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WHO Collaborating Centre
for Research and Management
in Zoonoses Control

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POUR LA RAGE

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Rabies Serology

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SÉROLOGIE RAGE

Control and Elimination of Rabies in the Baltic States

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BIOR

THE BALTICS AND THEIR RABIE'S HISTORY

Topography relatively flat max ≈300m
≈40% of temperate forest

Sylvatic rabies emerged in 1950s-1960s
(European epidemic started in 1940s)

1990

Two principally infected species:

Nyctereutes procyonoides   *Vulpes vulpes*

RABIES CONTROL IN THE BALTICS

Before 2005: Various manual ORV field experimentations (area, frequency, bait, etc.) in Lithuania and Latvia
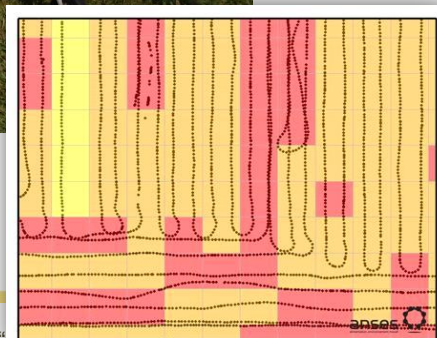
Following accession to the European Union in 2004:

2006

2005

Regular harmonised ORV plan in the three countries

Estonia and Latvia ≈ half territory

- Biannual campaigns (Spring and Autumn)
- On the whole territory since 2006
- Aerial distribution

Some variations remain, including:
- Bait density
- Bait type
- Use of automatic device

Rabigen (Virbac)   Fuchsoral (IDT)   Lysvulpen (Bioveta)

RABIES SURVEILLANCE

Assessment of rabies incidence

↓

Indicator animals
Animals suspected of having rabies
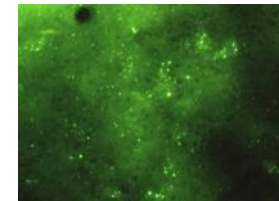Animals having contaminated human beings

↓

Rabies diagnosis
High chances to detect positive cases

- Rabies diagnosis (FAT, RTCIT, PCR)

⚠️ No sample size

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ORV MONITORING

Sampling scheme: Following each ORV (autumn and spring) – in all vaccinated areas
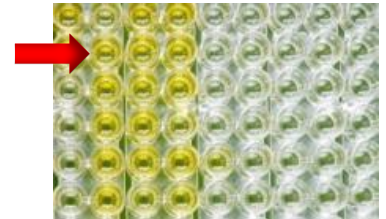
Evaluation of control strategy efficiency

Hunted foxes and raccoon dogs ("Healthy" animals)

Analysis of rabies antibodies

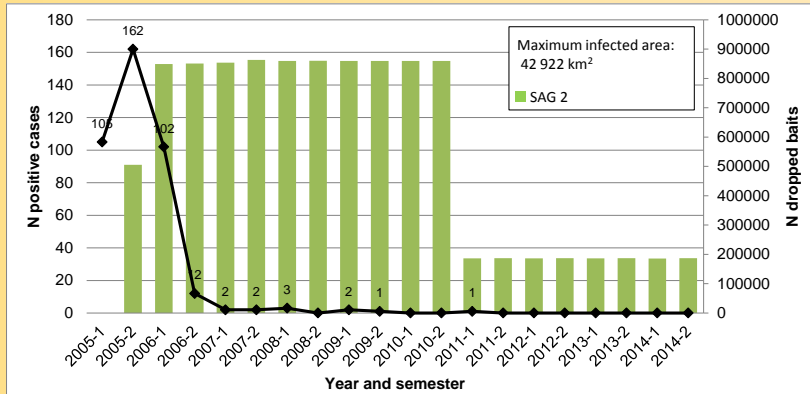Analysis of biomarker occurrence

- Seroconversion (ELISA test)
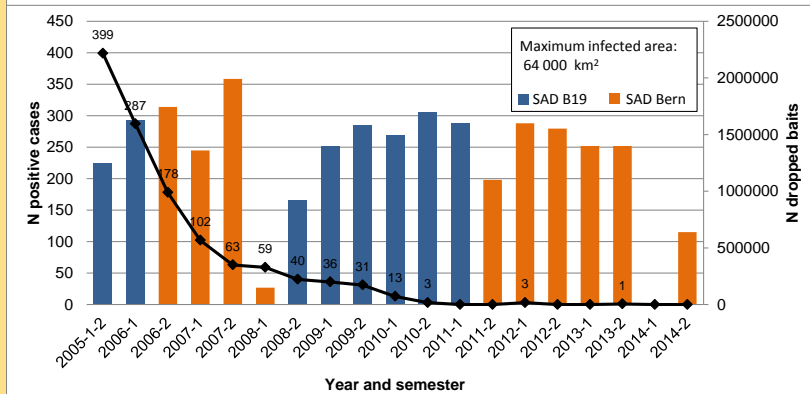
- Bait-uptake (Biomarker detection)
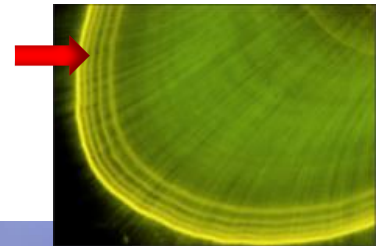
Sample size recommended: 4 animals per 100 km² annually
(WHO, 2013; EFSA,2010)
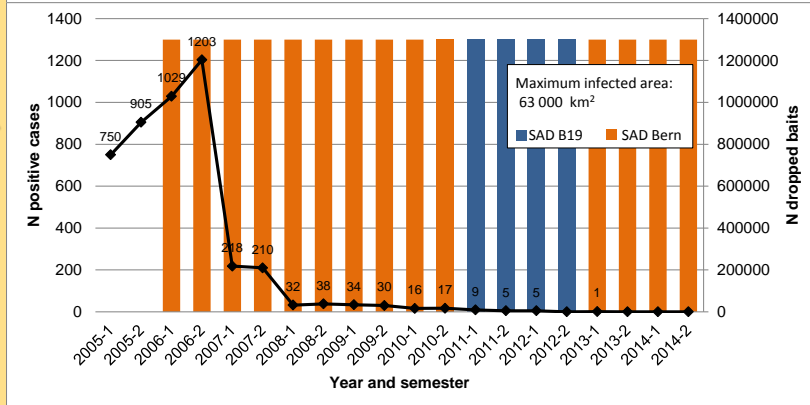
Ten years of Surveillance and Control
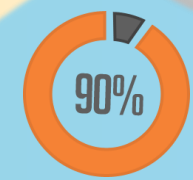

Estonia

Latvia

Lithuania

33% of foxes
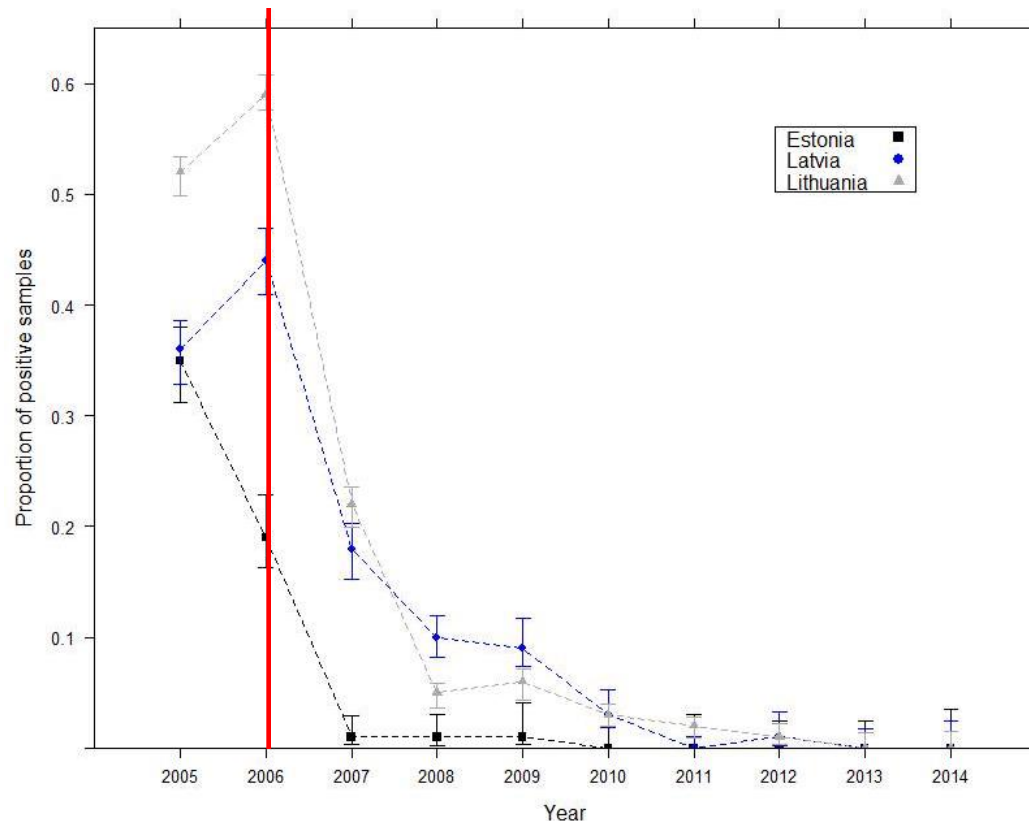

Positive cases

38% of raccoon dogs

90%

Time needed to reduce by 90% the number of positive detected cases (based from the maximum semi-annual incidence):

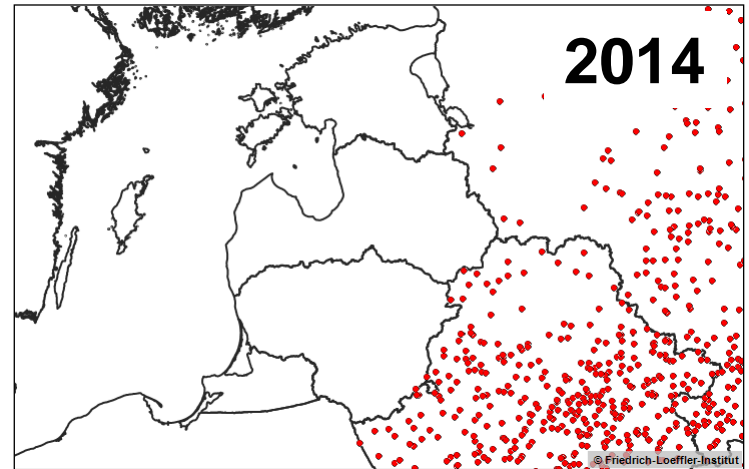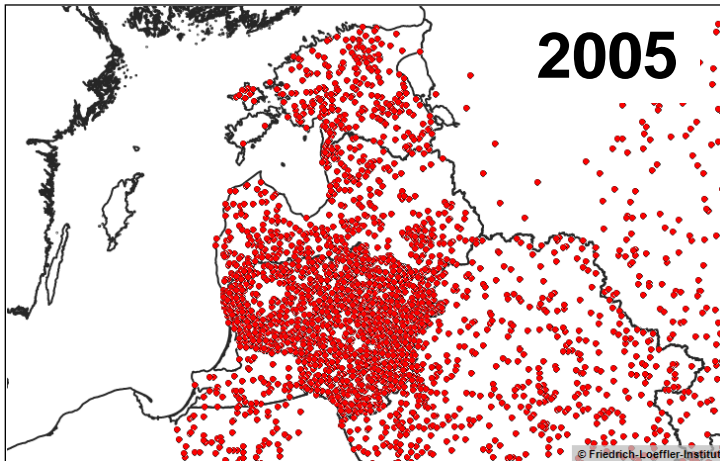**2 ORV campaigns in Estonia, 4 in Lithuania, and 8 in Latvia.**

Taking into account the total number of animals tested

24,919 animals tested in 10 years

Decrease of the proportion of positive samples, as soon as the whole territory of each country was vaccinated.

SURVEILLANCE OF RABIES

2005

2014

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Maps provided by the Rabies Bulletin Europe website

Last detected case:
2011 in Estonia
2012 in Latvia
2013 in Lithuania

Free status

Self-declaration by Estonia on the recovery of its rabies-
submitted to the OIE on 3 April 2013 by Dr Ago Pärtel, Delegate of Estonia to the OIE, Chief Veterinary Officer, Veterinary and Food Board, Ministry of Agriculture, Tallinn, Estonia

Notification

Rabies is a disease subject to compulsory notification since 1950; statistical data from outbreaks in the territory of Estonia are available, starting from this year.

Epidemiological evolution

According to records, dog-mediated rabies was a common disease in Estonia in the middle of last century. Thanks to the compulsory vaccination of cats and

Self-declaration

Other than for African horse sickness, bovine spongiform encephalopathy, classical swine fever, contagious bovine pleuropneumonia, foot and mouth disease and peste des petits ruminants, for which the OIE currently has a procedure of official recognition of status, the self-declaration of freedom of a country or a territory from a given OIE-listed disease is under the responsibility of the Member concerned. The OIE is not responsible for inaccuracies in the publication of self-declarations concerning the status of a country or zone with regard to a disease.

news from

Self-declaration

Other than for African horse sickness, bovine spongiform encephalopathy, classical swine fever, contagious bovine pleuropneumonia, foot and mouth disease and peste des petits ruminants, for which the OIE currently has a procedure of official recognition of status, the self-declaration of freedom of a country or a territory from a given OIE-listed disease is

Self-declaration by Latvia of freedom from rabies
submitted to the OIE on 8 December 2014 by Dr Maris Balodis, Delegate of Latvia to the OIE, Director General, Chief Veterinary Officer, Food and Veterinary Service, Ministry of Agriculture, Riga

Notification of rabies

Rabies has been a notifiable disease in Latvia since 1929. According to the Veterinary Medicine Law, animal owners must immediately notify a veterinarian of any animal death, abortion, simultaneous disease in several animals, and any case that

Self-declaration by Lithuania of freedom from rabies
submitted to the OIE on 9 March 2015 by Dr Jonas Milius, Delegate of Lithuania to the OIE, Director, State Food and Veterinary Service, Ministry of Agriculture, Vilnius

Notification

Rabies was enzootic in Lithuania and it is compulsory to notify any occurrence of this disease. Statistical information about rabies outbreaks in Lithuania is available back to 1960. Since 1992, in accordance with the Act on Veterinary Activities, every suspicion of rabies must be notified to the Veterinary Authorities.

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BAIT UPTAKE RATE

Influence of the
- country (Latvia vs Lithuania vs Estonia) on the TTC rate?
- species (fox VS raccoon dog)
- season (autumn vs spring)
- year
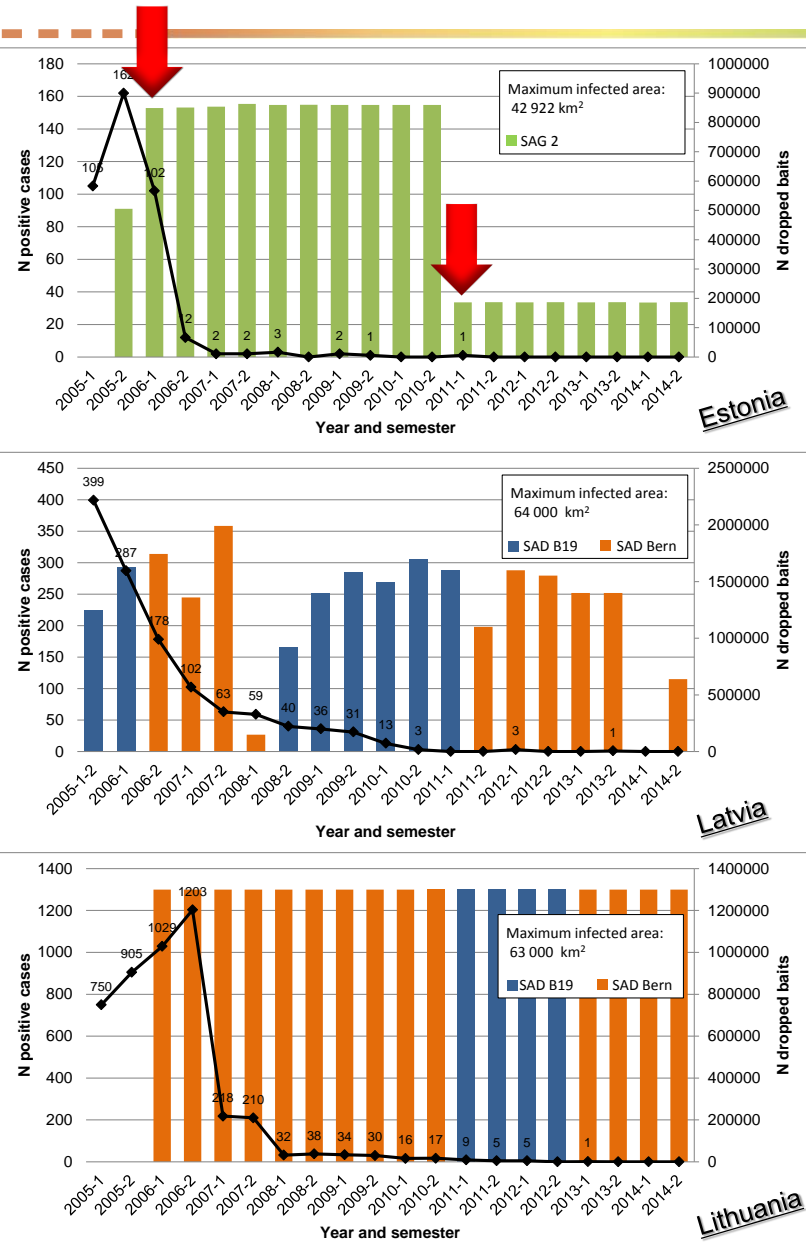- age (juvenile vs adult) *for Estonian and Lithuanian data only*

Models comparison performed using Akaike criterion (AICc)

**GLM formulae: glm.nb(npos~species+year+country+offset(log(ntest))**
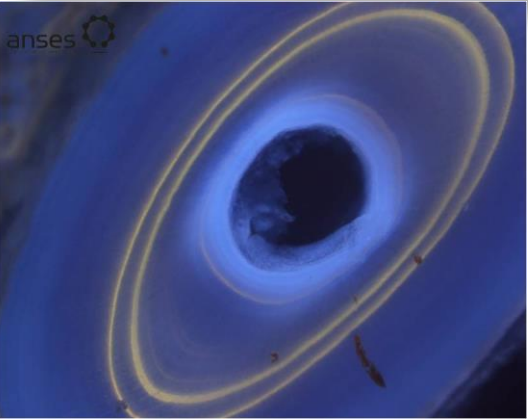
Variable	Group	Estimate	CI (95%)	P-value (Wald test)
		a) Baltic states		
SPECIES	**Raccoon dog**	-0.12	-0.190 ; -0.045	**0.00149**
YEAR		0.04	0.023 ; 0.052	**<0.0001**
COUNTRY	Latvia	-0.09	-0.175 ; 0.000	0.05277
COUNTRY	**Lithuania**	-0.21	-0.294 ; -0.116	**<0.0001**
		b) Estonia and Lithuania		
AGE	**Juvenile**	-0.11	-0.182 ; -0.033	**0.0048**
SPECIES	**Raccoon dog**	-0.11	-0.182 ; -0.334	**0.00417**
YEAR		0.03	0.019 ; 0.050	**<0.0001**
COUNTRY	**Lithuania**	-0.20	0.274 ; 0.121	**<0.0001**

BAIT UPTAKE RATE

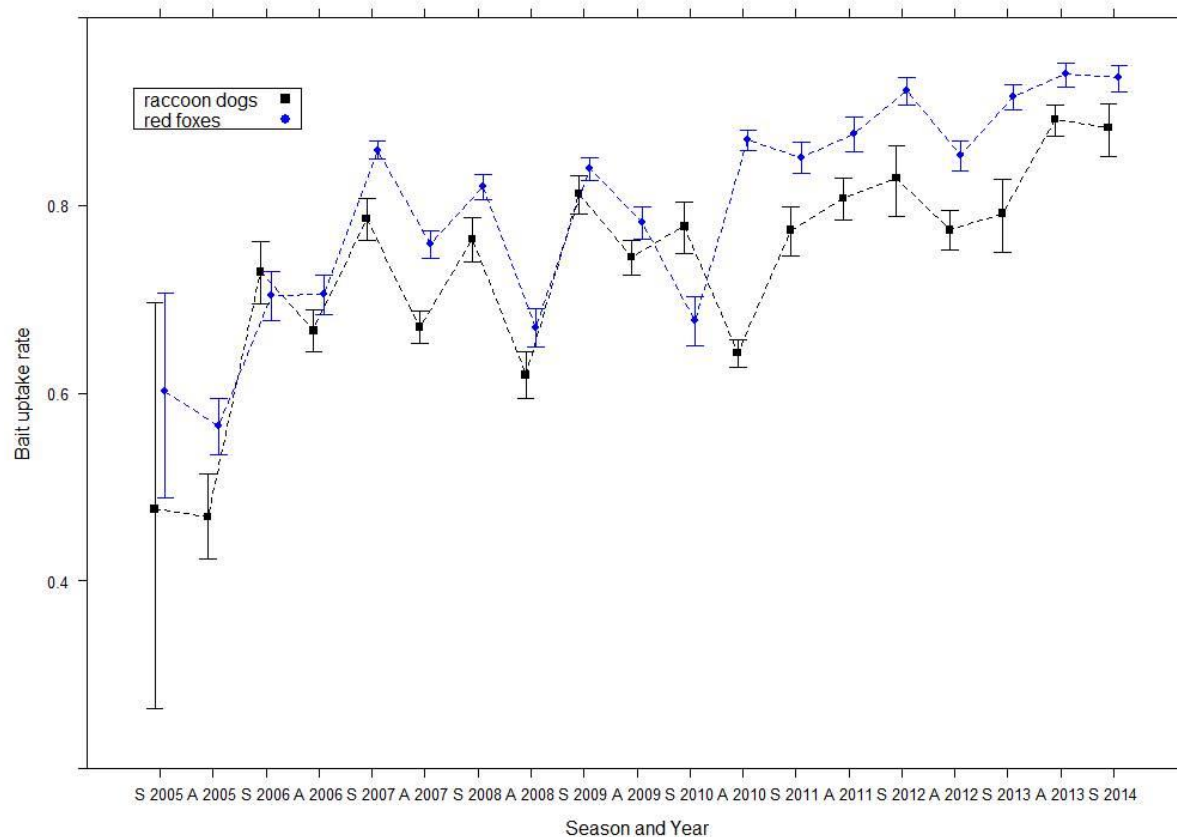Estonia

Latvia

Lithuania

Evolution of the bait uptake per country
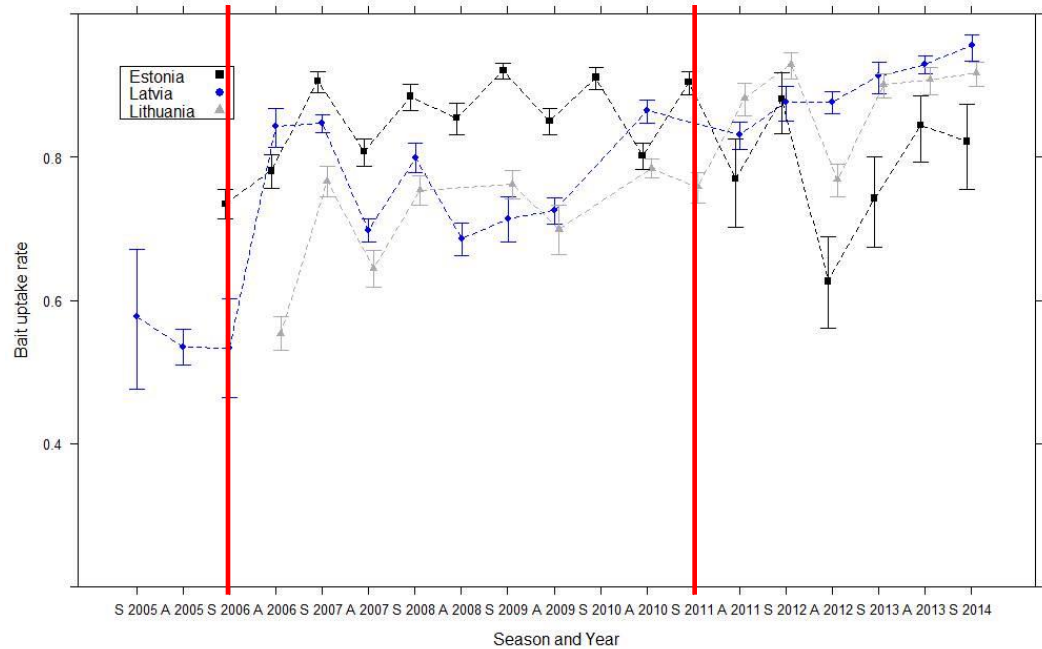
BAIT UPTAKE RATE

Evolution of the bait uptake per species

As suggested by GLM analysis:
TTC level increase over time,
TTC level higher in Red foxes than in Raccoon dogs.

SEROCONVERSION RATE

Influence of the
- country (Latvia vs Lithuania vs Estonia) on the Seroconverison rate?
- species (red foxes vs raccoon dogs)
- season (autumn vs spring)
- year
- age class (juvenile vs adult) *for Lithuanian data only*

> Models comparison performed using Akaike criterion (AICc)

GLM formulae: glm.nb(npos~season+offset(log(ntest))
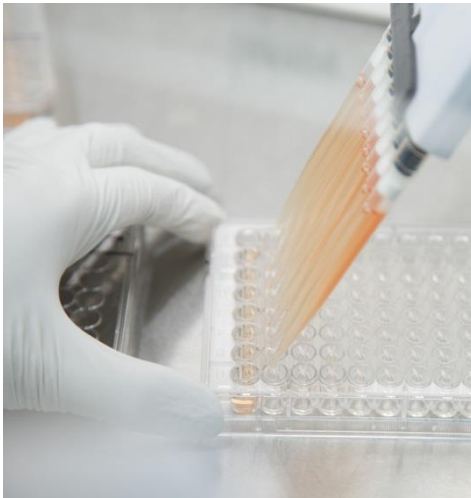
Variable	Group	Estimate	CI (95%)	P-value(Wald test)
a. Baltic states				
SEASON	Spring	0.07	-0.028 ; 0.164	0.125
b. Lithuania				
AGE	Juvenile	-0.15	-0.324 ; 0.017	0.0806

No significant factors detected
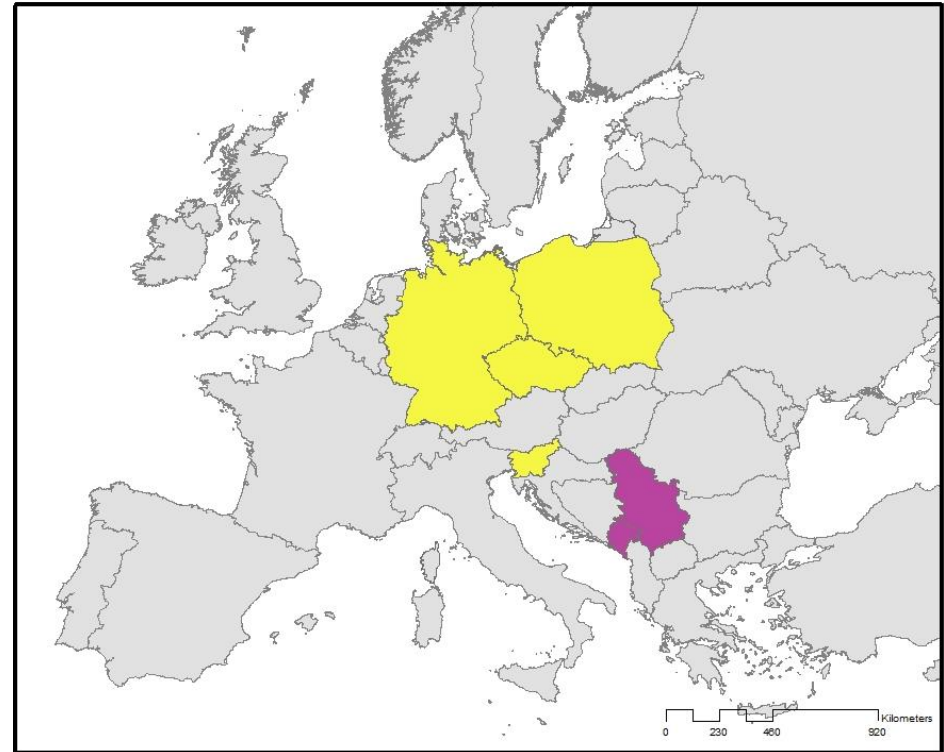
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SEROCONVERSION RATE

Evolution of the seroconversion rate per country

Mean = 50%
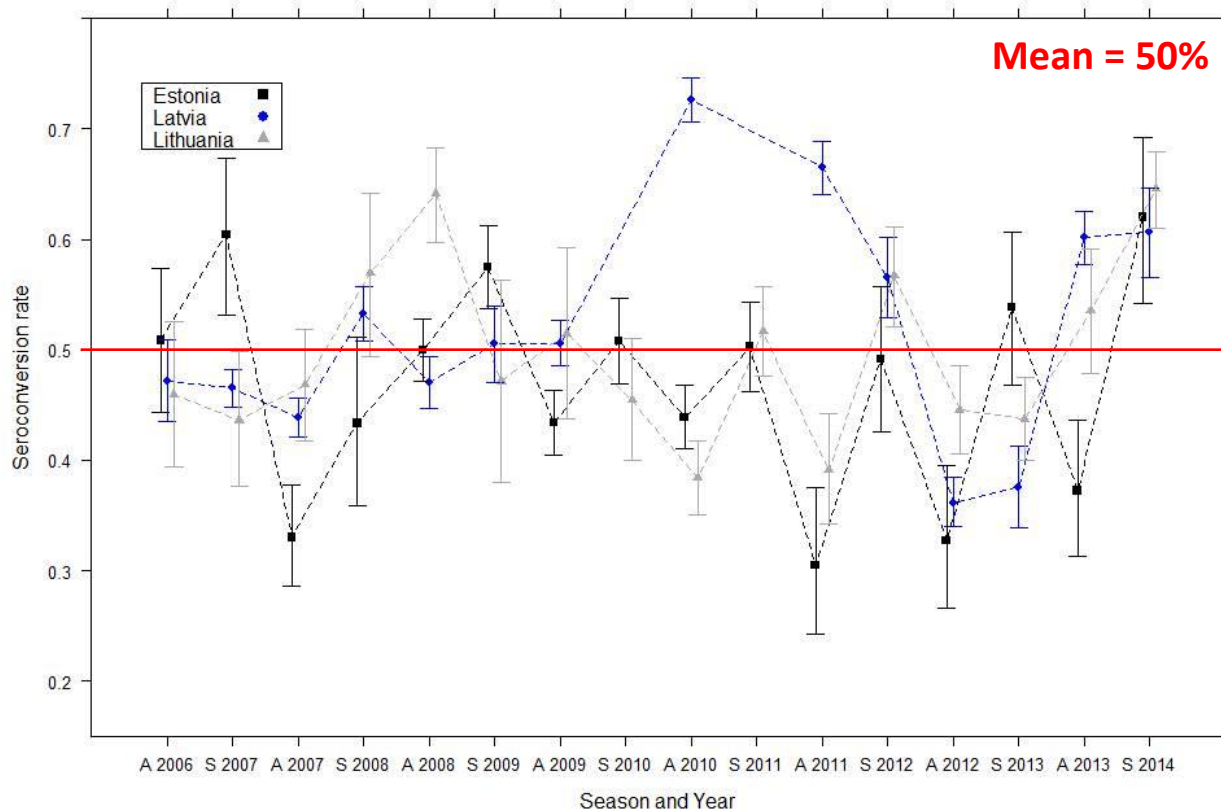
No specific pattern: Reliability of the ELISA tests used?

Suggested by Knoop, 2010; De Benedictis 2012; Wasniewski; 2014, etc..
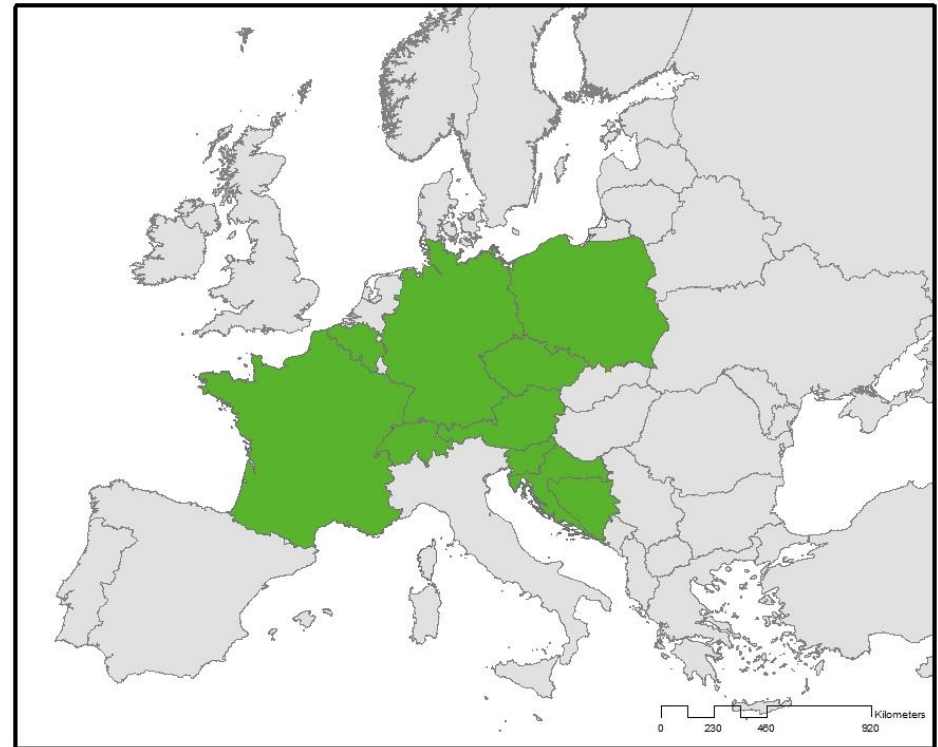
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Central Europe (CE)
and Serbian Fox phylogroup

Bourrhy et al., 1999

PHYLOGENETIC STUDY

Weastern Europe (WE)
phylogroup

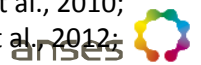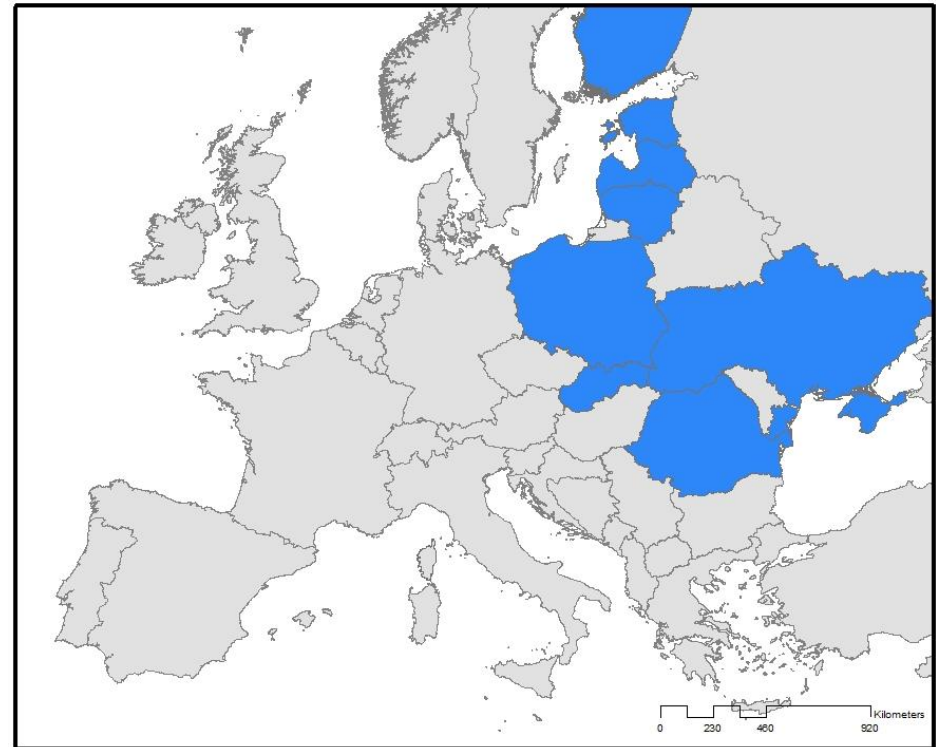Bourrhy et al., 1999; Lojkic at al., 2010; Mc Elihnney et al., 2011

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Eastern Europe (EE)
phylogroup

Bourrhy et al., 1999; Mc Elihnney et al., 2006; Lojkic at al., 2010;
Turcitu at al., 2010; Mc Elihnney et al., 2011; Picard et al., 2012;

North Eastern Europe (NEE)
phylogroup

Bourrhy et al., 1999; Vanaga et al, 2003;
Turcitu at al., 2010; Picard et al., 2012
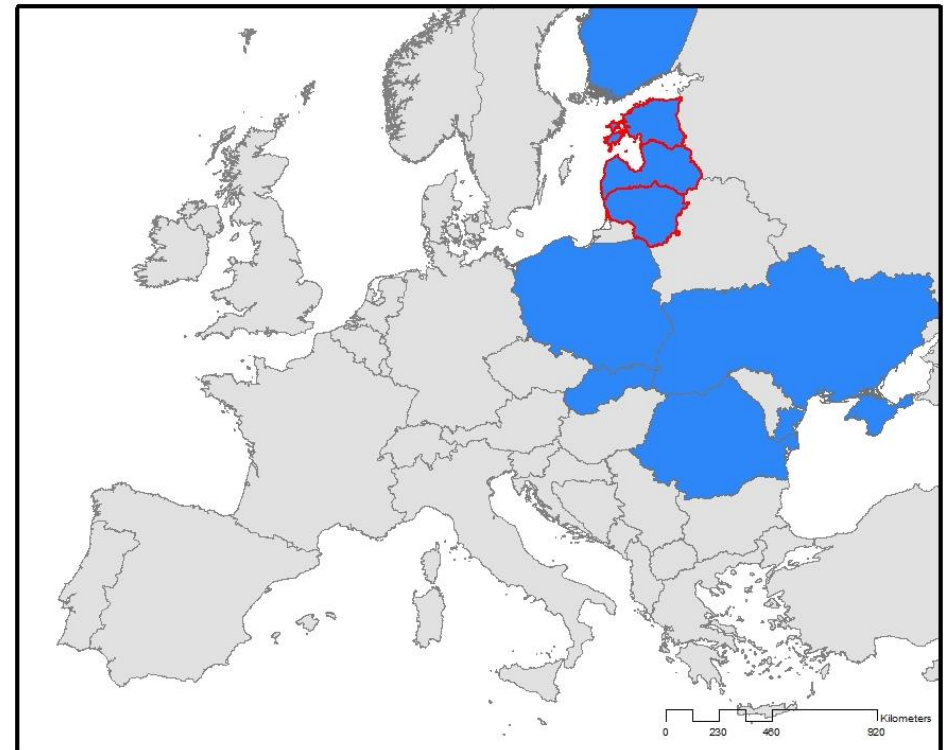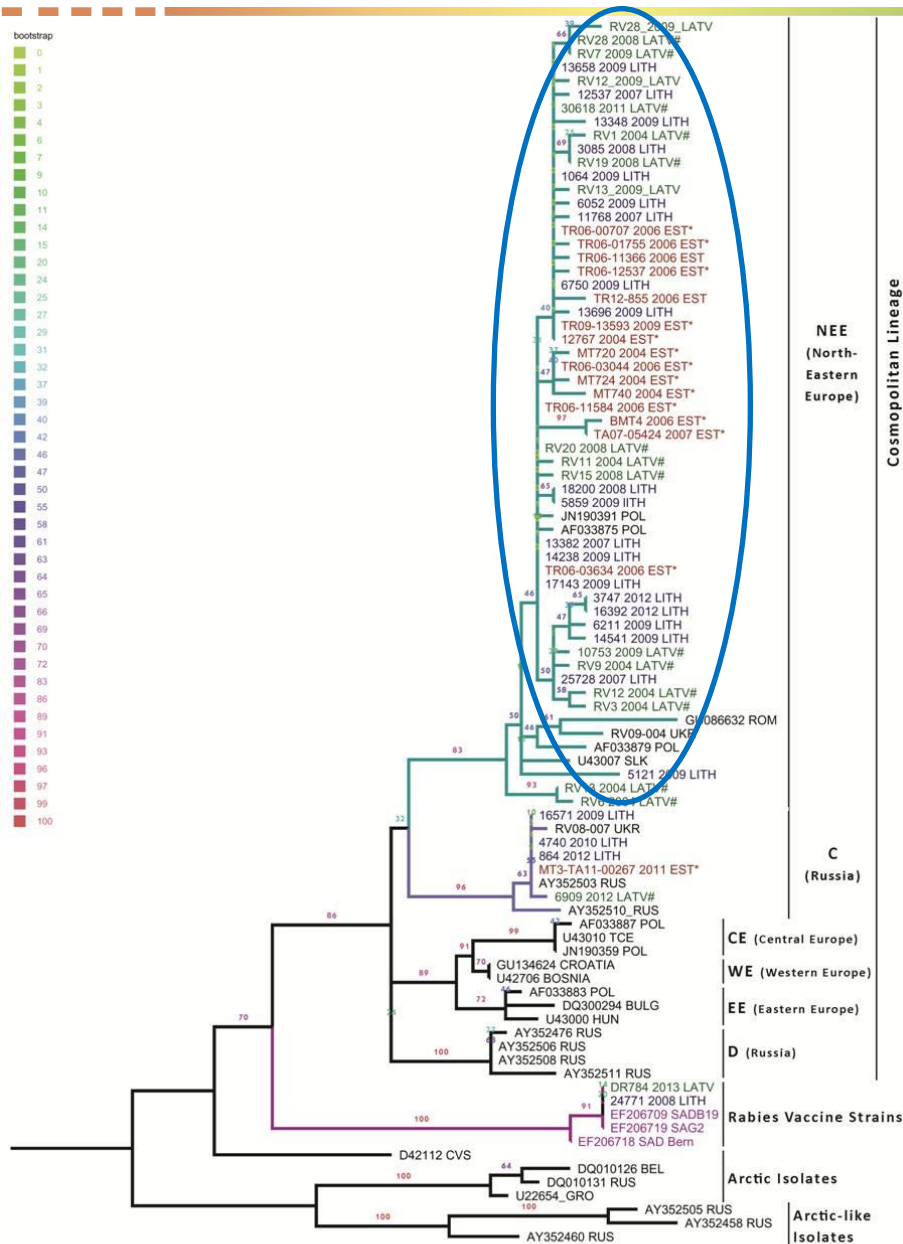
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East of Russia (C)
phylogroup

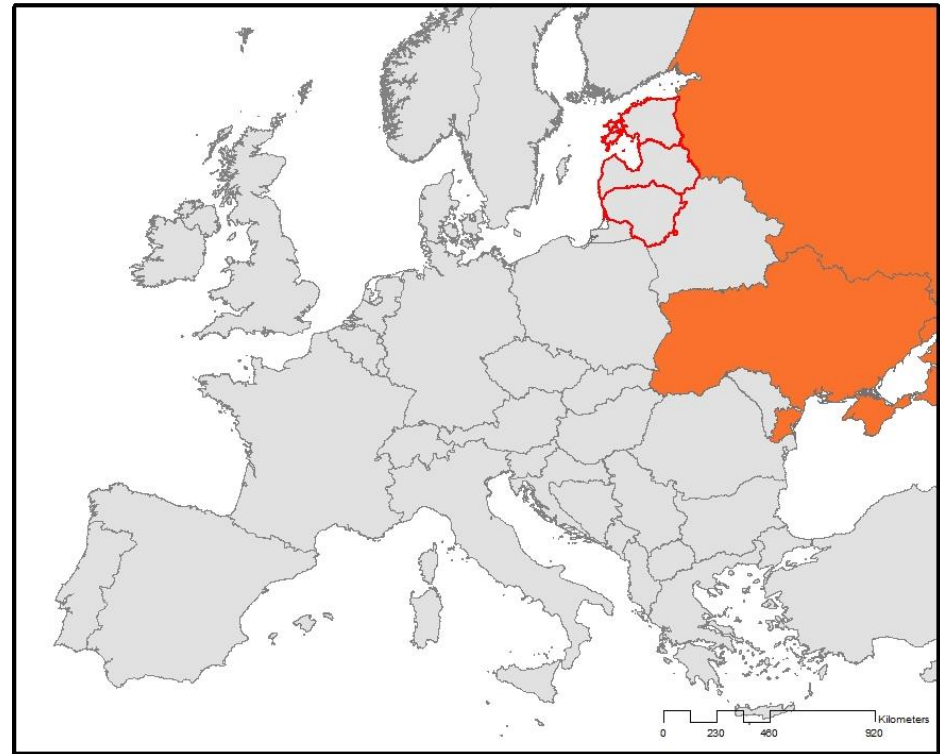Kuzmin et al., 2004; Picard et al., 2012

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PHYLOGENETIC STUDY
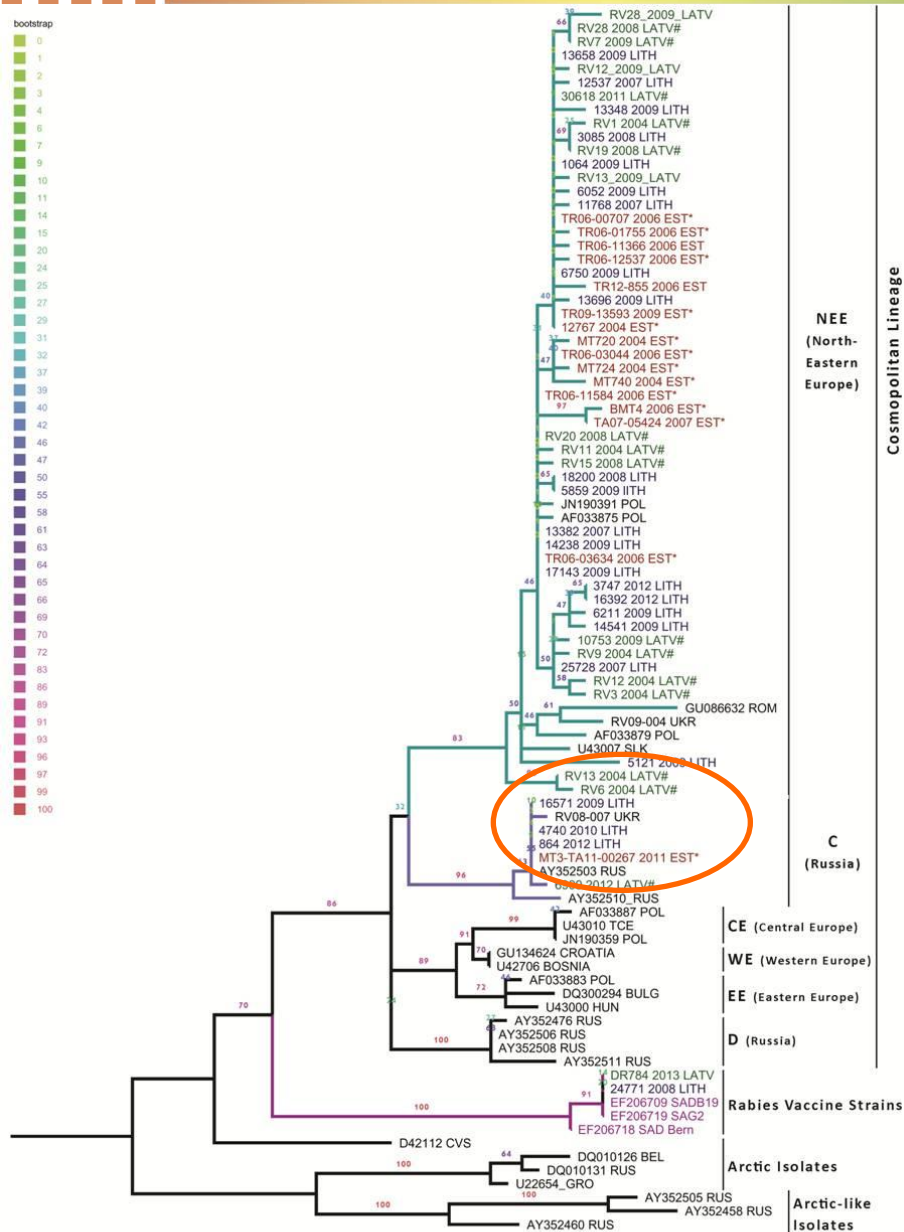

158 field rabies virus collected

North Eastern Europe (NEE) phylogroup

PHYLOGENETIC STUDY

5 field rabies virus collected

Western Russia (C)
phylogroup

PHYLOGENETIC STUDY

2 vaccine associated cases

☒ **1st case:**
Marten marten
2008 in Lithuania
SAD B19 strain identified (N gene)
but...ORV using Lysvulpen

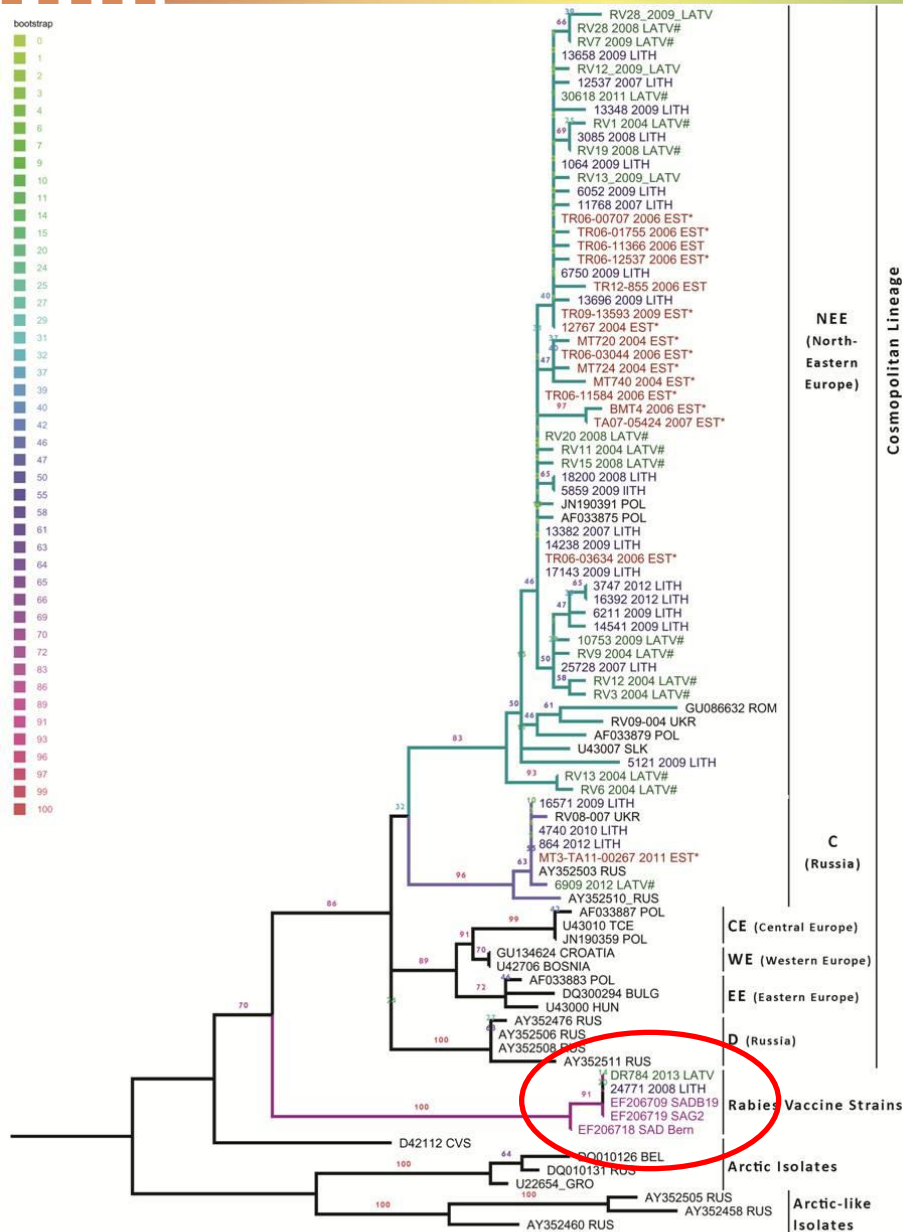☒ **2nd case:**
Badger badger
2013 in Latvia
SAD B19 strain identified
(N and G genes)
but...ORV using Lysvulpen

First identification in two non target species

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CONCLUSION

☑ ORV effective to eliminate the disease in the three countries.

☑ Possibility to improve the ORV effectiveness by adapting the method more on the raccoon dog biology ?

☑ Concern on the reliability of the serological tests, but promising new ELISA kit recently evaluated.

☑ Risk of reintroduction highlighted by sporadic cases of the C lineage: need to continue vaccination belt on border areas.

☑ Vaccine induced rabies cases reported for the first time in two non target species.

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ACKNOWLEDGEMENTS

* Melanie Biarnais from the French Agency for Food, Environmental and Occupational Health & Safety,

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* Rita Granta and Kristīne Grāve from Institute of Food Safety, Animal Health and Environment "BIOR".

THANK YOU FOR YOUR ATTENTION!

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