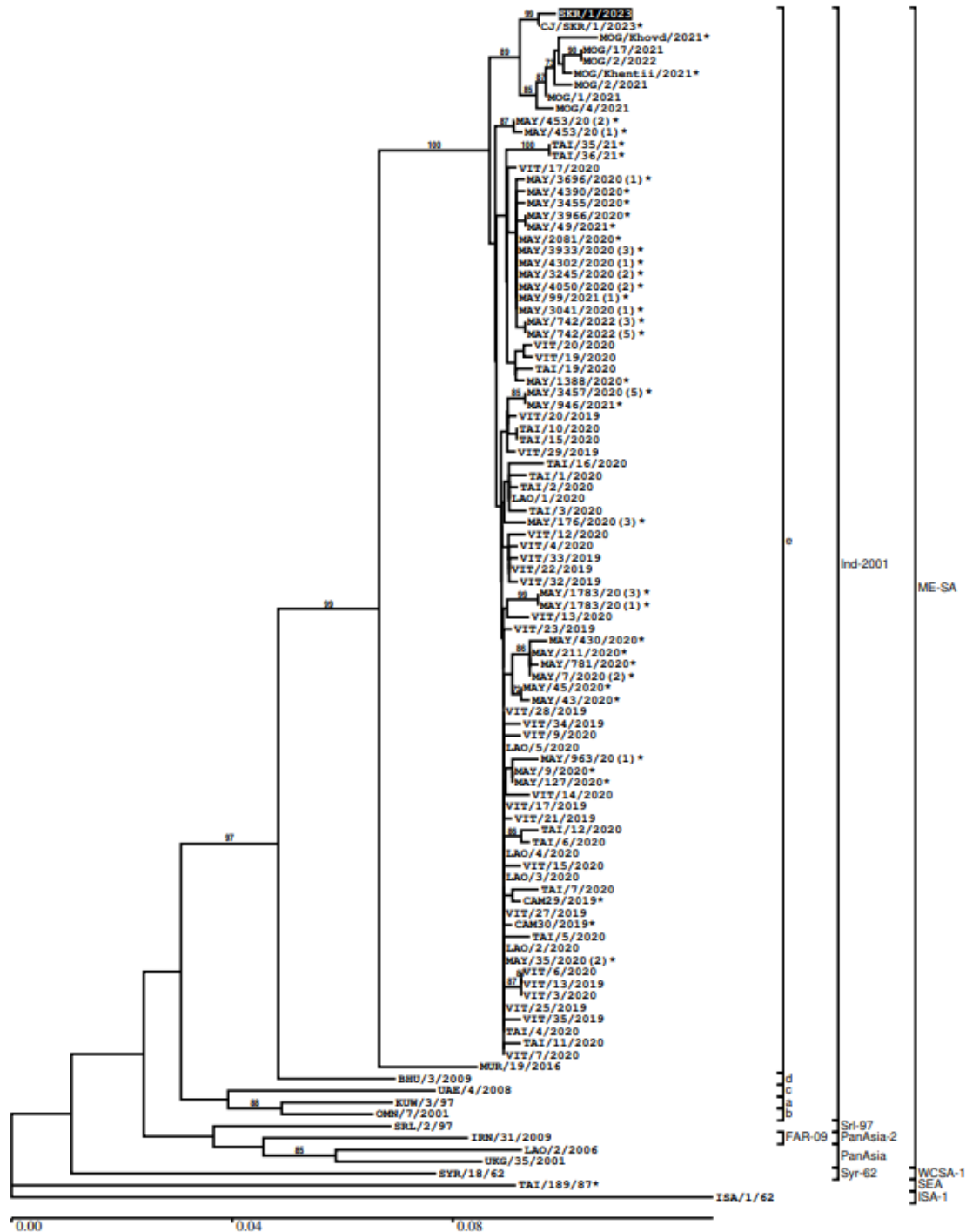


Country	O					A		Asia-1
	ME-SA/Ind-2001e	SEA / Mya-98	CATHAY	ME-SA / PanAsia	ME-SA/ PanAsia-2	ASIA / Sea-97	ASIA/Ind	
Cambodia	2019	2016		2019		2016		
Laos	2020	2017		2018		2018		
Malaysia	2023	2016	2005	2023	2009	2022		
Myanmar	2021	2021				2021	2010	2017
Thailand	2023	2018	2012	2019		2022		
Vietnam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

Lineage O/Tai-87

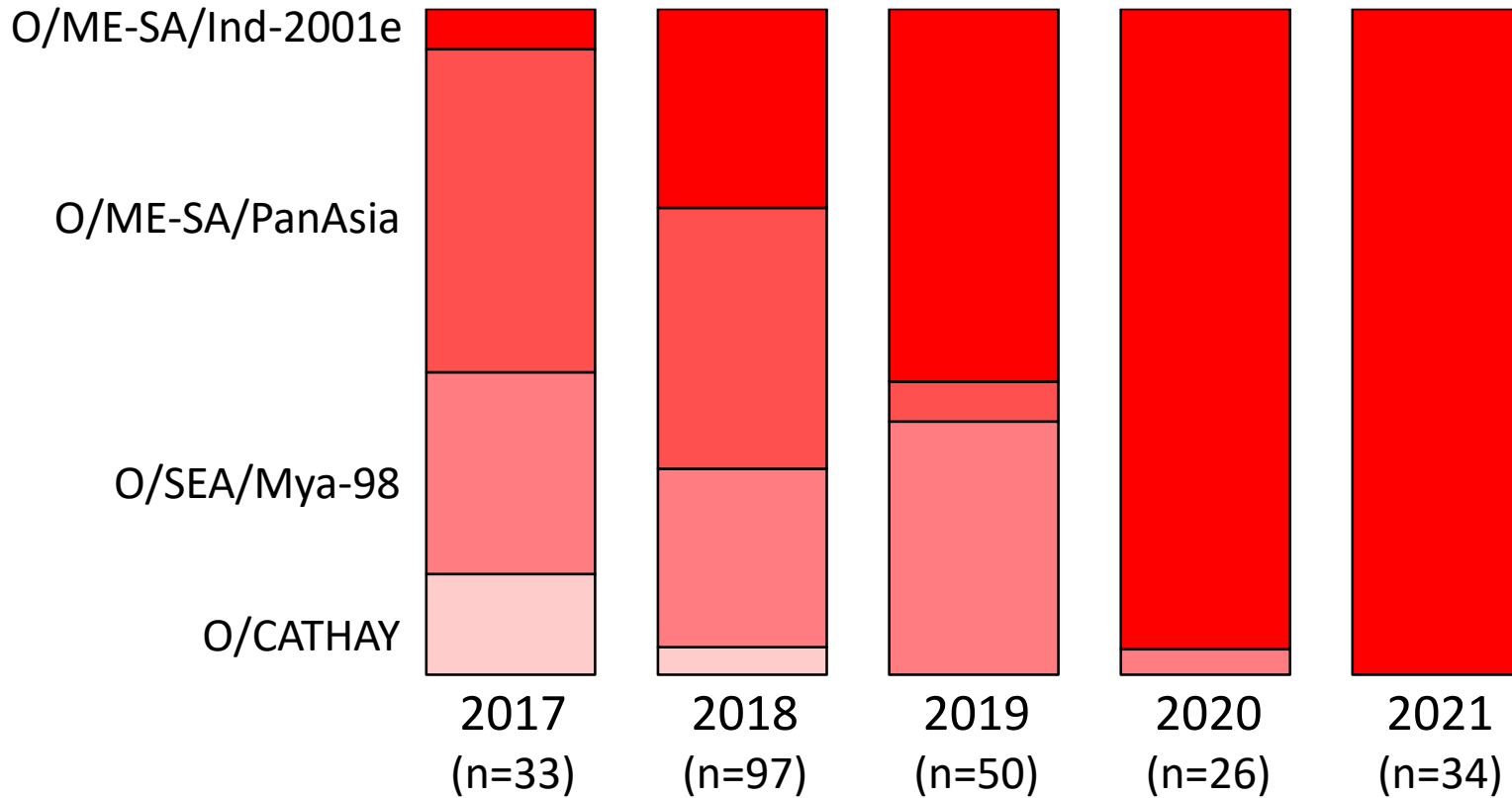


O/ME-SA/Ind-2001e



Pool 1: dominance of O/ME-SA/Ind-2001e

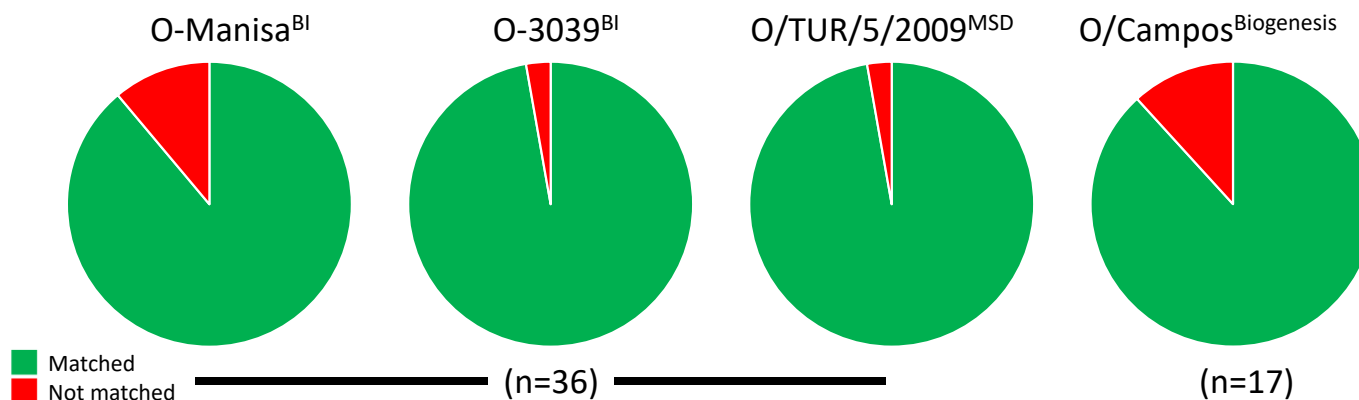
- Serotype O data for SEACFMD countries (WRLFMD data):



Data for 2022-2024: O/CATHAY detected in China in 2022; and O/ME-SA/PanAsia in Malaysia

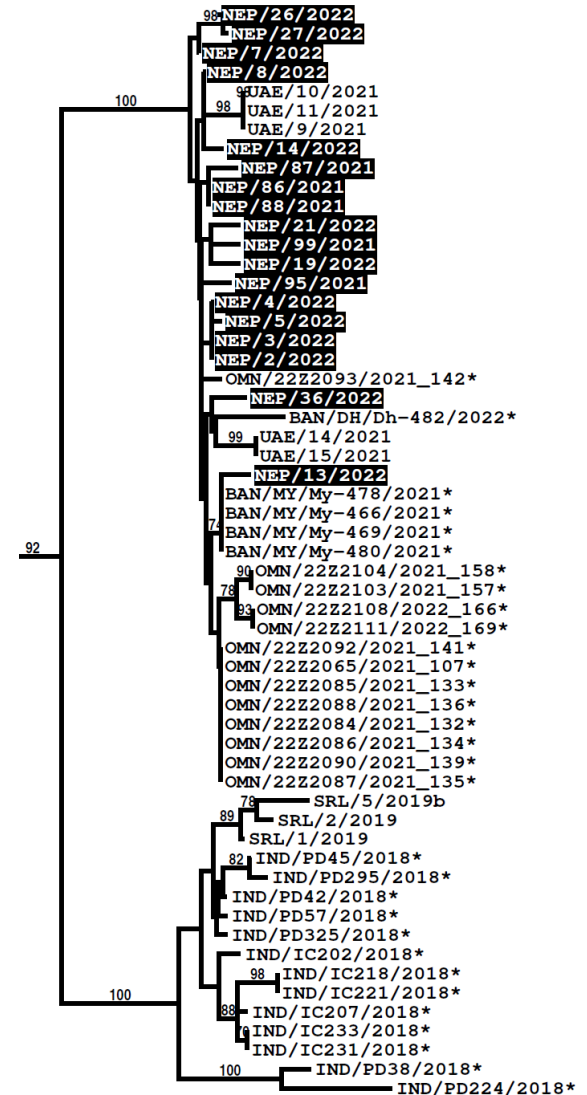
O/ME-SA/Ind-2001e: vaccine matching (2017-2023)

- Vaccine matching data for field isolates from regions where this lineage is present
- Vaccine matching data from WRLFMD for an Indonesia/South Korea field isolates support the selection of these vaccines
- Data support by *in vivo* studies with O-3039, O-Manisa and combination (Boehringer-Ingelheim)
 - Fishbourne et al., (2017) Vaccine 35: 2761-2765
 - Singanallur et al., (2021) Vaccines 9: 1110

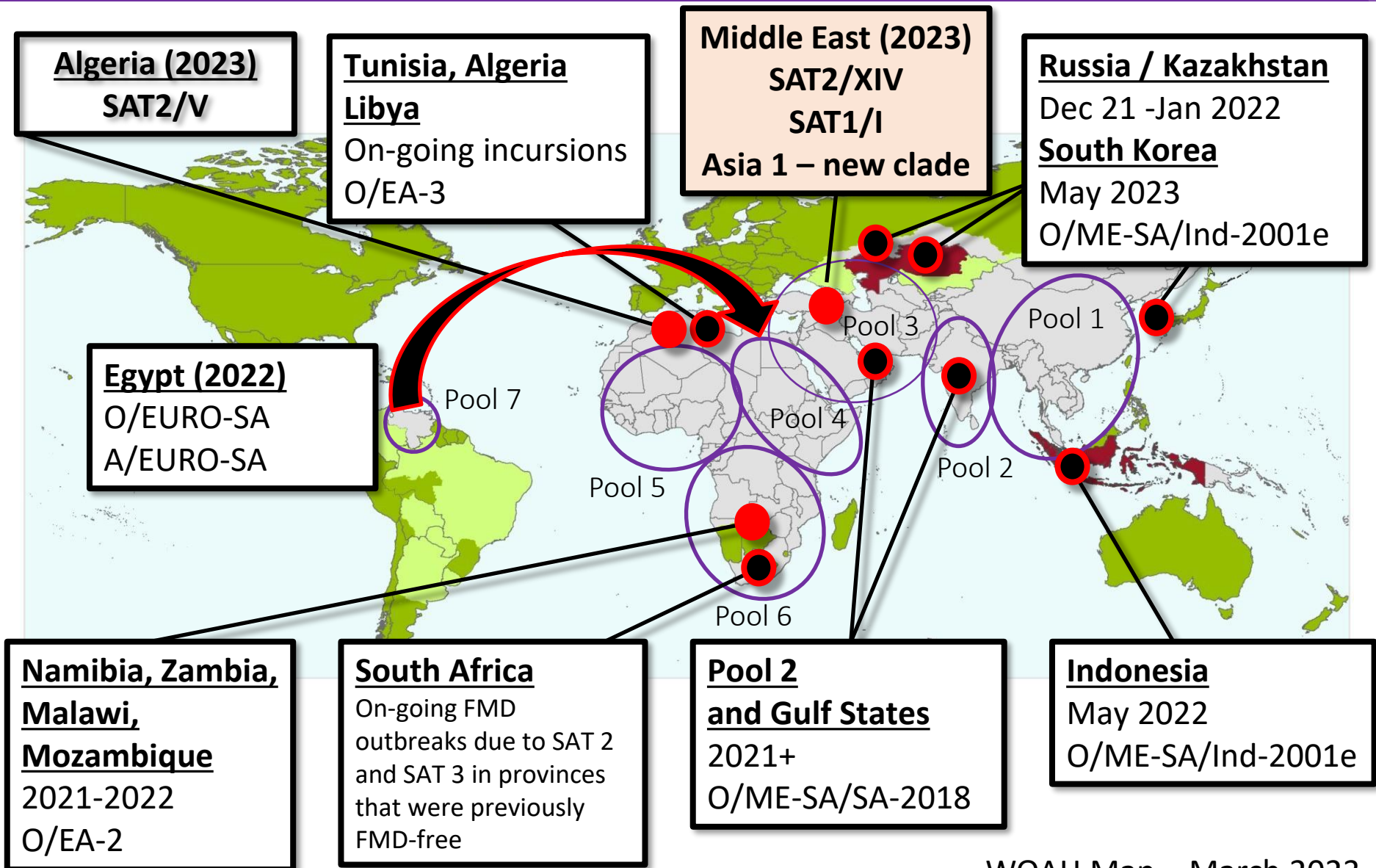


Pool 2/3: O/ME-SA/SA-2018

- An emerging lineage that threatens SEA?
- New serotype O lineage detected in pool 2
- 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
- Vaccine matching for this lineage appears to be similar to O/ME-SA/Ind-2001



Headline Global Events (2021-2024)



Asia 1 – new clade

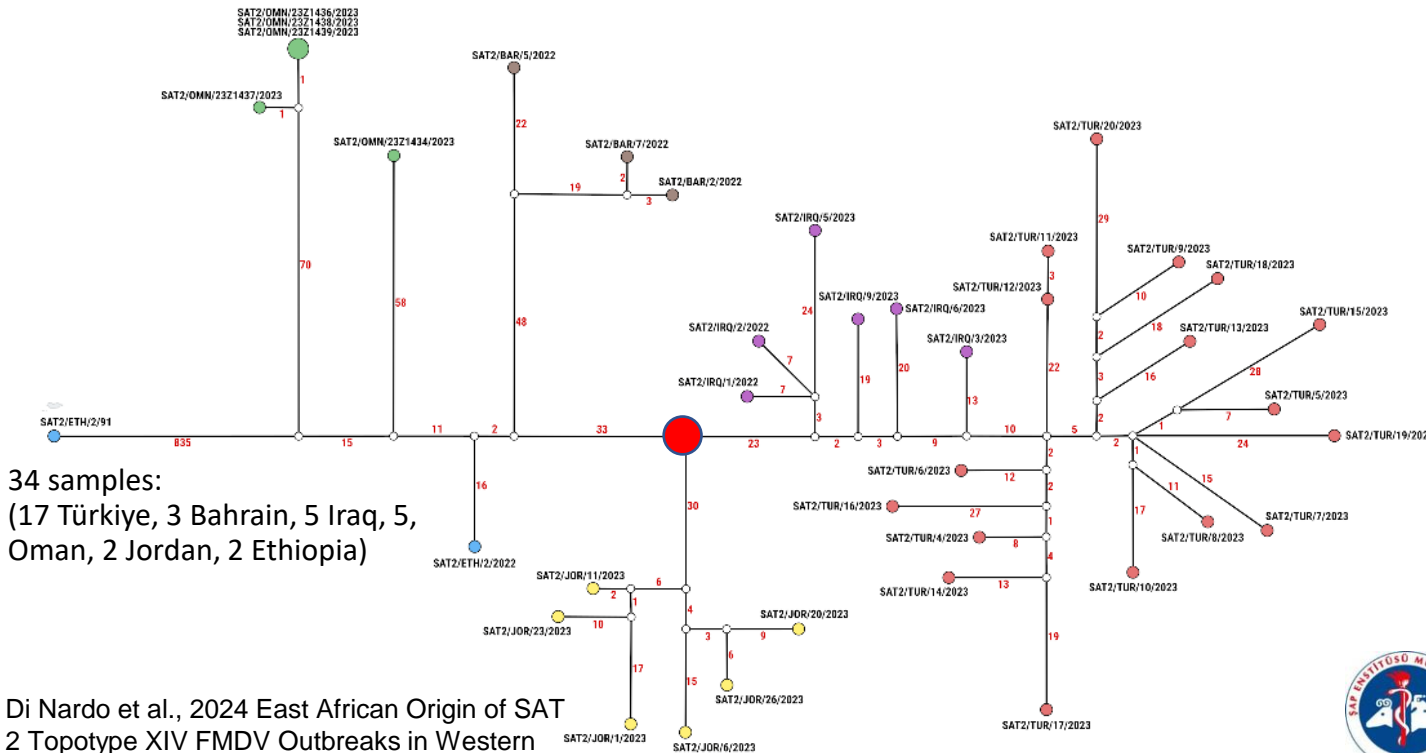
- Pool 3 – samples collected from Pakistan in 2021 and 2022 (via FAO office)
- Cattle in different locations in Pakistan
- Sequences are distinct to other Asia 1 serotype viruses including the Asia1/IX genotype that has been reported recently in Pool 2
- Vaccine matching Asia1 Shamir (BI):

Field virus	Asia 1 Shamir (BI)	
	Heterologous titre (log ₁₀)	r ₁
PAK/31/2021	2.15	0.44
PAK/48/2021	2.09	0.38
PAK/26/2022	2.14	0.40
PAK/39/2022	2.06	0.33



SAT2/XIV

- Multiple introduction 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?



SAT1/I

- Further unexpected event in the Middle East
- Cattle samples in April/May 2023
- ~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



WRLFMD protocols are online



WRLFMD serology
protocols



RT-PCR Detection
of FMDV



VP1 gene (1D
region) sequencing

Lineage specific rRT-PCR

- <https://www.foot-and-mouth.org/science/lineage-specific-pcr>

February-March 2023

- FMDV SAT2 outbreaks in Iraq and Jordan due to SAT2/XIV
- Results presented here are a preliminary evaluation of a second real-time RT-PCR assay for the detection of SAT2/XIV viruses that have caused these outbreaks

Primers and probes are listed in the table below.

OLIGO NAME	SEQUENCE (5'-3')	LOCATION (BASED ON SAT2/ETH/2/2022 FULL GENOME)	USE
SAT2_XIV_AS_P	CCTCCACTGCCATCCGCGGTGAYAGG	3663-3688	Probe *
SAT2_XIV_AS_F	ACCGTGTACAACGGTGAGTG	3629-3648	Forward primer
SAT2_XIV_AS_R	TCAGCGTACTTGGCCRCAAG	3714-3695	Reverse primer

* Probe oligonucleotide should be ordered to contain the appropriate reporter and quencher for your real time PCR system.

Sharing “real-time” data via dashboards

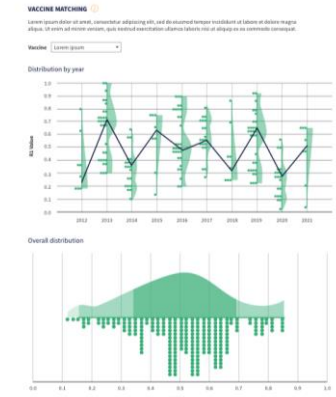
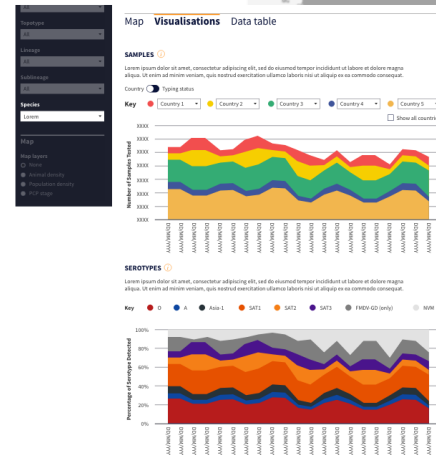
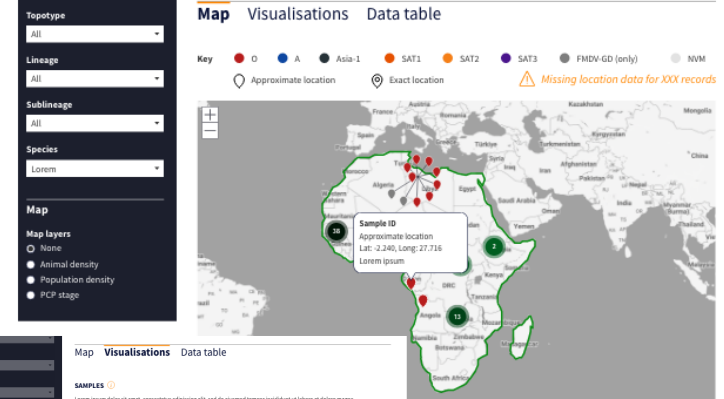
<https://www.openfmd.org>

- **FMDbase:** a curated database for FMDV genomes
- **FMDtype:** an interactive dashboard to generate genotyping reports
- **FMDwatch:** an interactive dashboard to explore and visualise surveillance data
- **PRAGMATIST:** a dashboard that assists vaccine bank managers to prioritise candidate strains for inclusion in an antigen bank

Explore by: **Location** Lineage

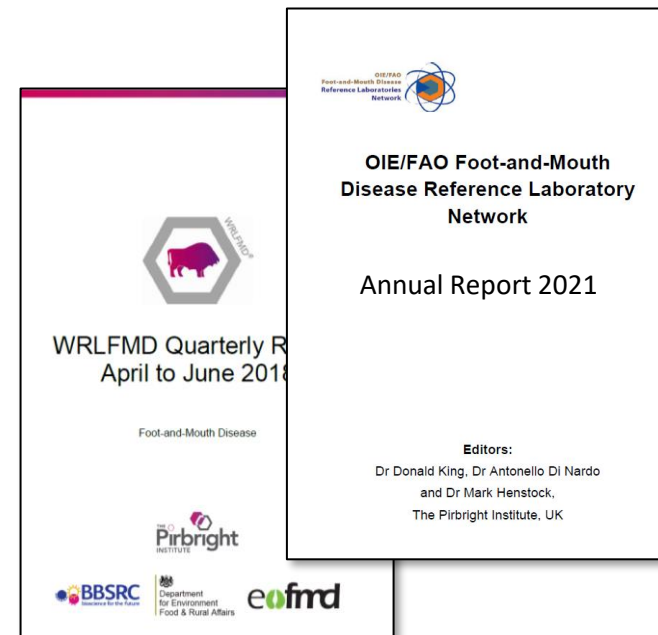
Africa
Outbreaks of FMD 2018-2023

Country	Serotypes	Current PCP stage	Country	Serotypes	Current PCP stage
Lorem ipsum	O, A, SAT3	5	Lorem ipsum	O, A, SAT3	5
Dolor sit	O	0	Dolor sit	O	0
Lorem ipsum	O	3	Lorem ipsum	O	3
Dolor sit	A	2	Dolor sit	A	2
Lorem ipsum	SAT1	4	Lorem ipsum	SAT1	4
Dolor sit	O	1	Dolor sit	O	1
Lorem ipsum	Asia-1, SAT1	5	Lorem ipsum	Asia-1, SAT1	5
Dolor sit	O	0			

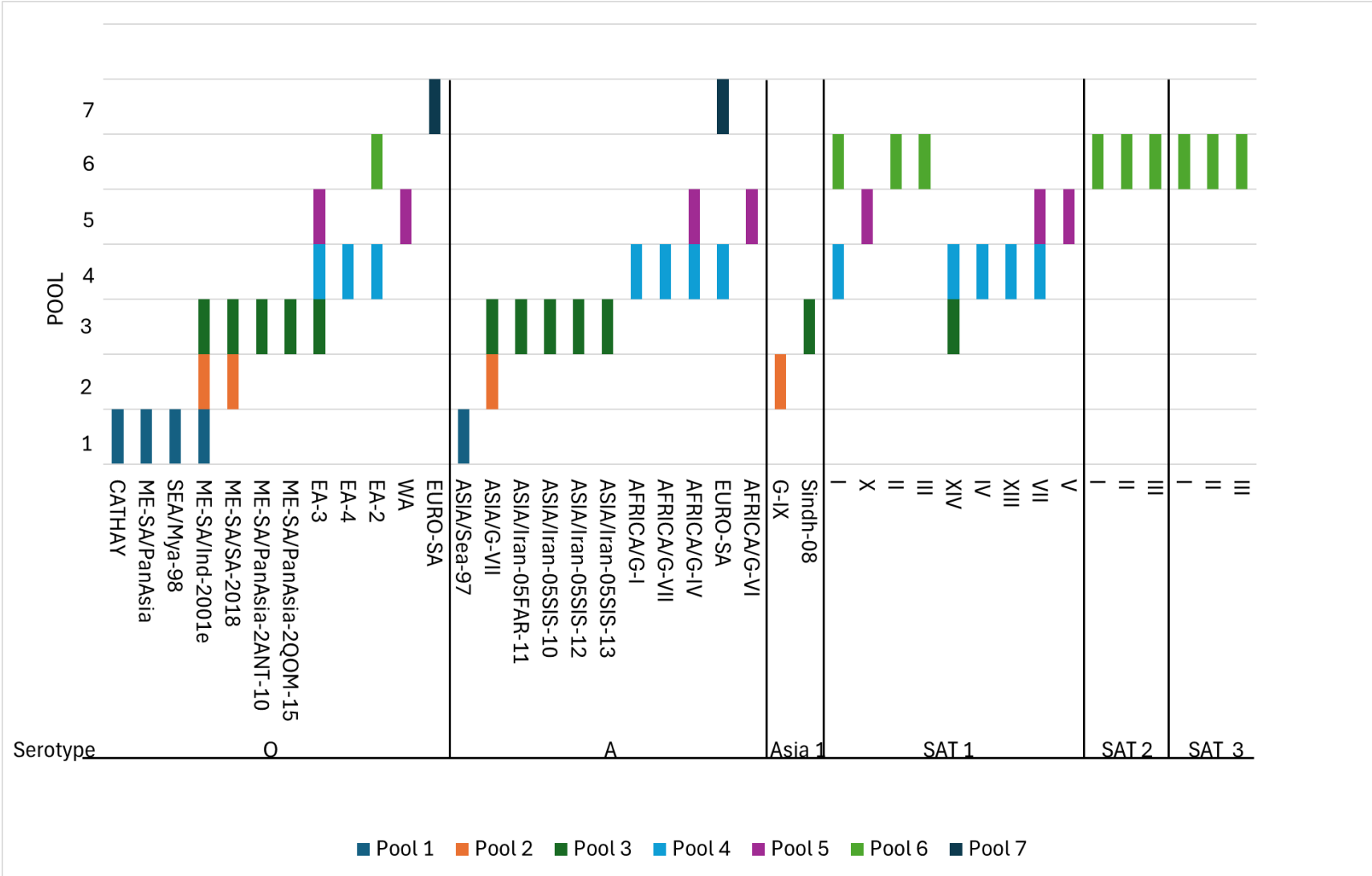


Additional Resources

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



Upcoming – Antigen Reference Panel



Sampling of field outbreaks is critical!!

- Monitor epidemiology and assess impacts of the disease
- Emergence of new strains
- Inform vaccine selection and deployment of vaccines

- WRLFMD and the WOAHA/FAO Lab Network welcome sample submission from member states
 - Testing of clinical samples is free of charge
 - Contact: Donald.King@pirbright.ac.uk, Anna.Ludi@pirbright.ac.uk