

Emerging vector borne viral diseases

Strategies for surveillance, prevention and control

René Bødker

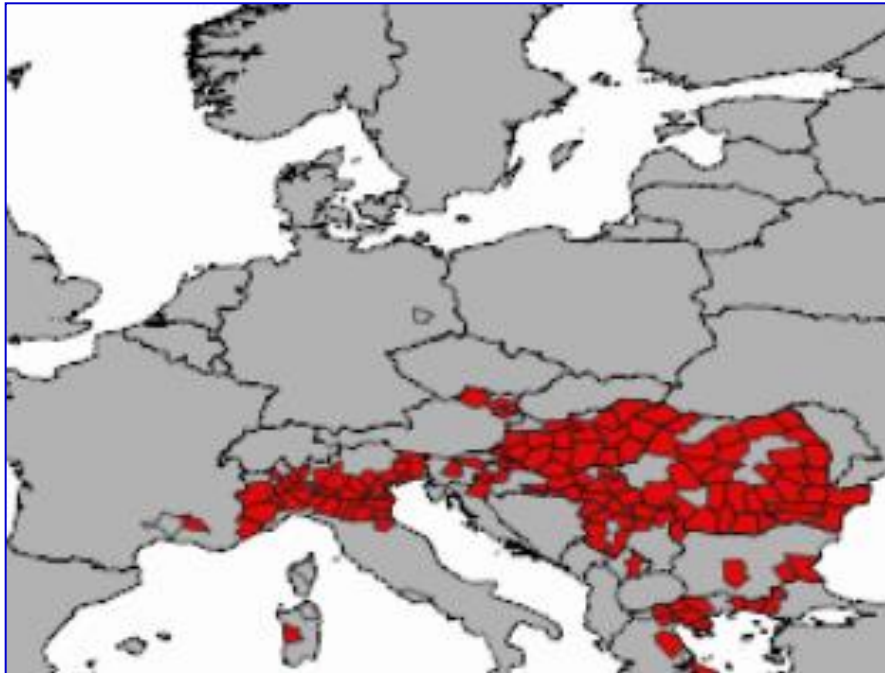
DTU National Veterinary
Institute



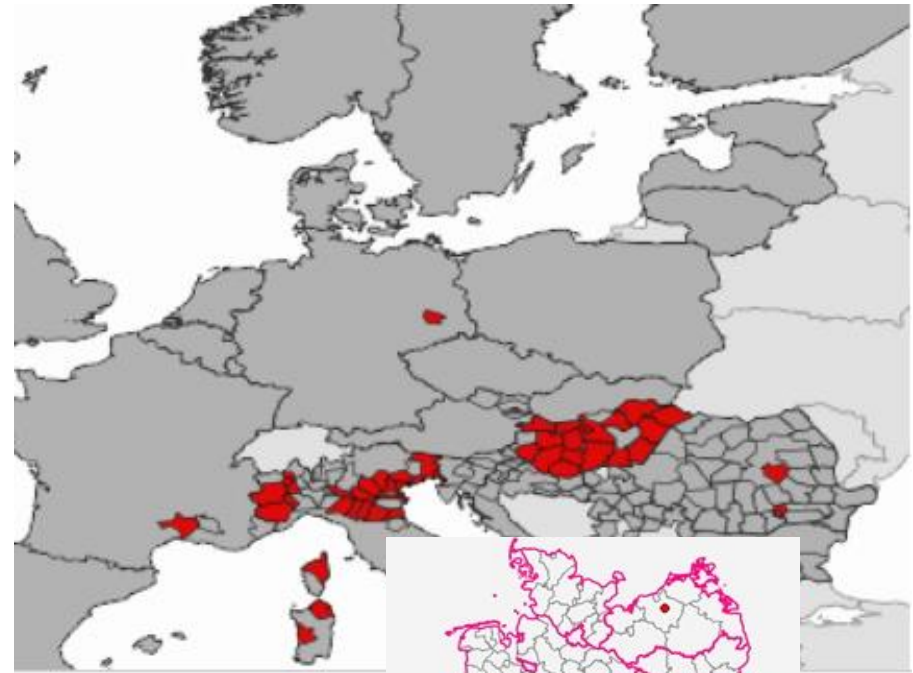
**Contingency planning – focus on:
vaccination, animal welfare, wildlife and costs.
Riga 3rd - 4th October 2018**

Status of West Nile virus in Europe

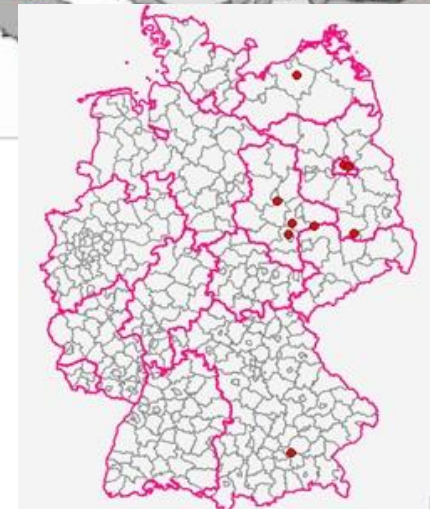
Human cases 2018 (1,266 in EU alone)



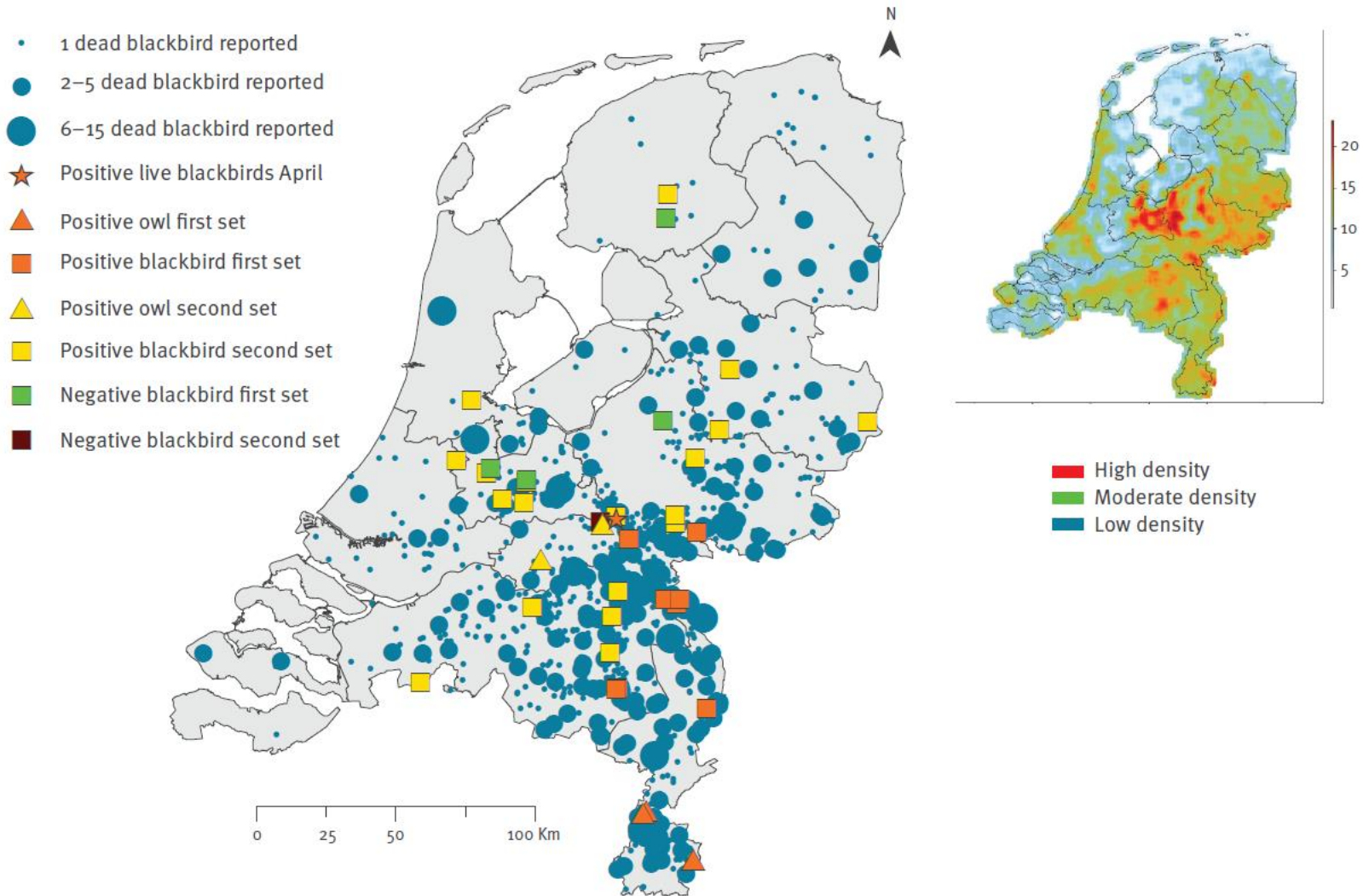
Equid cases 2018 (201 reported)



German cases (birds) 2018



Status of Usutu virus in Europe

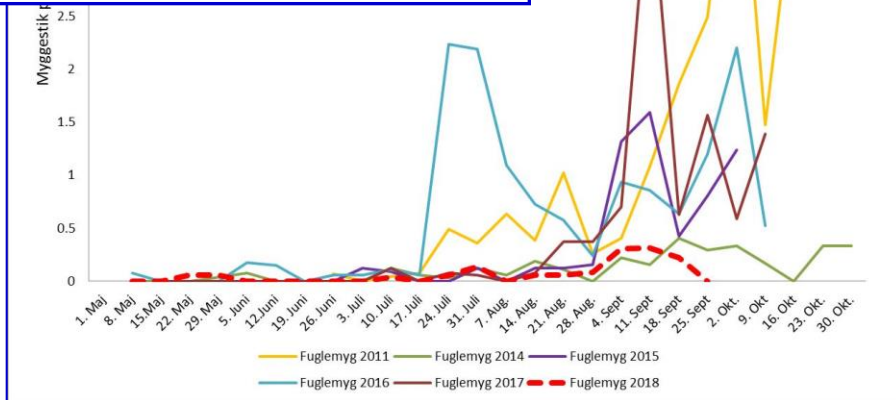
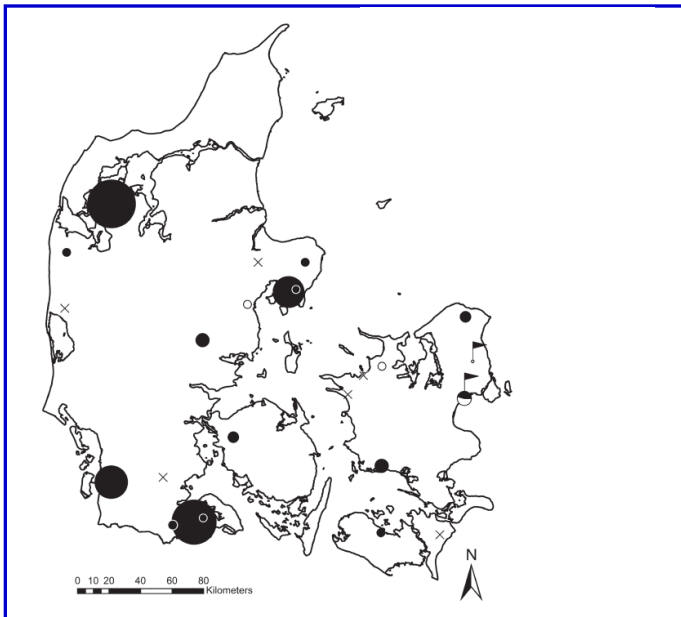


Rijks J, Kik M, Slaterus R, Foppen R, Stroo A, IJzer J, Stahl J, Gröne A, Koopmans M, van der Jeugd H, Reusken C. Widespread Usutu virus outbreak in birds in the Netherlands, 2016. *Euro Surveill.* 2016;21

Risk of Usutu and West Nile virus 2018

Culex pipiens and torrentium

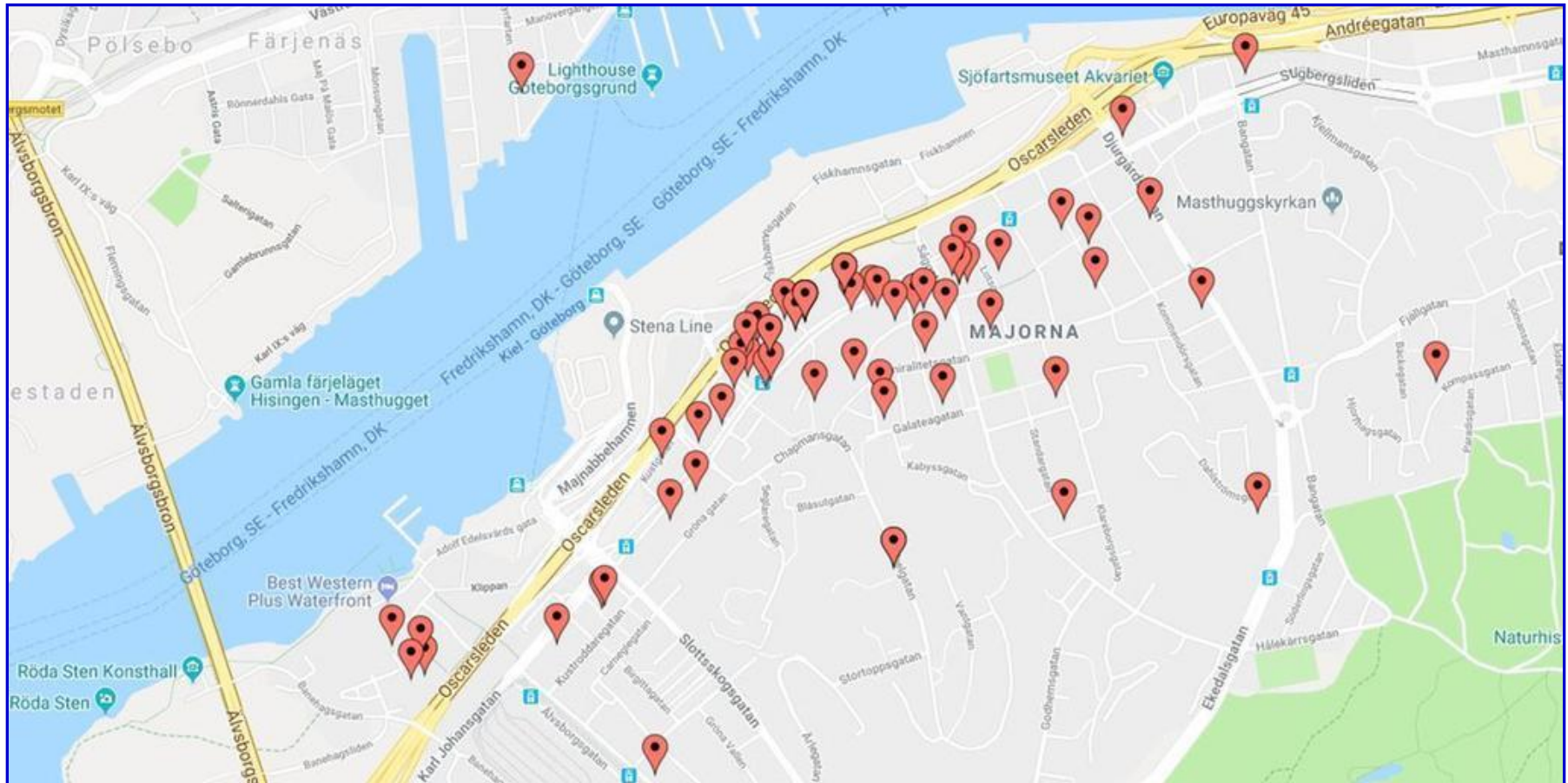
Culex modestus



www.myggetal.dk

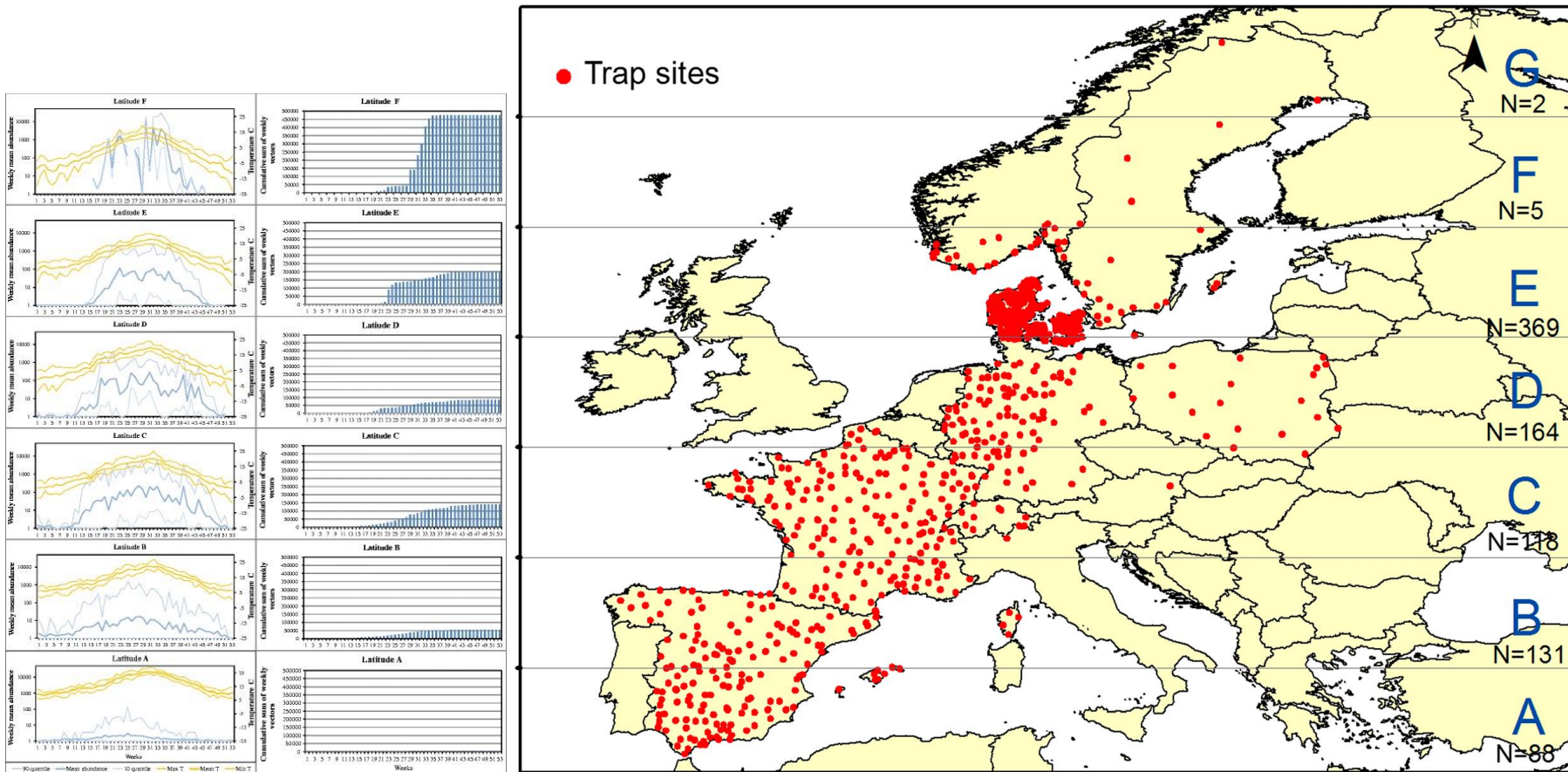
Anders Lindström SVA

The hunt for *Culex pipiens molestus* in Göteborg, Sweden 2018

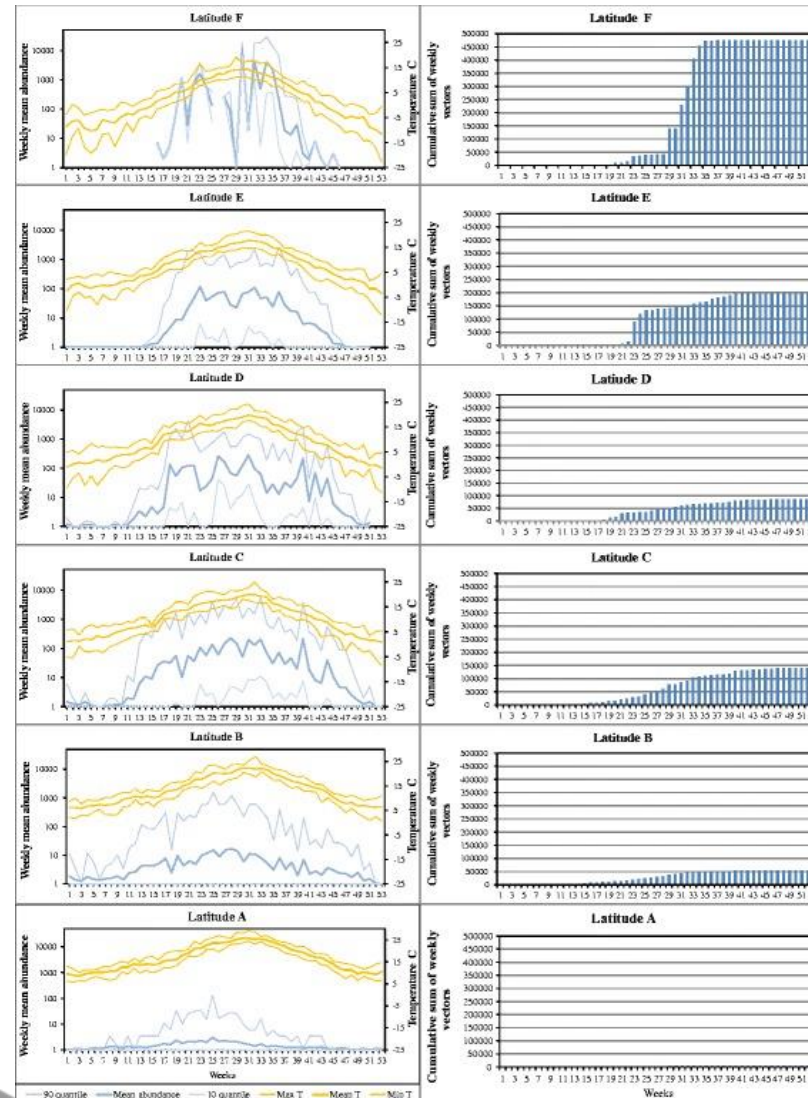


Göteborgs-Posten

Biting midges – seasonality and distribution

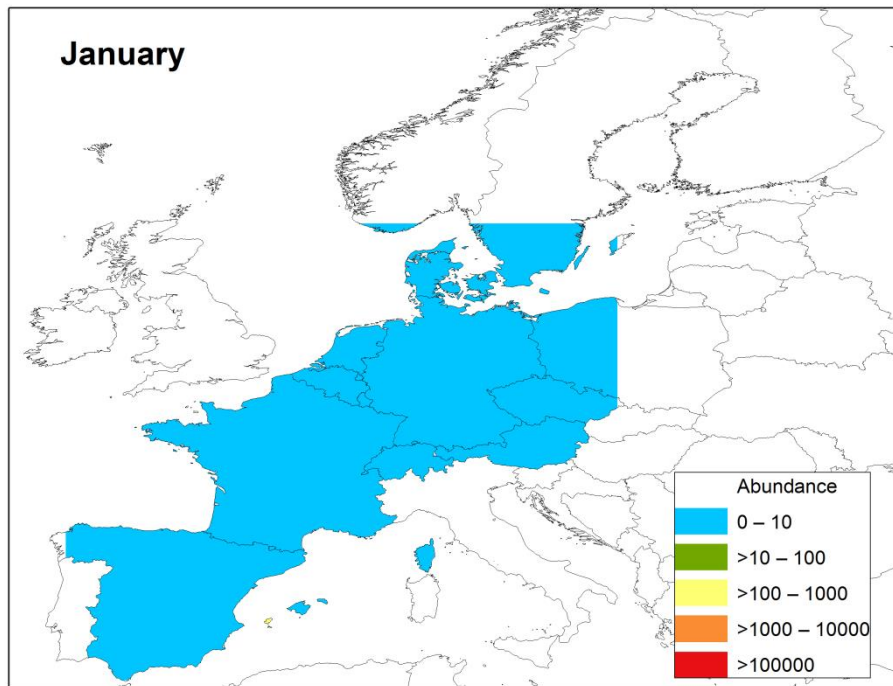


Biting midges – seasonality and distribution

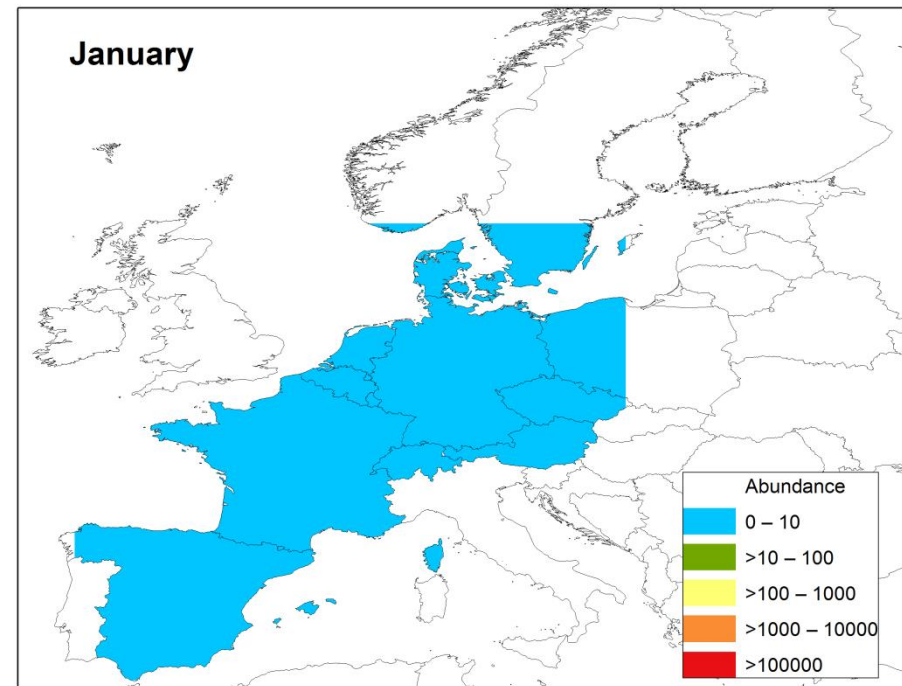


Biting midges – seasonality and distribution

Obsoletus ensemble

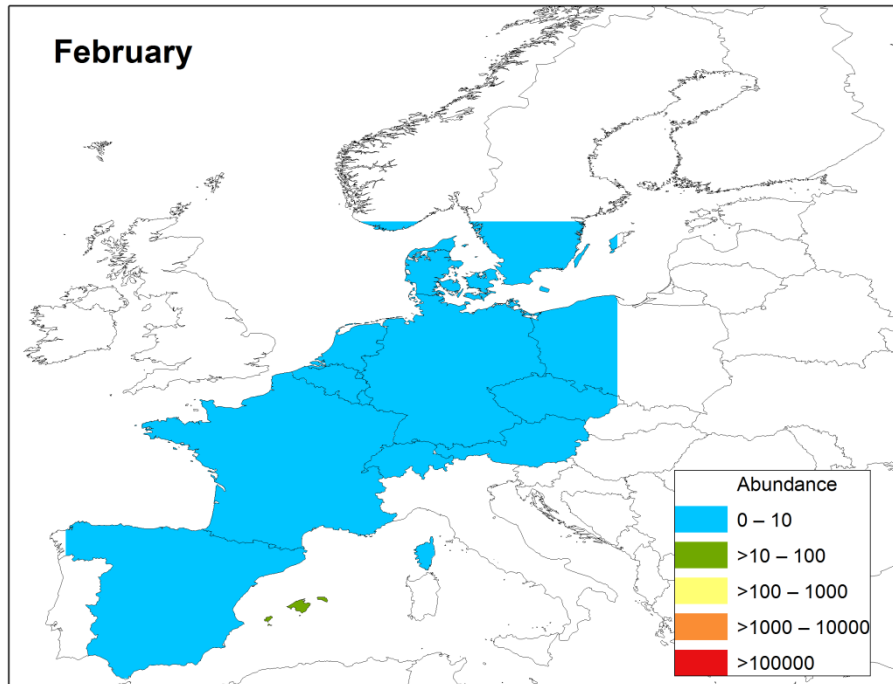


Pulicaris ensemble

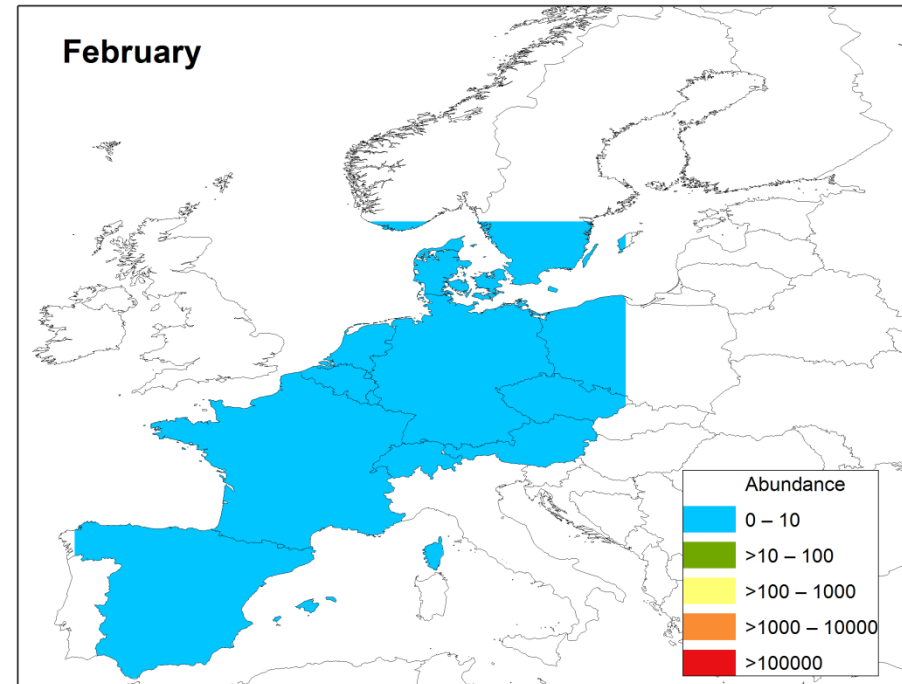


Biting midges – seasonality and distribution

Obsoletus ensemble

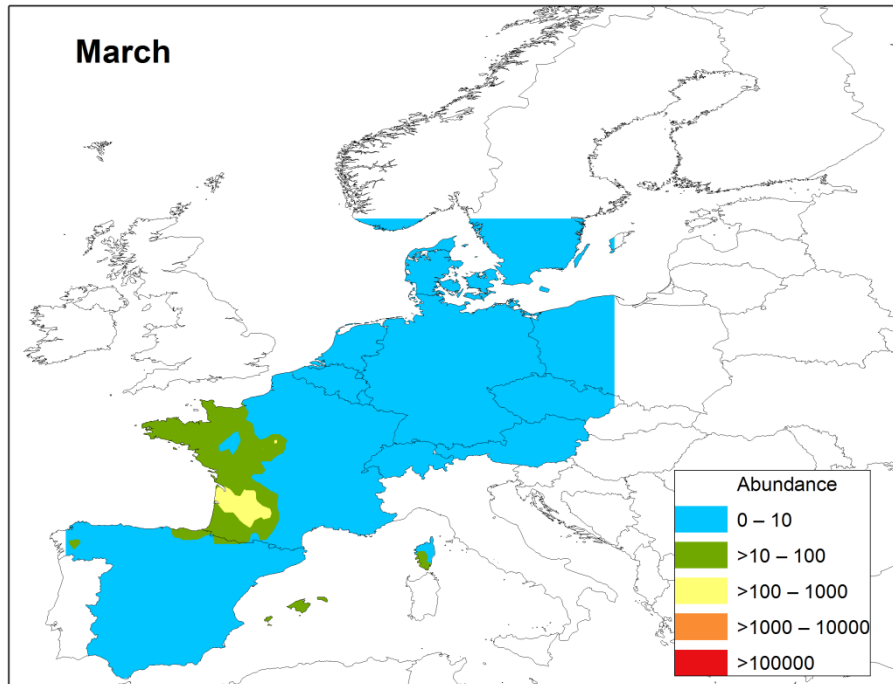


Pulicaris ensemble

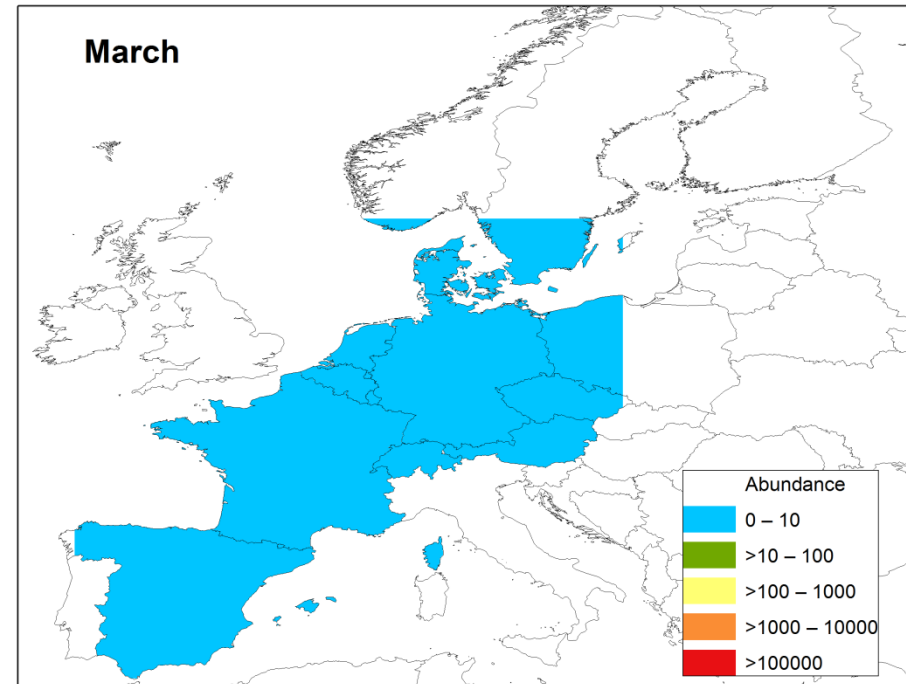


Biting midges – seasonality and distribution

Obsoletus ensemble

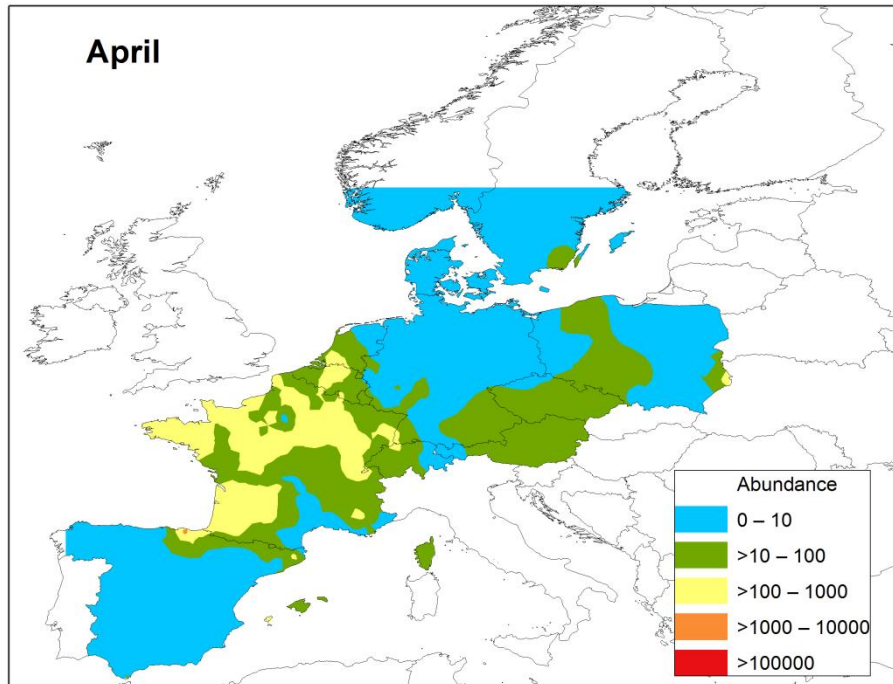


Pulicaris ensemble

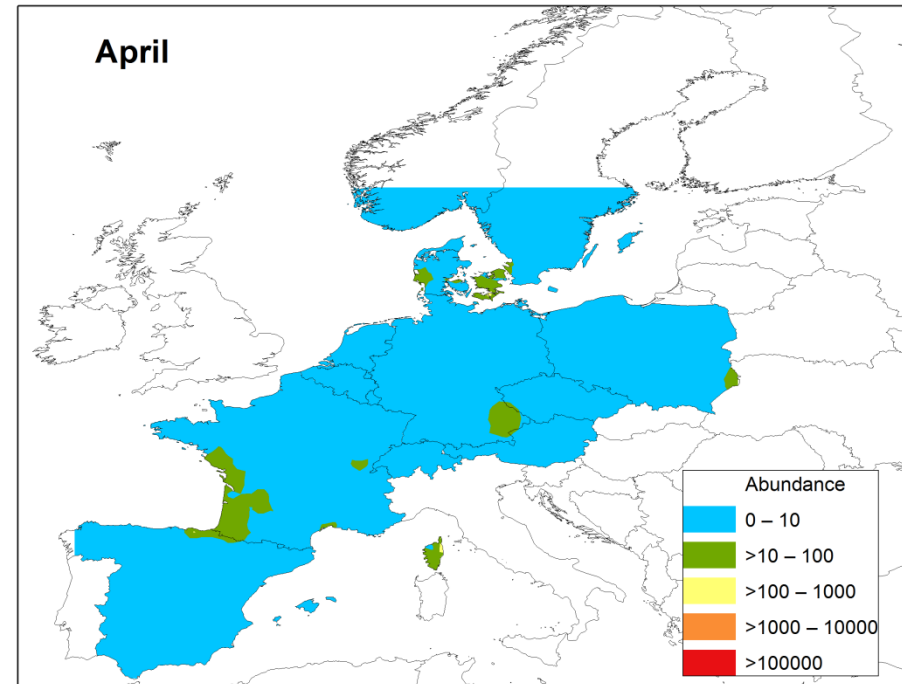


Biting midges – seasonality and distribution

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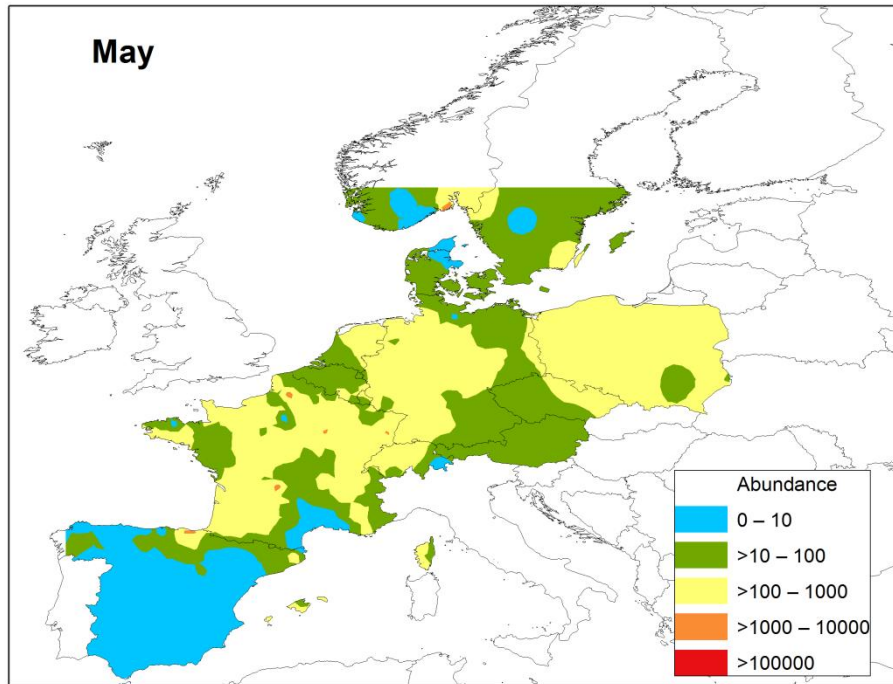


Pulicaris ensemble

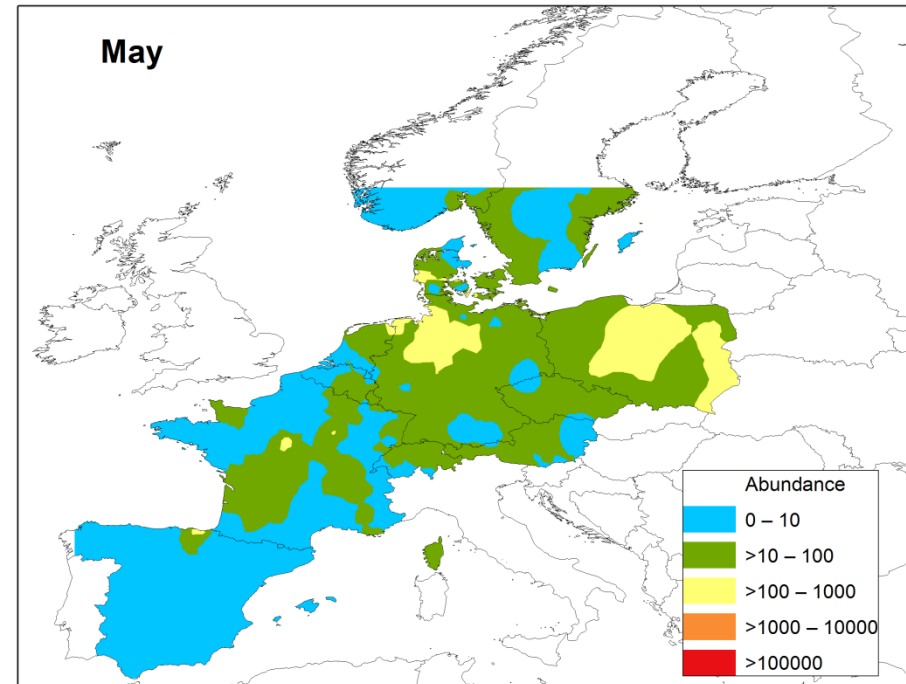


Biting midges – seasonality and distribution

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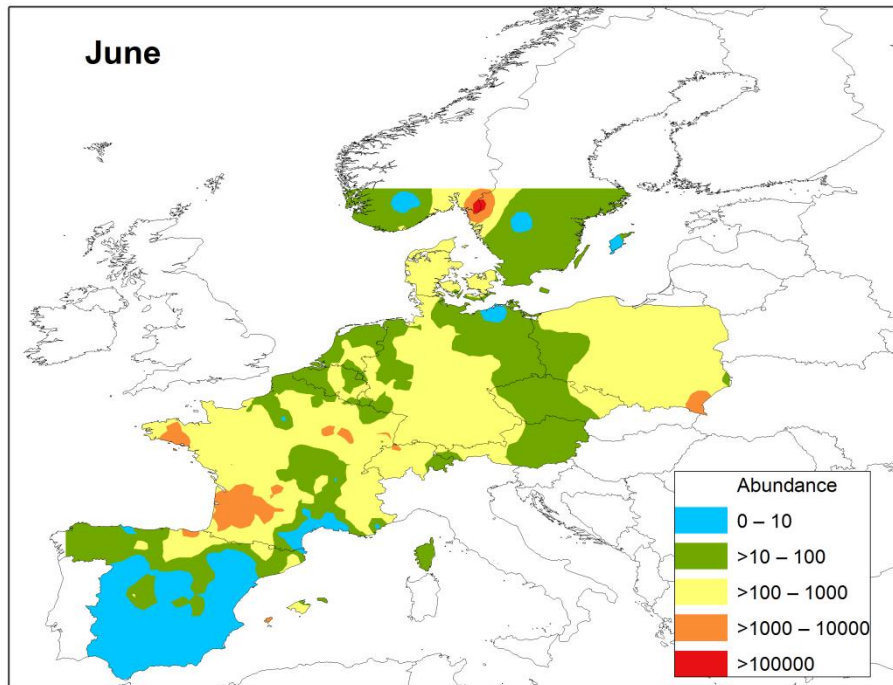


Pulicaris ensemble

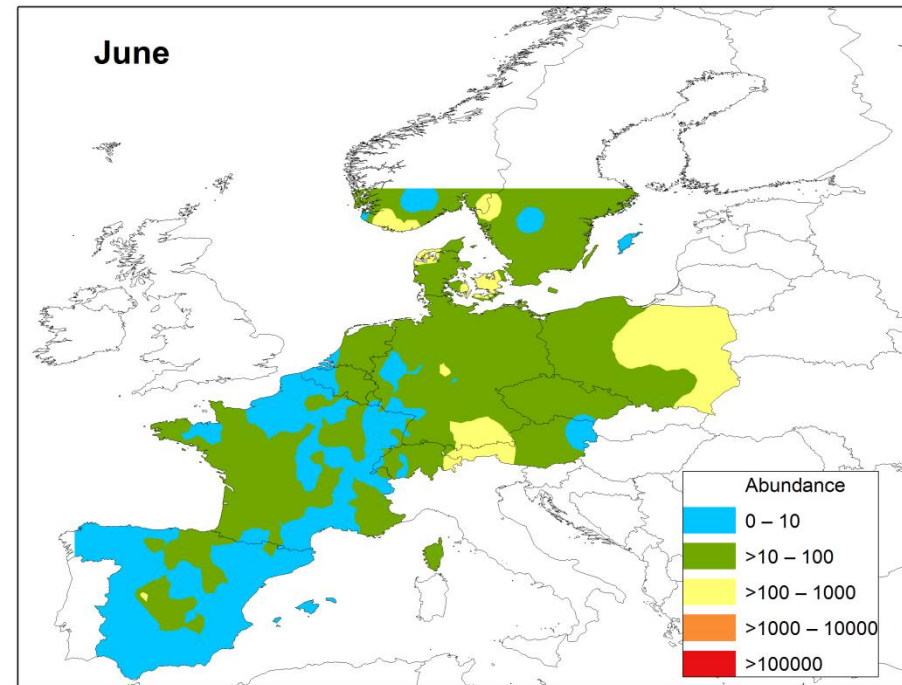


Biting midges – seasonality and distribution

Obsoletus ensemble

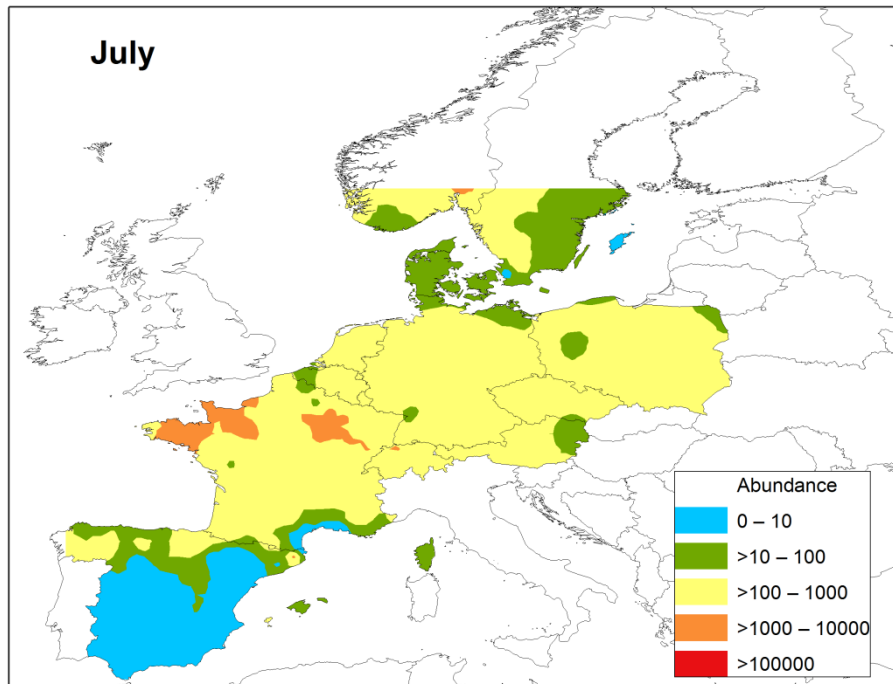


Pulicaris ensemble

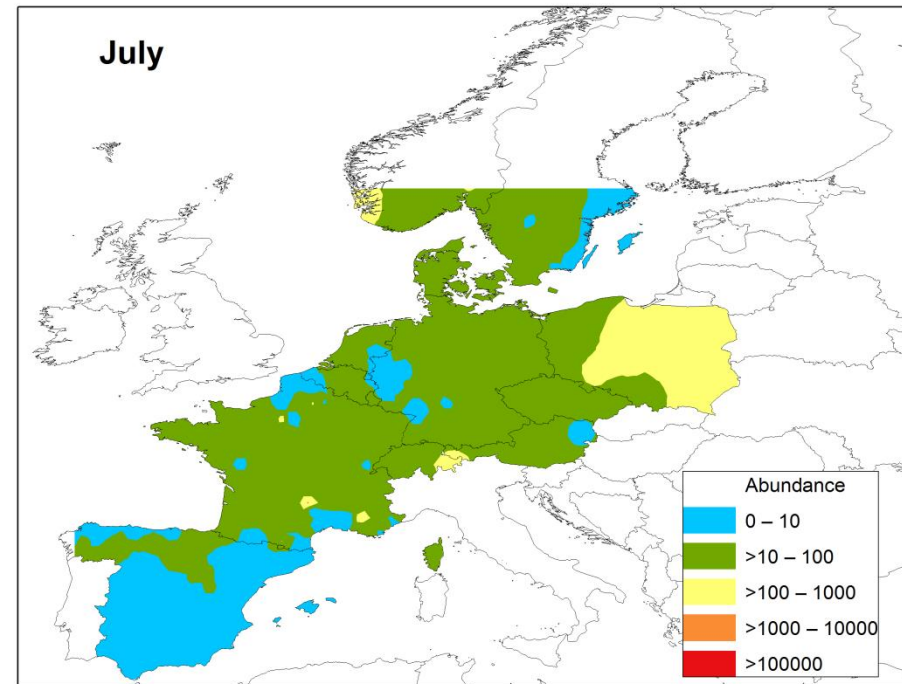


Biting midges – seasonality and distribution

Obsoletus ensemble

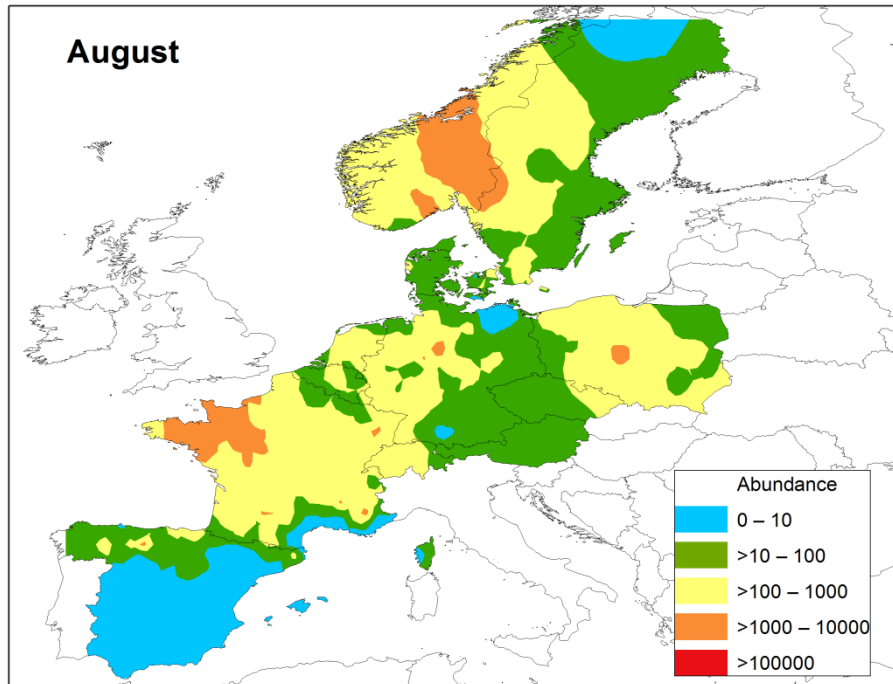


Pulicaris ensemble

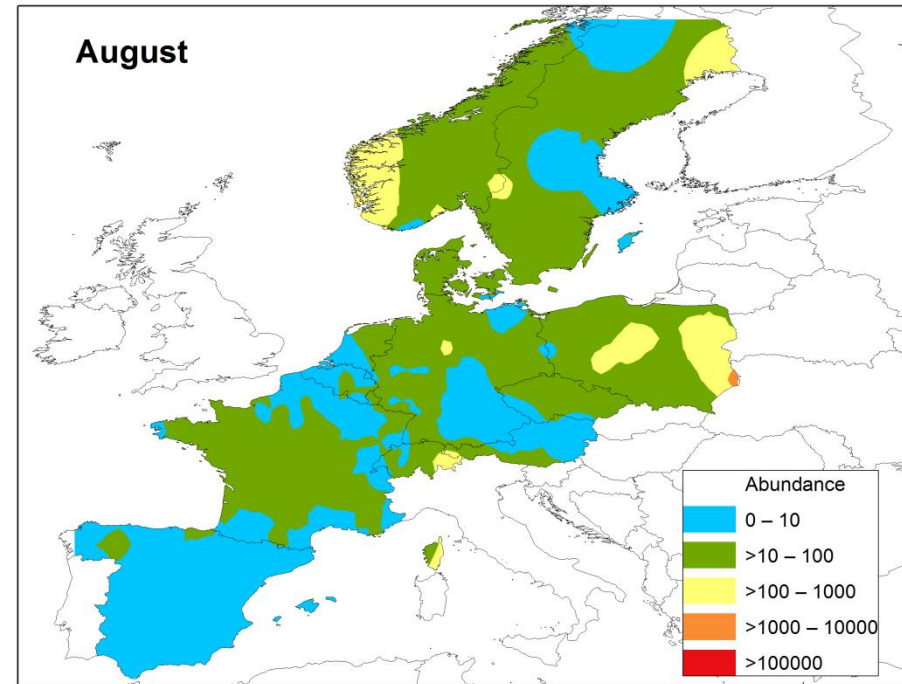


Biting midges – seasonality and distribution

Obsoletus ensemble

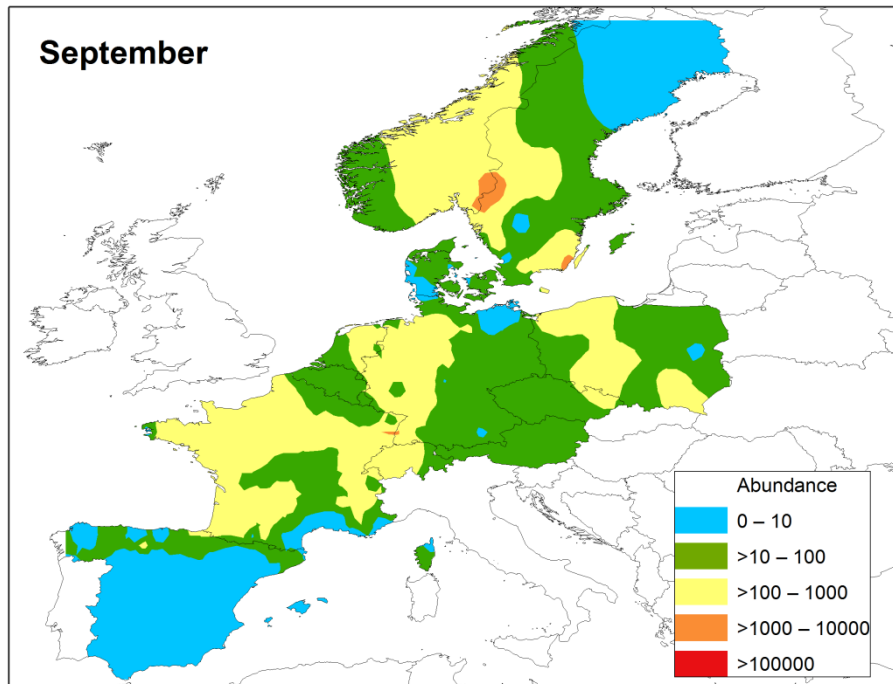


Pulicaris ensemble

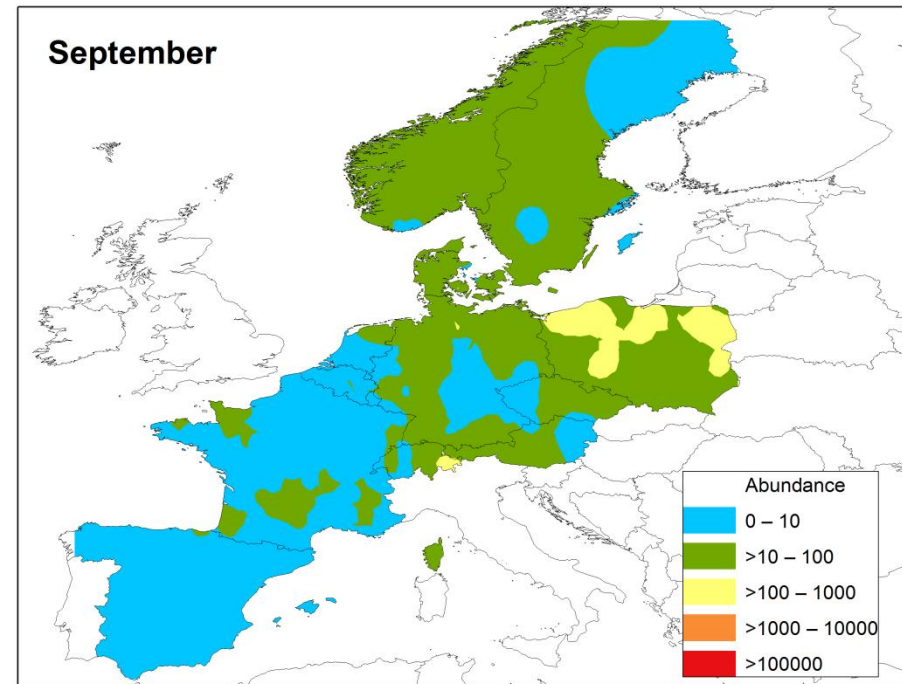


Biting midges – seasonality and distribution

Obsoletus ensemble

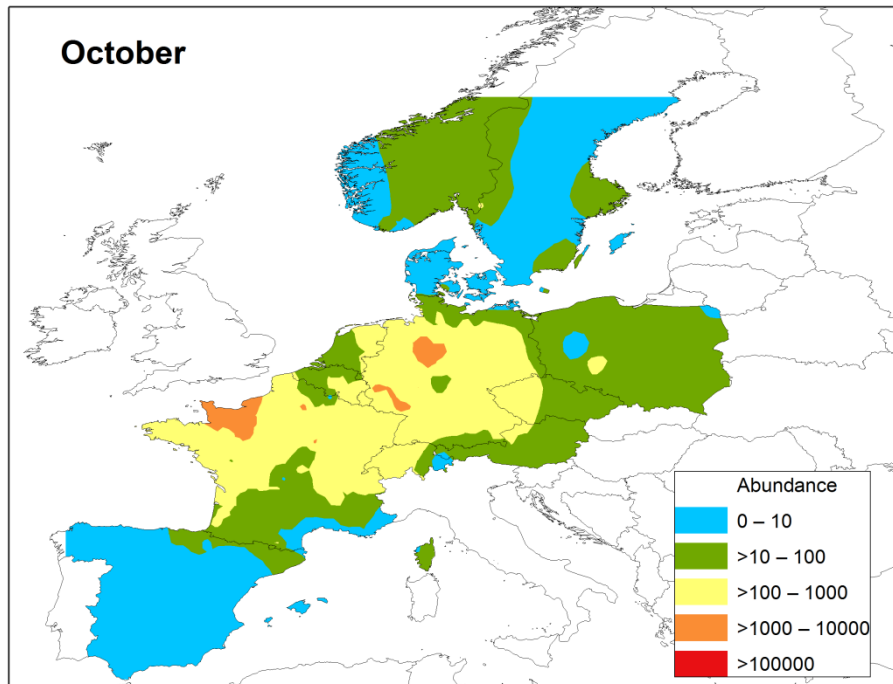


Pulicaris ensemble

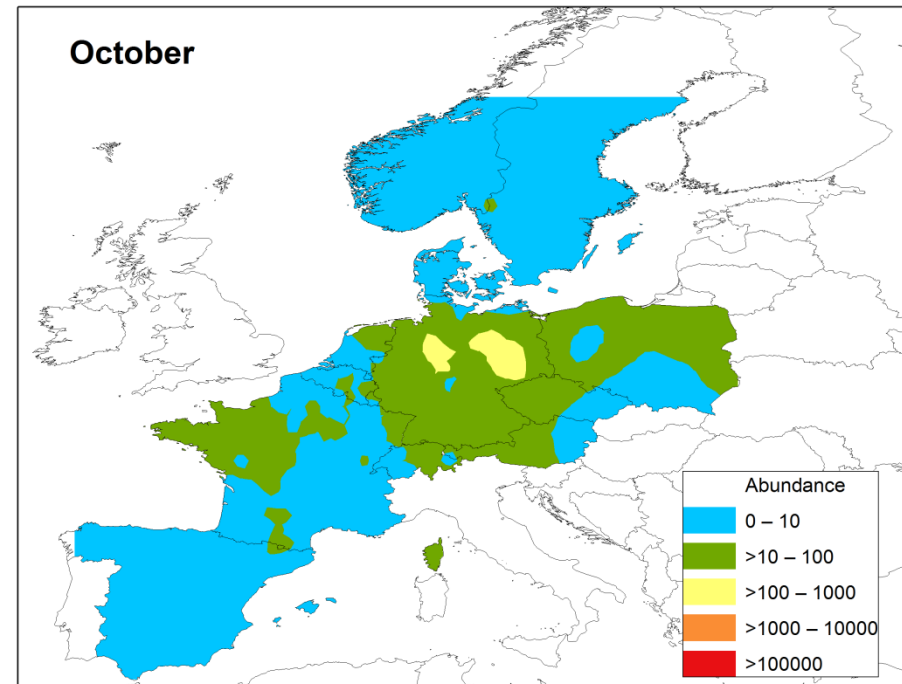


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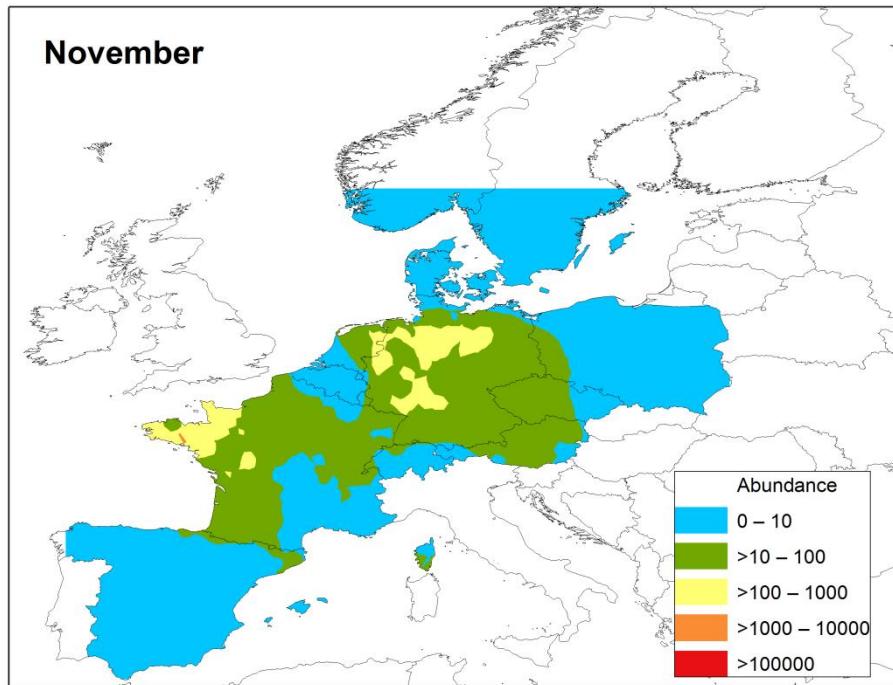


Pulicaris ensemble

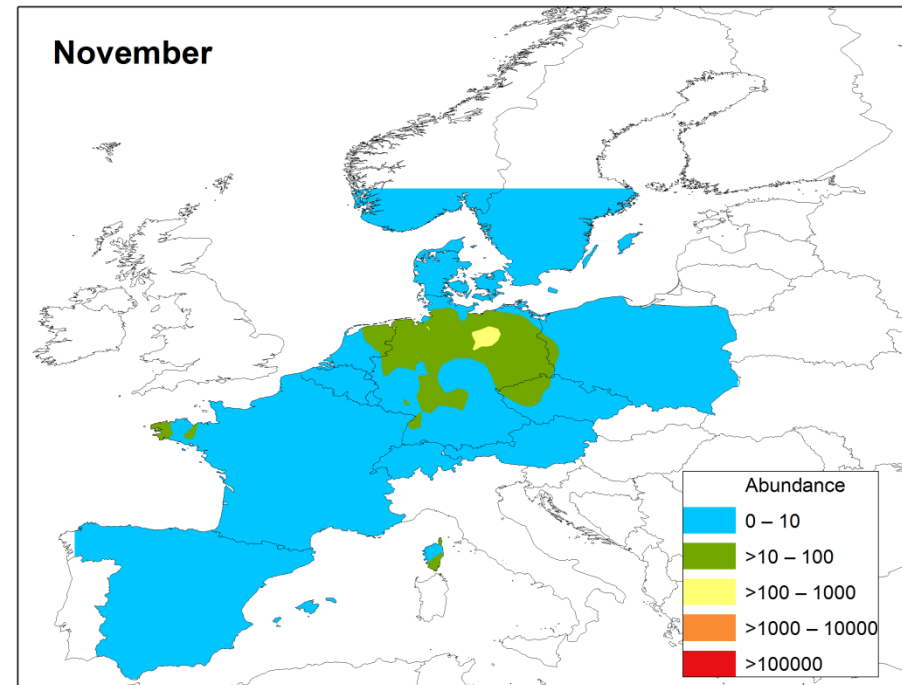


Biting midges – seasonality and distribution

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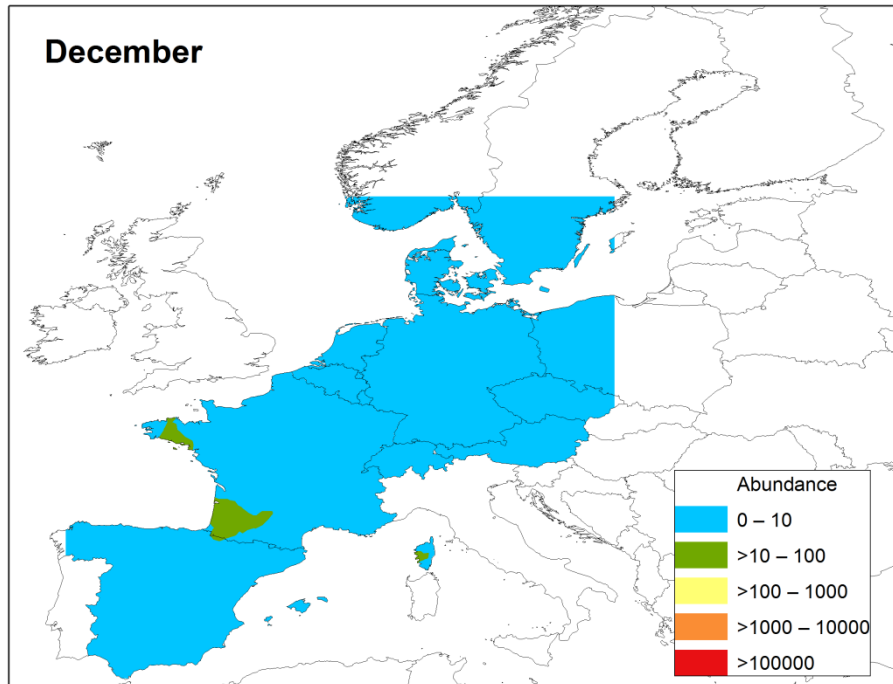


Pulicaris ensemble

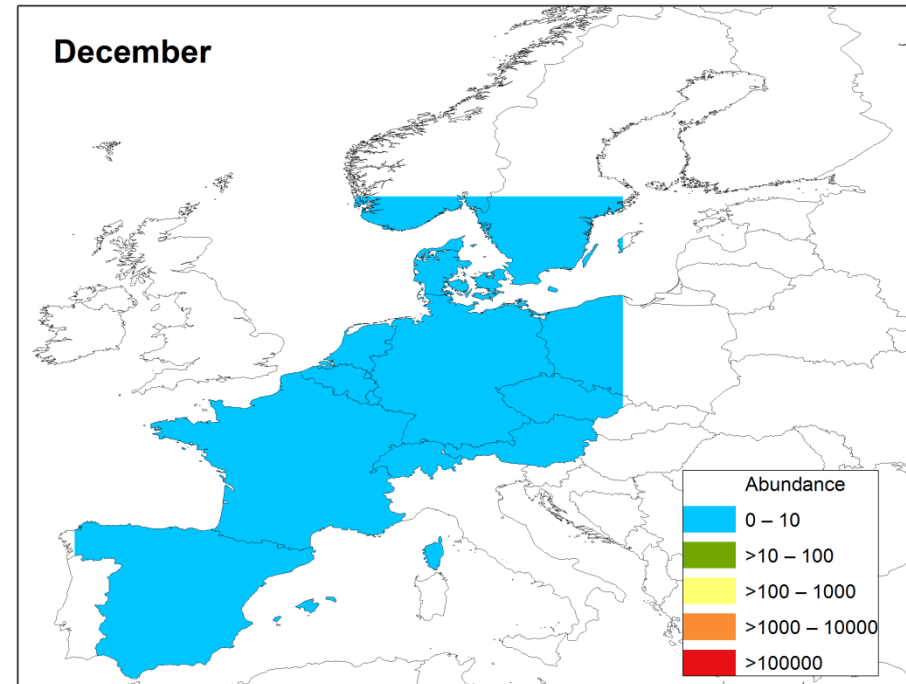


Biting midges – seasonality and distribution

Obsoletus ensemble



Pulicaris ensemble



Classical **biological** vectors



Mosquitoes:
Malaria parasites
Dengue / Zika virus



Biting midges:
Bluetongue /
Schmallenberg virus



Ticks:
Borrellia bacteria
TBE virus

Classical **biological** vectors



The pathogen develops in the vector

Development in vector may take long time and always depends on the temperature

For successful transmission there must be:

- 1) Vectors present
- 2) AND suitable temperatures
- 3) AND the vector has to survive long enough for the pathogen to complete the development in the vector.

Mechanical vectors



The pathogen do **not** develop in the vector. The pathogen merely contaminates the mouth parts of the vector



Transmission between animals is without delay and temperature is not a factor

For successful transmission there must be:

- 1) Vectors present with big mouth parts
- 2) Interrupted feeding so that vectors move from host to host
- 3) Not too far between host animals



Mechanical vectors

Mechanical transmission is common



We know *Stomoxys calcitrans* (the stable fly) is very efficient in transmitting African Swine Fever for up to 24 hours after biting



Horse flies (Tabanidae) transmit:

Brucella abortus

Classical swine fever (suspected)

Rinderpest

Influenza

TBE

Q fever

And even *Dirofilaria*

In EU they transmit Equine

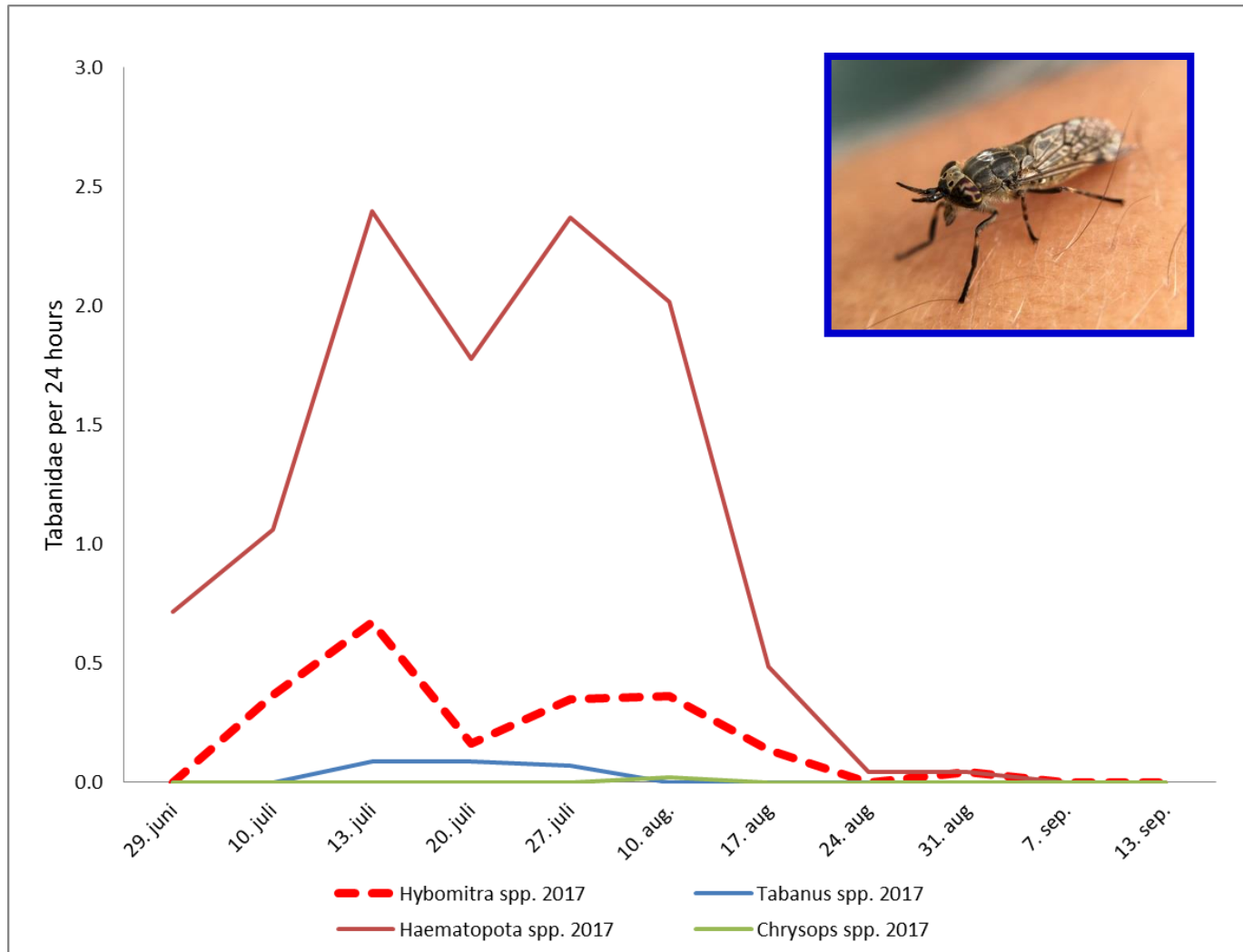
Infectious Anaemia and

Lumpy Skin Disease

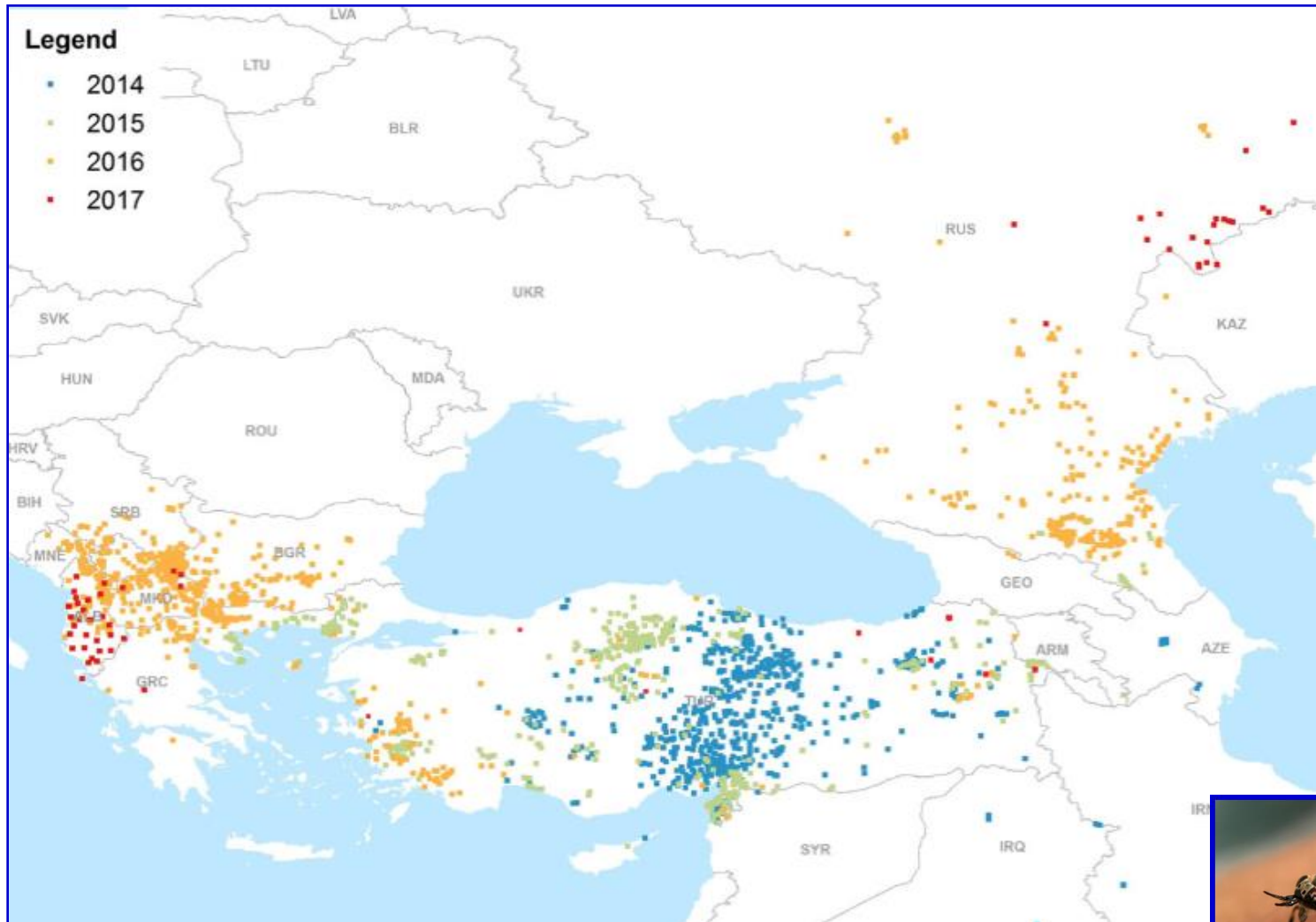


Mosquitoes can transmit myxoma virus between rabbits

Mechanical vectors



Lumpy skin disease



Can **mechanical** vectors spread ASFV in Europe?



Mechanical vectors oral infection mode



At infected farms we have found mosquitoes, horse flies and stable flies near the ventilation openings.



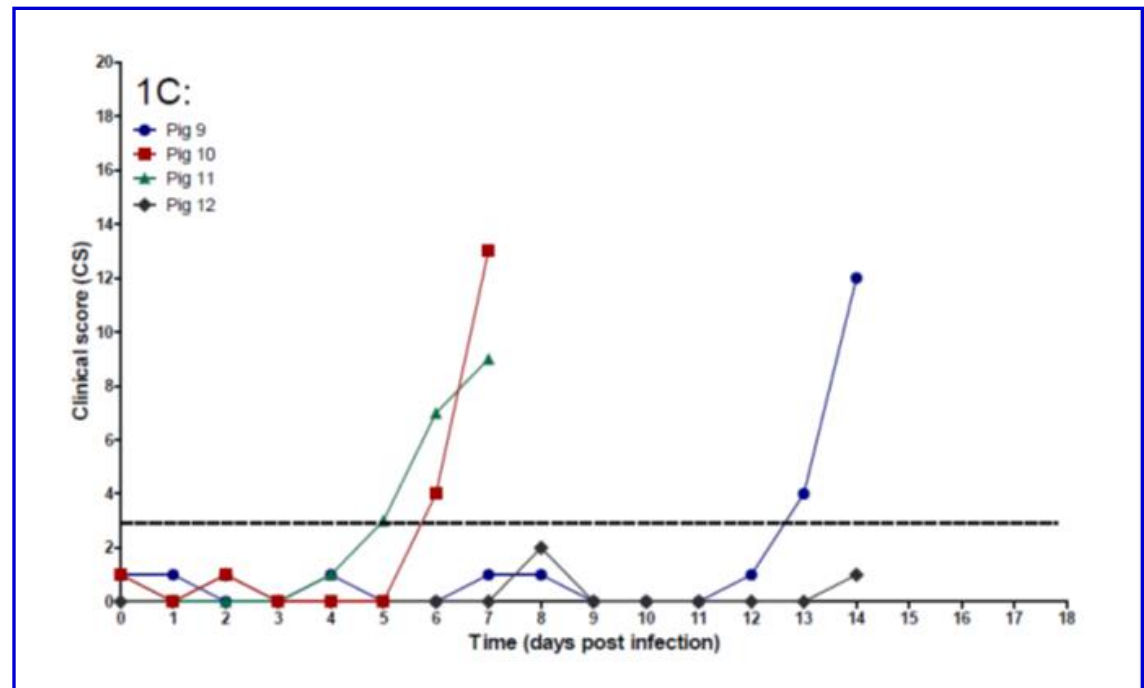
Mosquitoes and biting flies are not able to breed in stables – they come from the surrounding forest

Conclusion:

Stable flies, horse flies and mosquitoes may transport blood samples from infected wild pigs to pigs in stables across any fence.



Mechanical vectors oral infection mode



Mechanical vectors oral infection mode



- 1) If flies feed on ASF infected host
- 2) and then fly into a stable and dies
- 3) and accidentally gets eaten by pig,
- 4) will the pig get infected?

Conclusion:

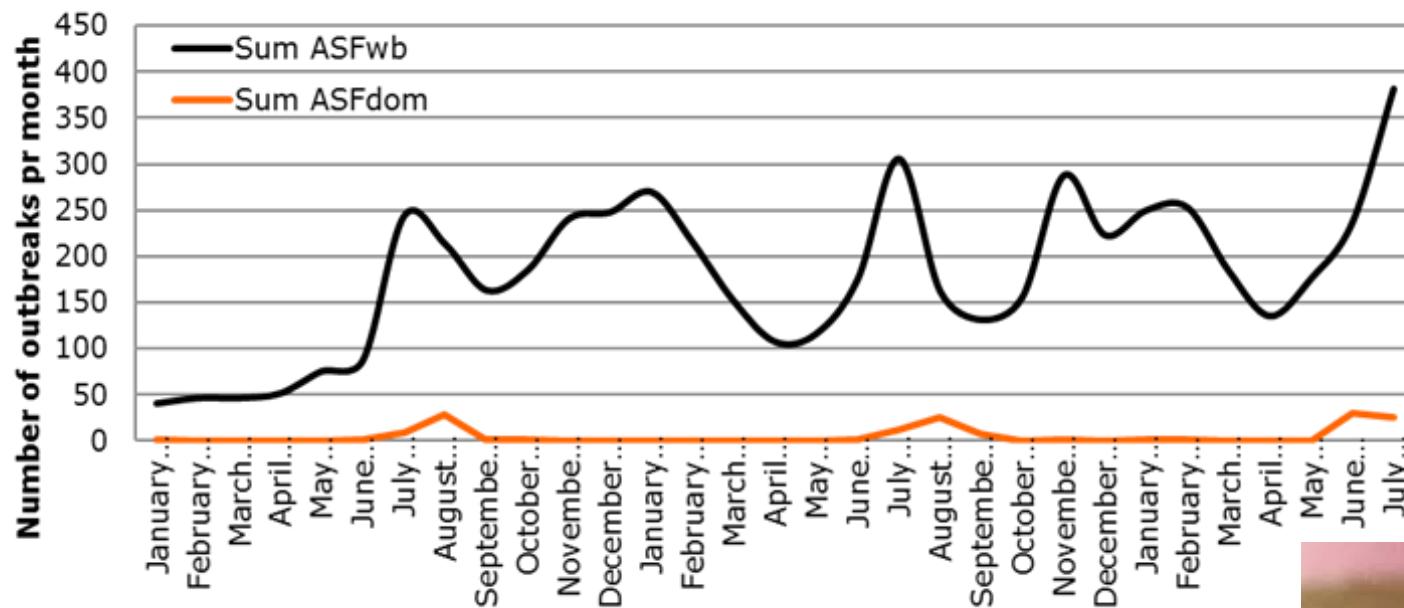
Yes !

In this case flies do not need to bite a pig to infect the pig.

Do **mechanical** vectors actually spread ASFV in Europe?



**ASF i wild boars and domestic pigs
in Estonia, Latvia, Lithuania and Poland in
2015-2017**



Tick vectors



Tick vectors



Dermacentor reticulatus



Ixodes ricinus

Tick vectors



Tick vectors

**New tick
vector for
Denmark
September
2018**



Hyalomma marginatum

The vector of Crimean Congo Haemorrhagic Fever

Crimean Congo haemorrhagic fever - a case story

Kazakhstan 2009:

- 24. June:** 23 year old woman gives birth at a hospital
- 29. June:** the mother is admitted at the hospital and operated resulting in severe bleeding
- 02. July:** the mother gets operated again twice
- 03. July:** the child dies
- 04. July:** the mother dies
- 09. July:** vascular surgeon dies
- 10. July:** paediatrician assisting with the birth admitted
- 10. July:** chief surgeon from operation admitted
- 10. July:** assistant gynaecologist admitted
- 11. July:** nurse handling the mother admitted
- 11. July:** chief surgeon dies
- 13. July:** paediatrician dies



A ScandTick Innovation survey of migrating birds in Denmark 2016



Common redstart (*Phoenicurus phoenicurus*)

Spring: 5 positive / 11 birds; 3 ticks per infested bird

Autumn: 0 positive / 7 birds;



European robin (*Erithacus rubecula*)

Spring: 3 positive / 5 birds; 3 ticks per infested bird

Autumn: 40 positive / 175 birds; 1.9 ticks per infested bird

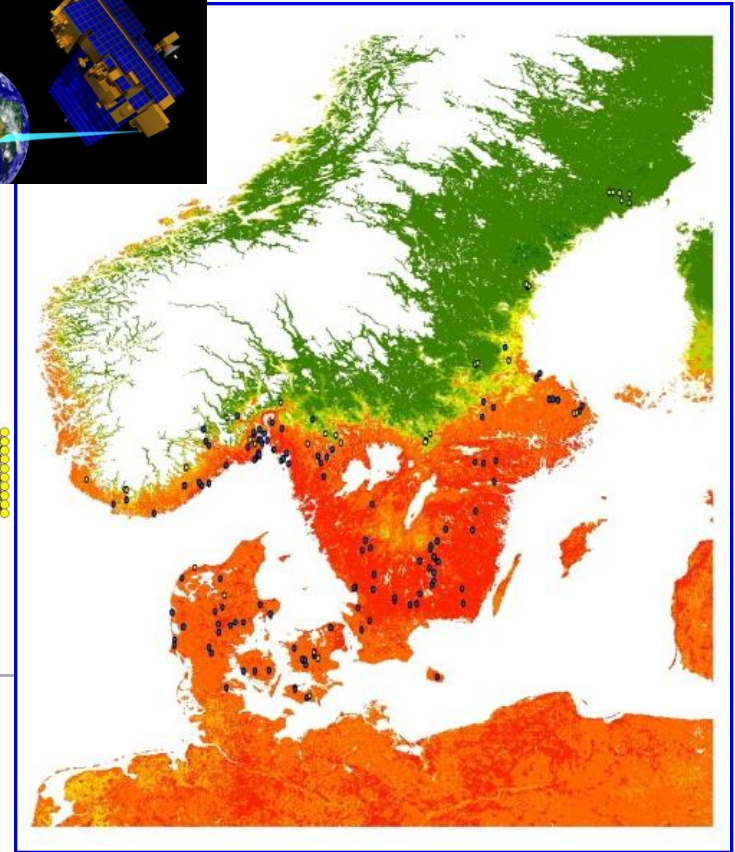
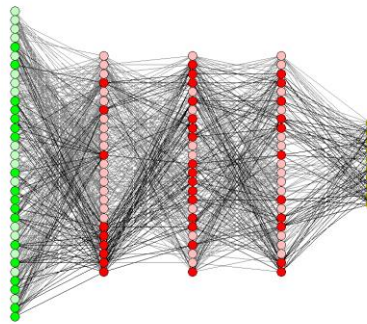
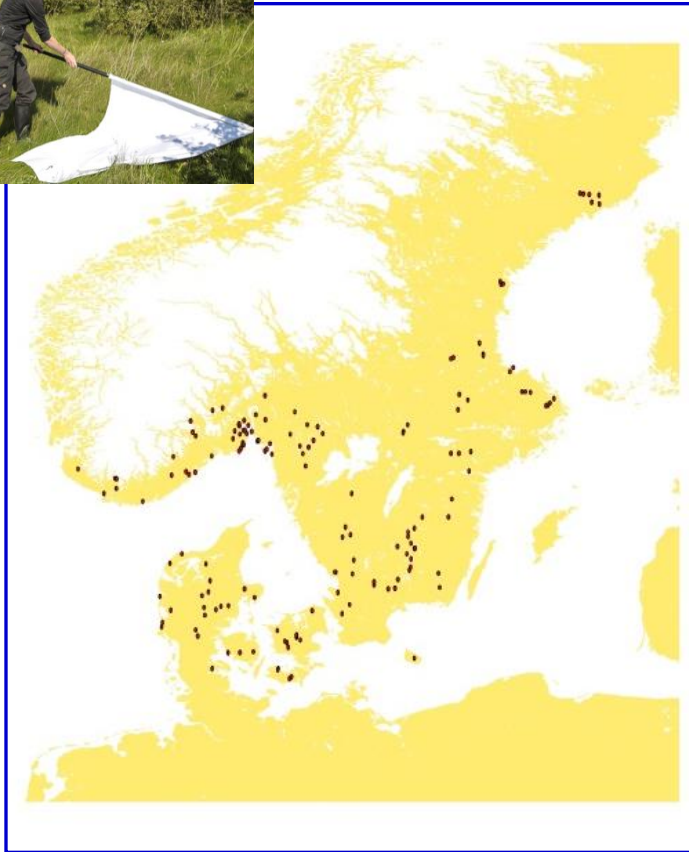
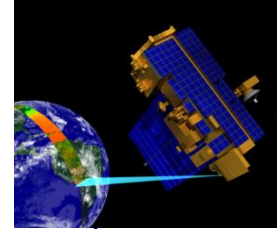


Common Blackbird (*Turdus merula*)

Spring: None examined

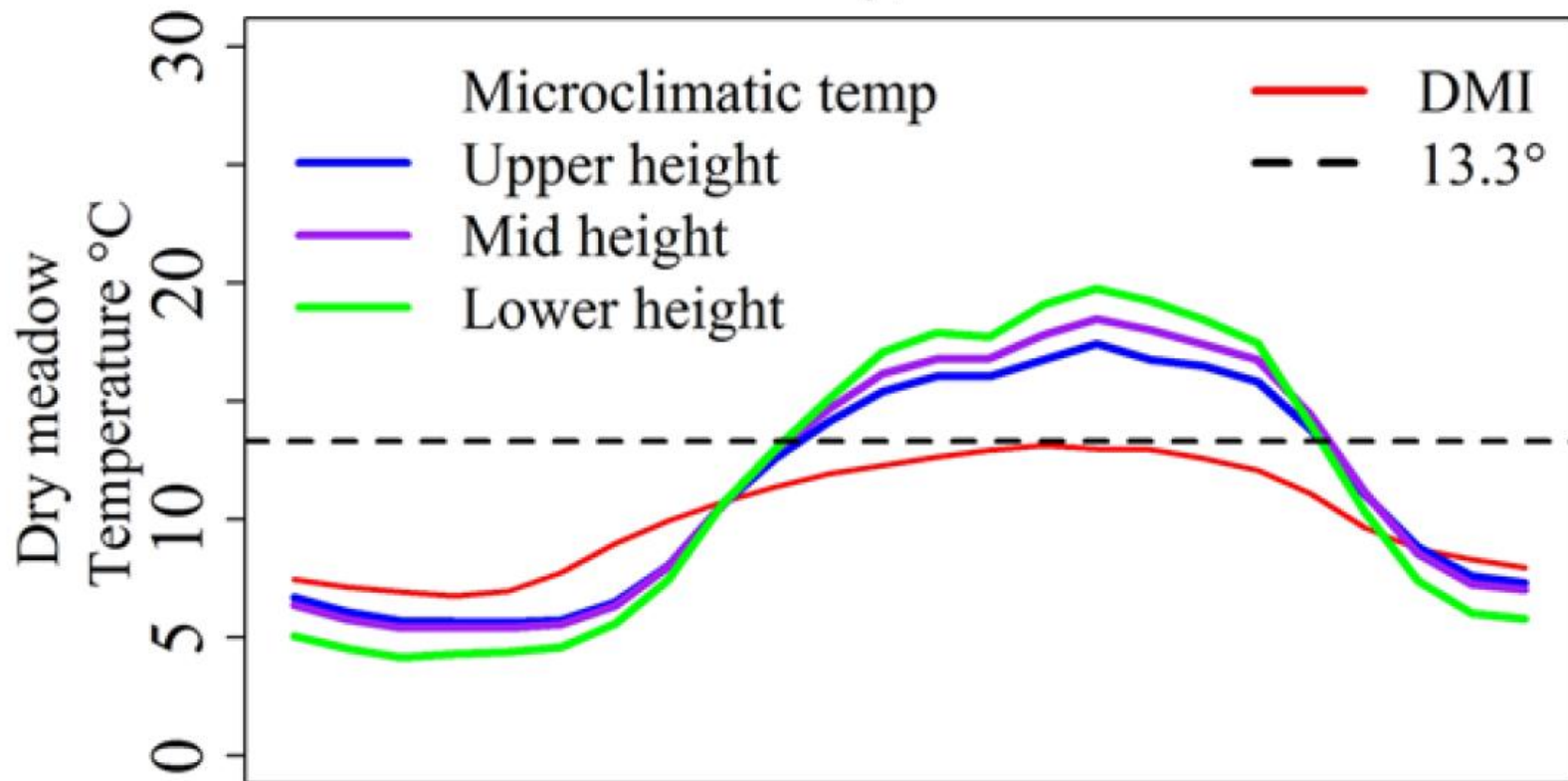
Autumn: 9 positive / 31 birds; 4.2 ticks per infested bird

A ScandTick Innovation survey of migrating birds in Denmark 2016

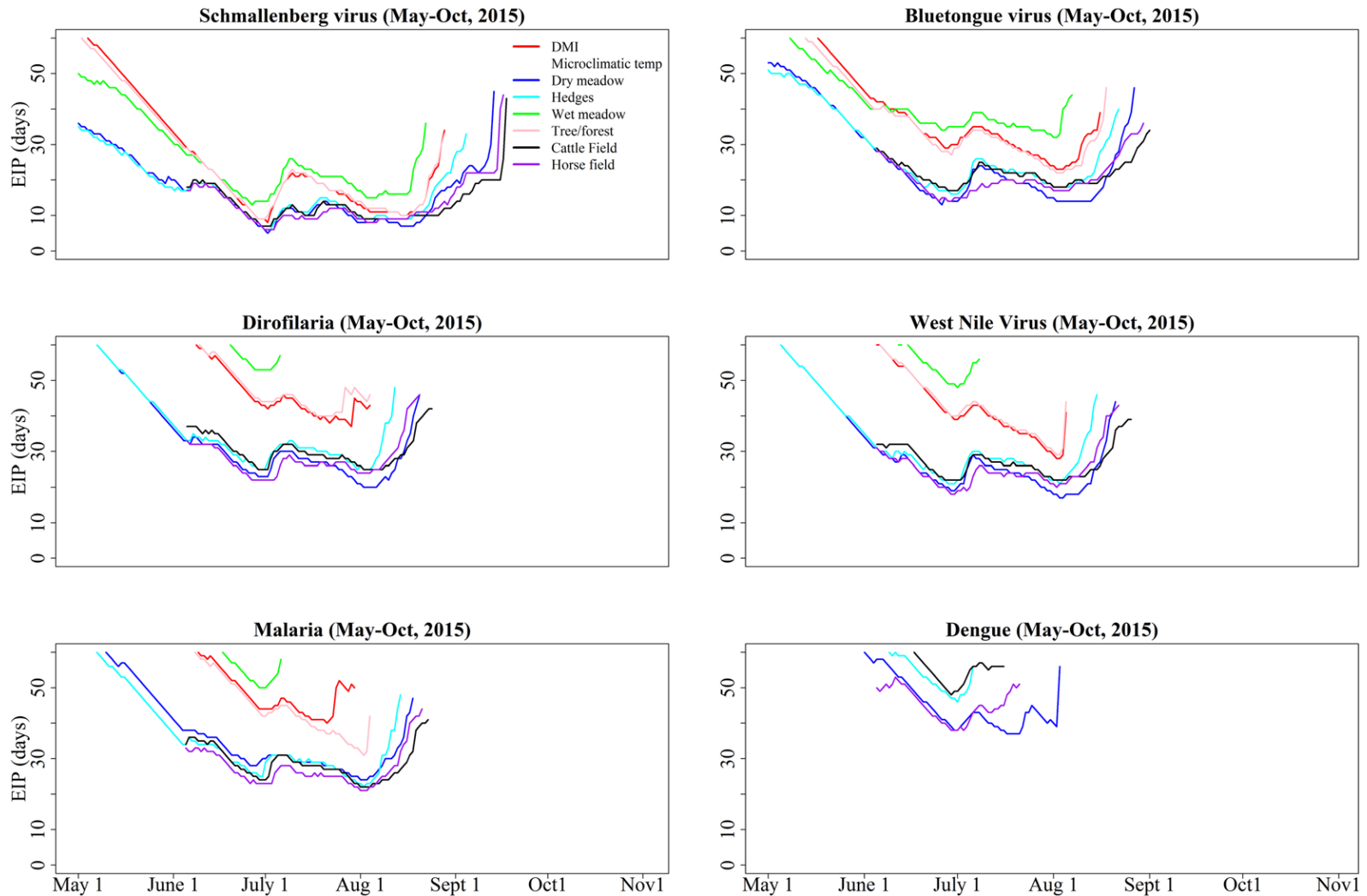


Micro climatic temperatures drive transmission

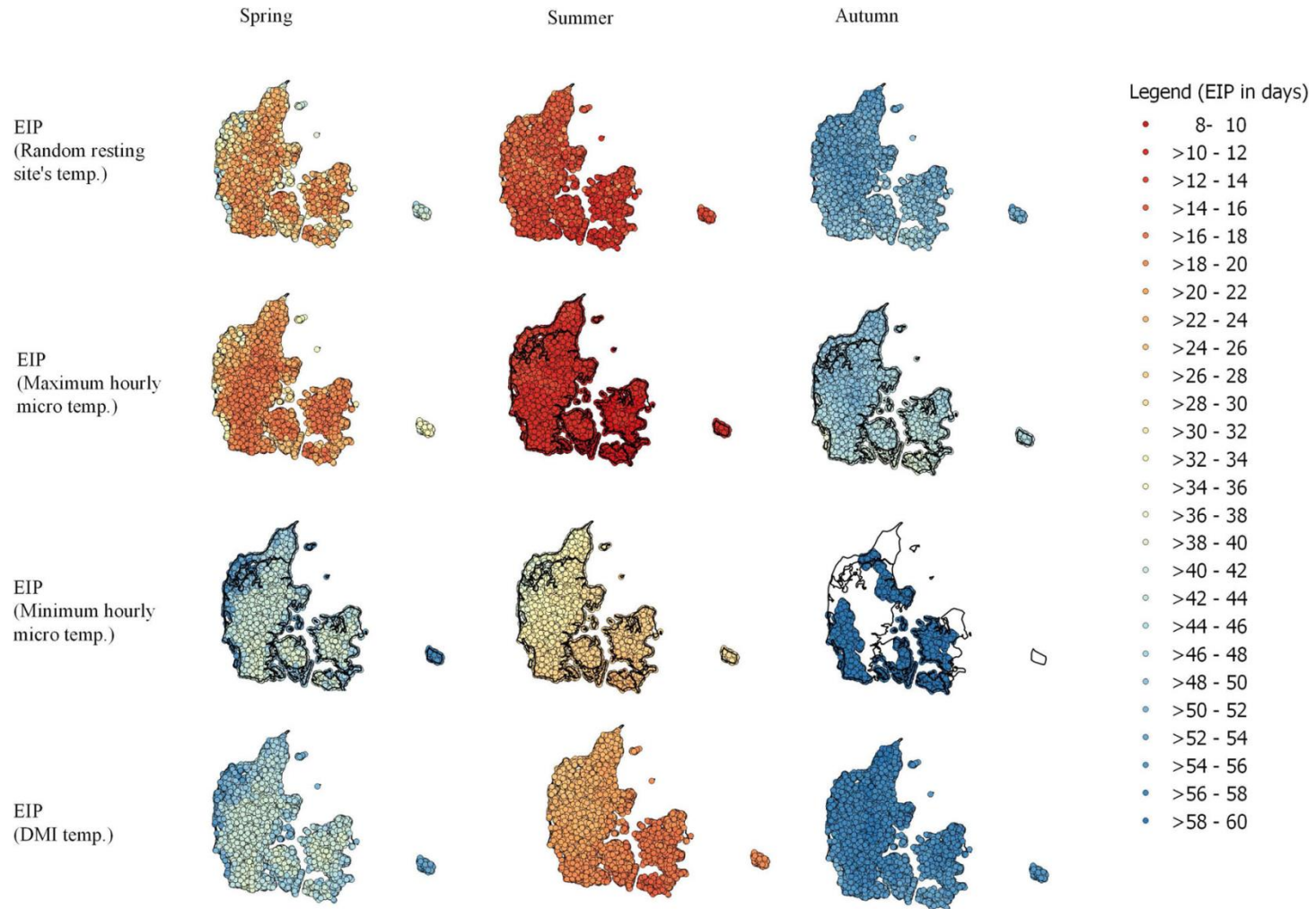
May, 2015



Micro climatic temperatures drive transmission

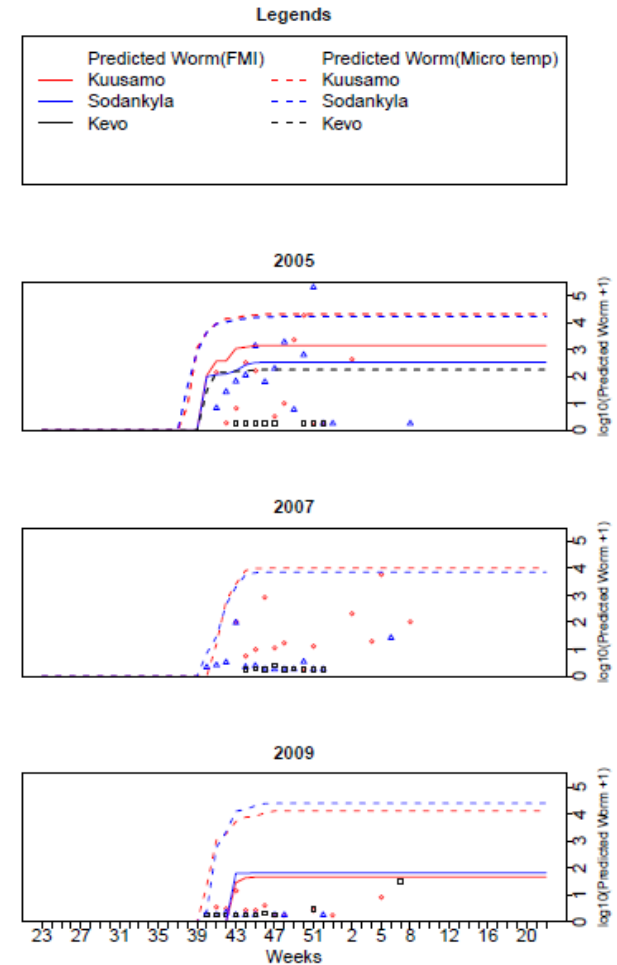
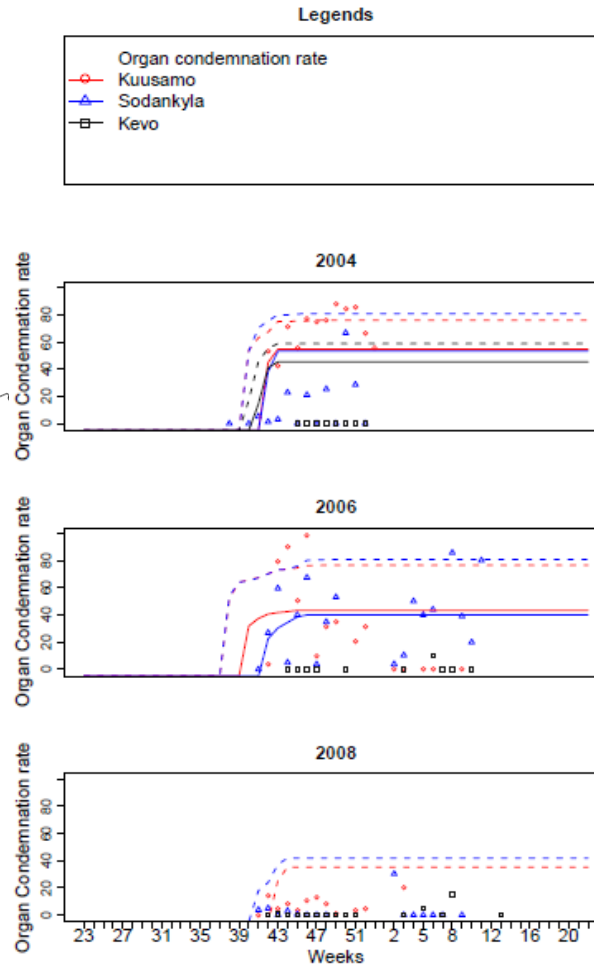
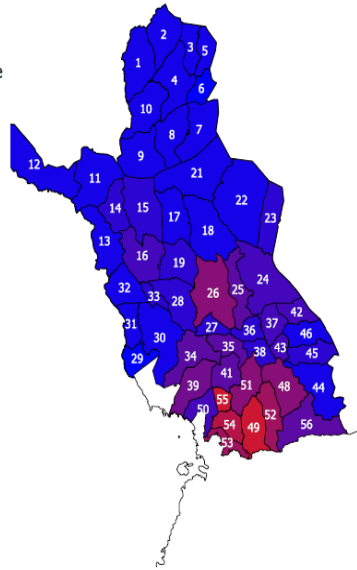
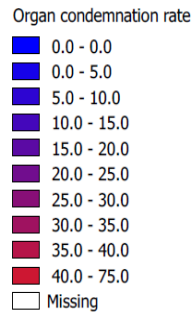


Micro climatic temperatures drive transmission



Mosquito borne *Setaria tundra* worms in Finnish reindeer – impact of climate

Organ condemnation rate due to *Setaria tundra* in Finnish reindeer cooperatives: 12 years (2004-2015) mean at each cooperative



What is next?

New diseases?



New vectors?



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VICE project partners

**Thank you
for your attention**

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