Büro für Freilandbiologie und Umweltgutachten

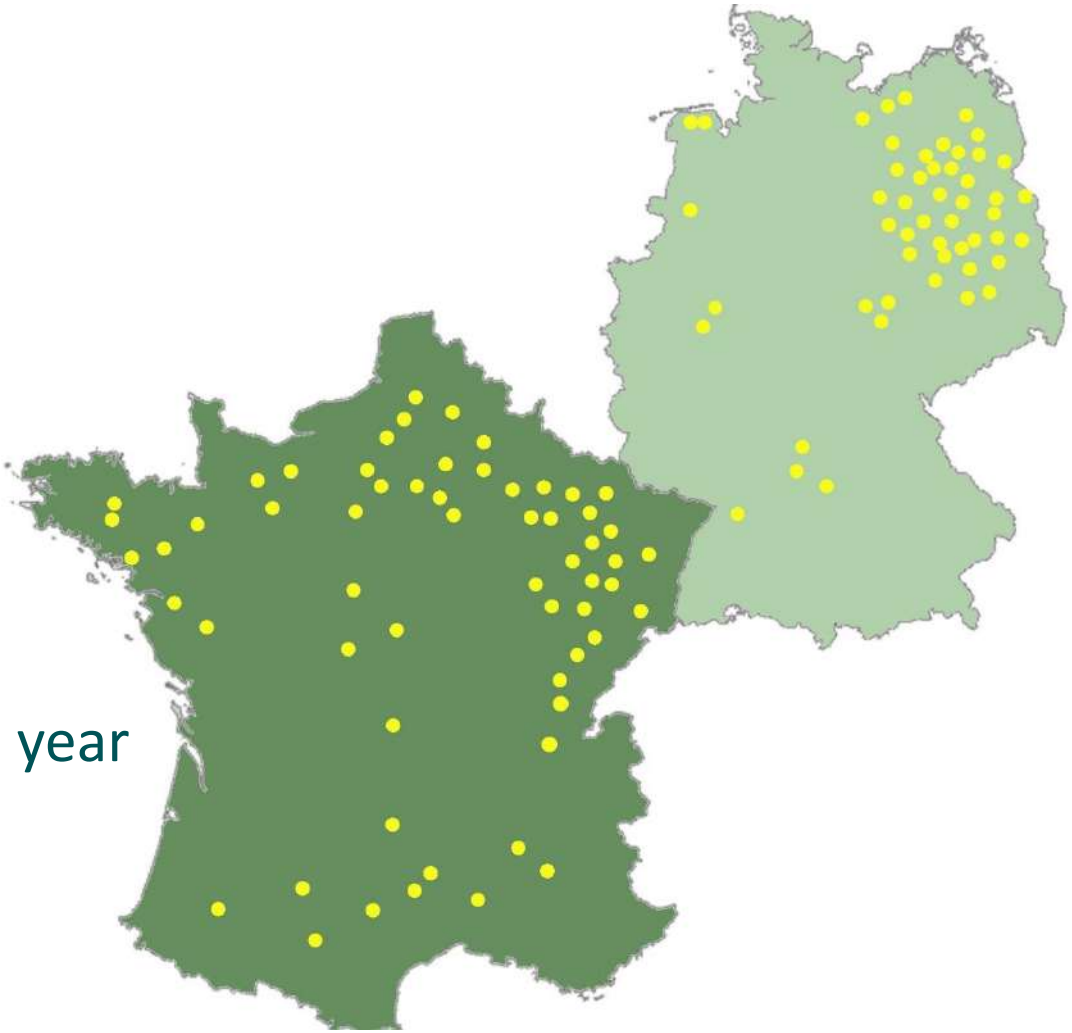
Who does the night belong to?

Bats and wind energy - a green-green dilemma with solutions

RGI webinar - Bats and Wind Energy - Protecting bats around onshore wind farms

Who we are?

- KS Umweltgutachten GmbH
- KJM conseil SAS
  - 50 employees
  - 25 years of experience
  - About 100 nacelle activity monitoring each year



What are the consequences of wind turbines for bats?

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- Wind power generation has grown exponentially over the past two decades
- Annual impact rates on individual wind turbines: Ø 14 bats (up to 70)
  (Brinkmann et al., 2011; Mantoiu et al., 2020; Rydell et al., 2010; Voigt et al., 2022)
- 75% of the wind turbines in Germany (approx. 30,000 in total) operate without restrictions to protect bats (Fritze et al., 2019; KNE, 2020)
- **Species with highest collision risk in Europe**
  - **Common Pipistrelle** (*Pipistrellus pipistrellus*) → estimated more than 50% of carcasses
    (Richardson et al., 2021)
  - **Greater noctule** (*Nyctalus noctula*) → an estimated 32% of carcasses
    (Voigt, 2020)
- **Ecosystem consequences of bat loss are unclear**
- **Ecosystem services provided by bats are still not well understood in Europe**
  (Ghanem & Voigt, 2012; Heim et al., 2016; Russo et al., 2023)

Nyctalus noctula

Regulation in Europe

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- UNEP/EUROBATS agreement ratified by 37 countries
- EUROBATS Guidelines in wind energy planning are still not followed as intended (Barre et al., 2022)
- Several countries use Cut-In regulations for (bird or) bat protection
  - Usually wind depending Cut-Ins
  - Cut-In 4-7 m/s
- Lack of standardization and methodological requirements

Risk assessment and mortality reduction

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- Risk assessment via data collection (pre- or post construction)
  - Ground studies
  - Carcass search
  - Acoustic monitoring of bat activity at higher levels

Risk assessment and mortality reduction

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- Risk assessment via data collection (pre- or post construction)
  - Ground studies
  - Carcass search
  - Acoustic monitoring of bat activity at higher levels
- Reduction of the mortality risk
  - Feathering of turbine blades instead of idling may reduce fatality rates
  - Deterrent tools
  - Operational adjustments of wind turbines

Risk and mortality reduction via curtailment

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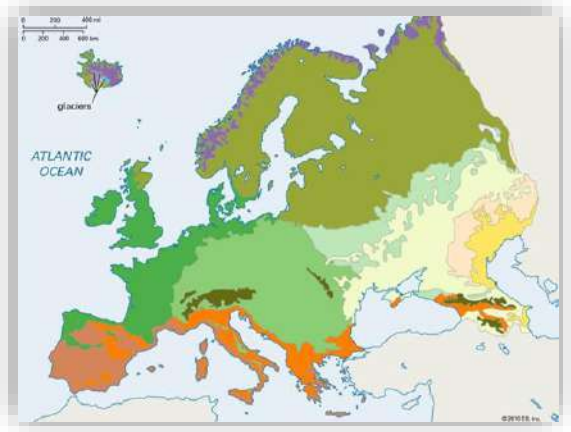
- Monitoring at height is of crucial importance for assessing collision risk (Baerwald et al., 2009)
- Clear link between activity and collision risk (Baerwald et al., 2011)
- Curtailment is still the most effective way to reduce bat mortality

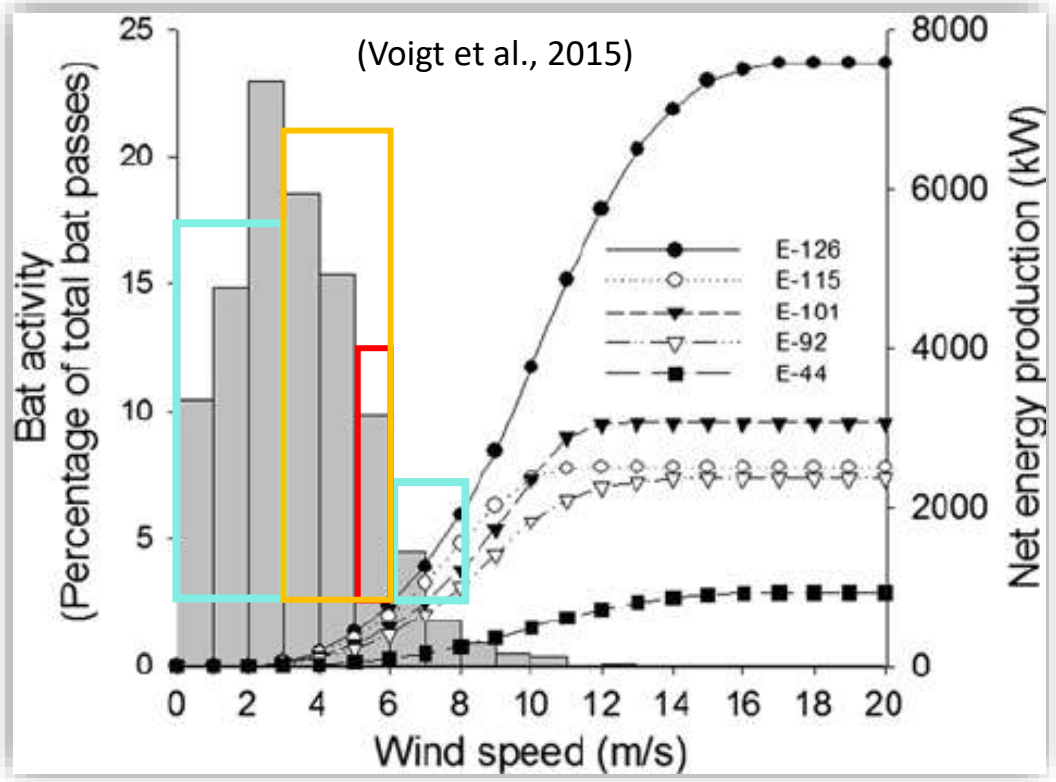
  - Blanket curtailment
  - Wind speed based curtailment
  - Live activity induced curtailment (e.g., TIMR)
  - multivariate algorithms to calculate curtailment

  →potentially high yield losses depending on used Cut-in speeds

Collision risk

- Maximum collision rate is between 3 and 6 m/s
- The highest risk between 5 and 6 m/s
- Below 3 m/s the rotors (often) do not move
- Above 6 m/s usually a lower activity

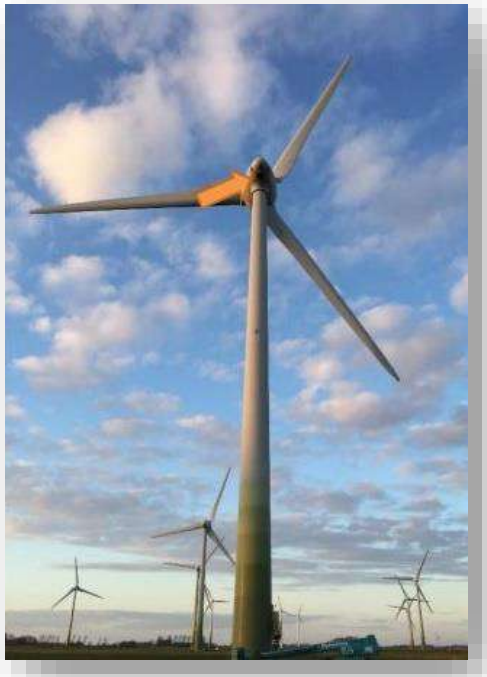


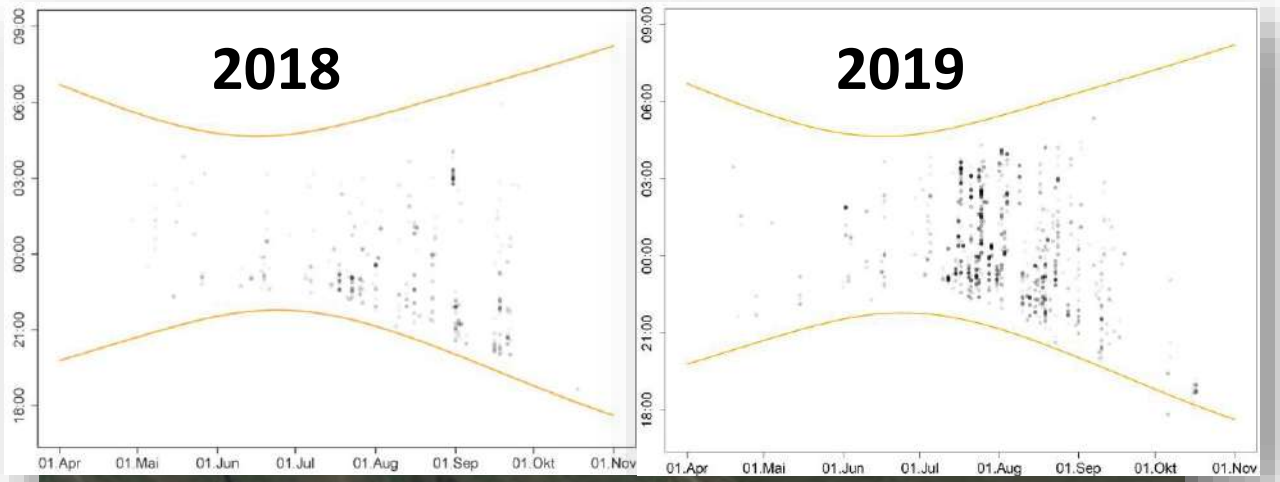


Nacelle activity monitoring

- Seasonal differences

- Mutli-year monitoring recommended





Protection of a percentage of the bat activity

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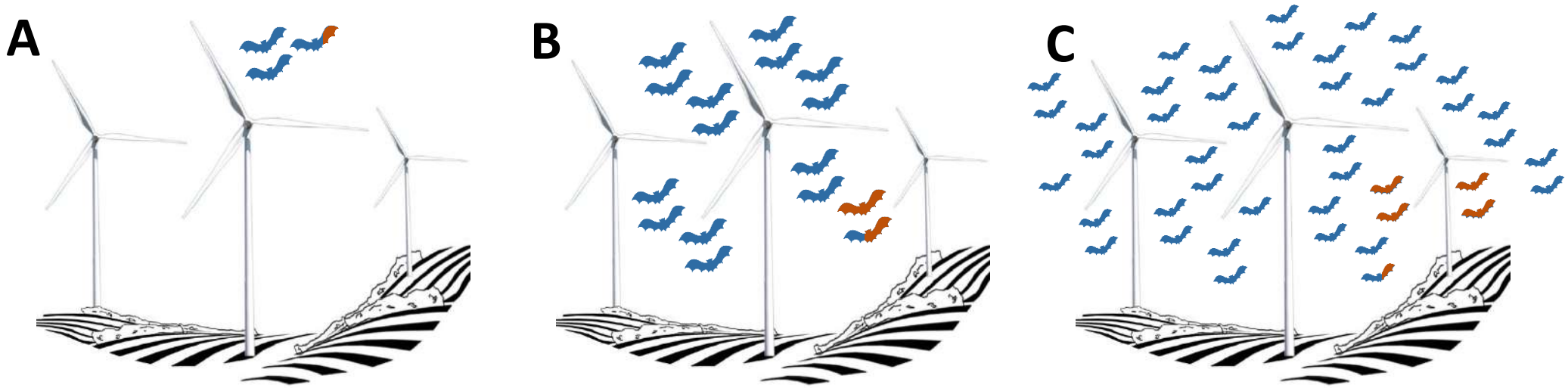

90% as activity threshold ➡ 10% vulnerable

	A	B	C
# bat recordings on nacelle height	556	993	4409
10 % of the activity unprotected	56	99	441

RENEBAT and ProBat

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Objective of RENEBAT I, II, III (2007-2016):

- **Standardize** recording methods and recording parameters (**Calibration**)
- Enable **comparability** and **equal treatment**
- **Ensure bat protection** through curtailment
- At the same time, **minimize energy loss** caused by curtailment

https://www.probat.org

RENEBAT and ProBat

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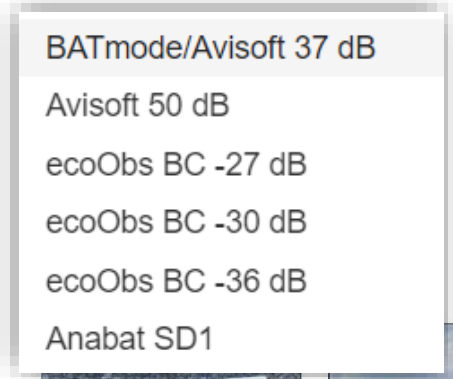
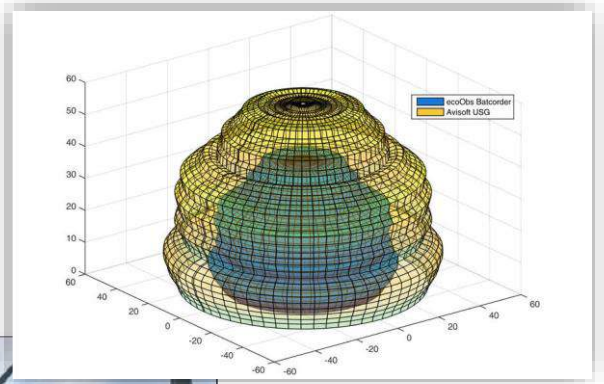
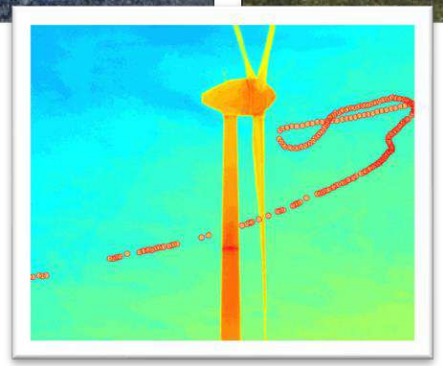
RENEBAT I, II, III (2007-2016)

- Bat activity
- Carcass search
- Bats use of space
- Detector range test
- Wind turbine characteristics







ProBat

RENEBAT and ProBat

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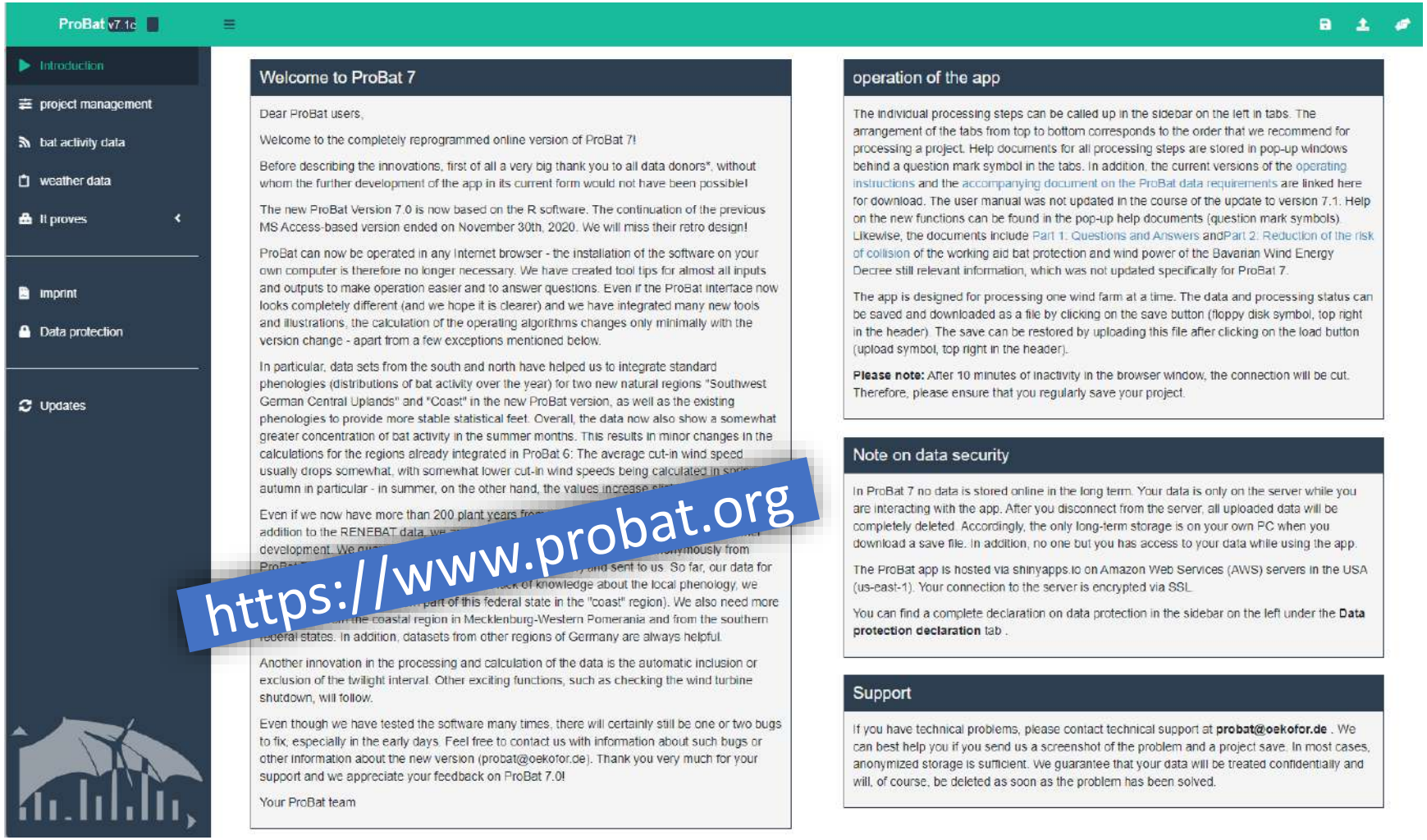

RENEBAT and ProBat

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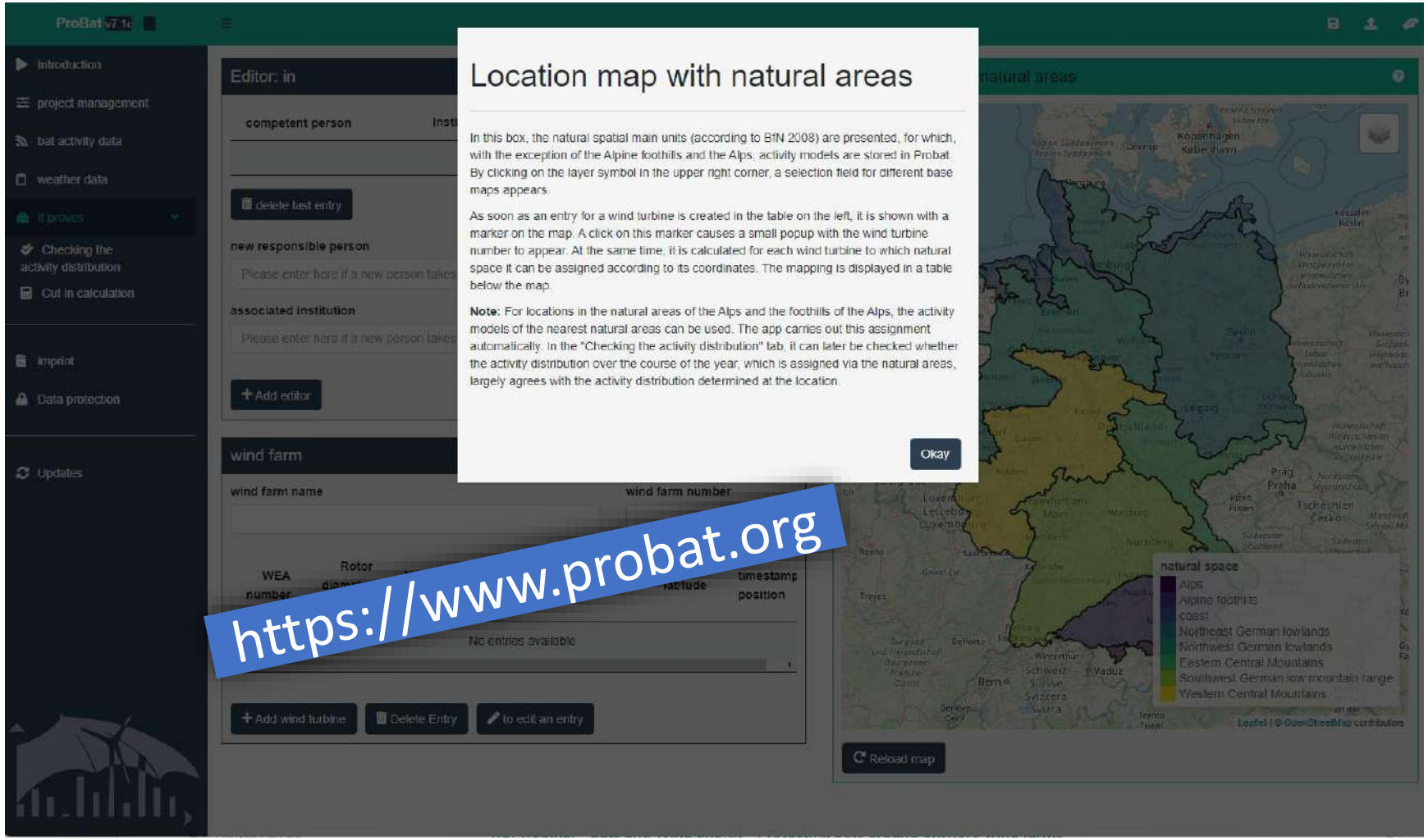

ProBat Inspector

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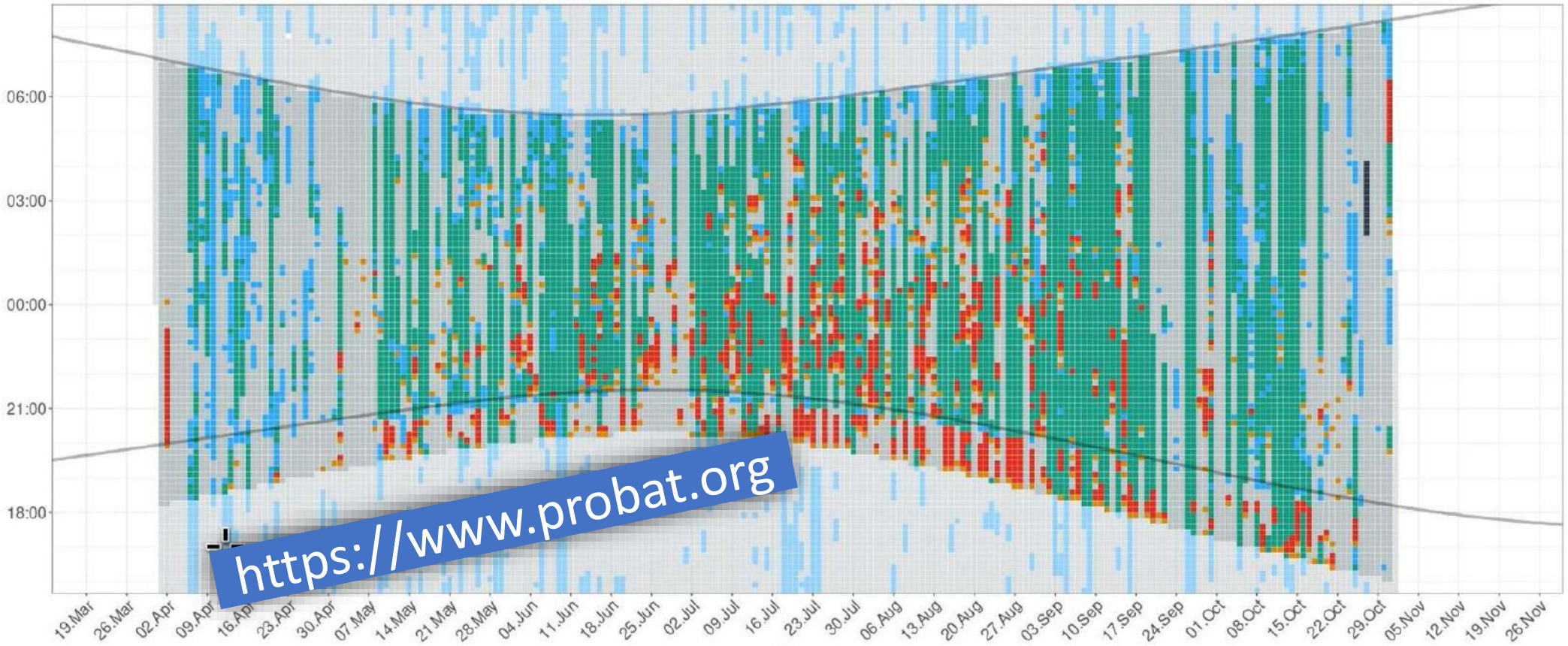

- Functional curtailment
- Non-functional curtailment
- Normal operation
- the shutdown must be initiated
  Authorized operation, unknown state
- non-functional machine
- Lack of data

From bioacoustic data to specific curtailment

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- **Statistical models**
  - Phenology of the bat acoustic activity
  - Natural habitat
  - Nighttime
  - Season
  - Wind speed
  - Bat activity levels at the monitored wind turbine
- This data is used to determine and reduce the site-specific collision risk

Prerequisites for correct data collection

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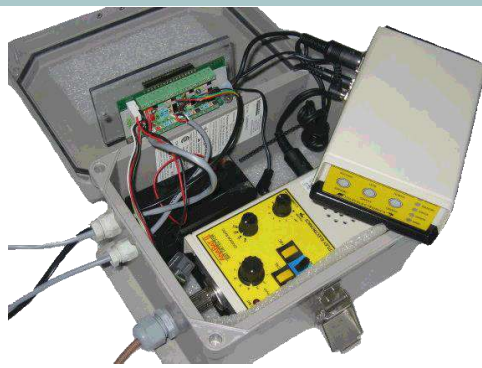
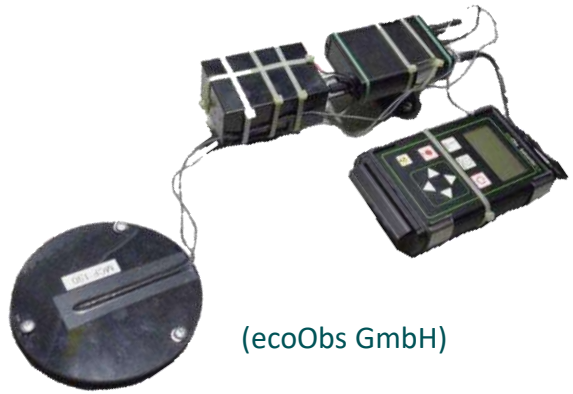
- **Data collection parameters**
  - Calibration and adjustment of recorder settings



(Avisoft Bioacoustics eK)

BATmode/Avisoft 37 dB
Avisoft 50 dB
ecoObs BC -27 dB
ecoObs BC -30 dB
ecoObs BC -36 dB
Anabat SD1

(bat bioacoustictechnology GmbH)



(ecoObs GmbH)

ProBat

Prerequisites for correct data collection

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- **Data collection parameters**
  - Calibration and adjustment of recorder settings
  - Correct microphone installation

Prerequisites for correct data collection

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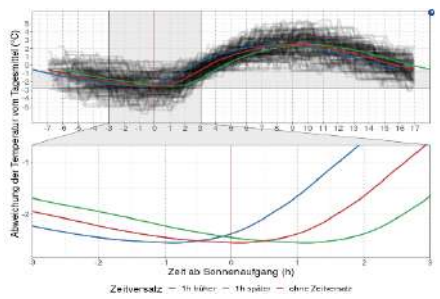
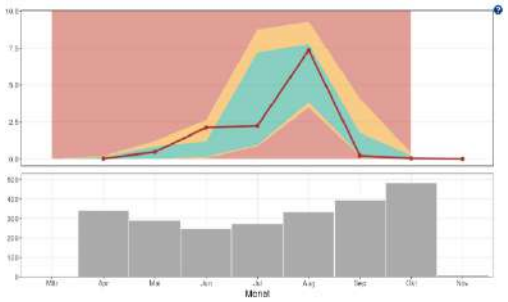
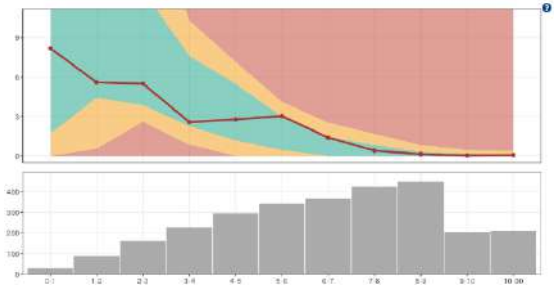
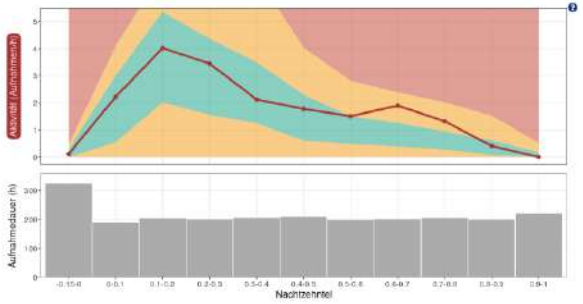
- **Data control and correction**
  - Calibration and adjustment of recording device
  - Correct times of recordings (summer and winter time)
  - Measurement of current microphone sensitivity (daily)

RENEBAT
DATABASE
65 000 nights from 3 studies









RENEBAT and ProBat

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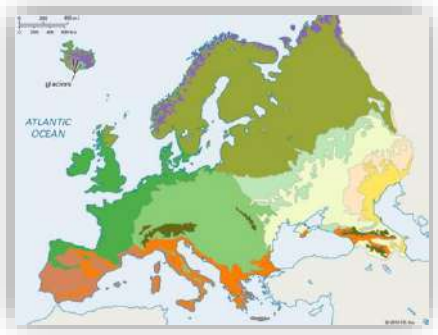
RENEBAT DATABASE
65 000 nights from 3 studies

- Phenology of bat activity
- Mortality
- Different biomes in background data
- Standardization of measuring parameters



Statistical models

Data control

ProBat

Graphical diagrams for validation

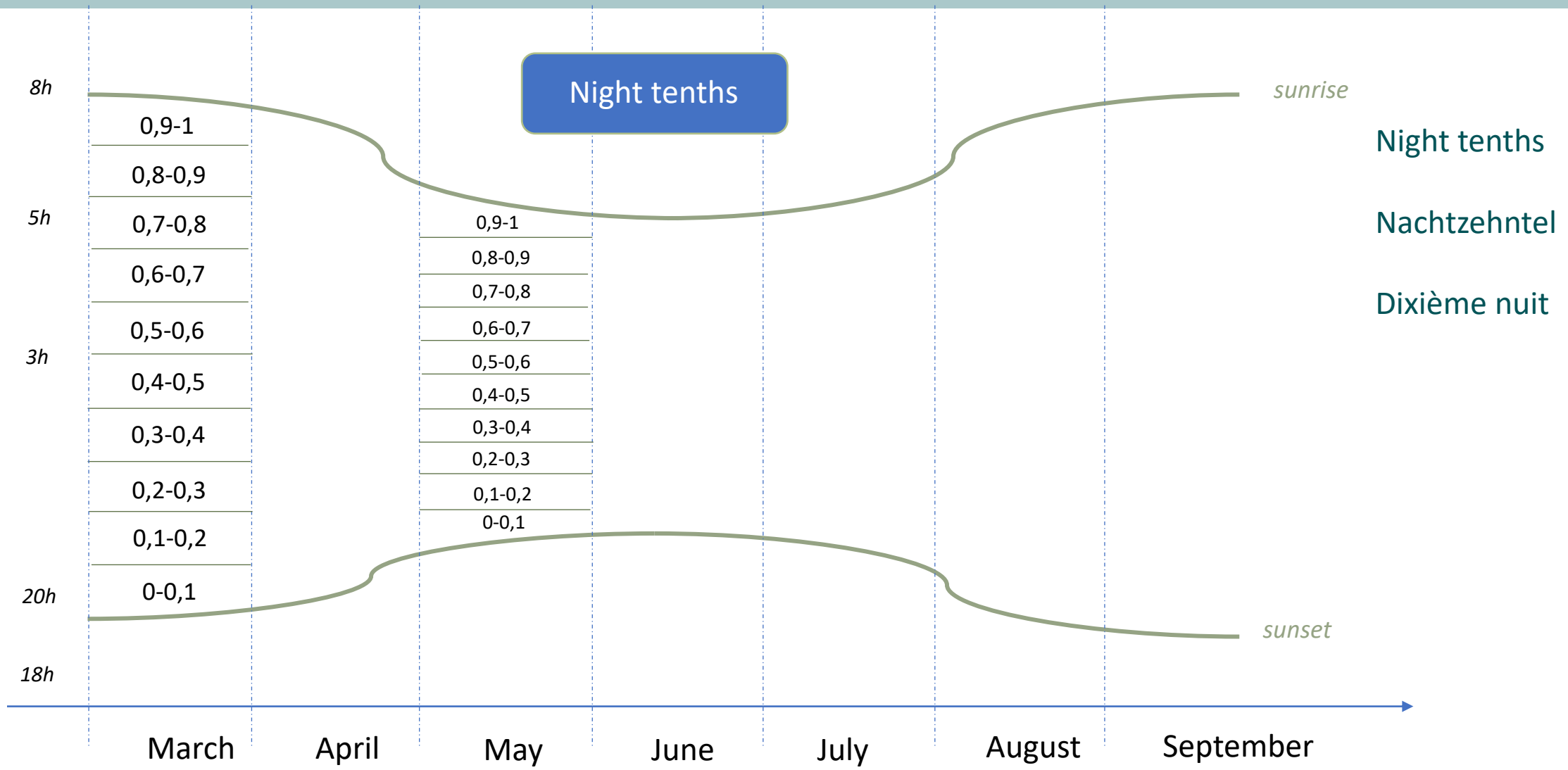
Report
Site-specific collision risk
Operational adjustment

Site specific data set
Standardized collection

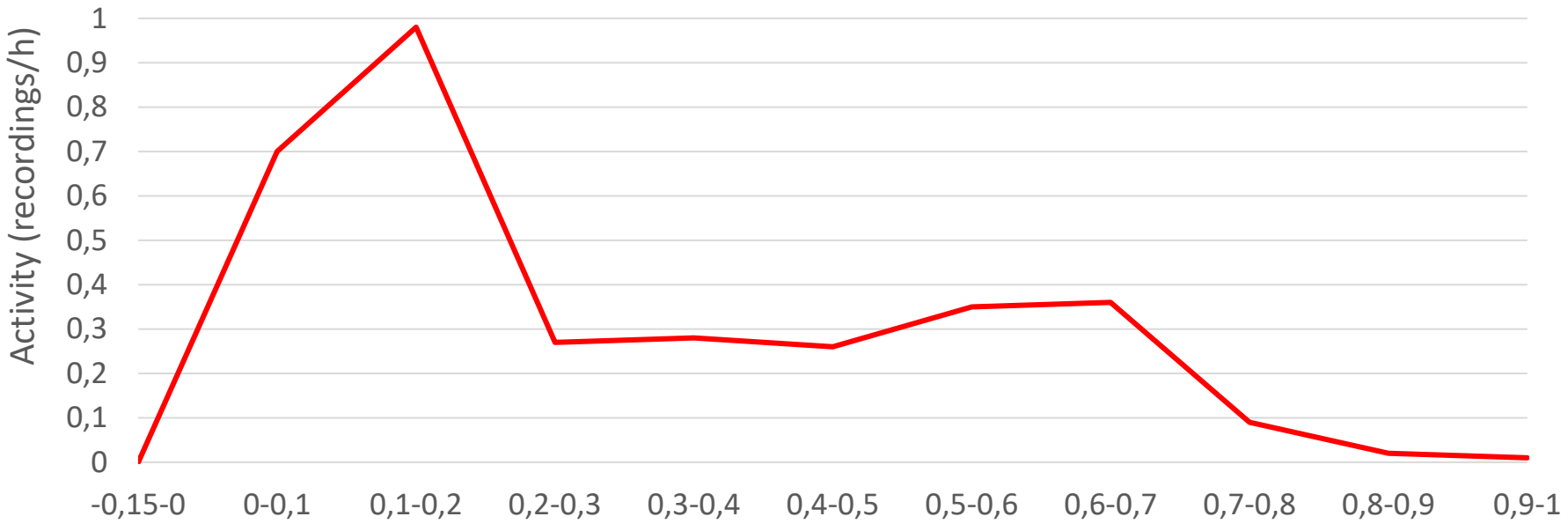
- Phenology
- Geography
- Characteristics of wind turbines
- Weather data
- Activity

ProBat

RENEBAT and ProBat



RENEBAT and ProBat



Night tenths

Nachtzehntel

Dixième nuit

RENEBAT and ProBat

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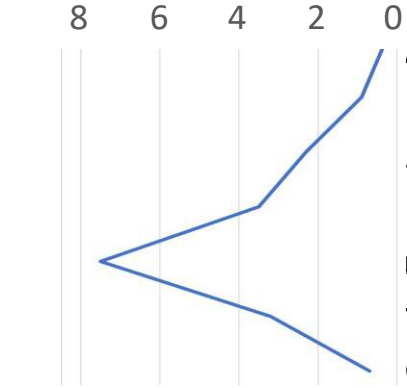
Night tenths

Nachtzehntel

Dixième nuit



	-0,15-0	0-0,1	0,1-0,2	0,2-0,3	0,3-0,4	0,4-0,5	0,5-0,6	0,6-0,7	0,7-0,8	0,8-0,9	0,9-1
April		1,9	3	2,5	2,4	2,5	1,6	1,7	1,3	1,3	0,7
May		3,6	4,1	3,8	3,8	3,8	3,5	3,6	2,8	2,6	1,1
June		4,1	4,6	4,2	4,2	4,1	3,8	3,9	3,4	3,1	1,2
July		4,3	4,8	4,4	4,2	4,2	3,9	4	3,7	3,7	1,4
ıgust		4,4	5	4,7	4,6	4,4	4	4	3,7	3,6	1,4
nber	1,5	4,2	4,8	4,5	4,5	4,4	4,1	4,1	3,7	3,7	1,5
ober	0,9	3,2	3,8	3,4	3,2	3	2,3	2,5	1,6	1,6	0,9

RENEBAT and ProBat as a solution?

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Energy conflict

Lack of standardization of methods

Standardization

- Recording devices
- Recording parameters
- Microphone calibration
- Duration of monitoring

Verification

- Data control
- Verifiable through authorities
- Follow-up carcass searches

Adaptable

- Choice of wind turbine
- Number of monitoring years
- Integration of new parameters

Equal treatment

- Mortality regulation
- Thresholds by authorities
- comparability

Applicability

- Similar biomes
- Or in depth case by case examinination

Thank you for your attention!

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https://www.probat.org

An application of ProBat outside Germany

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- Central Europe
  - Measured activity patterns must be compared with ProBat assumptions
  - Has already been successfully used in France, Austria, Netherlands…
- Southern and Northern Europe
  - In depth case by case examination
  - Eventually adaptation might be necessary
- Data sets from other species (e.g. the bulldog bat *Tadarida teniotis* show similar behavior to that from other species
- The data sets and algorithms are available and possibly need some supplements

RENEBAT and ProBat

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Cut-In Windgeschwindigkeiten (m/s)
WEA 1 - 2015

Geschätzte jährl. Schlagopferzahl ohne Abschaltung = 11.0
Pauschale Cut-In-Windgeschwindigkeit = 6.1 m/s

	Monat							
Nachtzehntel	4	5	6	7	8	9	10	11
-0.15-0	3.2	4.1	4.5	5.0	5.0	4.8	4.0	1.5
0-0.1	4.8	5.7	6.2	6.4	6.5	6.3	5.6	4.0
0.1-0.2	5.3	6.1	6.6	6.9	7.0	6.7	6.0	4.3
0.2-0.3	5.0	5.9	6.3	6.5	6.7	6.5	5.7	4.0
0.3-0.4	4.9	5.8	6.3	6.4	6.7	6.5	5.5	3.9
0.4-0.5	5.0	5.9	6.2	6.3	6.5	6.5	5.4	3.8
0.5-0.6	4.7	5.5	5.9	6.1	6.2	6.2	5.1	3.4
0.6-0.7	4.7	5.6	5.9	6.2	6.2	6.2	5.1	3.5
0.7-0.8	4.2	5.1	5.5	5.8	5.8	5.7	4.7	3.0
0.8-0.9	4.1	5.0	5.3	5.8	5.8	5.8	4.8	3.0
0.9-1	2.5	3.8	4.0	4.4	4.4	4.4	3.6	1.2