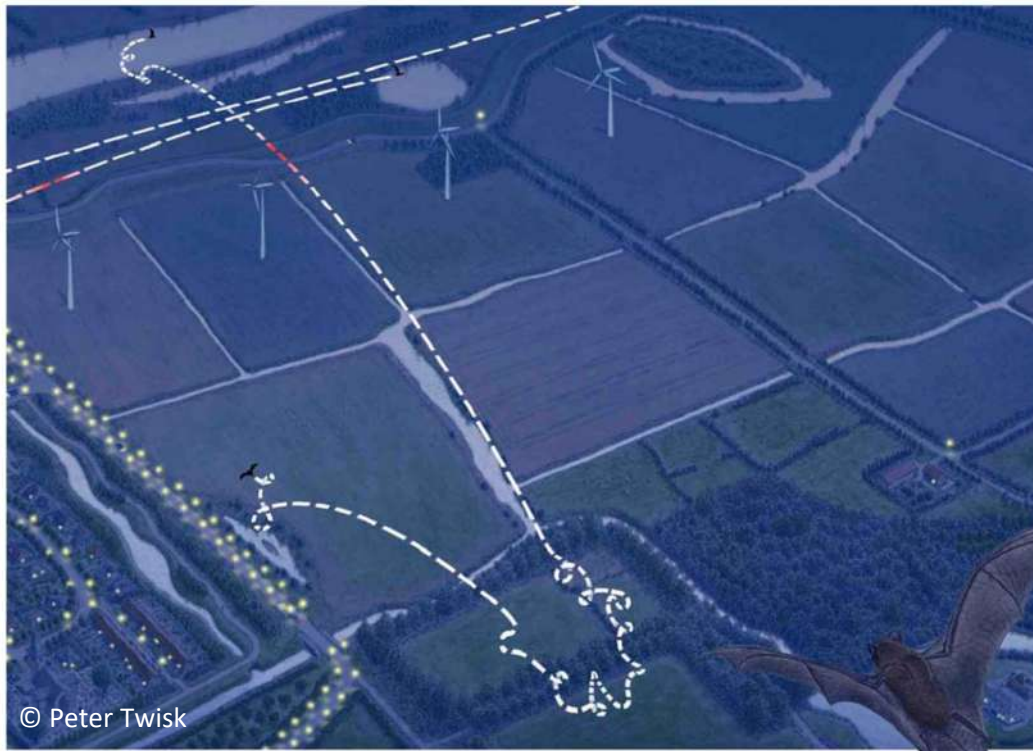


# The issue of bat mortality related to onshore wind farms in Europe

## a NGO / conservation scientist's perspective



# Bats & wind turbines



**bat ≠ bat**

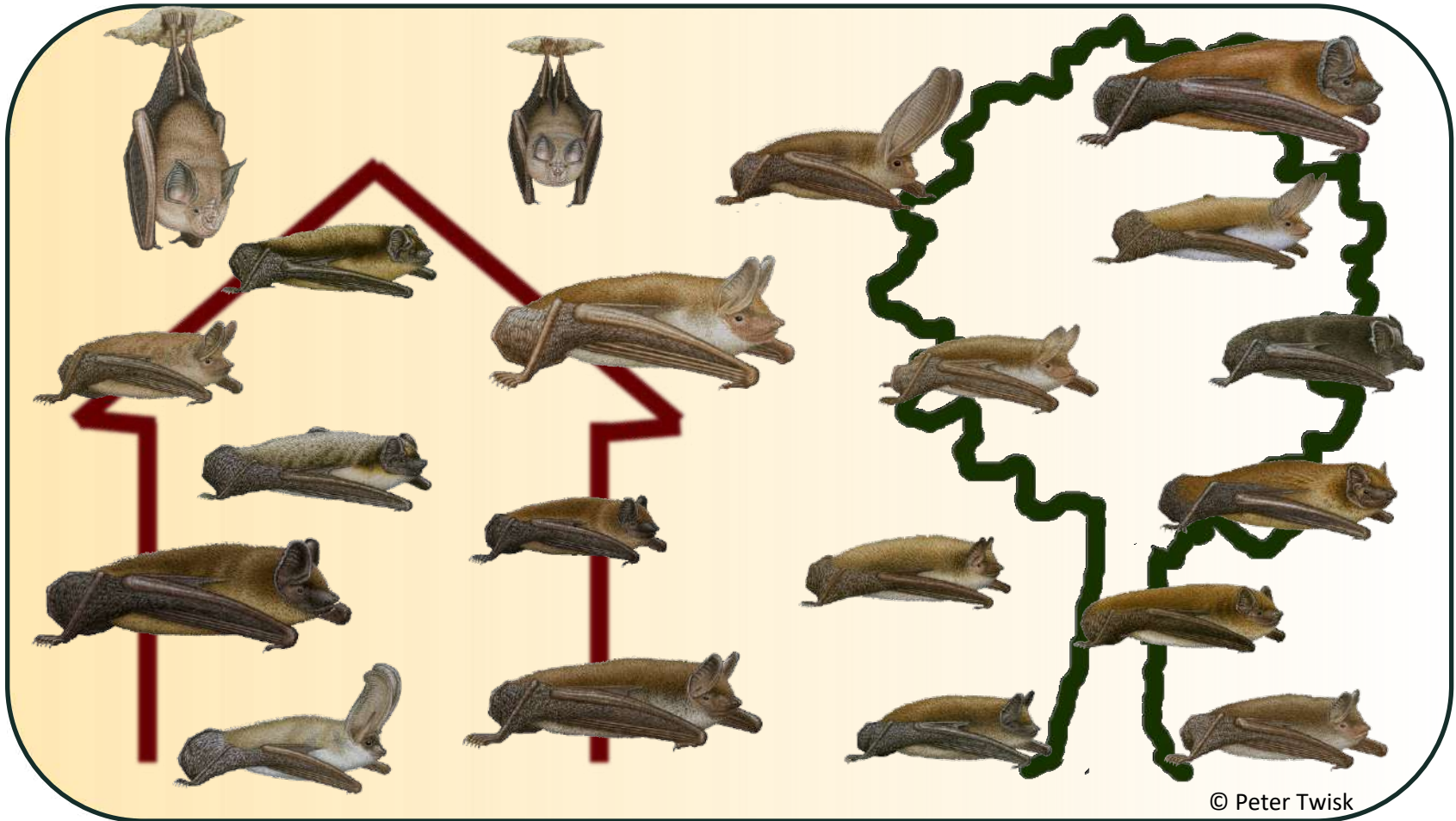
**Many  
different  
species!**



# Bats & wind turbines

bat ≠ bat

Many different species!



© Peter Twisk

Buildings

Trees



# Bats & wind turbines



**bat ≠ bat**

**Many  
different  
species!**

© Peter Twisk  
P. Twisk '96



Maternity period



emergence



Foraging

# year cycle

spring

summer

winter

autumn



Hibernation period



mating period



foraging







© Zomer Bruin – *Myotis dasycneme*



© Zomer Bruin – *Nyctalus noctula*



© Peter Twisk – *Pipistrellus nathusii*

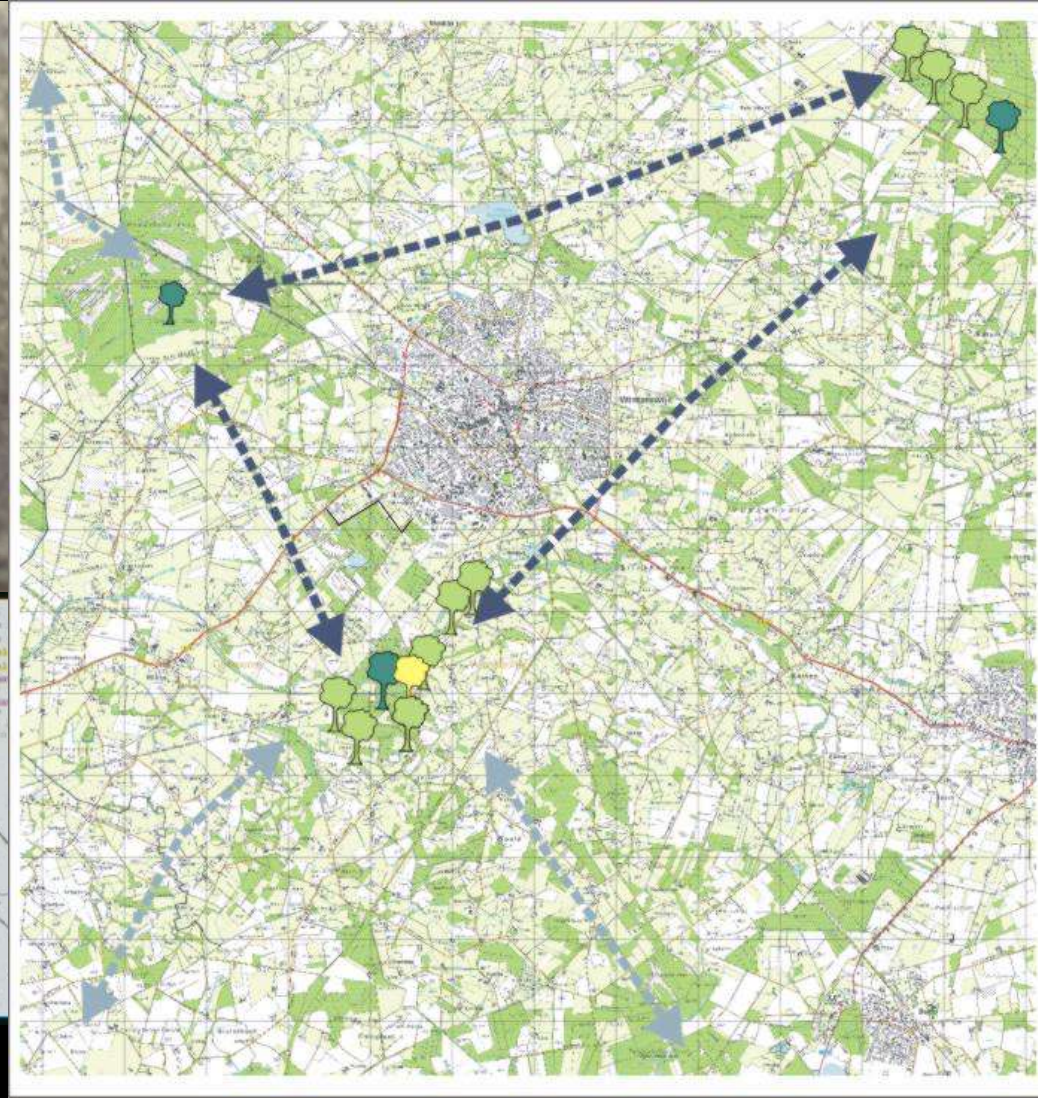
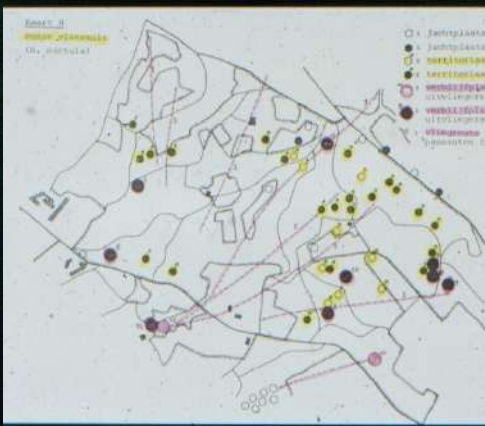




© Zomer Bruin



© Ditmar Nill



A network of habitats with different functions  
roosts + daily flight routes + foraging areas  
migration routes

*Nyctalus noctula*



## the different **bat species**

are highly social mammals  
with a complex behaviour,  
using a complex network of differentiated functional habitats  
for their maternity, mating and hibernation roosts,  
their daily foraging and seasonal migration routes,  
and their foraging habitats,  
to fuel their energy costly life.

Where behaviour and strategies  
are very much **differentiated between species ...**





**Wind turbines and renewable energy are a good thing!!**

**So what is the issue with bats & wind turbines?**

# Bats & wind turbines

What is the issue?

Some species fly high!  
Also in rotor swept area!  
- foraging  
- migration



© Peter Twisk



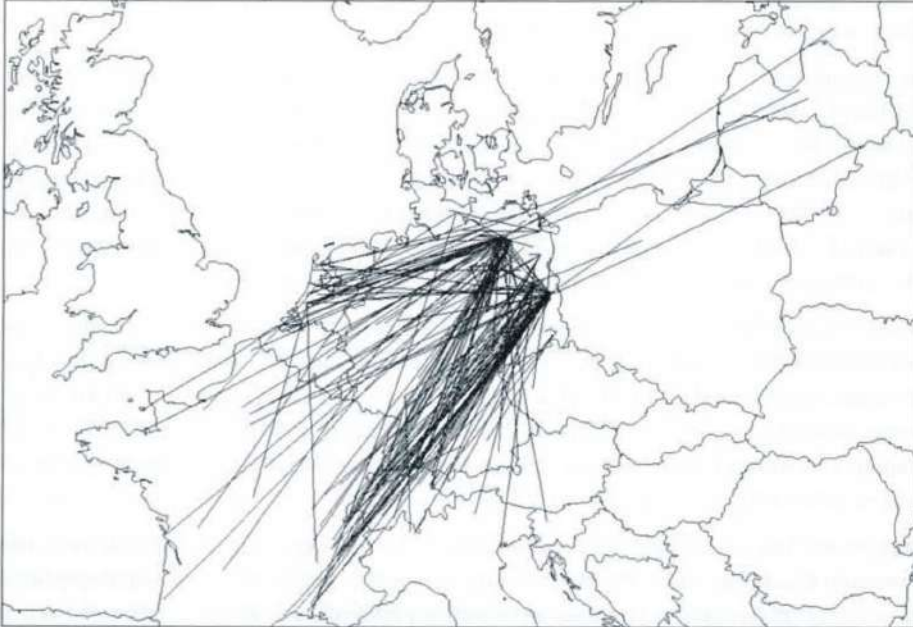
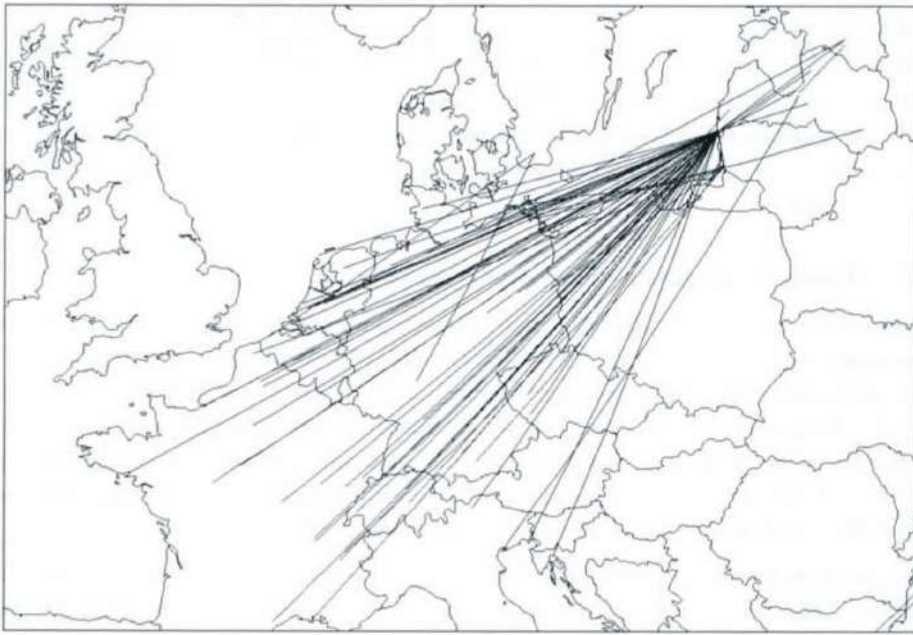


Fig. 25. Long-distance movements of *Nathusius*' bats banded in eastern Europe (Estonia, Latvia, Lithuania, Russia; top) and in central Europe (Germany, The Netherlands, Switzerland, Czech Republic; bottom).

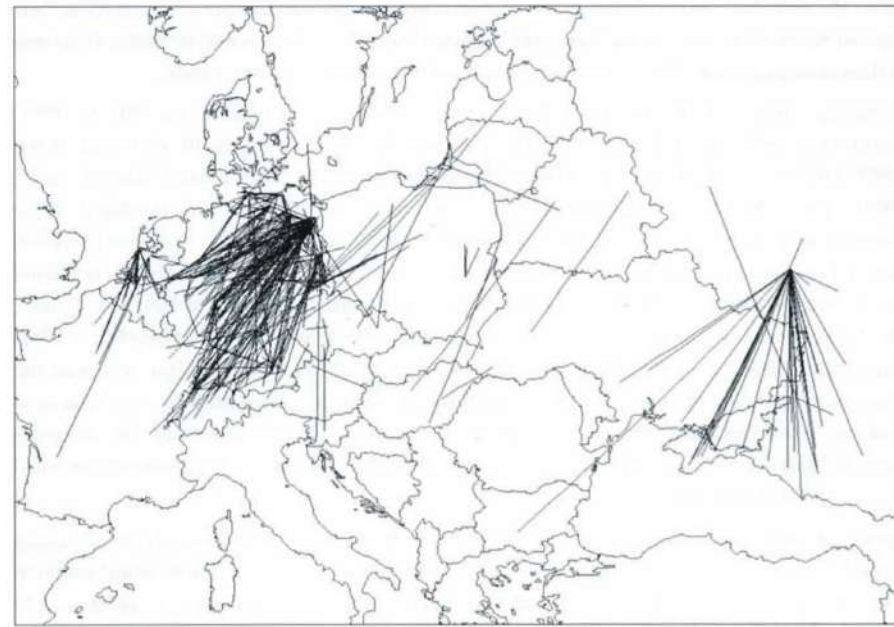


Fig. 23. Documented long-distance movements of *Nyctalus noctula* in Europe (n=667).

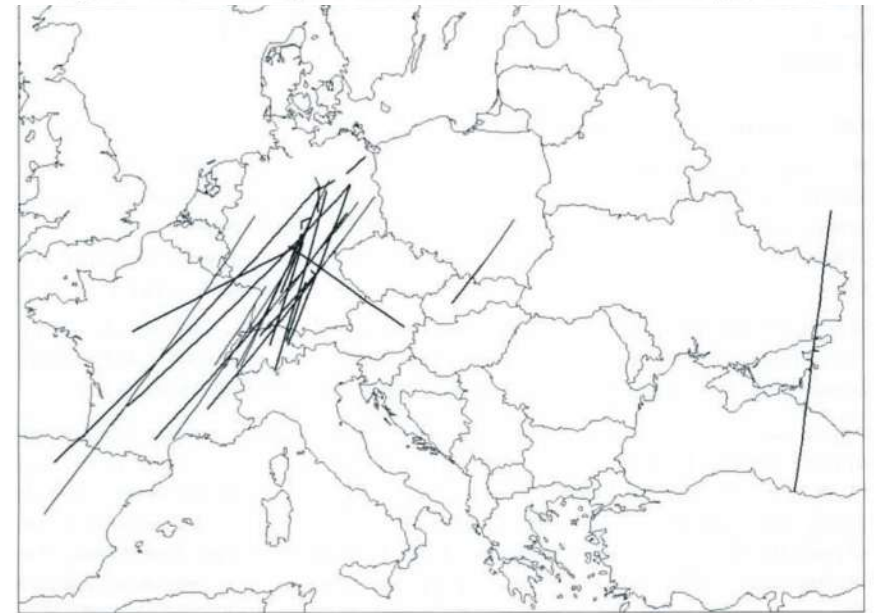
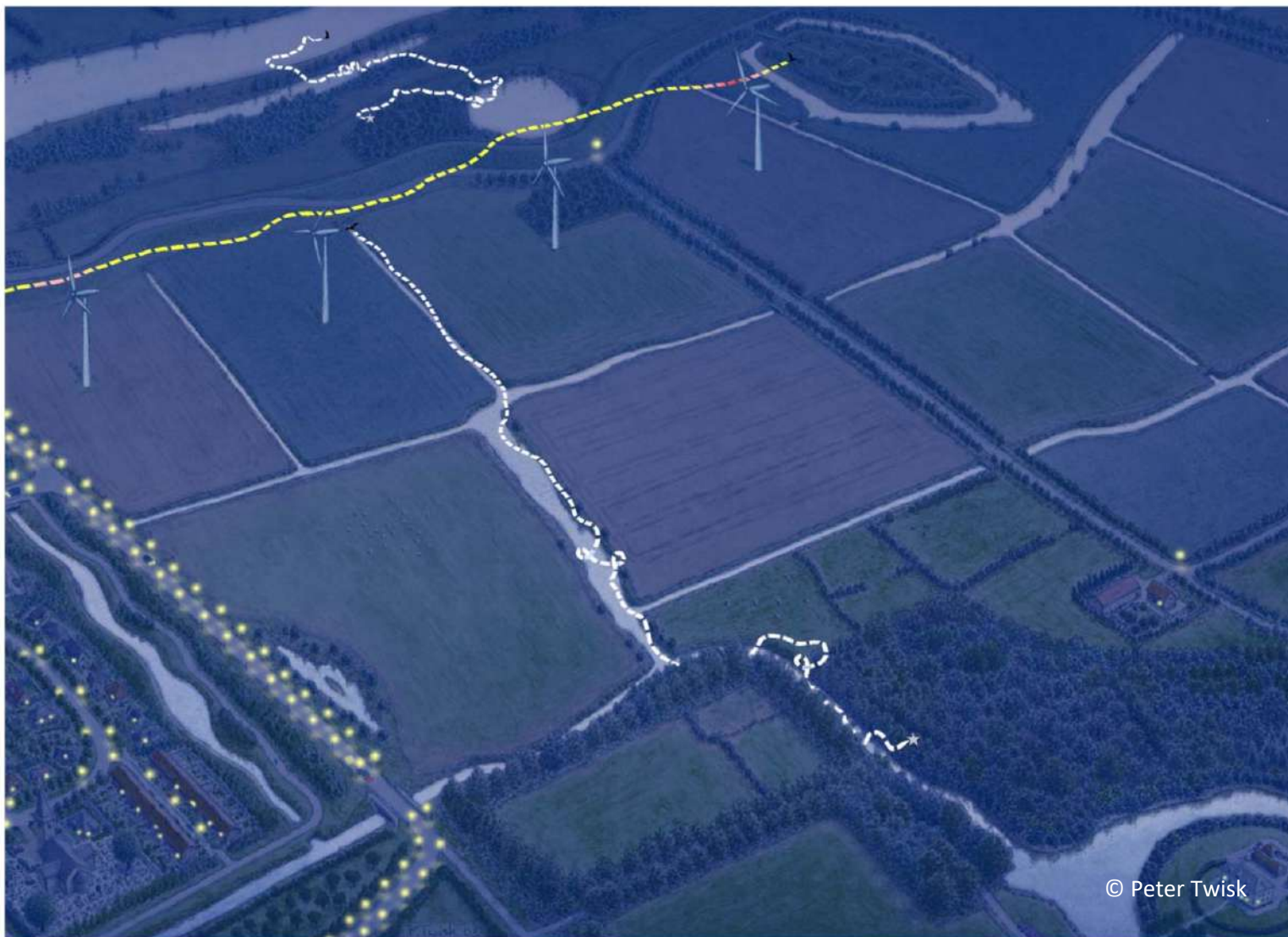


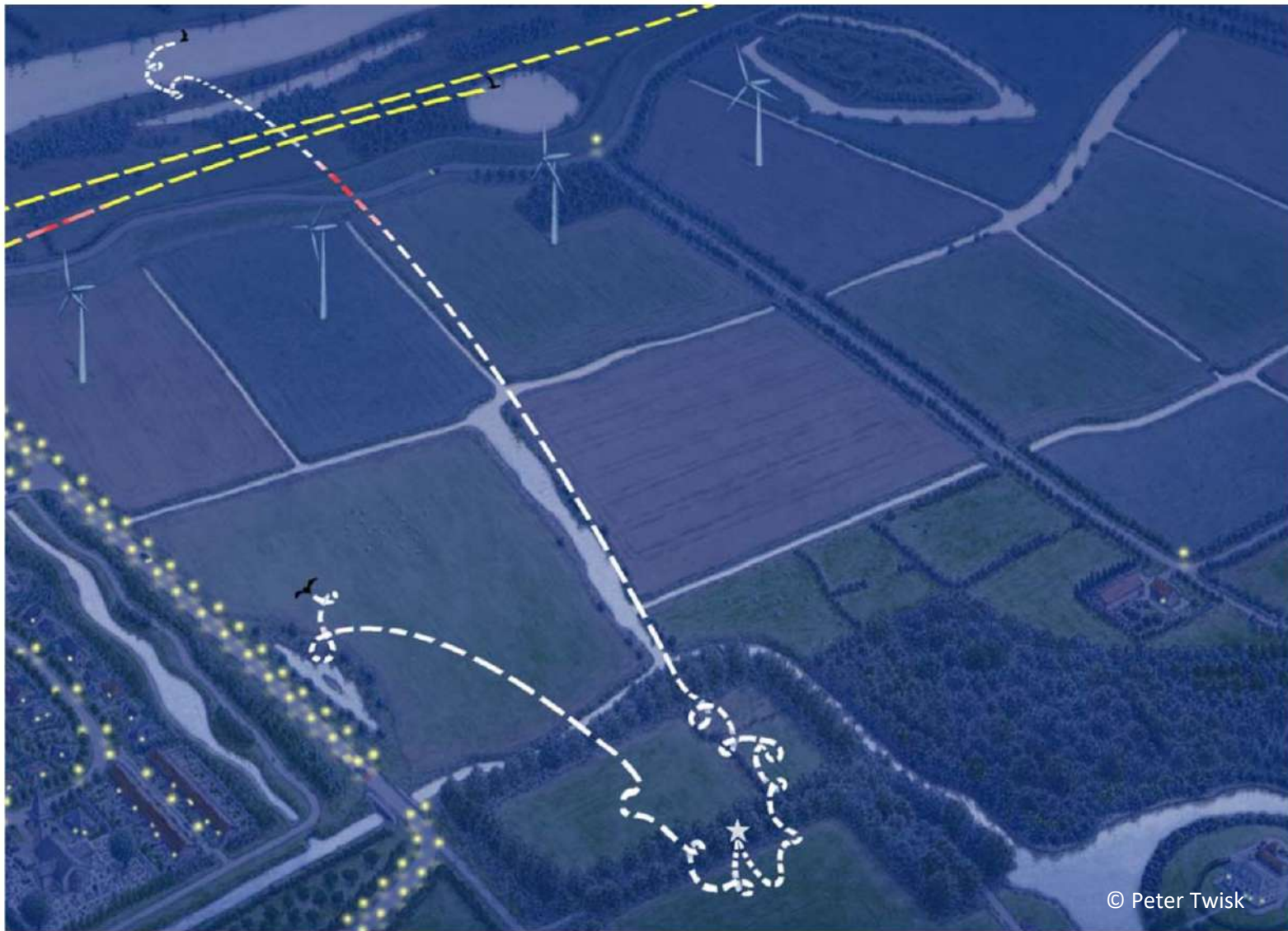
Fig. 22. Documented long-distance movements of *Nyctalus leisleri* in Europe (n=36).

Bat species migrate



*Pipistrellus nathusii*





*Nyctalus noctula*

# Bats & wind turbines

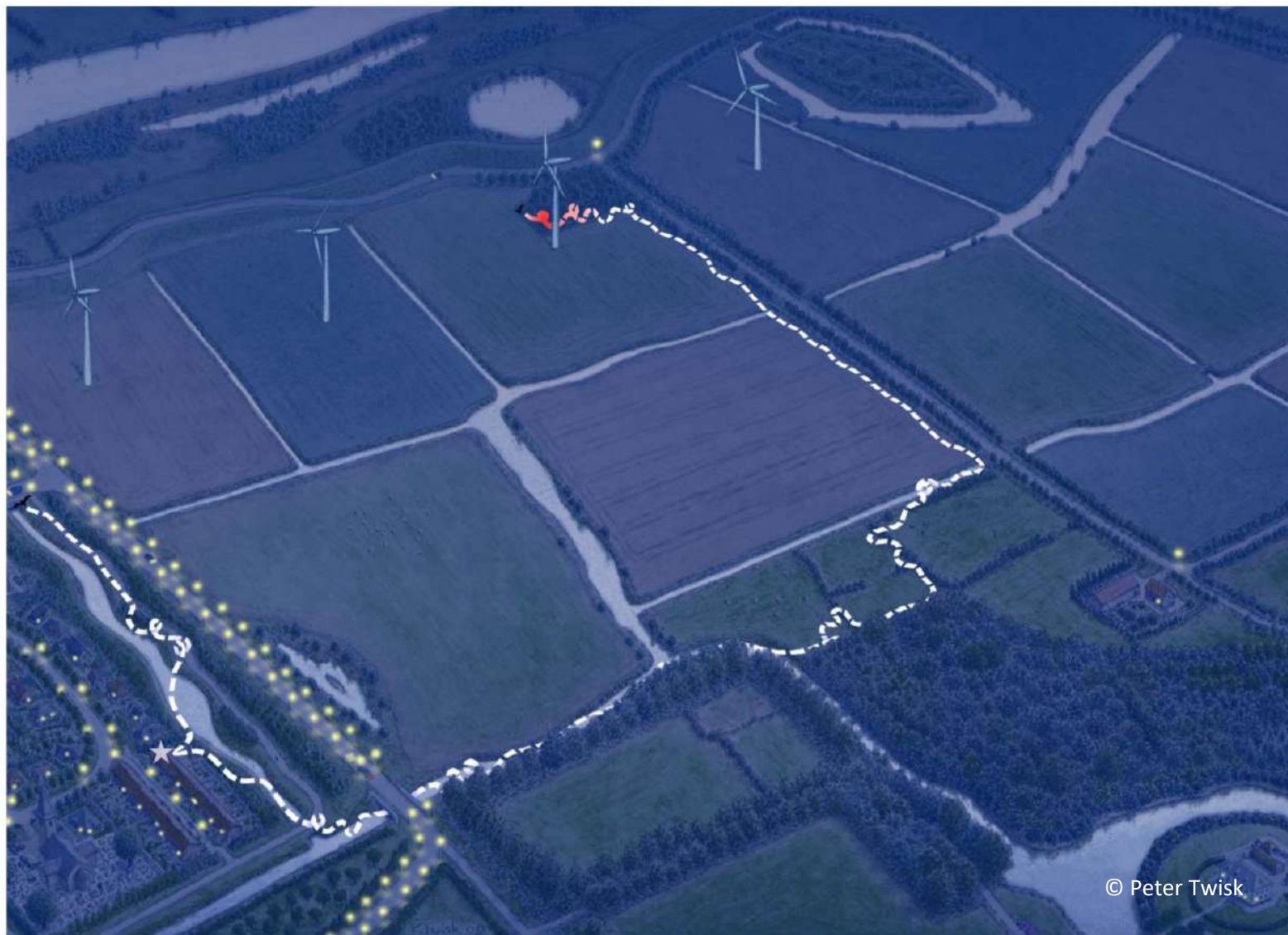
What is the issue?

Some species  
fly upwards  
in certain conditions!  
Also in rotor swept area!  
- foraging



© Peter Twisk







© Peter Twisk

*Eptesicus serotinus*



## What is the issue?

Bats get killed by wind turbines!



© Frinat



© BuWa

# Bats & wind turbines

## What is the issue?

### Fatality Risk correlated with ...

activity at higher altitudes

- (transit) flight at higher altitudes
- foraging at higher altitudes
- flying up to forage near turbine

high density of bats (foraging and/or transit)

- high numbers of bats
- high activity levels



# Bats & wind turbines

## What is the issue?

### Fatality Risk correlated with ...

activity at higher altitudes

specific species  
migration



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higher energy demands



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### Fatality Risk correlated with ...

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- (transit) flight at higher altitudes
- foraging at higher altitudes
- flying up to forage near turbine

specific species  
migration

higher energy demands

high density of bats (foraging and/or transit)

- high numbers of bats
- high activity levels

- migration period
- maternity period
- swarming period

higher energy demands



## What is the issue?

**Where are ??**

**Migration routes**

**+ roosts + foraging areas**

**Maternity/summer roosts**

**+ daily routes**

**+ foraging areas**

**Swarming & hibernation sites**

**+ roosts + foraging areas**

higher energy demands

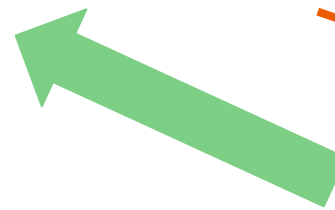


**- migration period**

**- maternity period**

**- swarming period**

higher energy demands



## Bats & wind turbines

### What is the issue?

Bats get killed by wind turbines!



© Frinat



© BuWa



## Bats & wind turbines

### What is the issue?

Bats get killed by wind turbines

We don't exactly know how many

- accidental findings
- high rate of disappearance
- yes/no fatality search
- where do they fall ?
- what portion is found ?

## Bats & wind turbines

### What is the issue?

Bats get killed by wind turbines

We don't exactly know how many

- accidental findings
- are data shared/reported?
- disappearance / fall, portion?
- (methodical) fatality search →  
not in every wind farm  
not all data shared



- incomplete overview fatalities!



# Fledermausverluste an Windenergieanlagen / bat fatalities at wind turbines in Europe

Dokumentation aus der zentralen Datenbank der Staatlichen Vogelschutzwarte im Landesamt für Umwelt Brandenburg

Stand: 09. August 2023, Tobias Dürr - E-Mail: tobias.duerr[at]lfu.brandenburg.de

<https://lfu.brandenburg.de/lfu/de/aufgaben/natur/artenschutz/vogelschutzwarte/arbeits-schwerpunkt-entwicklung-und-umsetzung-von-schutzstrategien/auswirkungen-von-windenergieanlagen-auf-voegel-und-fledermaeuse/>

Art		A	BE	CH	CR	CZ	D	DK	ES	EST	FI	FR	GR	IT	LV	NL	N	PT	PL	RO	S	UK	ges.	
<i>Nyctalus noctula</i>	Großer Abendsegler	46	1			31	1287		1			269	10					2	17	76	14	11	1765	
<i>N. lasiopterus</i>	Riesenabendsegler								21			10	1					9						41
<i>N. leisleri</i>	Kleiner Abendsegler			1	4	3	199		15			243	58	2				273	5	10				813
<i>Nyctalus spec.</i>							2		2			5						17						26
<i>Eptesicus serotinus</i>	Breitflügel-Fledermaus	1				11	72		2			72	1			2			3	1				165
<i>E. isabellinus</i>	Isabellfledermaus								117									3						120
<i>E. serotinus / isabellinus</i>									98									17						115
<i>E. nilssonii</i>	Nordfledermaus	1				1	6				2	6				13	1		1	1	13			45
<i>Vespertilio murinus</i>	Zweifarb-Fledermaus	2	1		17	6	153					11	1		1				9	15	2			218
<i>Myotis myotis</i>	Großes Mausohr						2		2			5												9
<i>M. blythii</i>	Kleines Mausohr								6			1												7
<i>M. dasycneme</i>	Teichfledermaus						3																	3
<i>M. daubentonii</i>	Wasserfledermaus						8					2						2						12
<i>M. bechsteini</i>	Bechsteinfledermaus											2												2
<i>M. nattereri</i>	Fransenfledermaus						2					3										1		6
<i>M. emarginatus</i>	Wimperfledermaus								1			3						1						5
<i>M. brandtii</i>	Große Bartfledermaus						2																	2
<i>M. mystacinus</i>	Kleine Bartfledermaus						3					4	1											8
<i>Myotis spec.</i>							2		3			1									4			10
<i>Pipistrellus pipistrellus</i>	Zwergfledermaus	2	30	6	5	16	802		211			1931	0	1		16		323	5	6	1	46		3401
<i>P. nathusii</i>	Rauhautfledermaus	13	6	6	17	7	1144	2				415	35	1	23	11			16	90	5	1		1792
<i>P. pygmaeus</i>	Mückenfledermaus	4			1	2	169					199	0		1			42	1	5	18	52		494
<i>P. pipistrellus / pygmaeus</i>		1		2			3					40	54					38	1	2				412
<i>P. kuhlii</i>	Weißrandfledermaus					144			44			411	1					51		10				661
<i>Pipistrellus spec.</i>	<i>Pipistrellus spec.</i>	8	2		102	9	104		25			421	1		2			128	2	48		12		864
<i>Hypsugo savii</i>	Alpenfledermaus	1			137		1		50			59	28	12				56		2				346
<i>Barbastella barbastellus</i>	Mopsfledermaus						1		1			6												8
<i>Plecotus austriacus</i>	Graues Langohr	1					8					2												11
<i>P. auritus</i>	Braunes Langohr						7					1										1		9
<i>Plecotus spec.</i>												1												1
<i>Tadarida teniotis</i>	Bulldogfledermaus				7				36			3						39						85
<i>Miniopterus schreibersi</i>	Langflügel-Fledermaus								2			8						4						14
<i>Rhinolophus ferrumequinum</i>	Große Hufeisennase								1			1												2
<i>R. mehelyi</i>	Mehely-Hufeisennase								1															1
<i>Rhinolophus spec.</i>	Hufeisennase unbest.								1															1
<i>Chiroptera spec.</i>	<i>Fledermaus spec.</i>	1	11		60	1	78		320	1		465	8	1				120	3	15	30	9		1123
<b>gesamt:</b>		<b>81</b>	<b>51</b>	<b>15</b>	<b>494</b>	<b>87</b>	<b>4058</b>	<b>2</b>	<b>1231</b>	<b>3</b>	<b>6</b>	<b>4594</b>	<b>199</b>	<b>17</b>	<b>40</b>	<b>29</b>	<b>1</b>	<b>1125</b>	<b>63</b>	<b>285</b>	<b>83</b>	<b>133</b>	<b>12597</b>	

A = Österreich, BE = Belgien, CH = Schweiz, CR = Kroatien, CZ = Tschechien, D = Deutschland, DK = Dänemark, ES = Spanien, EST = Estland, FI = Finnland, FR = Frankreich, GR = Griechenland, IT = Italien

# Fledermausverluste an Windenergieanlagen / bat fatalities at wind turbines in Europe

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Stand: 09. August 2023, Tobias Dürr - E-Mail: tobias.duerr[at]lfu.brandenburg.de

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<i>Myotis myotis</i>												5											9
<i>M. b. ...</i>												1											7
<i>M. da ...</i>																							3
<i>M. da ...</i>												2						2					12
<i>M. be ...</i>												2											2
<i>M. nat ...</i>												3										1	6
<i>M. eme ...</i>												3						1					5
<i>M. bran ...</i>												4	1										2
<i>M. myst ...</i>												1											8
<i>Myotis s ...</i>												1								4			10
<i>Pipistrell ...</i>												1931	0	1		16		323	5	6	1	46	3401
<i>P. nathus ...</i>												415	35	1	23	11			16	90	5	1	1792
<i>P. pygma ...</i>												199	0		1			42	1	5	18	52	494
<i>P. pipistre ...</i>												40	54					38	1	2			412
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<i>Pipistrellus ...</i>												421	1		2			128	2	48		12	864
<i>Hypsugo sa ...</i>												59	28	12				56		2			346
<i>Barbastella ...</i>												6											8
<i>Plecotus au ...</i>												2											11
<i>P. auritus</i>																						1	9
<i>Plecotus spe ...</i>																							1
<i>Tadarida ten ...</i>												3						39					85
<i>Miniopterus sc ...</i>									2			8						4					14
<i>Rhinolophus fe ...</i>									1			1											2
<i>R. mehelyi</i>	Mehely-Hufeisennase								1														1
<i>Rhinolophus spec.</i>	Hufeisennase unbest.								1														1
<i>Chiroptera spec.</i>	<i>Fledermaus spec.</i>	1	11		60	1	78		320	1		465	8	1				120	3	15	30	9	1123
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It is expressly pointed out that the number of reports of finds only reflects the intensity of recording and the willingness to report, but does not illustrate the extent of the problem in the individual states.

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Tabel 3.7

*Gevonden soorten vleermuizen in de slachtofferonderzoeken bij windparken (zie Tabel 3.5), inclusief de gevonden slachtoffers in Windpark Delfzijl Zuid en Windpark Echteld (waar wel slachtoffers zijn gevonden, maar niet specifiek is gezocht naar vleermuizen).*

Soorten	Aantal gevonden slachtoffers	Bijdrage provincies
ruige dwergvleermuis	52	Flevoland (71%), Noord-Brabant (13,5%), Groningen (13,5%), Noord-Holland (2%)
gewone dwergvleermuis	16	Noord-Brabant (88%), Noord-Holland (6%), Flevoland (6%)
dwergvleermuis spec.	4	Flevoland (100%)
laatvlieger	1	Gelderland (100%)
rosse vleermuis	1	Flevoland (100%)
tweekleurige vleermuis	1	Flevoland (100%)

## Jeninga/Bureau Waardenburg, 2020

Graag citeren als: Jeninga, S.K., 2020. Monitoring van vogel- en vleermuis slachtoffers bij windparken en hoogspanningsverbindingen in Nederland. Begeleidende rapportage bij interactieve database. Rapport 20-101. Bureau Waardenburg, Culemborg.



# Bats & wind turbines

## What is the issue?

Bats get killed by wind turbines

We don't exactly know how many



Almere - turbine A10



- **methodical** fatality search
- fatalities + acoustic activity



- **estimates !!**
- **confidence intervals !!**

## What is the issue?

Bats get killed by wind turbines

We don't exactly know how many

- methodical fatalities search
- fatalities + acoustic activity



Population effects ??

(added) mortality !?  
population sizes ??



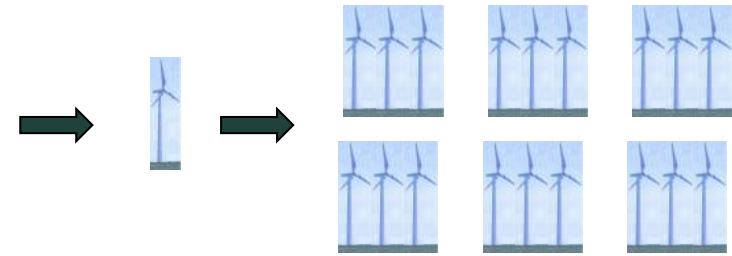
- estimates !?
- confidence intervals !?



## What is the issue?

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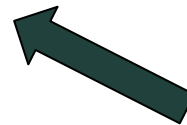
- methodical fatalities search
- fatalities + acoustic activity



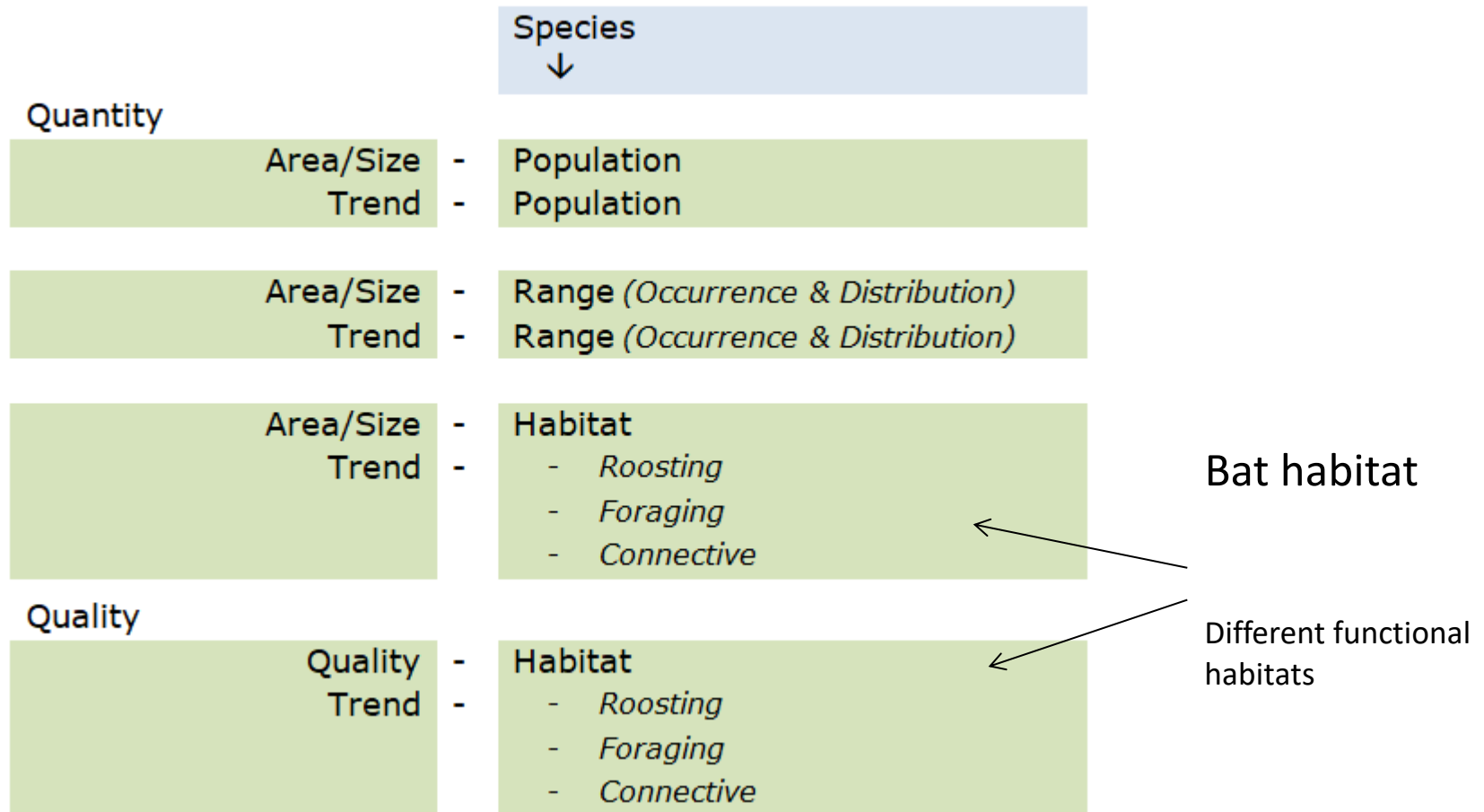
- estimates !?
- confidence intervals !?
- (inter)national cumulation ??

## Population effects ?????

(added) mortality !?  
population sizes ??



## Conservation Status Indicators $\approx$ viability Indicators



## Conservation Status *Pipistrellus nathusii*

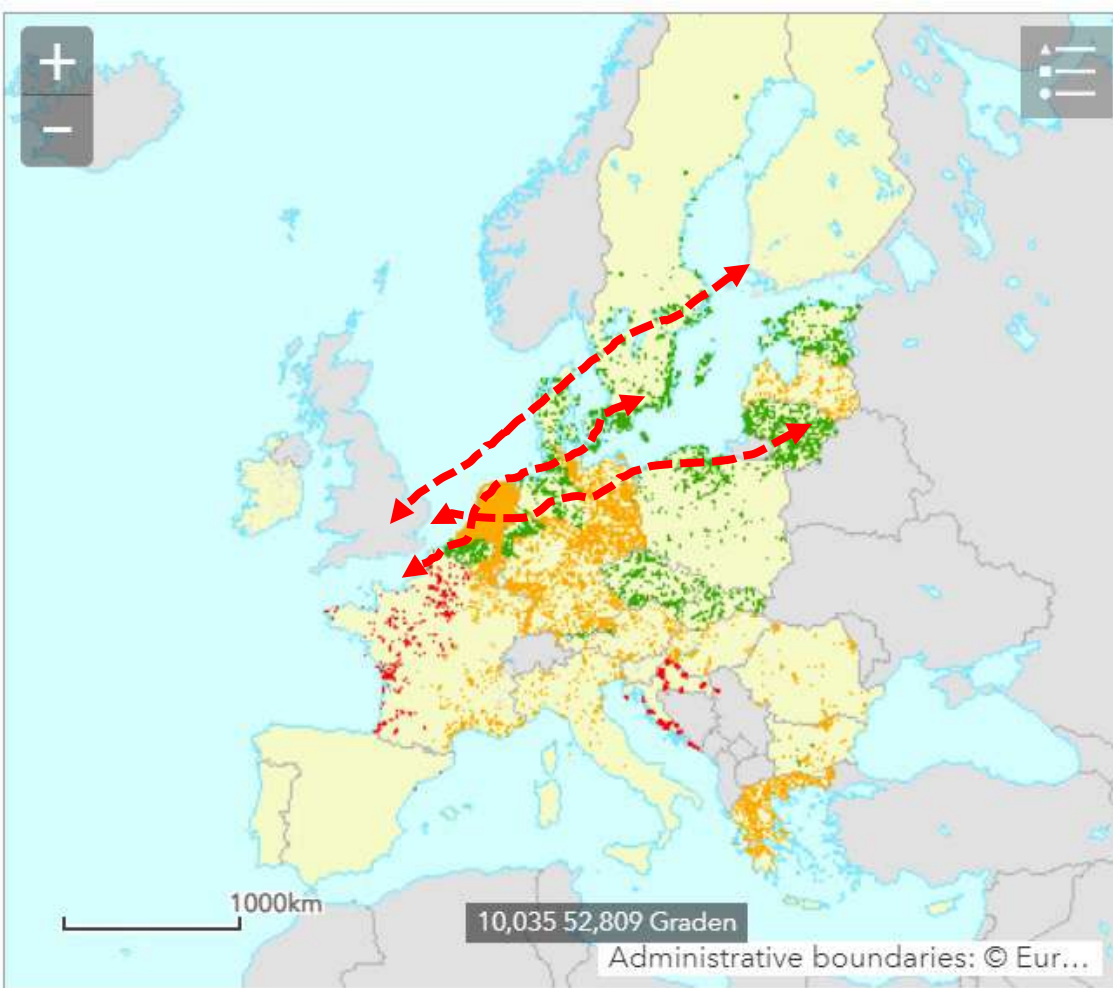
- CS mostly poor
- data availability poor

+

- migration → **cumulation !!**



- risk for species
- legal/planning risk for  
development



**Good:** the species is viable and maintaining itself on a long-term basis, its natural range is not reduced, and it has a sufficient large habitat.

**Poor:** the species is not as critical as being unfavourable-bad, but still requires significant conservation and restoration measure to make it viable in the long-term, or to enlarged its current range, or to improve the quality and availability of its habitat.

**Bad:** the species is either not maintaining itself on a long-term basis and is not viable, or its natural range as been or is being drastically reduced, or its habitat is largely insufficient; the species requires major conservation and restoration measures.

**Unknown:** the information available for the species is scarce and does not allow a proper assessment of its conservation status.




## What is the issue?

Bats get killed by wind turbines

We don't exactly know how

**Population effects ??????**

added mortality !?  
population sizes ??



National ...  
on European scale ...

- data fatalities?
- data population dynamics?
- data CS or viability?
- completeness, accessibility/sharing data?
- lacking combined data analysis

- (inter)national cumulation ??

# Bats & wind turbines – working together



Energy transition

→ long and complex planning

→ acceleration planning process & deployment needed

Bat Species (BioDiv)

→ Conservation Status needs to be improved

# Bats & wind turbines – working together

Energy transition

→ long and complex planning

→ acceleration planning & deployment

Bat Species (BioDiv)

→ Conservation Status needs to be improved



Stakeholders working together

Authorities →

Industry →

Conservation organisations →



**Nature Inclusive** Energy Transition

- Speed up process
- Improve Conservation Status



# Bats & wind turbines – working together

Energy transition → acceleration  
Bat Species (BioDiv) → improvement

Stakeholders working together → **Nature Inclusive** Energy Transition

- Accelerate process development renewable Energy / Wind
  - Make planning process simpler and standardised
  
  - Planning process with accurate handling of species
    - in compliance to demands Nature Conservation Law (EHD)
  - Wind farm operation with adequate mitigation / curtailment
- +
- Additional appropriate species conservation measures contributing to the maintenance or restoration of the populations of the species

# Bats & wind turbines – working together

Energy transition → acceleration  
Bat Species (BioDiv) → improvement

Stakeholders working together → **Nature Inclusive** Energy Transition

→ Accelerate process development renewable Energy / Wind

→ Make planning process simpler and standardised

→ Planning process with accurate handling of species

- in compliance to demands Nature Conservation Law (EHD)

→ Wind farm operation with adequate mitigation / curtailment

+

→ Additional appropriate species conservation measures contributing to the maintenance or restoration of the populations of the species

Applicable Legal requirements

+ = additional

# Bats & wind turbines – working together



Stakeholders Nature Inclusive Energy Transition Wind and Grid on land	Responsible for Nature inclusive Energy Transition	Competent Authority	Specialized Technical and Organizational Knowledge	Business Interest	Interest group	Parties Covenant
Ministry of Economic Affairs & Climate	■ ■ ■ ■					■ ■ ■ ■
Ministry of Agriculture, Nature and Food Quality	■ ■ ■ ■	■ ■ ■ ■				■ ■ ■ ■
Provinces	■ ■ ■ ■	■ ■ ■ ■				■ ■ ■ ■
Provinces - work associations	■ ■ ■ ■		■ ■ ■ ■			
Operators Grid - TenneT			■ ■ ■ ■	■ ■ ■ ■		■ ■ ■ ■
Developers/operators/energy industry			■ ■ ■ ■	■ ■ ■ ■		
Netherlands Wind Energy Association			■ ■ ■ ■	■ ■ ■ ■	■ ■ ■ ■	■ ■ ■ ■
NGO Nature/Environment - Nature & Environment Federations			■ ■ ■ ■		■ ■ ■ ■	■ ■ ■ ■
NGO Bats - Dutch Mammal Society			■ ■ ■ ■		■ ■ ■ ■	■ ■ ■ ■
NGO Birds - BirdLife Netherlands			■ ■ ■ ■		■ ■ ■ ■	■ ■ ■ ■



# Bats & wind turbines – working together

	Stakeholders Nature Inclusive Energy Transition Wind and Grid on land	Responsible for Nature inclusive Energy Transition	Competent Authority	Specialized Technical and Organizational Knowledge	Business Interest	Interest group	Parties Covenant
<b>Complementary expertise →</b>							
<b>Authorities →</b>	Ministry of Economic Affairs & Climate	■■■■					■■■■
	Ministry of Agriculture, Nature and Food Quality	■■■■	■■■■				■■■■
	Provinces	■■■■	■■■■				■■■■
	Provinces - work associations	■■■■		■■■■			
<b>Industry →</b>	Operators Grid - TenneT			■■■■	■■■■		■■■■
	Developers/operators/energy industry			■■■■	■■■■		
	Netherlands Wind Energy Association			■■■■	■■■■	■■■■	■■■■
<b>Conservation organisations →</b>	NGO Nature/Environment - Nature & Environment Federations			■■■■		■■■■	■■■■
	NGO Bats - Dutch Mammal Society			■■■■		■■■■	■■■■
	NGO Birds - BirdLife Netherlands			■■■■		■■■■	■■■■

## Additional input from

- Other ministries
- Legal specialists ministries
- Bats/birds specialists
- Managers Nature Conservation areas

Complementary expertise →

Authorities →

Industry →

Conservation organisations →

	Interest group	Parties	Covenant
Netherlands Wind Energy Association	■■■■	■■■■	■■■■
NGO Nature/Environment - Nature & Environment Federations	■■■■	■■■■	■■■■
NGO Bats - Dutch Mammal Society	■■■■	■■■■	■■■■
NGO Birds - BirdLife Netherlands	■■■■	■■■■	■■■■

## Shared challenges

- Legal structure 'agreement/covenant'
- Data & knowledge gaps species
- Organisation of data sharing
- Organisation of meta analysis of shared data
- Species are just one of the factors that slow down the process → less development
- Budgets extra conservation measures
- Getting extra measures incorporated in existing landscape/nature management processes
- Capacity for fieldwork and research

Complementary  
expertise →

Authorities →

Industry →

Conservation  
organisations →

Interest group	Parties Covenant
	■■■■
	■■■■
	■■■■
	■■■■
■■■■	■■■■
■■■■	■■■■
■■■■	■■■■



## Shared challenges

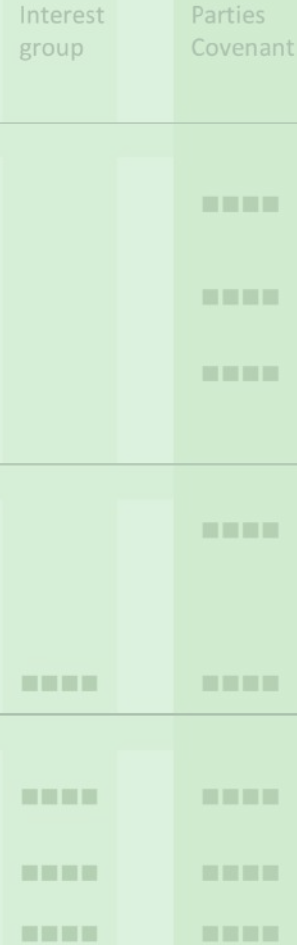
- Legal structure 'agreement/covenant'
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- Budgets extra conservation measures
- Getting extra measures incorporated in existing landscape/nature management processes
- Capacity for fieldwork and research

Complementary  
expertise →

Authorities →

Industry →

Conservation  
organisations →



## Shared challenges

- **Data & knowledge gaps species**

- **Research & development program**

- Protocol preconstruction assessment
- Update post construction monitoring protocol (fatalities/acoustic activity)
- Spatial risk analysis model
- Improvement prediction model fatalities, optimisation curtailment
- Modelling population effects
- Spatiotemporal modelling bat migration

Complementary expertise →

Authorities →

Industry →

Conservation organisations →

Interest group

Parties Covenant

■ ■ ■ ■

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# Partners – working together

stakeholders agree on application of curtailment and monitoring

Complementary expertise →

Authorities →

Industry →

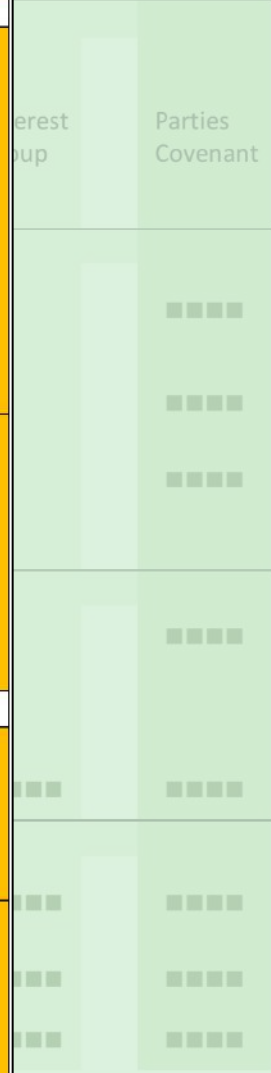
Conservation organisations →

Stakeholders Nature Inclusive Energy Transition Wind and Grid on land	Responsible for Nature inclusive Energy Transition	Competent Authority	Specialized Technical and Organizational Knowledge	Business Interest	Interest group	Parties Covenant
Ministry of Economic Affairs & Climate	■■■■■					■■■■■
Ministry of Agriculture, Nature and Food Quality	■■■■■	■■■■■				■■■■■
Provinces	■■■■■	■■■■■				■■■■■
Provinces - work associations	■■■■■		■■■■■			
Operators Grid - TenneT			■■■■■	■■■■■		■■■■■
Developers/operators/energy industry			■■■■■	■■■■■		
Netherlands Wind Energy Association			■■■■■	■■■■■	■■■■■	■■■■■
NGO Nature/Environment - Nature & Environment Federations			■■■■■		■■■■■	■■■■■
NGO Bats - Dutch Mammal Society			■■■■■		■■■■■	■■■■■
NGO Birds - BirdLife Netherlands			■■■■■		■■■■■	■■■■■



stakeholders agree on application of curtailment and monitoring

		HIGH-RISK-PERIOD	LOW-RISK-PERIOD
	HIGH-RISK-LOCATION	Curtailment standard	Curtailment <u>not</u> standard
Complete expertise			
		Monitoring standard	Monitoring standard
Authorities			
	LOW-RISK-LOCATION	Curtailment <u>not</u> standard	Curtailment <u>not</u> standard
Industry →			
		Monitoring standard	Monitoring standard
Conservation organisation			
Herm			



stakeholders agree on application of curtailment and monitoring

**HIGH-RISK-PERIOD**

**LOW-RISK-PERIOD**

**HIGH-RISK-LOCATION**

**Curtailment standard**

**Curtailment not standard**

Compleme  
expertise

Interest  
group Parties  
Covenant

Authorities

**Monitoring standard**

**Monitoring standard**

Industry →

**LOW-RISK-LOCATION**

**Curtailment not standard**

**Curtailment not standard**

Conservati  
organisatio

**Monitoring standard**

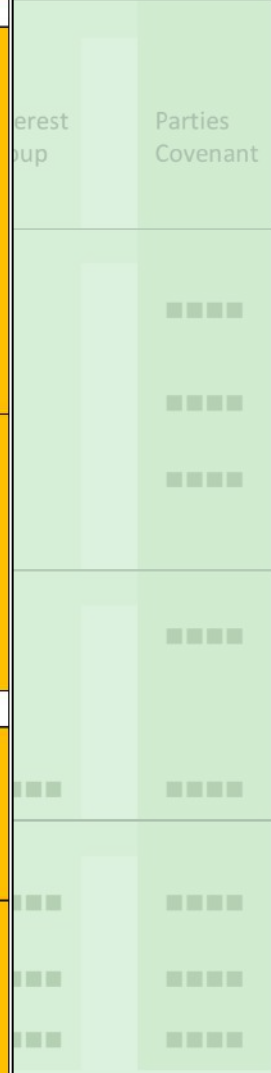
**Monitoring standard**

Herm



stakeholders agree on application of curtailment and monitoring

		HIGH-RISK-PERIOD	LOW-RISK-PERIOD
	<b>HIGH-RISK-LOCATION</b>	Curtailment standard	Curtailment <u>not</u> standard
Authorities		Monitoring standard	Monitoring standard
	<b>LOW-RISK-LOCATION</b>	Curtailment <u>not</u> standard	Curtailment <u>not</u> standard
Conservation organisation		Monitoring standard	Monitoring standard



Compleme expertise

Authorities

Industry

Conservation organisation

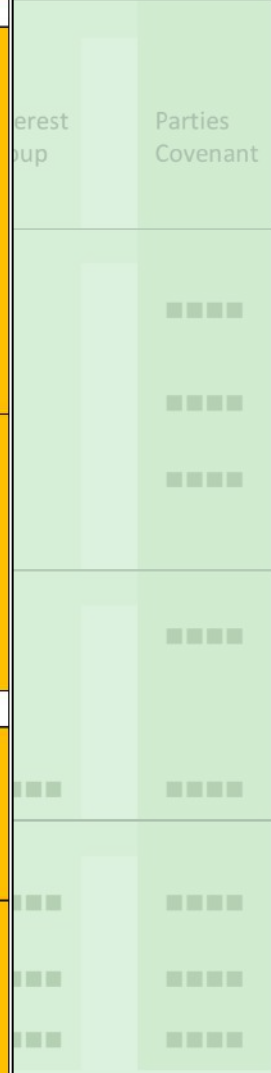
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stakeholders agree on application of curtailment and monitoring

Compleme expertise  
Authorities  
Industry →  
Conservati organisati  
Herm

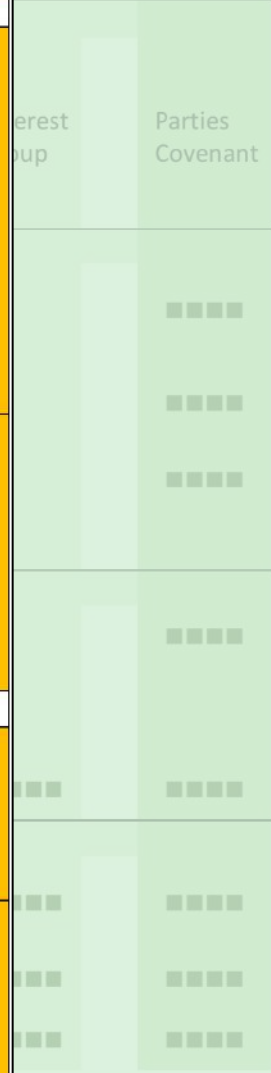
	HIGH-RISK-PERIOD	LOW-RISK-PERIOD
	Curtailment standard	Curtailment <u>not</u> standard
	Monitoring standard	Monitoring standard
	LOW-RISK-LOCATION	Curtailment <u>not</u> standard
		Monitoring standard



stakeholders agree on application of curtailment and monitoring

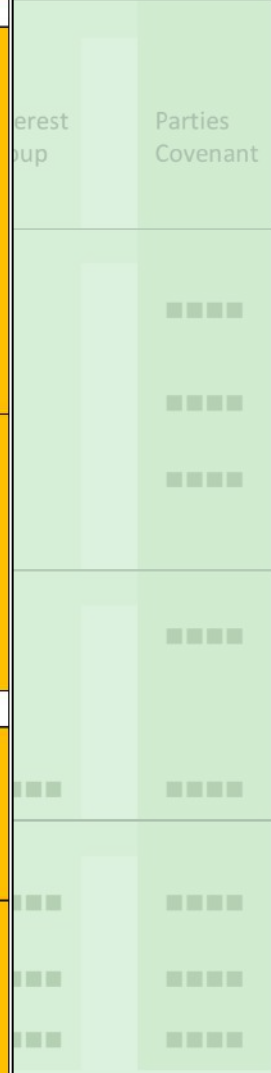
Complete expertise  
 Authorities  
 Conservation organisation  
 Hermit

	HIGH-RISK-PERIOD	LOW-RISK-PERIOD
	Curtailment standard	Curtailment <u>not</u> standard
	Monitoring standard	Monitoring standard
	Curtailment <u>not</u> standard	Curtailment <u>not</u> standard
	Monitoring standard	Monitoring standard



stakeholders agree on application of curtailment and monitoring

		HIGH-RISK-PERIOD	LOW-RISK-PERIOD
	HIGH-RISK-LOCATION	Curtailment standard	Curtailment <u>not</u> standard
Complete expertise			
Authorities		Monitoring standard	Monitoring standard
Industry	LOW-RISK-LOCATION	Curtailment <u>not</u> standard	Curtailment <u>not</u> standard
Conservation organisation		Monitoring standard	Monitoring standard
Herm			



stakeholders agree on application of curtailment and monitoring

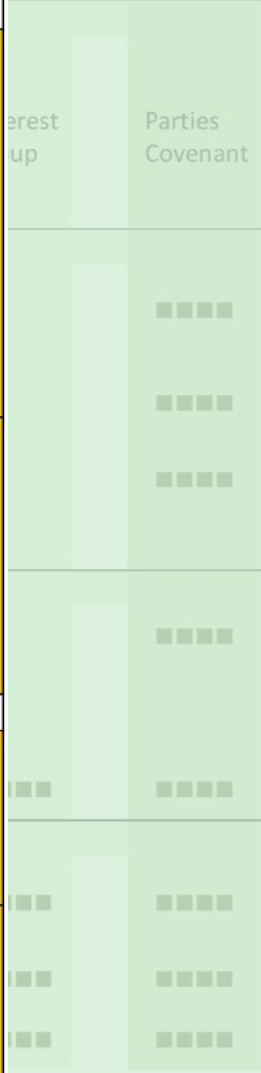
		HIGH-RISK-PERIOD	LOW-RISK-PERIOD
	HIGH-RISK-LOCATION	Curtailment standard	Curtailment <u>not</u> standard
Complete expertise			
		Monitoring standard	Monitoring standard
Authorities			
	LOW-RISK-LOCATION	Curtailment <u>not</u> standard	Curtailment <u>not</u> standard
Industry			
		Monitoring standard	Monitoring standard
Conservation organisation			
Herm			





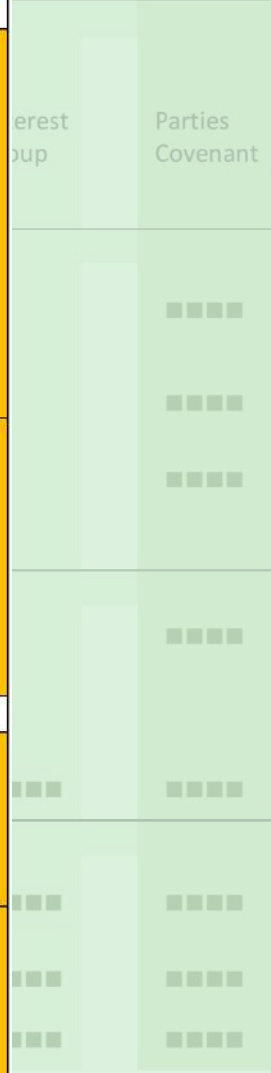
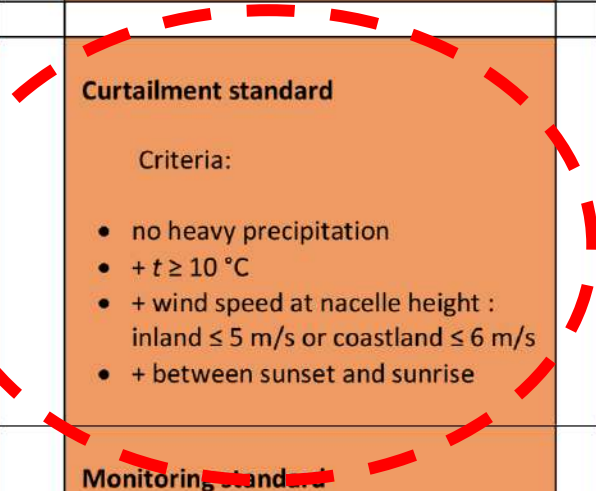
stakeholders agree on application of curtailment and monitoring

		HIGH-RISK-PERIOD	LOW-RISK-PERIOD
		Autumn Migration (15 July - 15 October)	Outside Autumn Migration (15 March – 15 July)
Complementary expertise	HIGH-RISK-LOCATION Turbines - on or close to larger water bodies (<150 m) - and/or close to forest (<150/200 m)	Curtailment standard	Curtailment <u>not</u> standard
		Monitoring standard	Monitoring standard
Authorities		Monitoring standard	Monitoring standard
Industry →	LOW-RISK-LOCATION - other locations	Curtailment <u>not</u> standard	Curtailment <u>not</u> standard
		Monitoring standard	Monitoring standard
Conservation organisations		Monitoring standard	Monitoring standard
Herm			



stakeholders agree on application of curtailment and monitoring

		HIGH-RISK-PERIOD	LOW-RISK-PERIOD
		Autumn Migration (15 July - 15 October)	Outside Autumn Migration (15 March – 15 July)
Compleme expertise	HIGH-RISK-LOCATION Turbines - on or close to larger water bodies (<150 m) - and/or close to forest (<150/200 m)	<b>Curtailment standard</b>  Criteria: <ul style="list-style-type: none"><li>• no heavy precipitation</li><li>• + <math>t \geq 10</math> °C</li><li>• + wind speed at nacelle height : inland <math>\leq 5</math> m/s or coastland <math>\leq 6</math> m/s</li><li>• + between sunset and sunrise</li></ul>	<b>Curtailment <u>not</u> standard</b>
		<b>Monitoring standard</b>	<b>Monitoring standard</b>
Industry	LOW-RISK-LOCATION - other locations	<b>Curtailment <u>not</u> standard</b>	<b>Curtailment <u>not</u> standard</b>
Conservat organisati		<b>Monitoring standard</b>	<b>Monitoring standard</b>



Compleme expertise

Authority

Industry

Conservat organisati

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stakeholders agree on application of curtailment and monitoring

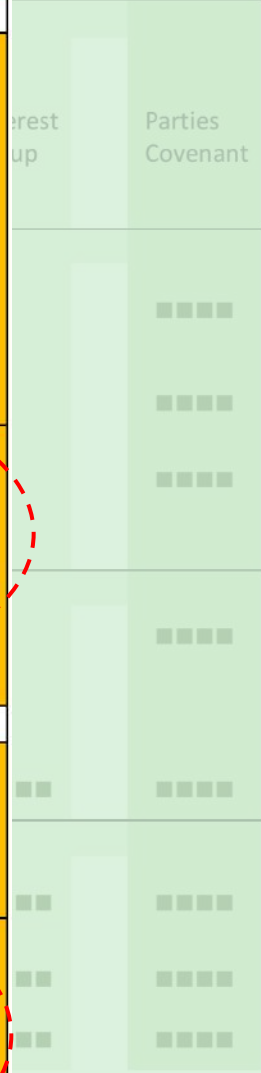
Complementary expertise

Authorities

Industry

Conservation organisations

		HIGH-RISK-PERIOD	LOW-RISK-PERIOD
		Autumn Migration (15 July - 15 October)	Outside Autumn Migration (15 March – 15 July)
		<b>Curtailment standard</b>	<b>Curtailment <u>not</u> standard</b>
<b>HIGH-RISK-LOCATION</b> Turbines - on or close to larger water bodies (<150 m) - and/or close to forest (<150/200 m)		<b>Criteria:</b> <ul style="list-style-type: none"> <li>• no heavy precipitation</li> <li>• + <math>t \geq 10^\circ\text{C}</math></li> <li>• + wind speed at nacelle height : inland <math>\leq 5</math> m/s or coastland <math>\leq 6</math> m/s</li> <li>• + between sunset and sunrise</li> </ul>	
		<b>Monitoring standard</b> - methodical fatality search - monitoring acoustic activity - adequate sample size per wind farm and on national level	<b>Monitoring standard</b> - monitoring acoustic activity - adequate sample size per wind farm and on national level
<b>LOW-RISK-LOCATION</b> - other locations		<b>Curtailment <u>not</u> standard</b>	<b>Curtailment <u>not</u> standard</b>
		<b>Monitoring standard</b> - monitoring acoustic activity adequate sample size per wind farm and on national level	<b>Monitoring standard</b> - monitoring acoustic activity - adequate sample size per wind farm and on national level



**Bats & wind turbines?**

**→ working together!**

**Energy Transition & species?**

Ministry of Agriculture, Nature and  
Food Quality

Provinces

**Thank you for your attention !!**

NGO Nature/Environment - Nature &  
Environment Federations

NGO Bats - Dutch Mammal Society

NGO Birds - BirdLife Netherlands



# De Zoogdiervereniging - *Dutch Mammal Society*



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[herman.limpens@zoogdiervereniging.nl](mailto:herman.limpens@zoogdiervereniging.nl)

+ bat team DMS

Note: many thanks to all who helped with pictures & graphs and critical discussions ....

# De Zoogdiervereniging - *Dutch Mammal Society*



## Our mission

- Study and conservation of mammals
- Data and evidence / science based conservation
- Objective and constructive
- Platform & knowledge hub
- Communication
- Identification of conservation problems – policy and research agenda
- Pilot projects regarding emerging conservation problems
- Development and innovation of mammal/bat methods
- Monitoring mammal species: Dutch Network Ecological Monitoring scientific methods + volunteers / citizen science
- Assessment of Favourable Conservation Status and Red Listing
- Education, training and courses: professional and volunteers bat workers