



The importance of coastal area of Baltic Sea for bat migration

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Outline

- I. Bats and zoonosis
- II. Bats on coast
 - Evidence of migration
 - Case study in SW Latvia
- III. Conclusions



manual

INVESTIGATING THE ROLE OF BATS IN EMERGING ZONOSSES

Balancing ecology, conservation and public health interest



Phylogroup	Genotype	Lyssavirus	Maintenance hosts	Location	Number of human cases
I	1	Rabies virus	Canivora and multiple species of insectivorous and haematophagus bats	Carnivores on all continents except Australia and Antarctica Insectivorous and haematophagus bats in the Americas	> 55 000/year attributed to carnivore-variants 100s/year (estimated) due to vampire bat rabies 1-4/year attributed to other bat rabies variants
I	5	European bat lyssavirus-1 (EBLV-1)	Insectivorous bats – typically <i>Eptesicus serotinus</i> (serotine bat)	Europe	2 (1977 and 1985) ^b
I	6	European bat lyssavirus-2 (EBLV-2)	Insectivorous bats – typically <i>Myotis daubentonii</i> (Daubenton's bat)	Western Europe	2 (1985 and 2002) ^b
III		West Caucasian bat virus ^a	Unconfirmed – single isolate from <i>Miniopterus schreibersii</i> (Schreiber's bent-winged bat) 2002	Western Caucasus mountains	None reported to date

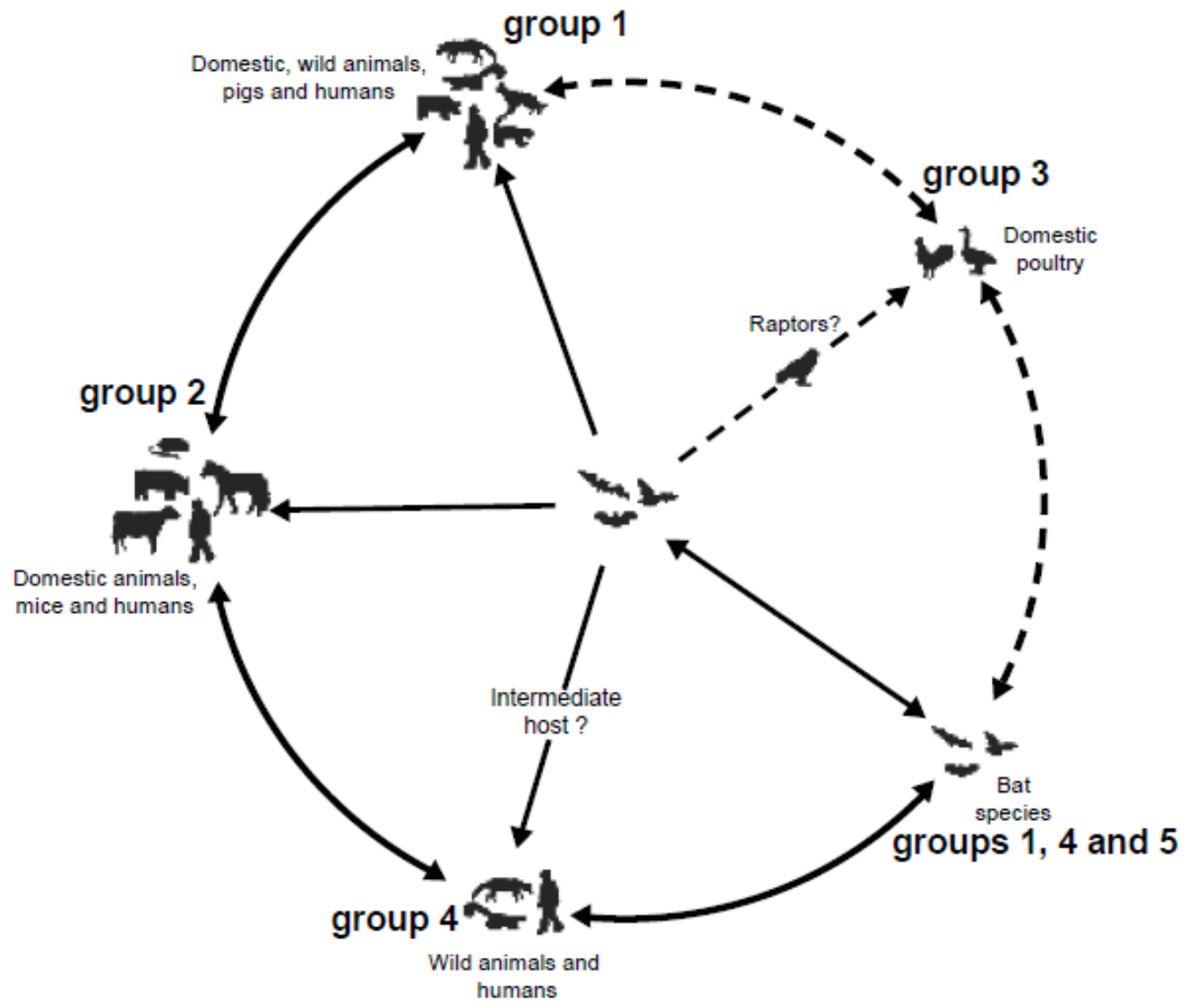
SPECIAL ISSUE – BATS

Bat Rabies Surveillance in Europe

J. Schatz¹, A. R. Fooks², L. McElhinney², D. Horton², J. Echevarria³, S. Vázquez-Moron³, E. A. Kooi⁴, T. B. Rasmussen⁵, T. Müller¹ and C. M. Freuling¹ 2012

Four different lyssavirus species have been isolated from European bats: the European bat lyssaviruses type 1 and 2 (EBLV-1, EBLV-2) (Bourhy et al., 1992), the recently discovered putative new lyssavirus species Bokeloh Bat Lyssavirus (BBLV) (Freuling et al., 2011) and the West Caucasian Bat Virus (WCBV) (Kuzmin et al., 2005). The

Postulated evolution of CoVs



All animal and human CoVs (groups 1, 2, 4 and 5, also known as groups 1, 2a, 2b and 2c) evolved from the interspecies transmission of CoVs from bats (solid lines). Interspecies transmission and evolution of group 3 CoVs in poultry possibly resulted via an intermediary host such as a raptor (dashed lines) preying on bats and poultry.

Source: Vijaykrishna et al., 2007.

Traits enhancing viral diversity in bats

- **Species richness - > 1150 species globally**
- Long lifespan >30 y in some species
- Torpor and hibernation
- Social life style, intra- and interspecific contacts
- Flight – high mobility
- Long distance migrations

A comparison of bats and rodents as reservoirs of zoonotic viruses: are bats special?

Angela D. Luis, David T. S. Hayman, Thomas J. O'Shea, Paul M. Cryan, Amy T. Gilbert, Juliet R. C. Pulliam, James N. Mills, Mary E. Timonin, Craig K. R. Willis, Andrew A. Cunningham, Anthony R. Fooks, Charles E. Rupprecht, James L. N. Wood and Colleen T. Webb

Proc. R. Soc. B 2013 **280**, 20122753, published online 1 February 2013

order	mean no. hosts/virus	total viruses		zoonotic viruses	
		no.	mean/host (range)	no.	mean/host (range)
bats	4.51	137	2.71 (1,15)	61	1.79 (0,12)
rodents	2.76	179	2.48 (1,20)	68	1.48 (0,11)

0 150 300 km

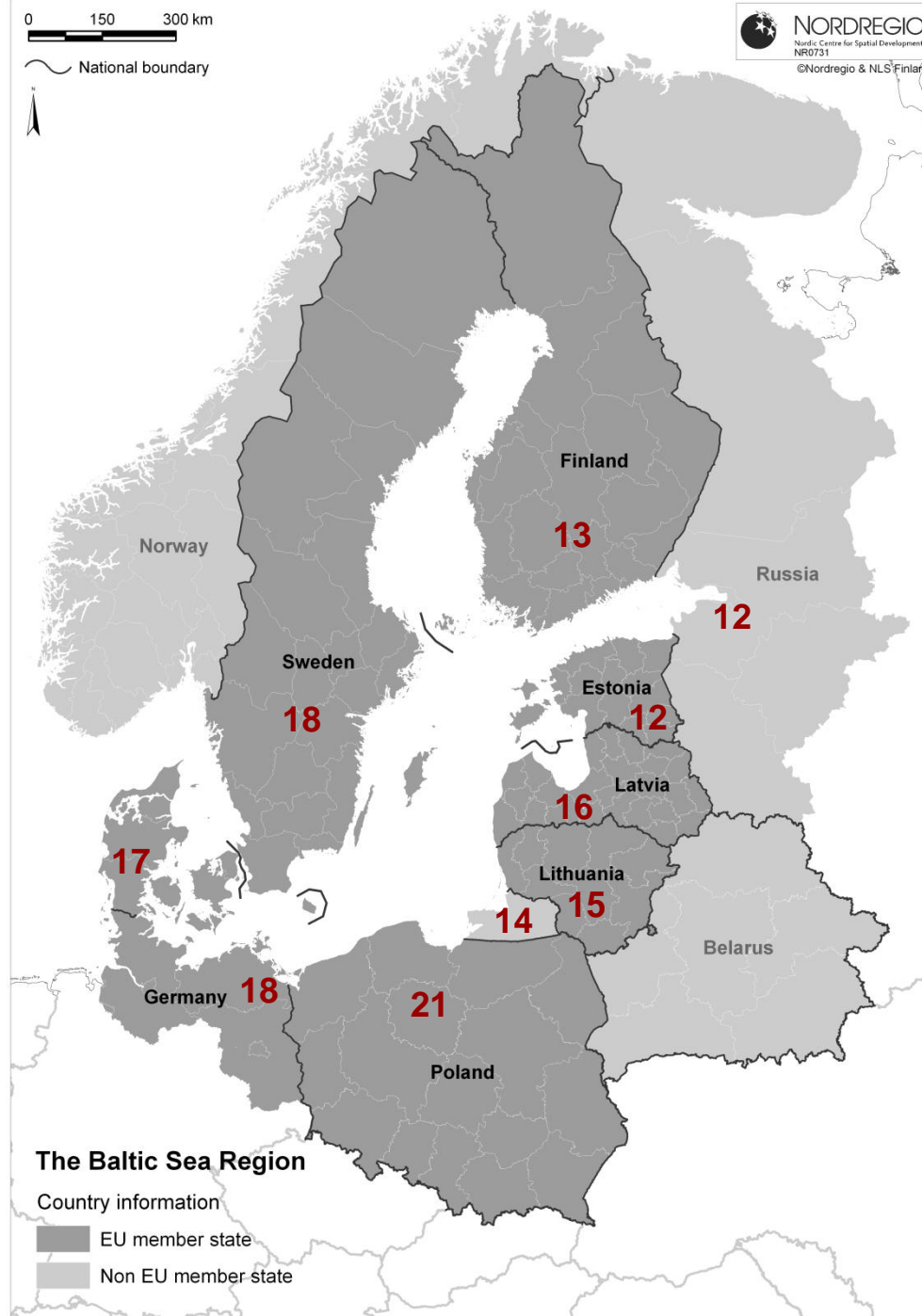


National boundary



NORDREGIO
Nordic Centre for Spatial Development
NR0731

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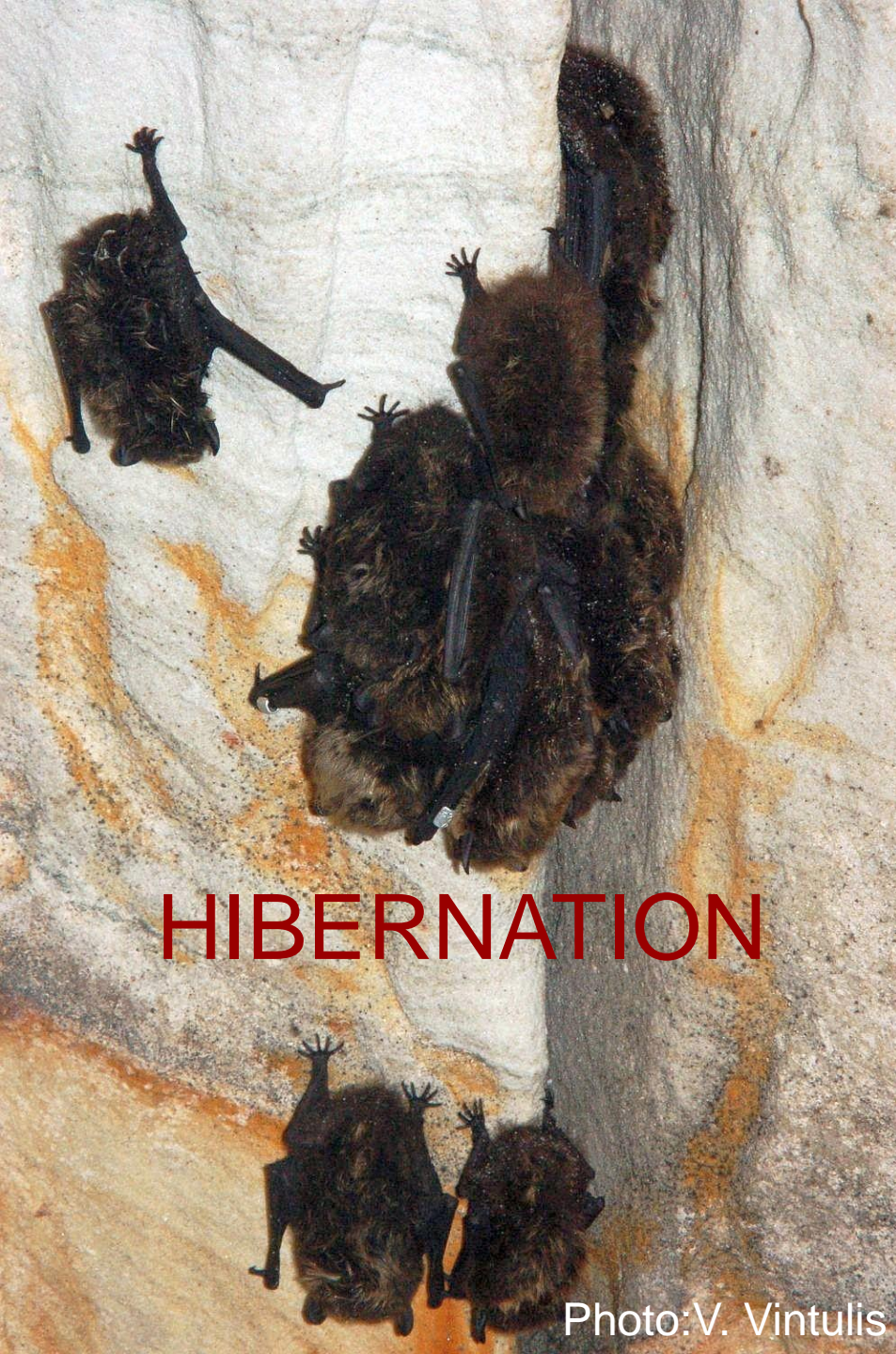
The Baltic Sea Region

Country information

- EU member state
- Non EU member state

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HIBERNATION

Photo:V. Vintulis



REPRODUCTION

Photo:I.Priedniece

SWARMING

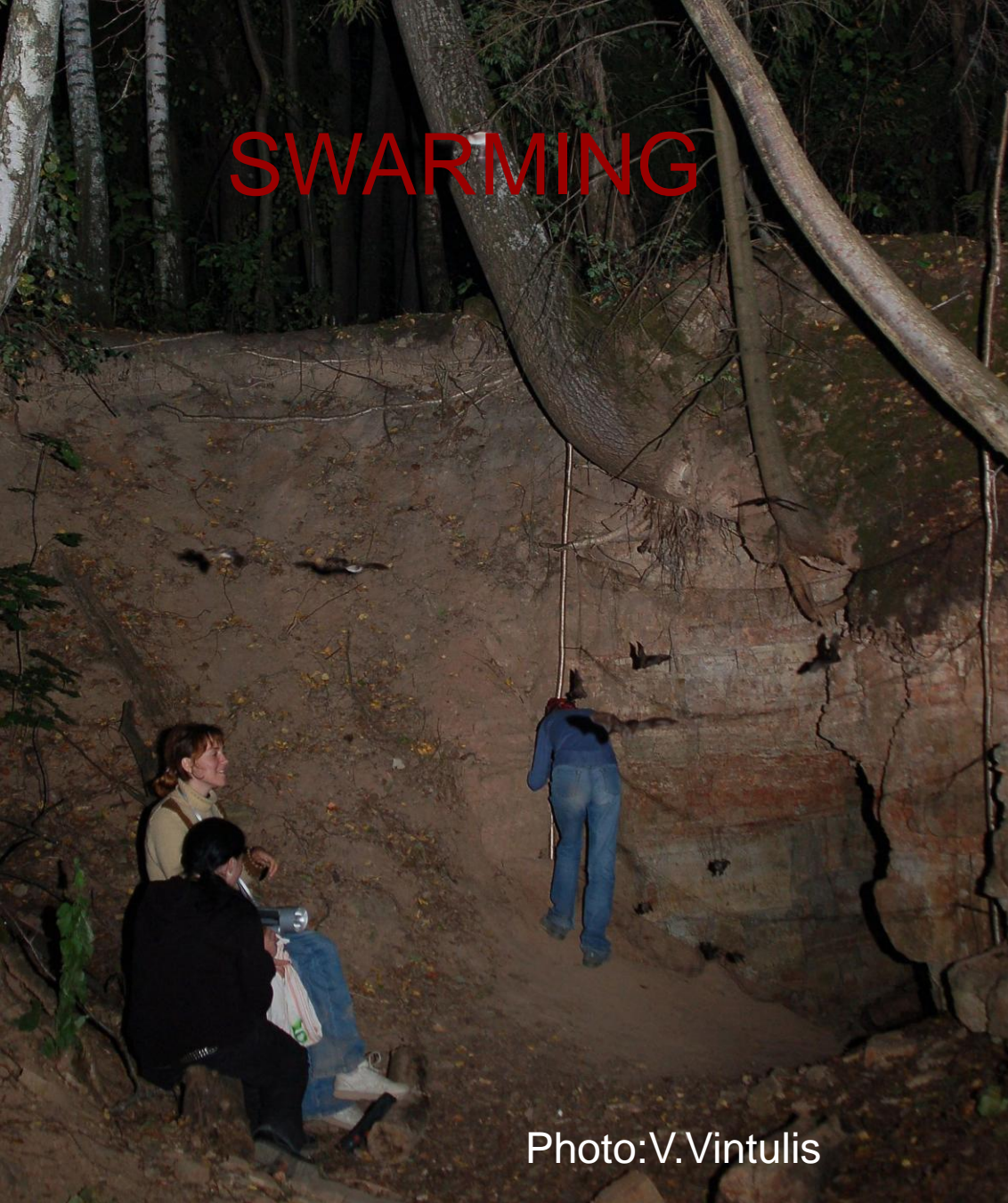


Photo: V. Vintulis

ARKive
www.arkive.org



MATING

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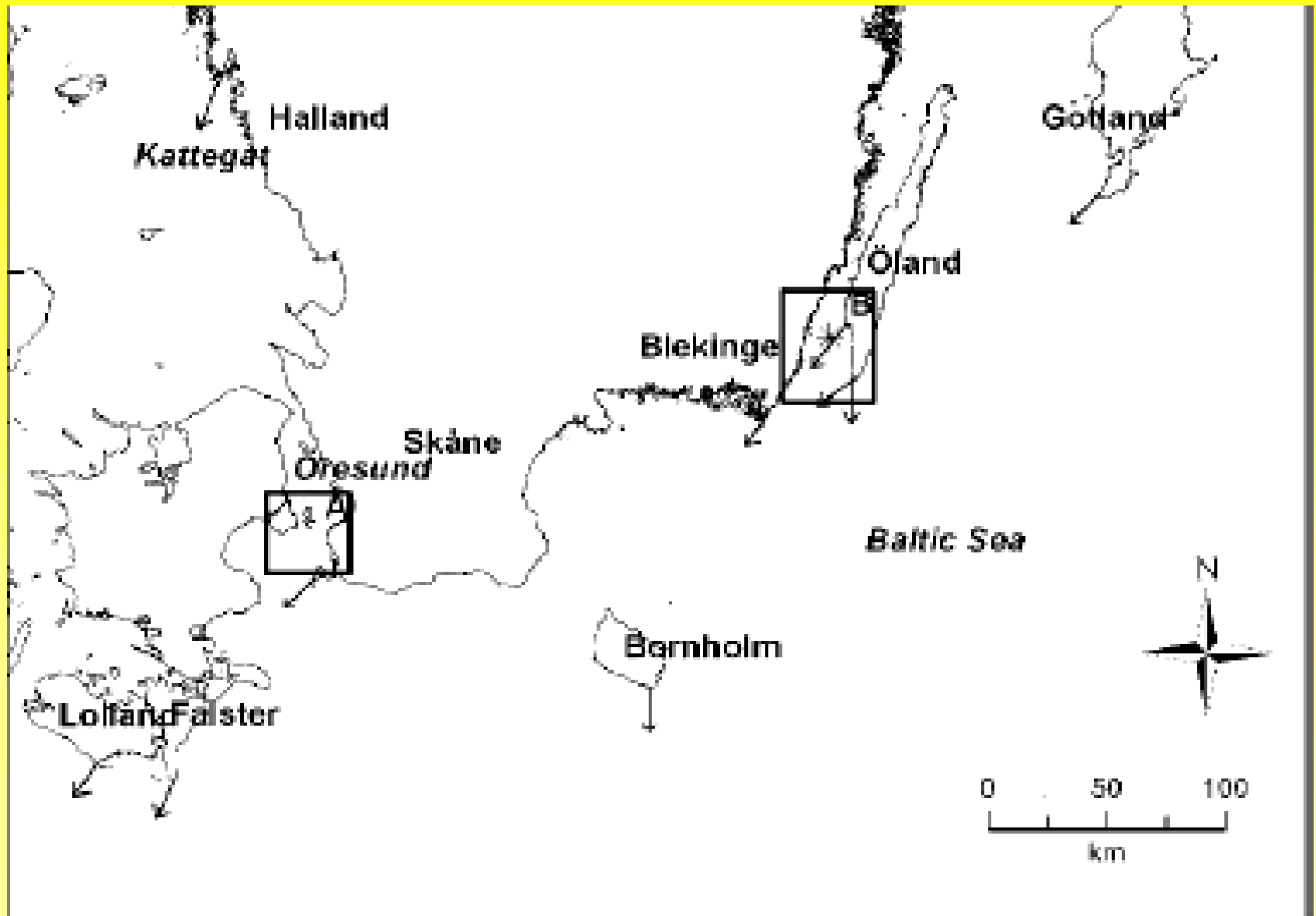
Traits enhancing viral diversity in bats

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Evidence of migration

- Seasonal differences in distribution
- Observations and records of bats in the sea
- Observations of bats on the coast in autumn
- Records of banded bats

Departure sites of migrating bats in autumn identified by acoustic and visual observations



Long-distance flights of *Pipistrellus nathusii* banded in Europe **Hutterer et al. 2005**



Photo: V.Vintulis

Classification of European bat species according to their migration behaviour

- Long-distance migrants – round-trip seasonal movements > 1000 km
- Local migrants – movements < 100 km
- Sedentary bats – short movements < 100 km

Locations of ornithological stations with Heligoland traps used to capture bats

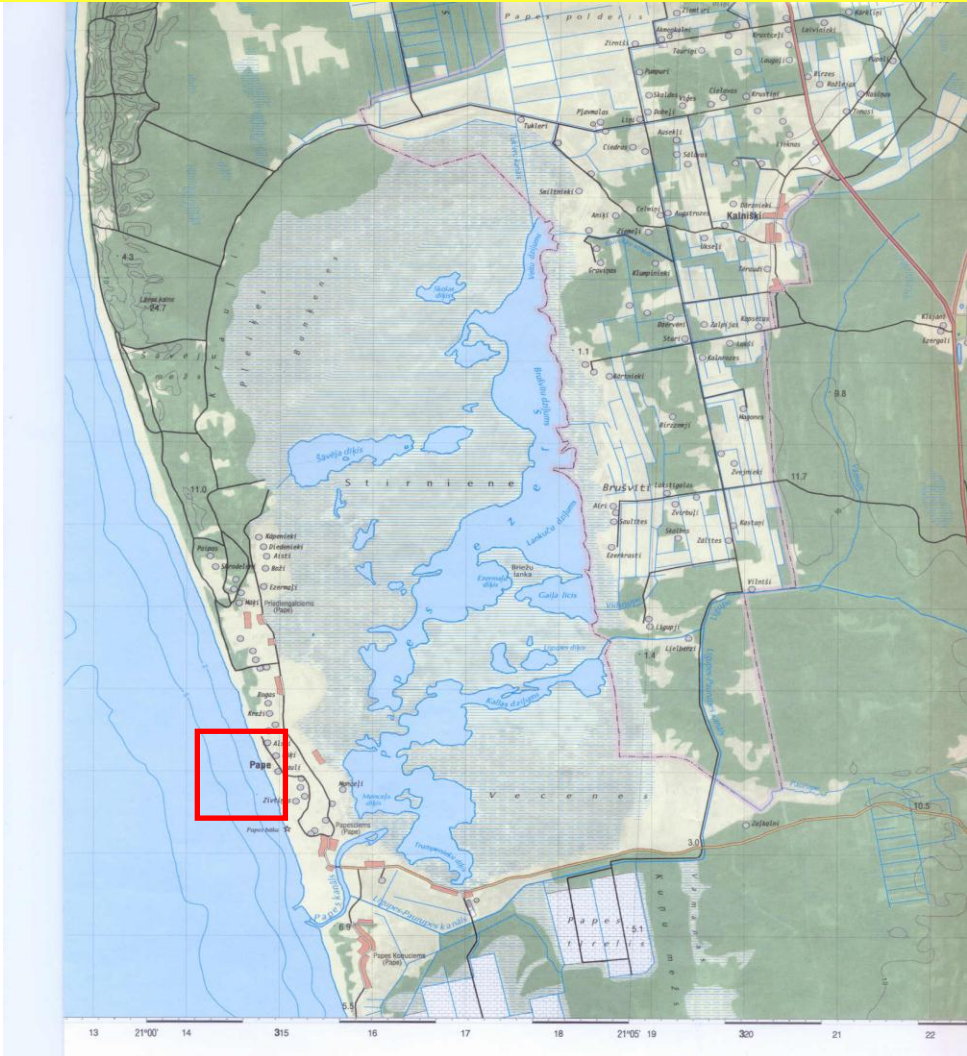


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- 1. Kabli EST**
Masing, M., T. Laur ,
A. L eivits & H.
Vilbaste (1987)
- 2. Pape LV**
Pētersons G. 1990,
2004
- 3. Ventes ragas LT**
Balbierius 1987;
Hutterer et al. 2005
- 4. Ribachij RUS**
Markovets et al.
2004

Location of the Pape Ornithological Research center SW of Latvia

The Baltic States





Heligoland trap used in 1997-2012









Numbers - capture data 1986-1992

Year	N captured total	N max/night
1986	341	183
1987	1681	498
1988	3193	615
1989	3512	1130
1990	3975	1068
1991	558	257
1992	585	242

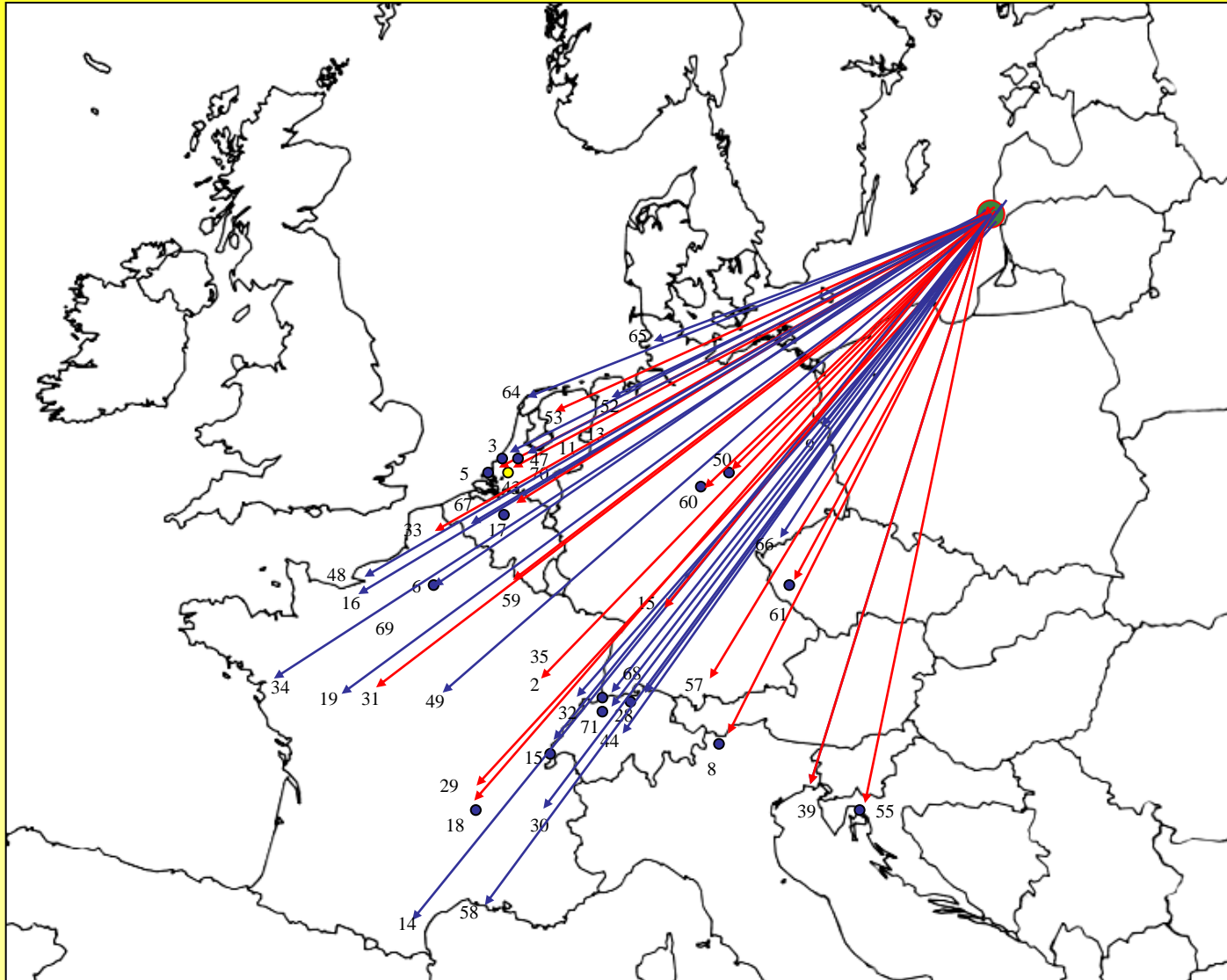
Species composition 1985-1996

Migratory species in bold

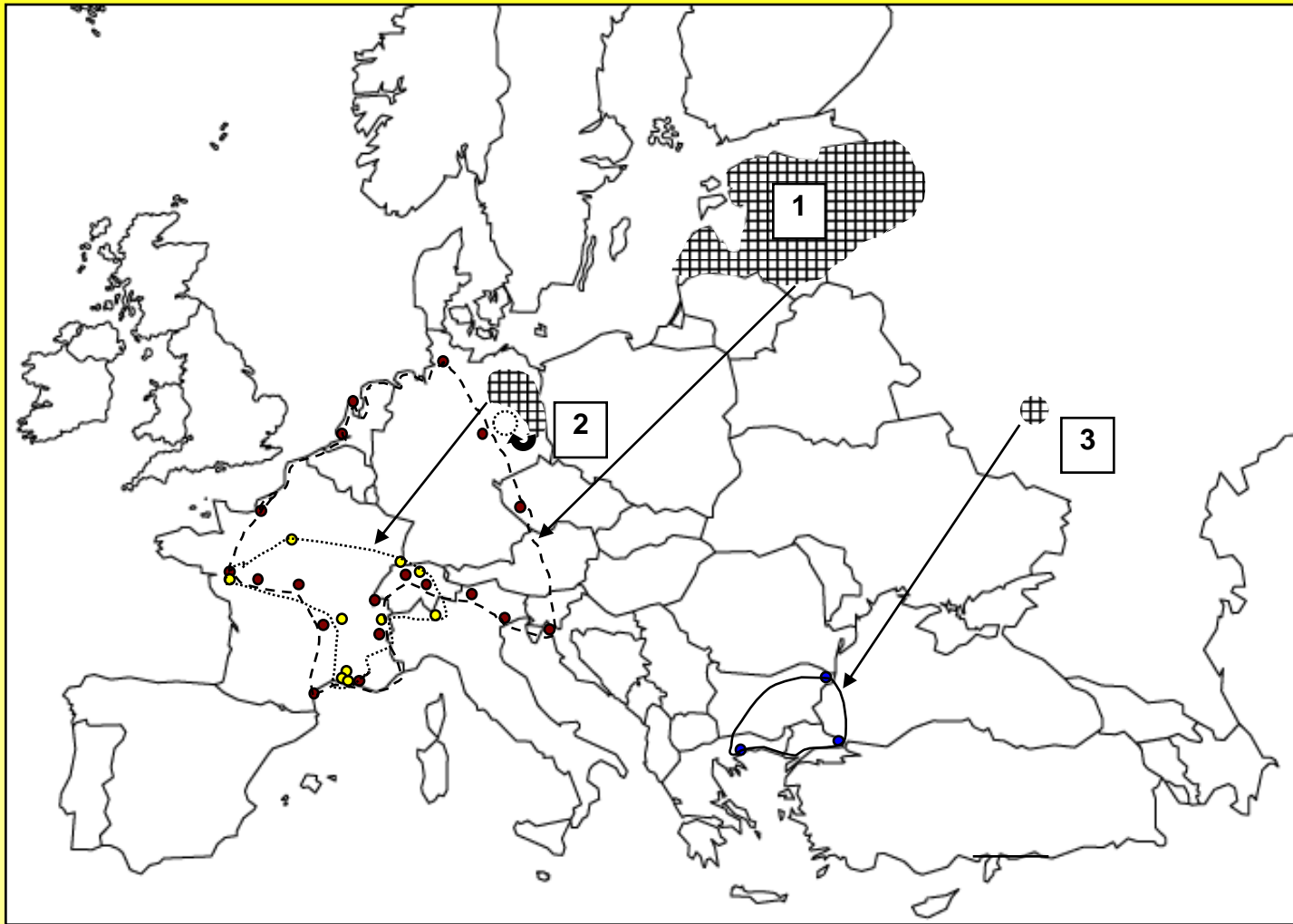
Open-air species	
<i>Pipistrellus nathusii</i>	13146
<i>P. pipistrellus</i>	350
<i>Nyctalus noctula</i>	591
<i>N. leisleri</i>	9
<i>Vespertilio murinus</i>	96
<i>Eptesicus nilssonii</i>	83
<i>E. serotinus</i>	1
98,2%	

Clutter species	
<i>Myotis daubentonii</i>	101
<i>M. brandtii</i>	66
<i>M. mystacinus</i>	13
<i>M. dasycneme</i>	7
<i>M. nattereri</i>	5
<i>M. myotis</i>	1
<i>Plecotus auritus</i>	59
<i>Barbastella barbastellus</i>	9
1,8%	

Flights of *Pipistrellus nathusii* males (blue lines) and females (red lines) captured and banded in Pape



Hibernation area of three summer populations of *Pipistrellus nathusii* according to banding and recapture data



1: Masing 1988, Petersons 1990, 1994; 2: Stratmann 1973; Heise 1982; Schmidt 1985, 1994a, 2000; Oldenburg & Hackethal 1989; 3: Strelkov 1969

W
↑



S
↑



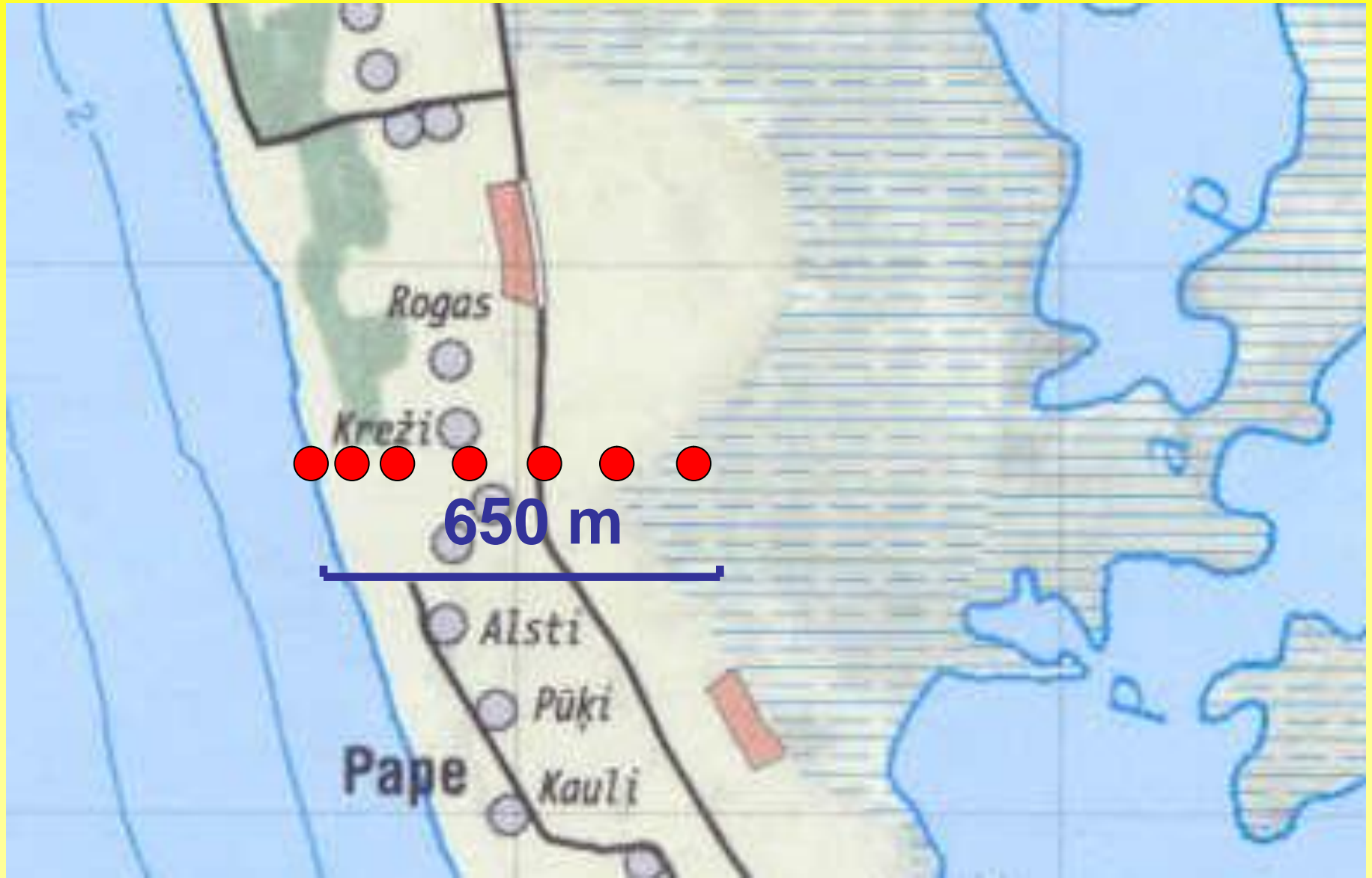
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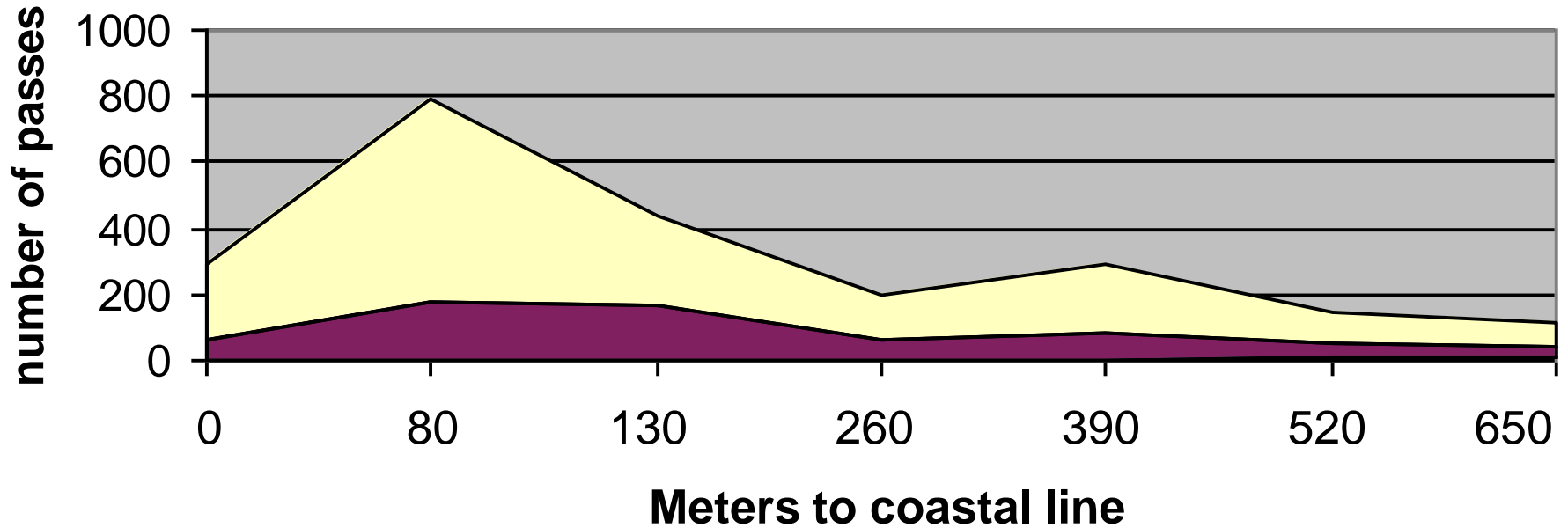
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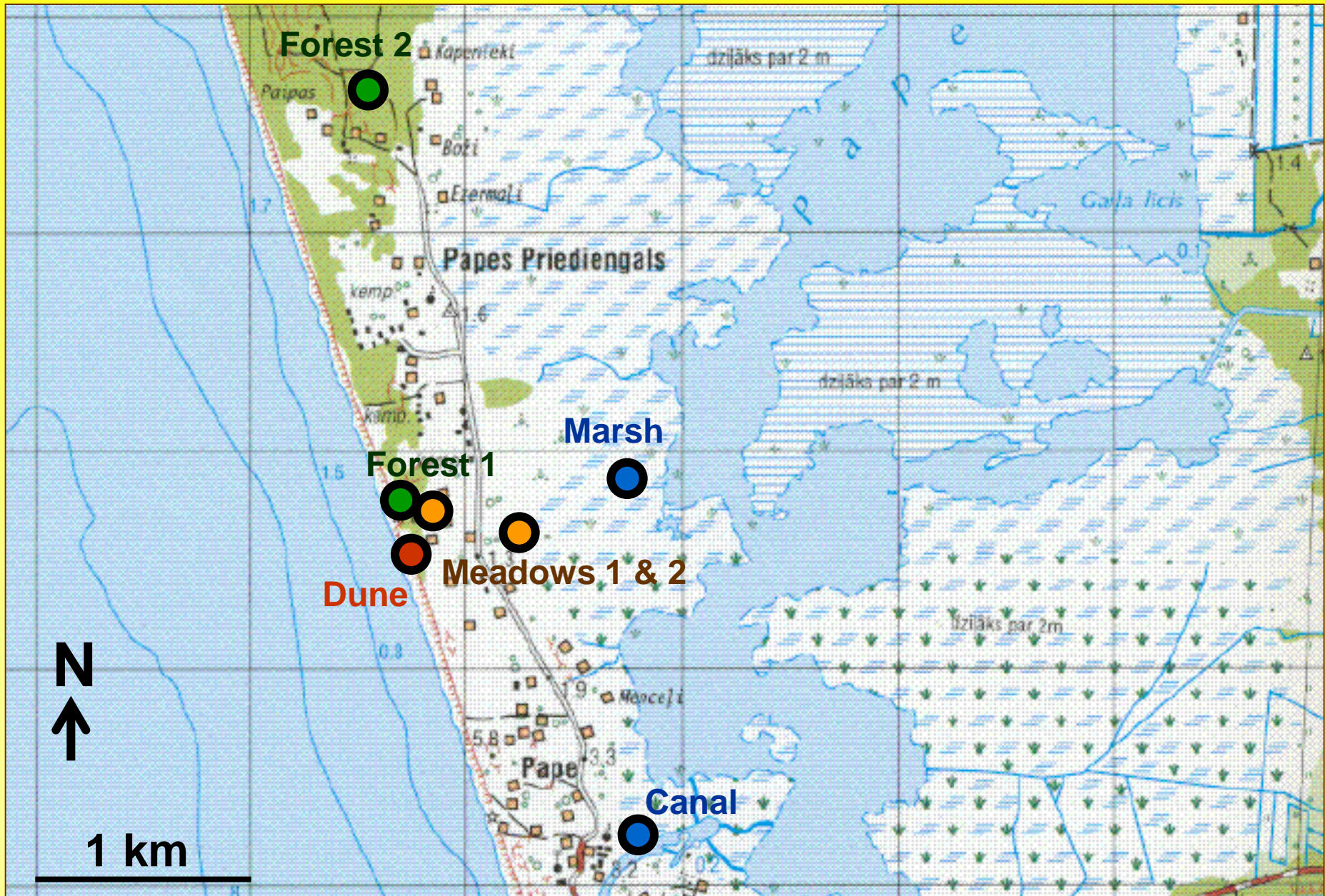
Location of spots for acoustic monitoring 1993-2012



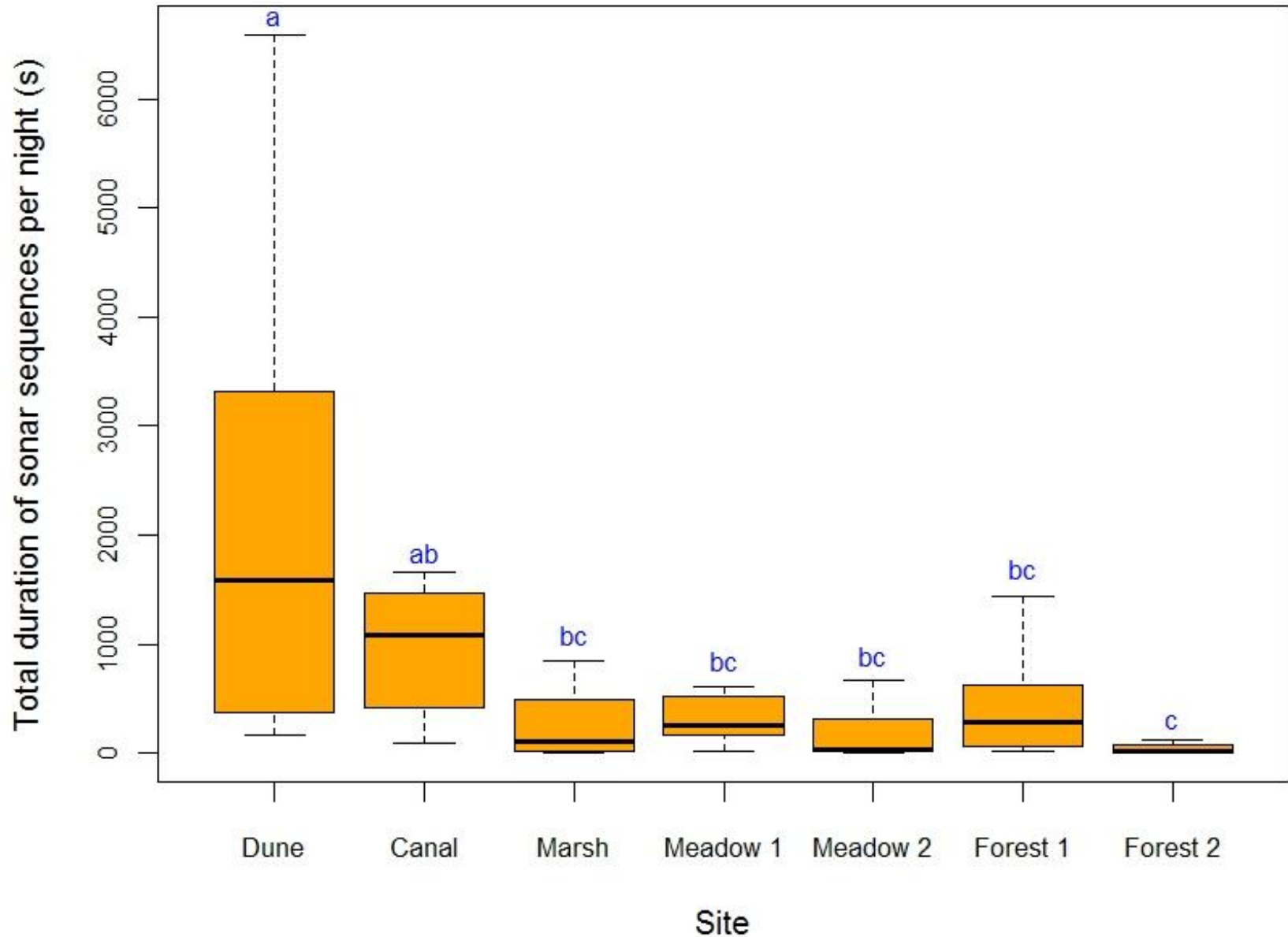
Distribution of *Pipistrellus* passes counted at seven spots in Pape in sessions with favourable (yellow; n=79) and unfavourable (red; n=102) wind



Study on habitat use of Nathusius' bat in 2010



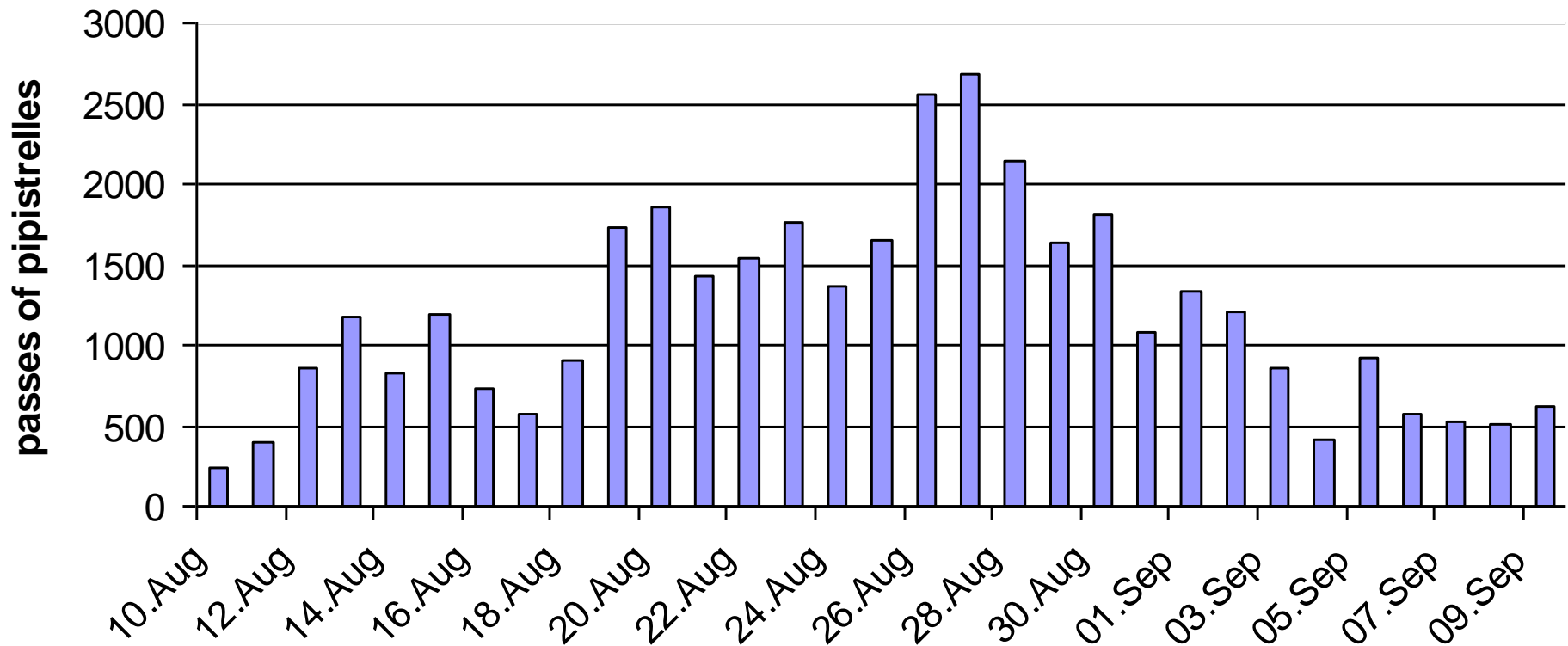
Activity of *Pipistrellus nathusii* at different habitats on the coastal area in Pape during autumn migration



Numbers- acoustic survey 2011

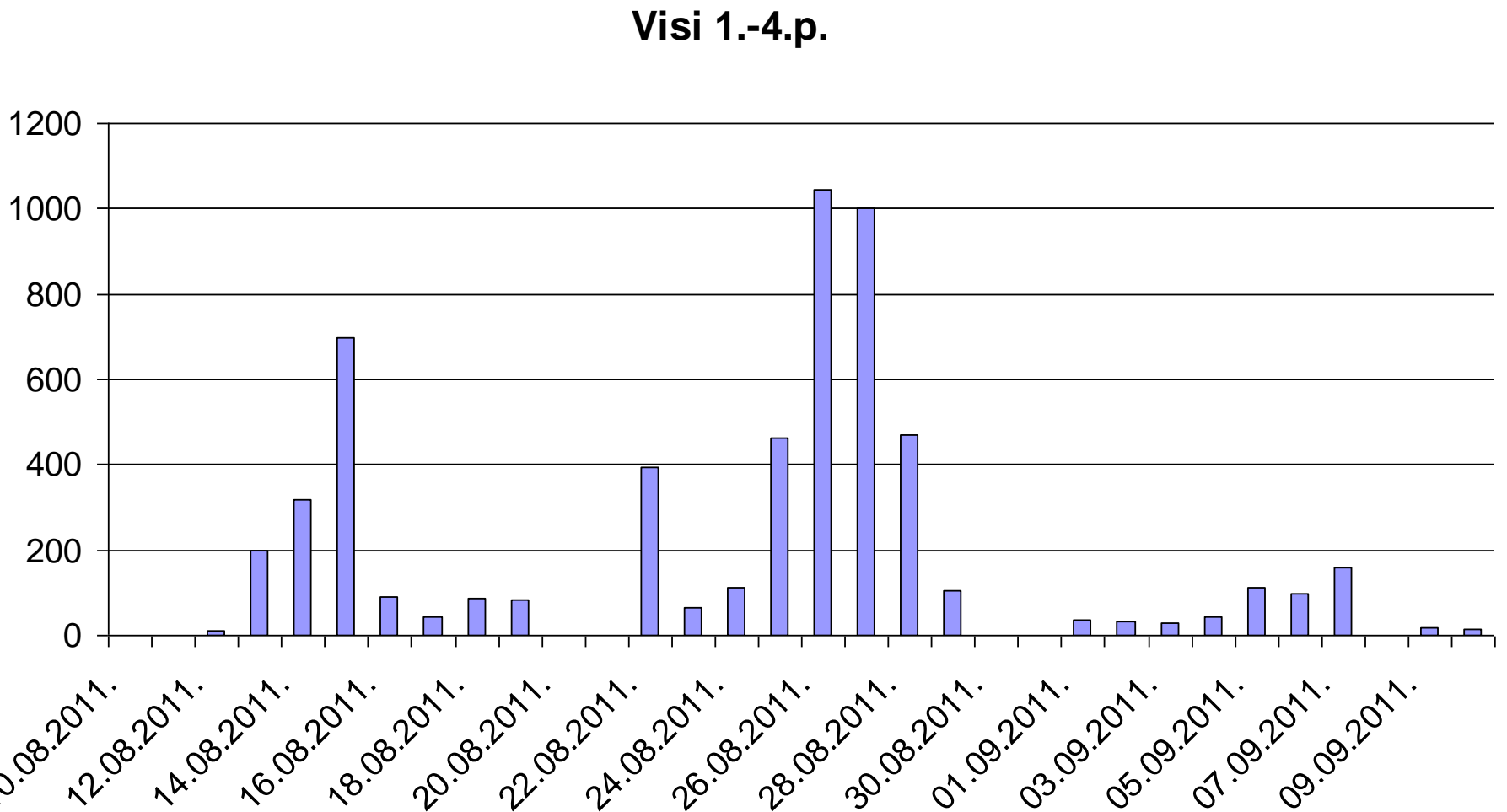
- Totally 5733 passes per 30 nights; maximum per night 1044
- **45** min counts at each spot
- 1 night=6 hours or **360** min of time useful for migration
- $360 \text{ min}/45 \text{ min}=\mathbf{8}$
- Total number of passes per season
 $=5733 \times 8=\mathbf{45,864}$ passes or bats (?)
- Number per maximum night = $1044 \times 8=\mathbf{8352}$

Timing of *Pipistrellus spp.* migration in Pape Acoustic monitoring 1993-2012

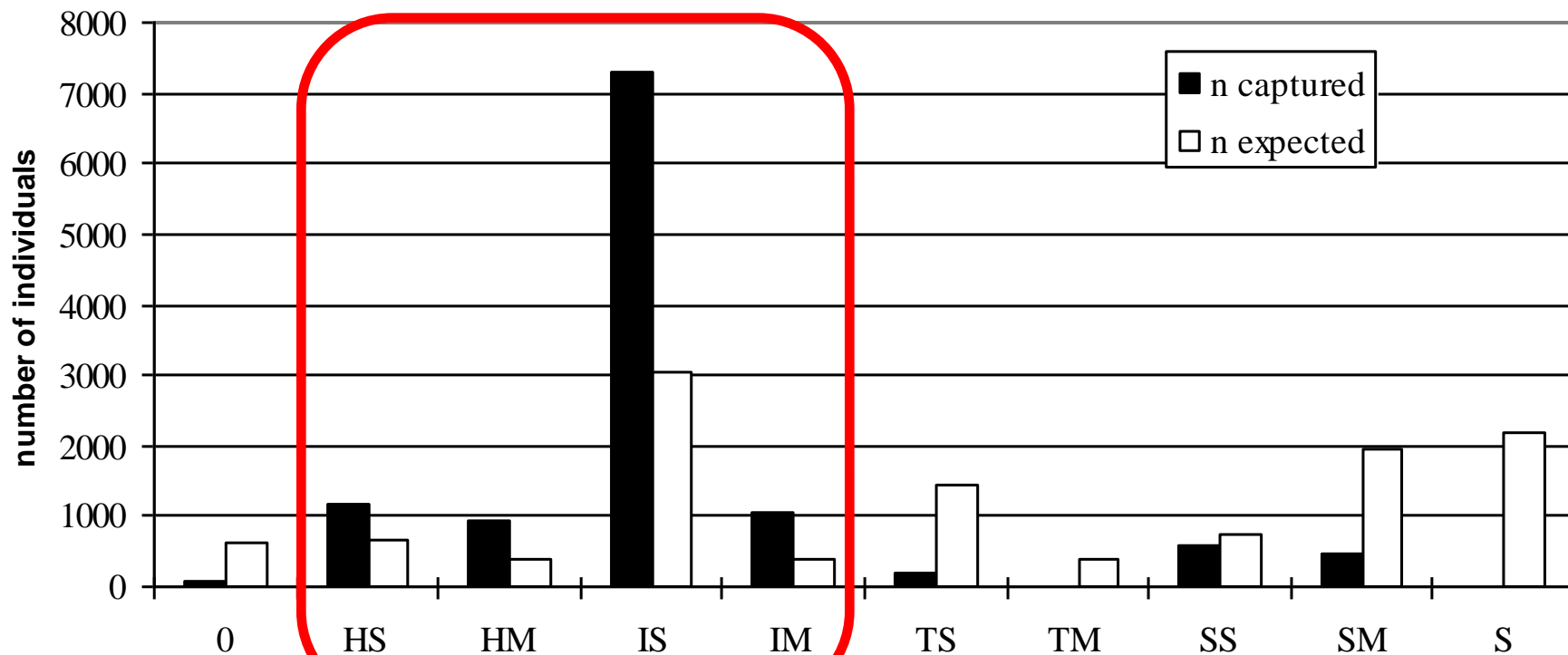


Phenology of bat migration in Pape in 2011.

Acoustic survey at 4 observation spots, 3x15 min sessions



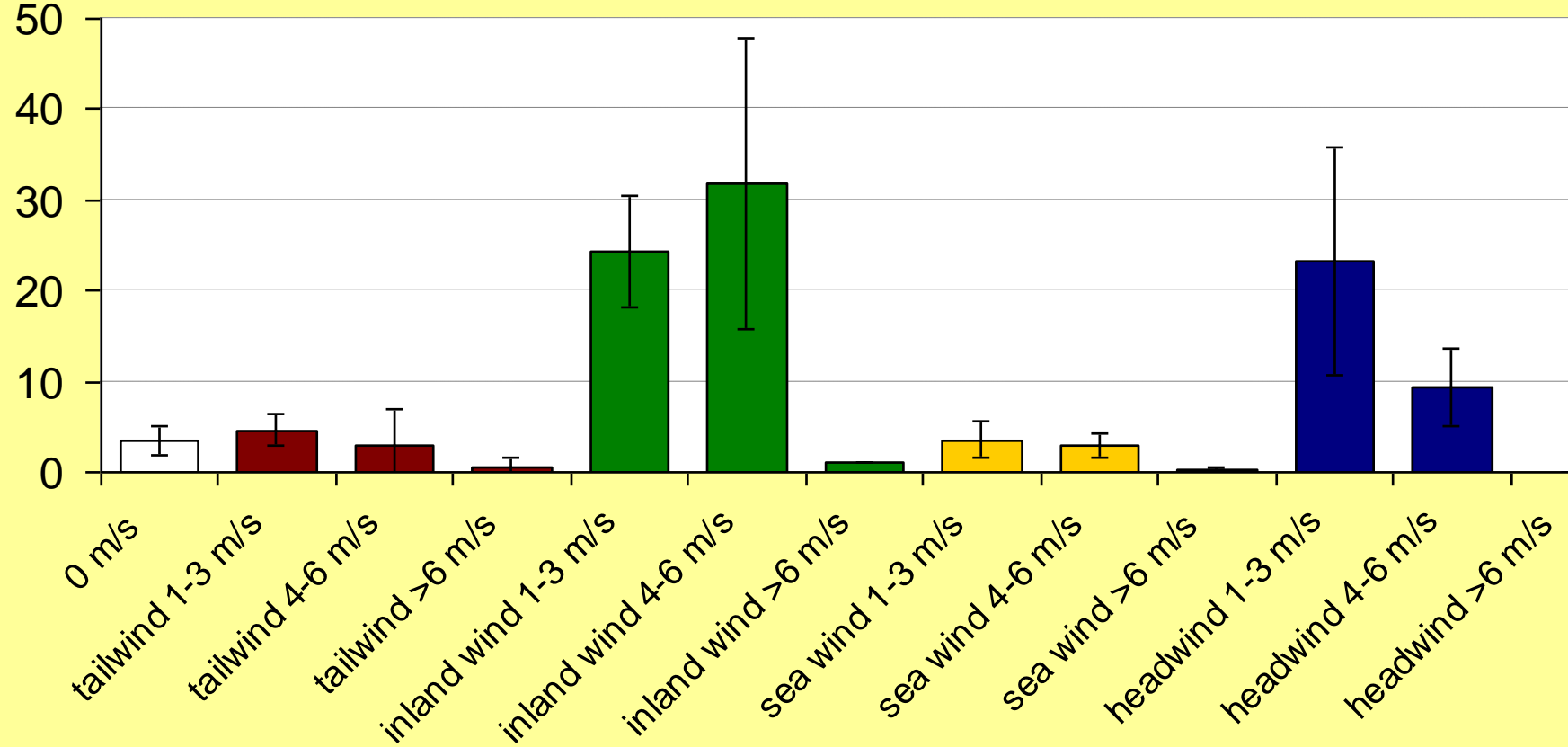
Influence of wind on capture results of *P. nathusii* in 1987-1992 (n=11824)



0 – no wind; HS – headwind 1-3 m/s; HM – headwind 4-6 m/s; IS – inland wind 1-3 m/s; IM – inland wind 4-6 m/s; TS – tailwind 1-3 m/s; TM – tailwind 4-6 m/s; SS – seawind 1-3 m/s; SM – seawind 4-6 m/s; S – strong wind >6 ms

Activity of *Pipistrellus nathusii* in relation to wind in Pape 2003-2008

mean number of passes per 15 min





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Conclusions

- All northeuropean bat species were found at the coastal area in SW Latvia, however long-distance migrating species strongly dominated, where *P. nathusii* composed >90% of all bats
- The coastal area in SW of Latvia is an important migration area with et least 8000 - 45000 bats passing it annually
- The peak of migration occurs during the second half of August – first decade of September
- The migration is predictable – favoured by eastern or southern winds at speed < 6 m/s
- Mass concentration of bats on the costal area is distanced up to 100 m from the coastline
- Does the migration favour intra- and interspecies exchange of viruses?

Acknowledgement

The studies in Pape were supported by the Latvian Environmental Protection Fund and by Institute of Biology of the University of Latvia.

Most of the work to capture and monitor bats surveys was done on voluntary bases by more than 50 bat workers and assistants

Thank you!