

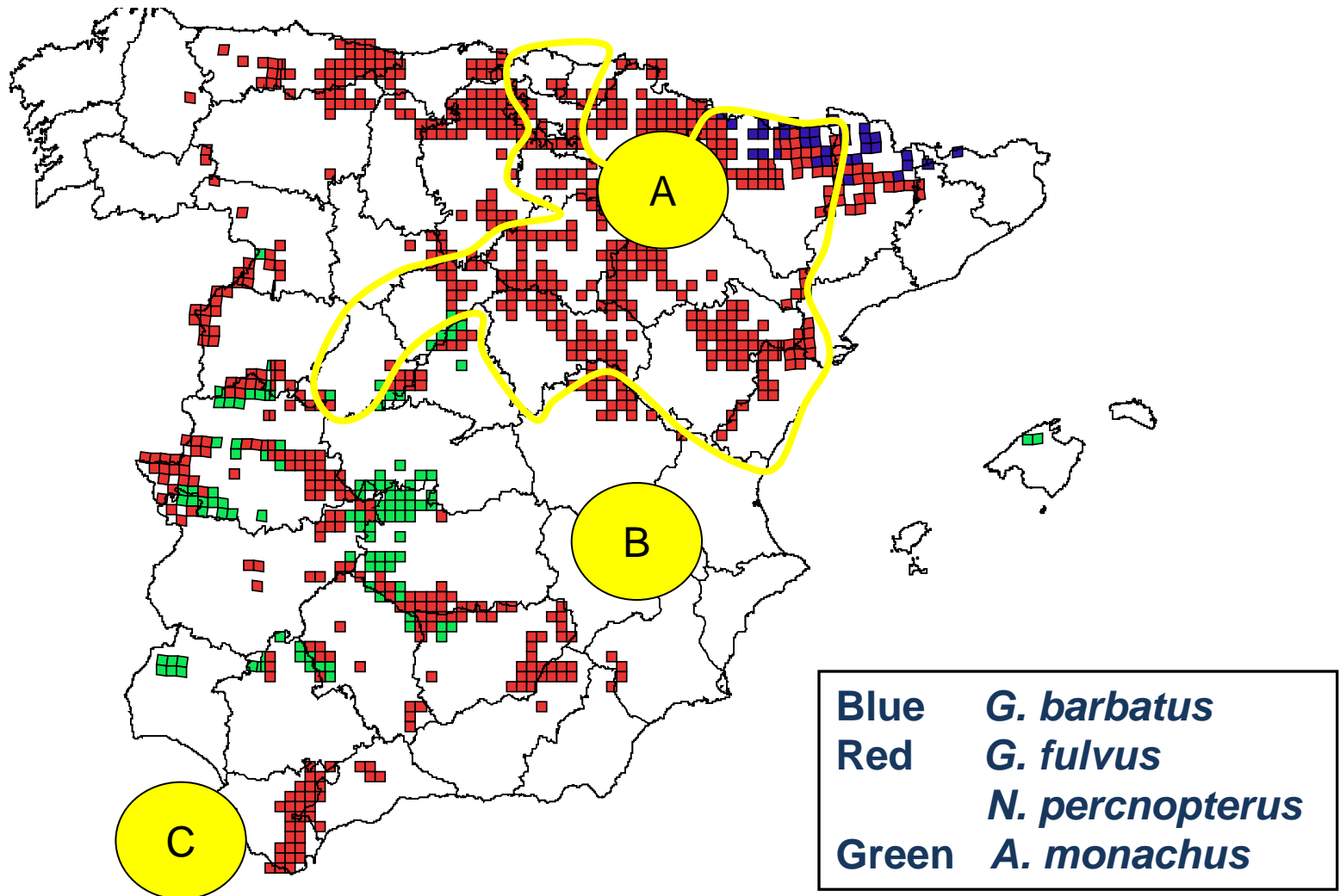
# Vultures, Bats and Wind farms

# WIND ENERGY : COLLISIONS

- Eurasian Griffon vulture
- Bearded vulture
- Cinereous (Black) vulture
- Egyptian vulture
- Rüppell's Griffon Vulture
- White-Backed Vulture



# WIND ENERGY : COLLISIONS



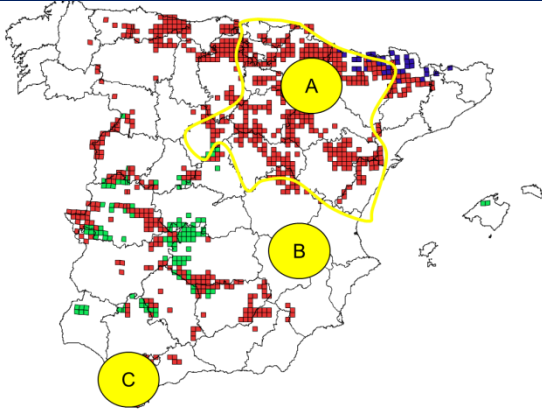


# FATALITIES

Area	A	B	C
Wind farms	206	78	73
Turbines	4217	1071	908
Turbines sampled	57.4%	49.3%	100%

Collisions	2000-2015	2003-2012	1993- 2016
<i>Gyps fulvus</i>	2585*	21	1860 (88%)
<i>Gyps rueppellii</i>	-	-	5
<i>Gyps africanus</i>	-	-	2
<i>Aegyptus monachus</i>	2+3	-	1
<i>N. Percnopterus</i>	5	-	9
<i>G. barbatus</i>	-	-	-

# FATALITY RATES



Area	A	B	C
Wind farms	125	64	63
Turbines	3305	1879	908
Turbines sampled	57.45%	49.39%	100%
<b>Fatality rates</b>	<b>0.18</b>	<b>0.002</b>	<b>0.15-0.36</b>

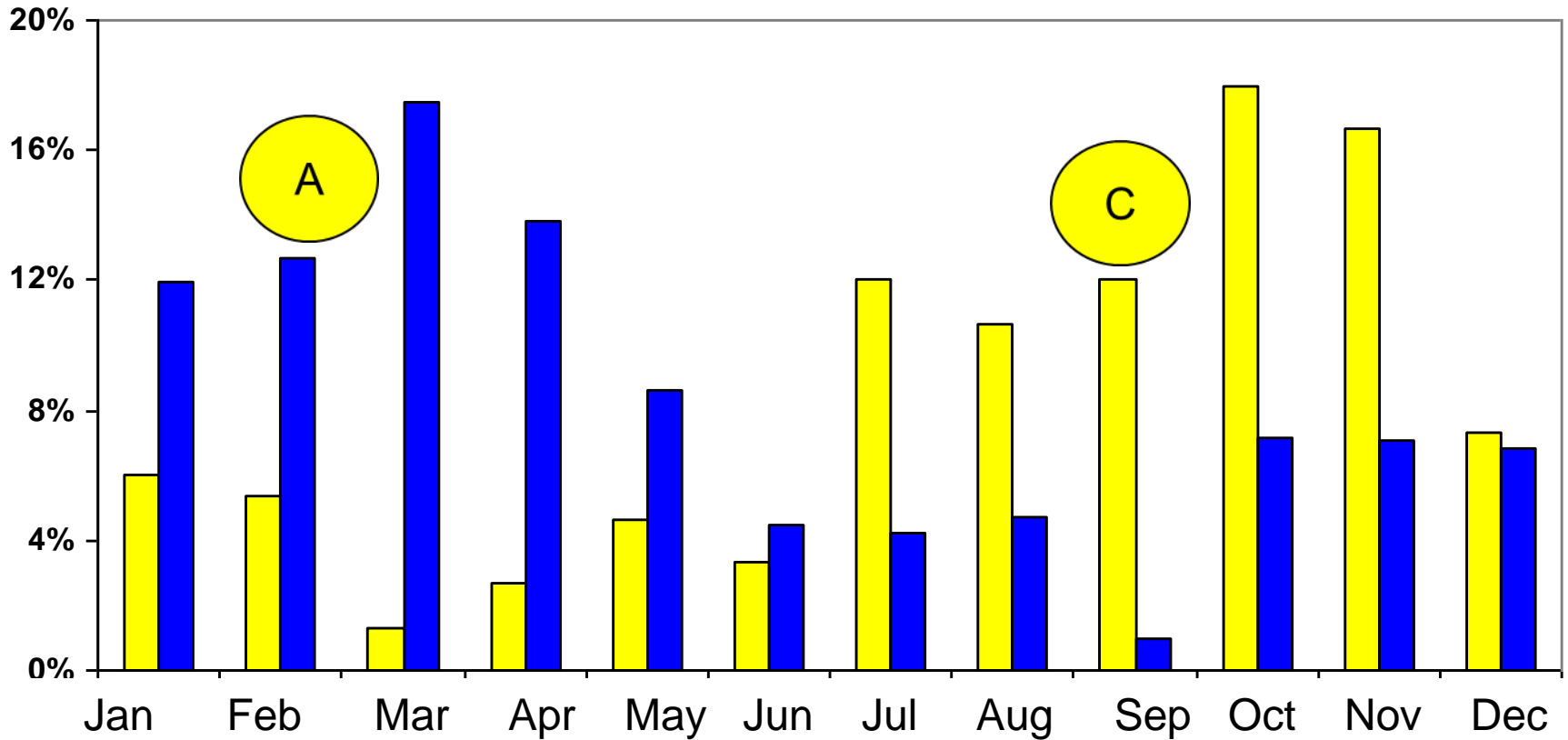
735-935 Vultures /year





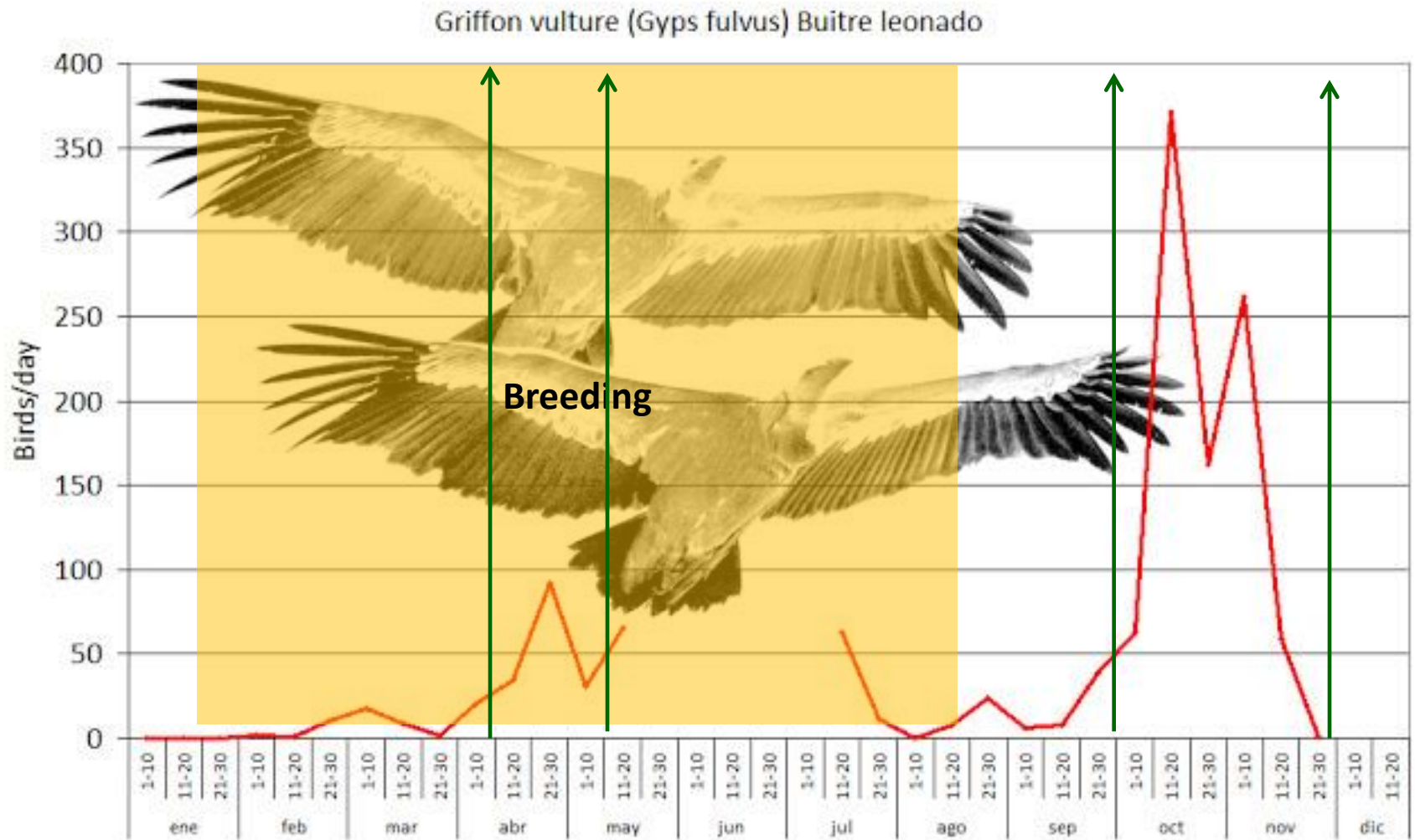
# SAME SPECIES BUT DIFFERENT SITES

Monthly % of fatalities over the year



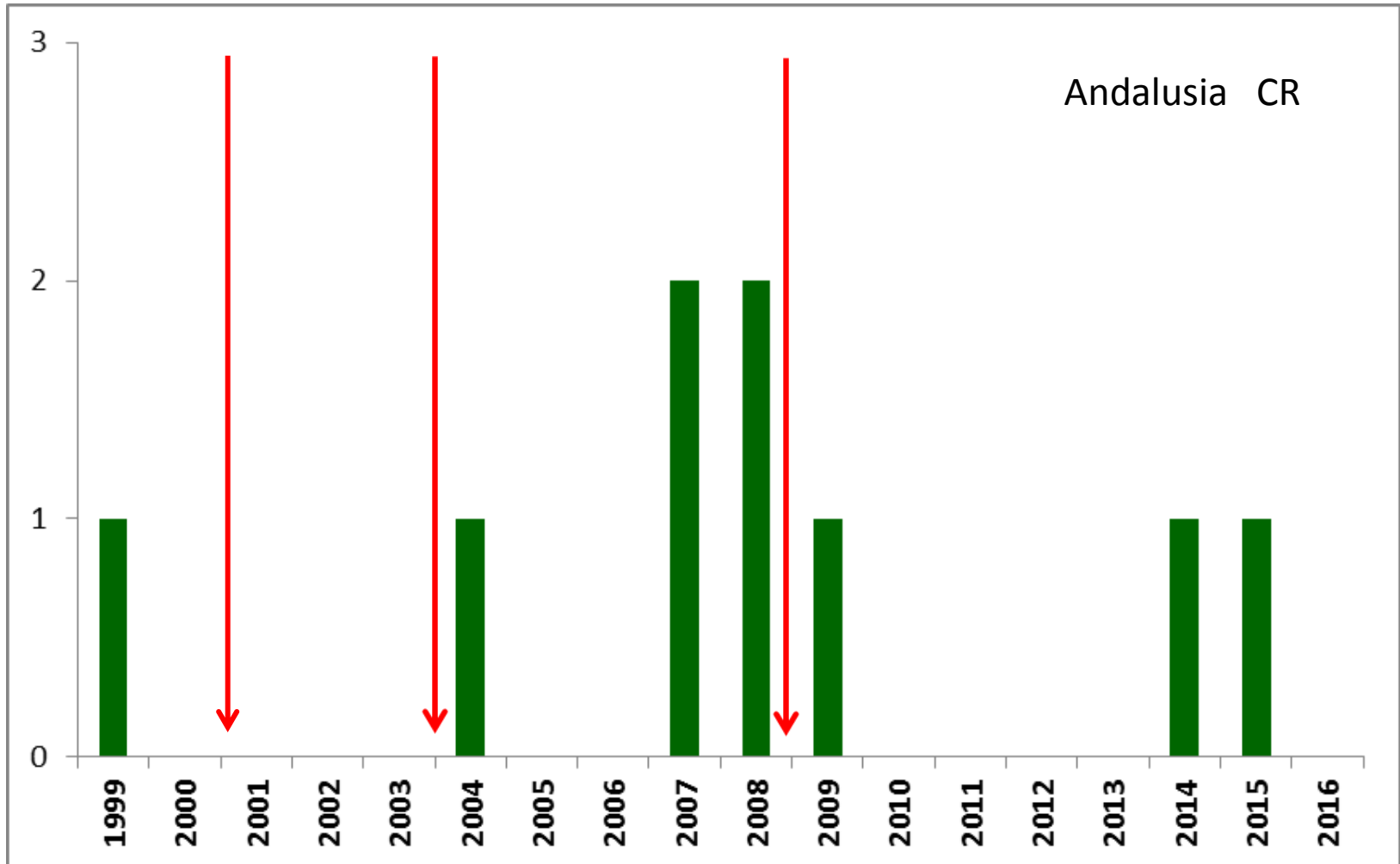


# Griffon Vulture

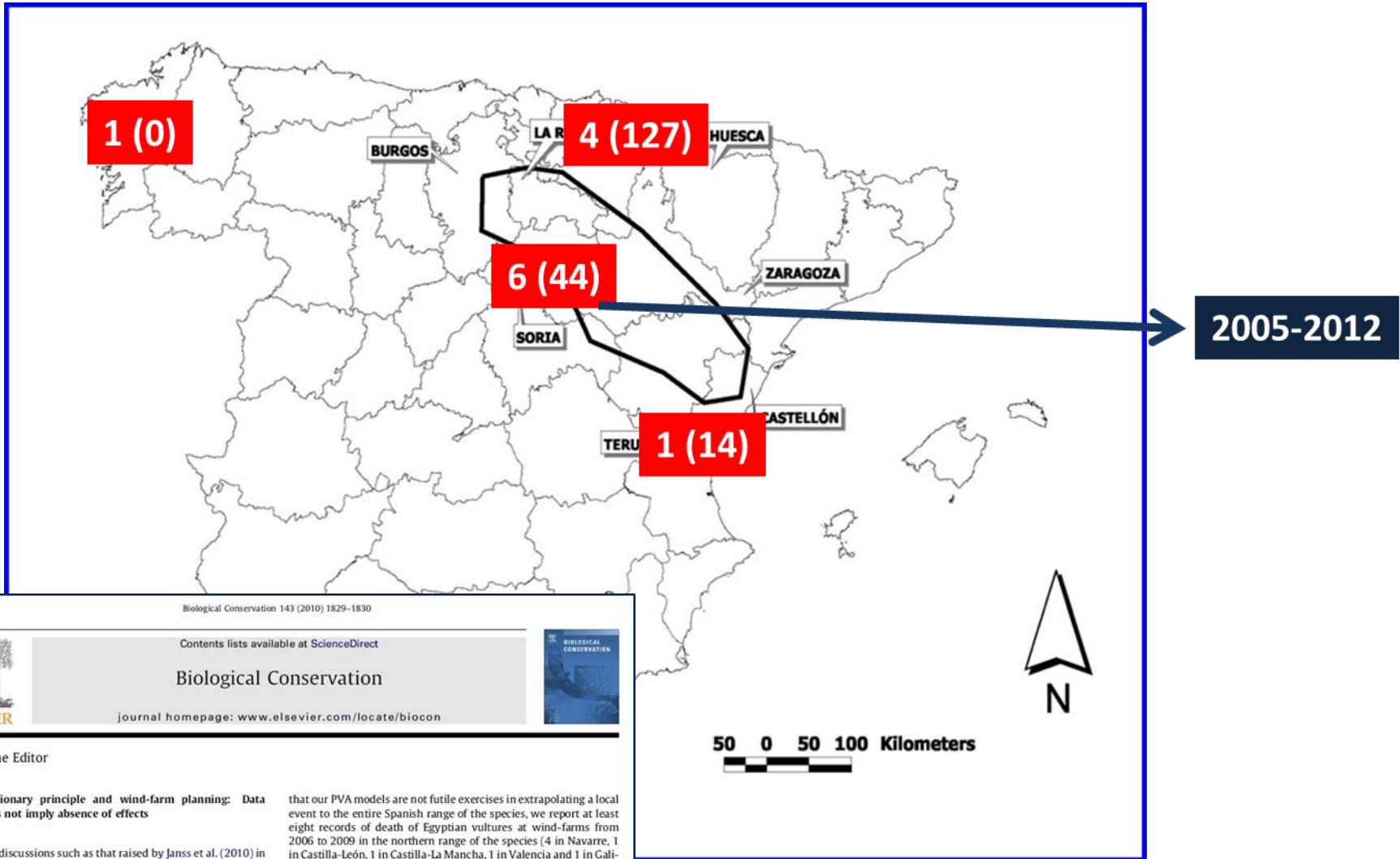




# THE NEED OF LONG TERM POST CONS MONITORING (Egyptian Vulture)



# THE NEED OF LONG TERM POST CONS MONITORING (Egyptian Vulture)



Biological Conservation 143 (2010) 1829–1830

Contents lists available at ScienceDirect

**Biological Conservation**

journal homepage: [www.elsevier.com/locate/biocon](http://www.elsevier.com/locate/biocon)

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Letter to the Editor

**The precautionary principle and wind-farm planning: Data scarcity does not imply absence of effects**

Scientific discussions such as that raised by Janss et al. (2010) in relation to our paper (Carrete et al., 2009) help to clarify issues in the field of wind energy planning, thus releasing non-technical issues that our PVA models are not futile exercises in extrapolating a local event to the entire Spanish range of the species, we report at least eight records of death of Egyptian vultures at wind-farms from 2006 to 2009 in the northern range of the species (4 in Navarre, 1 in Castilla-León, 1 in Castilla-La Mancha, 1 in Valencia and 1 in Galicia; Consellería Medio Ambiente, Generalitat Valenciana, authors of Carrete et al., 2009). The authors of Carrete et al. (2009) also mention that the PVA models are not futile exercises in extrapolating a local event to the entire Spanish range of the species, we report at least eight records of death of Egyptian vultures at wind-farms from 2006 to 2009 in the northern range of the species (4 in Navarre, 1 in Castilla-León, 1 in Castilla-La Mancha, 1 in Valencia and 1 in Galicia; Consellería Medio Ambiente, Generalitat Valenciana, authors of Carrete et al., 2009). The authors of Carrete et al. (2009) also mention that the PVA models are not futile exercises in extrapolating a local event to the entire Spanish range of the species, we report at least eight records of death of Egyptian vultures at wind-farms from 2006 to 2009 in the northern range of the species (4 in Navarre, 1 in Castilla-León, 1 in Castilla-La Mancha, 1 in Valencia and 1 in Galicia; Consellería Medio Ambiente, Generalitat Valenciana, authors of Carrete et al., 2009).

# OTHER SITES IN EUROPE WITH VULTURE FATALITIES

**FRANCE:** At least three (R. neuze, pers. Comm.)

**ITALY:** N/A

**GREECE:** 4 + 1 Crete (All Griffon Vultures); 1 Cinereous Vulture 0.07 Vultures /T/year  
(*Carcamo et al. 2011; Dotau et al. 2011*)

**JORDAN:** 0

**BULGARIA:** 1 Griffon V.

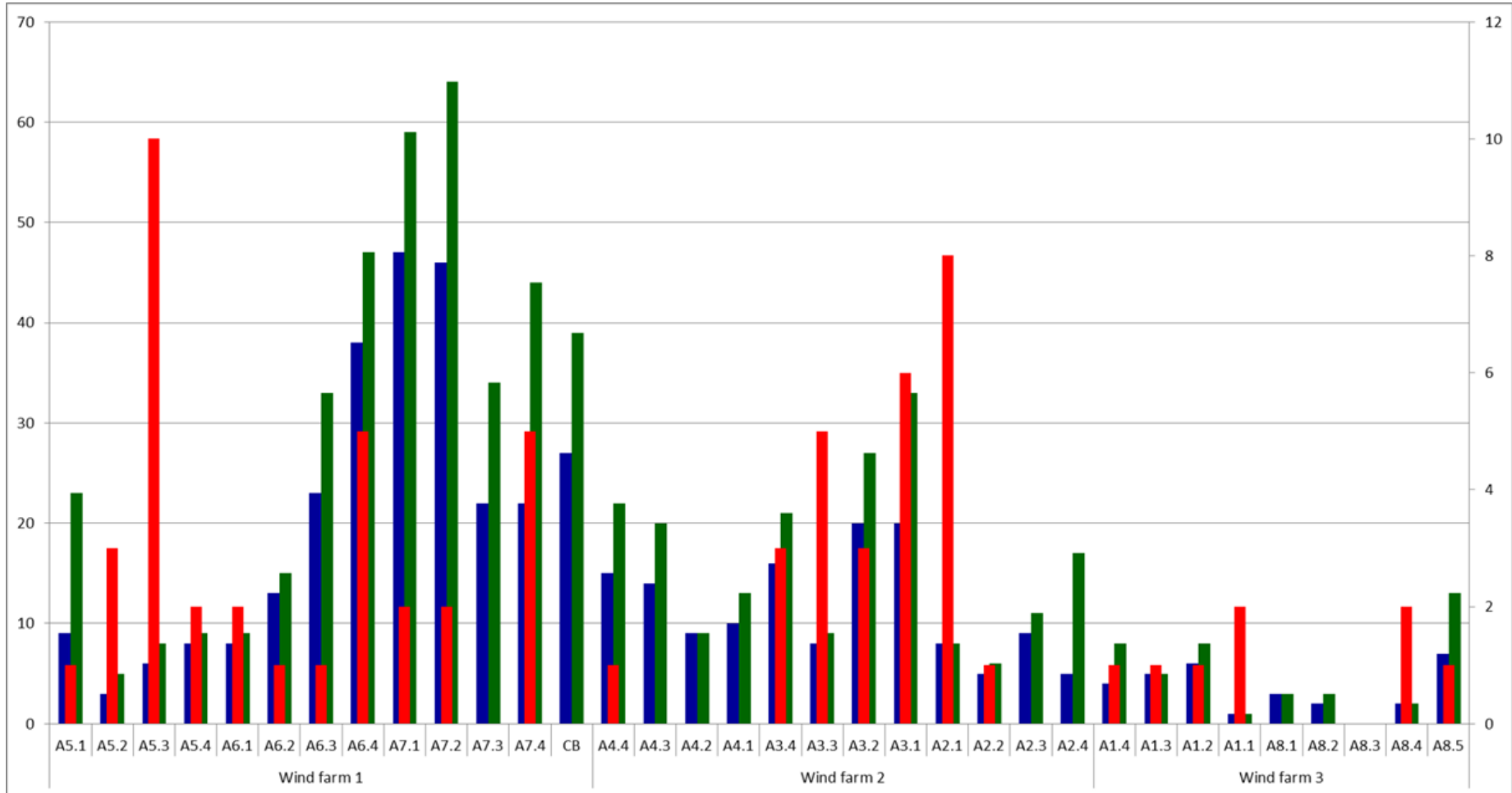
**PORTUGAL:** 3 Griffons (*Strix, 2012*)



# Species migrating vs colliding

SPECIES		Number	Collisions	2005-2012
<i>Ciconia ciconia</i>	White Stork	132,608	107	0.014 (15-41)
<i>Ciconia nigra</i>	Black Stork	3,597	3	0.0003* (0-1)
<i>Gyps fulvus</i>	Griffon V.	9,928	1,173	0.166 (63-240)
<i>Pernis apivorus</i>	Honey Buzzard	61,560	21	0.002 (0-12)
<i>Milvus migrans</i>	Black Kite	162,074	218	0.024 (31-71)
<i>Neophron perc.</i>	Egyptian V.	1,283	5	0.001 (0-2)
<i>Aquila pennata</i>	Booted Eagle	21,930	100	0.013 (5-27)
<i>Circaetus gallicus</i>	S-Toed Eagle	29,680	81	0.012 (3-20)
<i>Accipiter nisus</i>	Sparrowhawk	4,404	20	0.003 (1-6)
<i>C. aeruginosus</i>	Marsh Harrier	2,196	17	0.002 (0-6)
<i>Circus pygargus</i>	Montagu's H.	1,287	31	0.005 (2-11)
<i>P. haliaetus</i>	Osprey	845	8	0.001 (0-3)
<i>F. naumanni</i>	L. Kestrel	9,900	66	0.009 (4-18)
		<b>440,292</b>		

# Lack of relationship: birds at risk vs collisions



# Reasons of mortality

- **Biology of the species.**
- **Environmental variables.**
- **Wind farm characteristics.**





# Wind energy: Bats (post-cons)

## BATS AND ENVIRONMENTAL IMPACT ASSESSMENT

*Methodological guidelines for environmental impact assessment and strategic environmental impact assessment*



**A manual for environmental experts and consultancies, planning authorities and developers**



## BATS

**METHODOLOGY FOR ENVIRONMENTAL IMPACT ASSESSMENT AND APPROPRIATE ASSESSMENT**



## EUROBATS

Europe is faced with the need to tackle climate change and pollution, and to find sustainable means to meet demands for energy generation. Thus the promotion of alternative methods for the production of energy such as wind power has been intensified. The low emission production of wind energy brings benefits for the environment but on the other hand causes problems for wildlife, such as certain bat species. Therefore EUROBATS has developed guidelines for assessing potential impacts of wind turbines on bats and for planning, construction and operation of wind turbines in accordance with the ecological requirements of bat populations.

A first version of the guidelines was published in 2006, having the primary purpose to raise awareness amongst developers and planners of the need to consider bats and their roosts, migration routes and foraging areas. Guidelines should also be of interest to local and national consenting authorities who are required to draw up strategic sustainable energy plans. Furthermore, it was a base for national guidelines, that were subsequently published in several countries.

A large amount of research has been carried out into the impacts of wind turbines on bats and the increased knowledge urged for this revision of the document. The revised guidelines are applicable to larger wind farm developments in urban as well as in rural areas, on the land as well as offshore. Some case studies were included to illustrate implementation of mitigation measures in some countries. Member countries should adapt these guidelines to their situation and prepare or update their national guidelines accordingly.

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(printed version)

ISBN 978-92-95059-31-6  
(electronic version)

## EUROBATS

Publication Series  
No. **6**



**Guidelines for consideration of bats in wind farm projects**  
*Revision 2014*

L. Rodrigues • L. Bach • M.-J. Dubourg-Savage • B. Karapandža  
D. Kovač • T. Korryn • J. Dekker • A. Kepel • P. Bach • J. Collins  
C. Harbusch • K. Park • B. Micevski • J. Minderman

# Wind energy: Bats (post-cons)

- *At least three years of monitoring during the operational phase. According to the results, another 3 years may be necessary to gain a complete understanding.*
- *monitoring of activity at nacelle height will be more important*



# Wind energy: Bats (post-cons)

- *The recorded bat activity should be analyzed taking into account the season, the time of night and weather data such as wind speed and air temperature.*
- *species-specific detectability- Implication for bat detectors-skills of the monitoring teams.*

# Post cons monitoring of bats

Acta Chiropterologica, 14(1): xxx–xxx, 2012  
PL ISSN 1508-1109 © Museum and Institute of Zoology PAS  
doi: ???

Out 1,662 Collisions  
147 involved bats  
(8.84%)  
56 wind farms

## Bat fatalities at wind farms in northern Spain — lessons to be learned

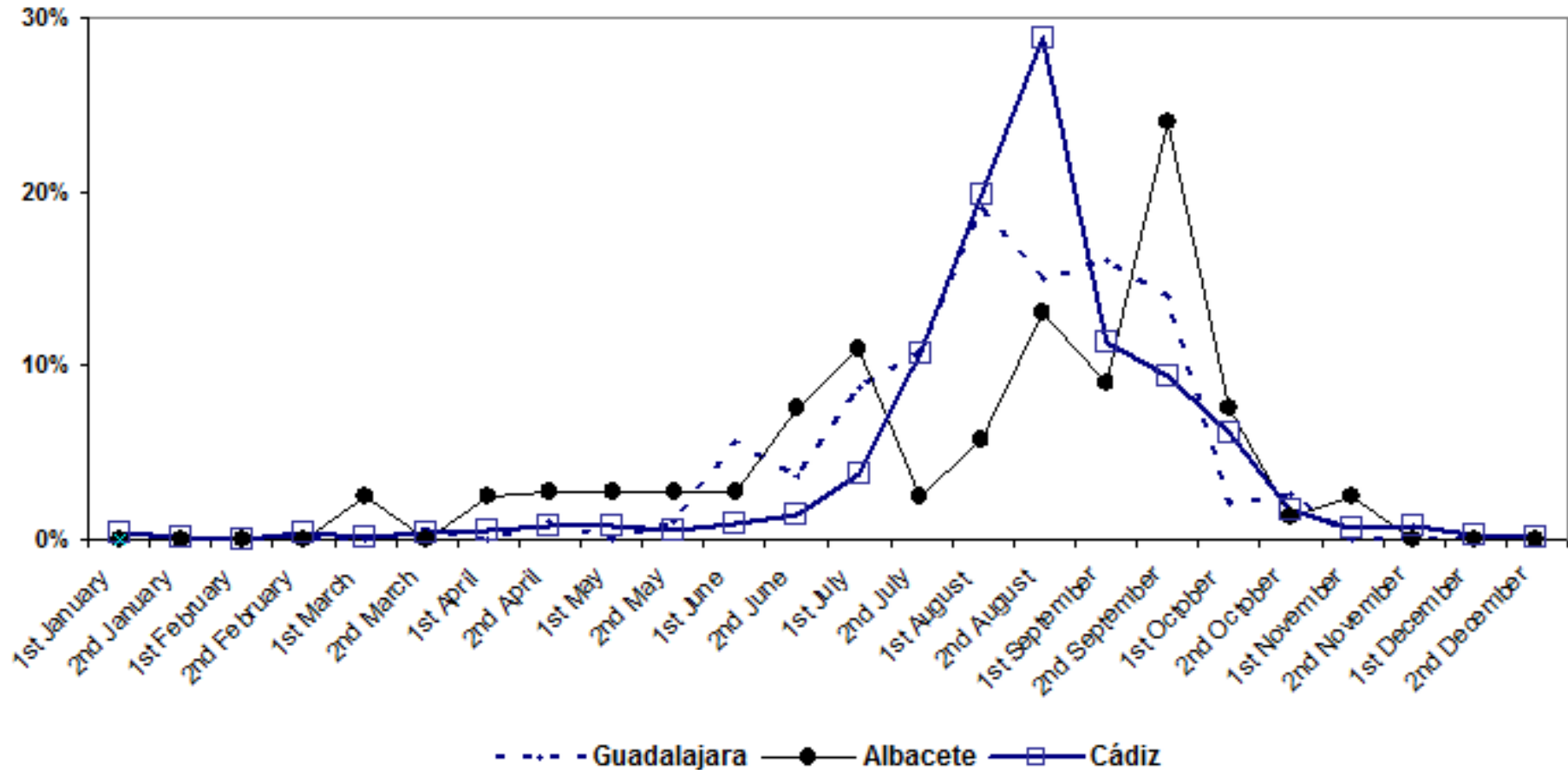
ÁLVARO CAMINA

*Apartado de Correos 339 28220 Majadahonda, Madrid, Spain  
Corresponding author: E-mail: acamina@acrenasl.eu*

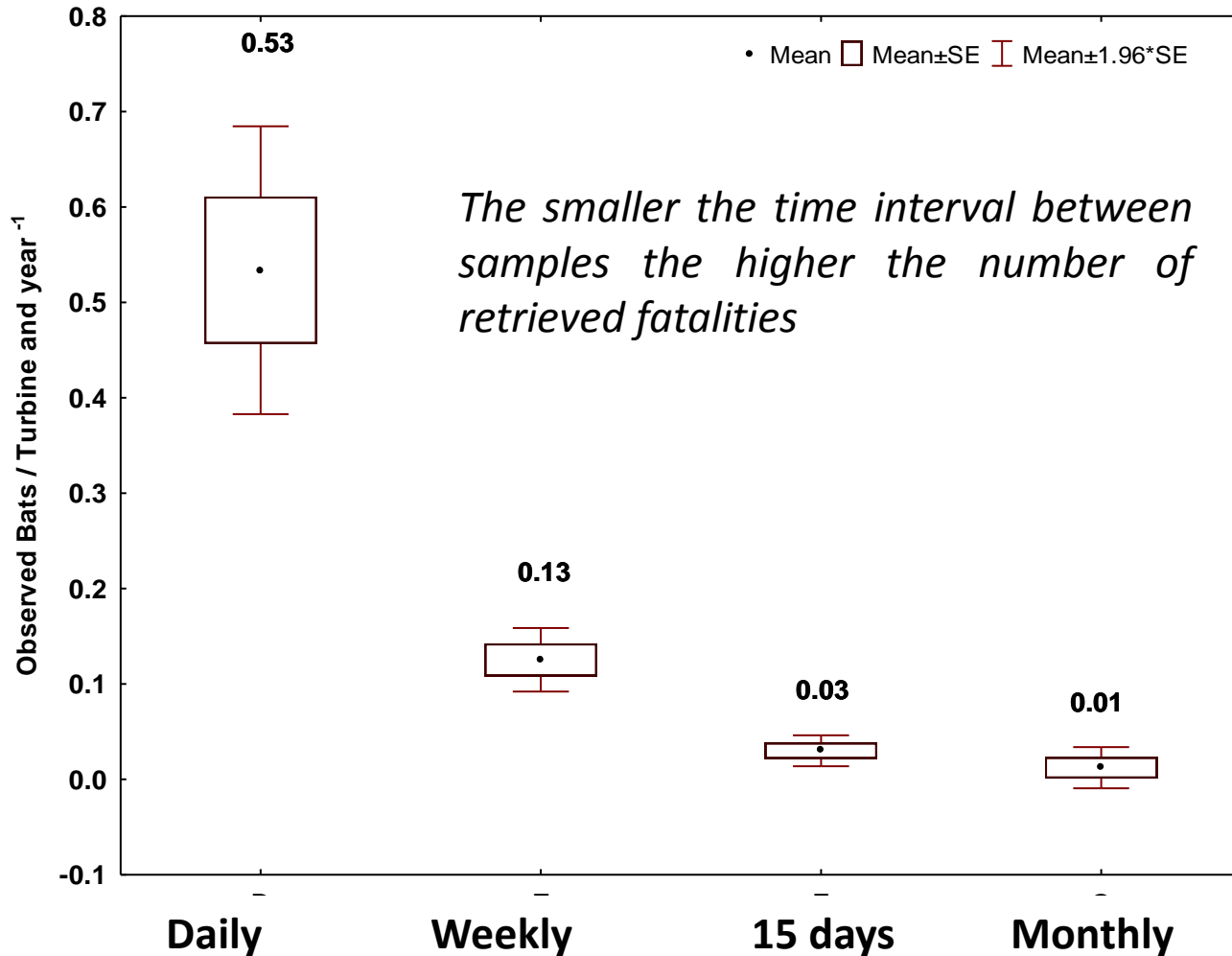
I analysed bat fatalities reported from 56 wind farms in the La Rioja, Soria and Aragón regions of northern Spain. Post-construction monitoring surveys revealed 147 fatalities belonging to seven species of bats, namely *Pipistrellus pipistrellus* (59%), *P. kuhlii* (14%), *Hypsugo savii* (18%), *Barbastella barbastellus*, *Nyctalus lasiopterus*, *N. leisleri* and *Tadarida teniotis* (< 5% each). In the mostly low elevations sites in Aragon, fatalities occurred between March and December and peaked (76%) from July to October. In the La Rioja and Soria provinces, where wind farms mostly are located at higher elevations, fatalities occurred between May and October and without any obvious late summer peak. The reports reviewed here revealed many deficiencies in their protocols that prevent comparisons with other studies nationally and internationally. For example, only five reports (9%) accounted for searcher efficiency or carcass removal biases. Consequently, fatality estimates appeared to be negatively associated with the number of turbines in the wind farm and also with the monitoring frequency, so that fewer bats seem to be killed when the monitoring intervals were longer. This should be of considerable concern for environmental authorities in Spain and elsewhere. Despite rapid development of wind power facilities in Spain, the impact surveys that are carried out at present are clearly inadequate with respect to bats.

*Key words:* bats, environmental impacts, mortality, monitoring, shortfalls, Spain, wind farms

# Distribution of fatalities

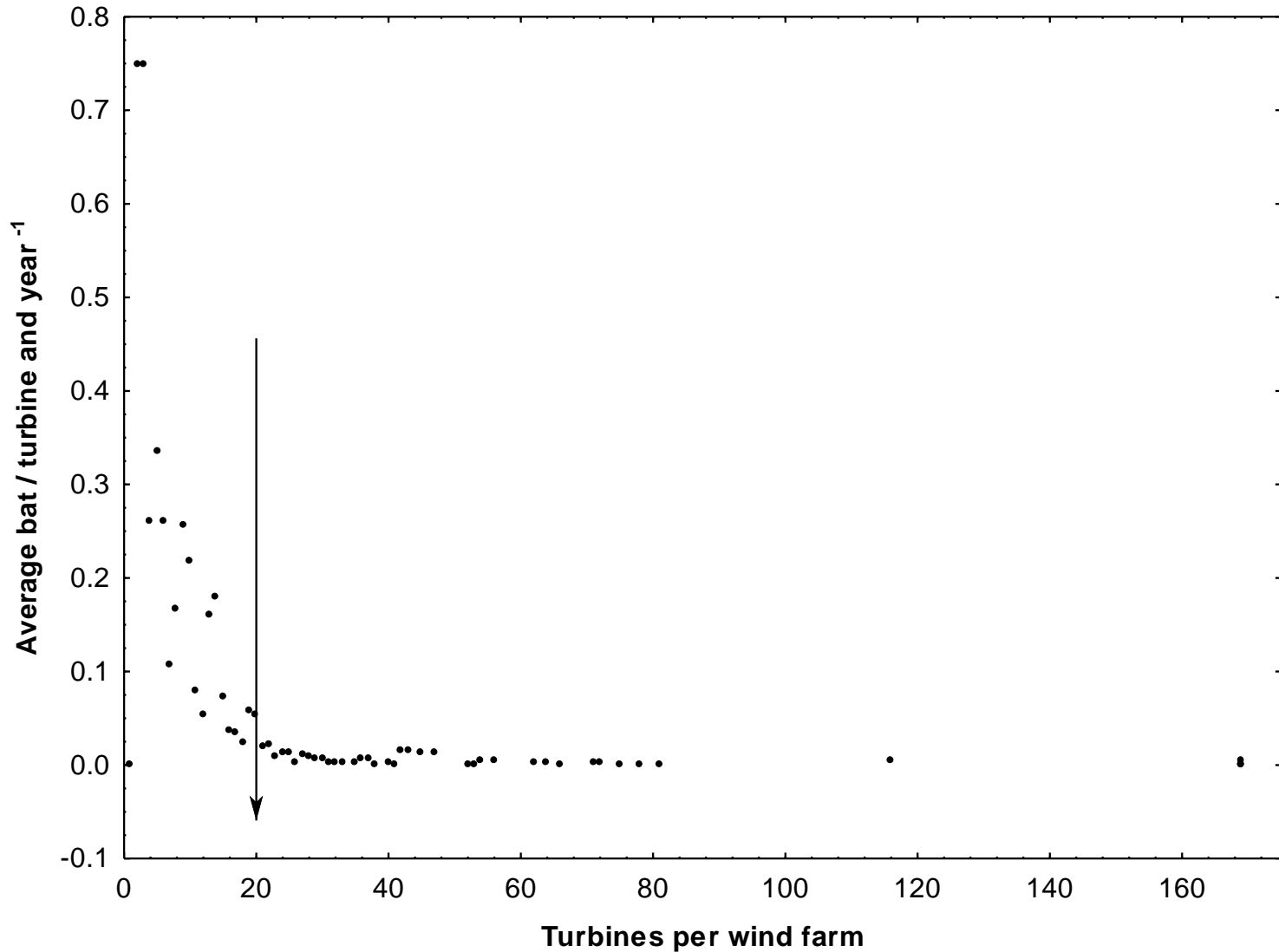


# Fatality rates vs monitoring frequency





# Fatality rates vs WF size



# 2015 review (in press)

## 3,987 Bat fatalities of 23 species

	Spain	Portugal	Croatia	France	Italy	Greece
<b>TOTAL</b>	<b>1,928</b>	<b>812</b>	<b>8</b>	<b>1028</b>	<b>10</b>	<b>194</b>
<i>Pipistrellus p.</i>			57.53%			LC
<i>Hypsugo savii</i>			11.05%			LC
<i>Nyctalus leisleri</i>			12.86%			LC
<i>Miniopterus sch.</i>			0.38%			NT
<i>Myotis bch.</i>			0.04%			NT
<i>Nyctalus lasiop.</i>			2.07%			NT
<i>Barbastella b.</i>			0.13%			NT

Source: EUROBATS (2013) & own data.

# Origin of the bats



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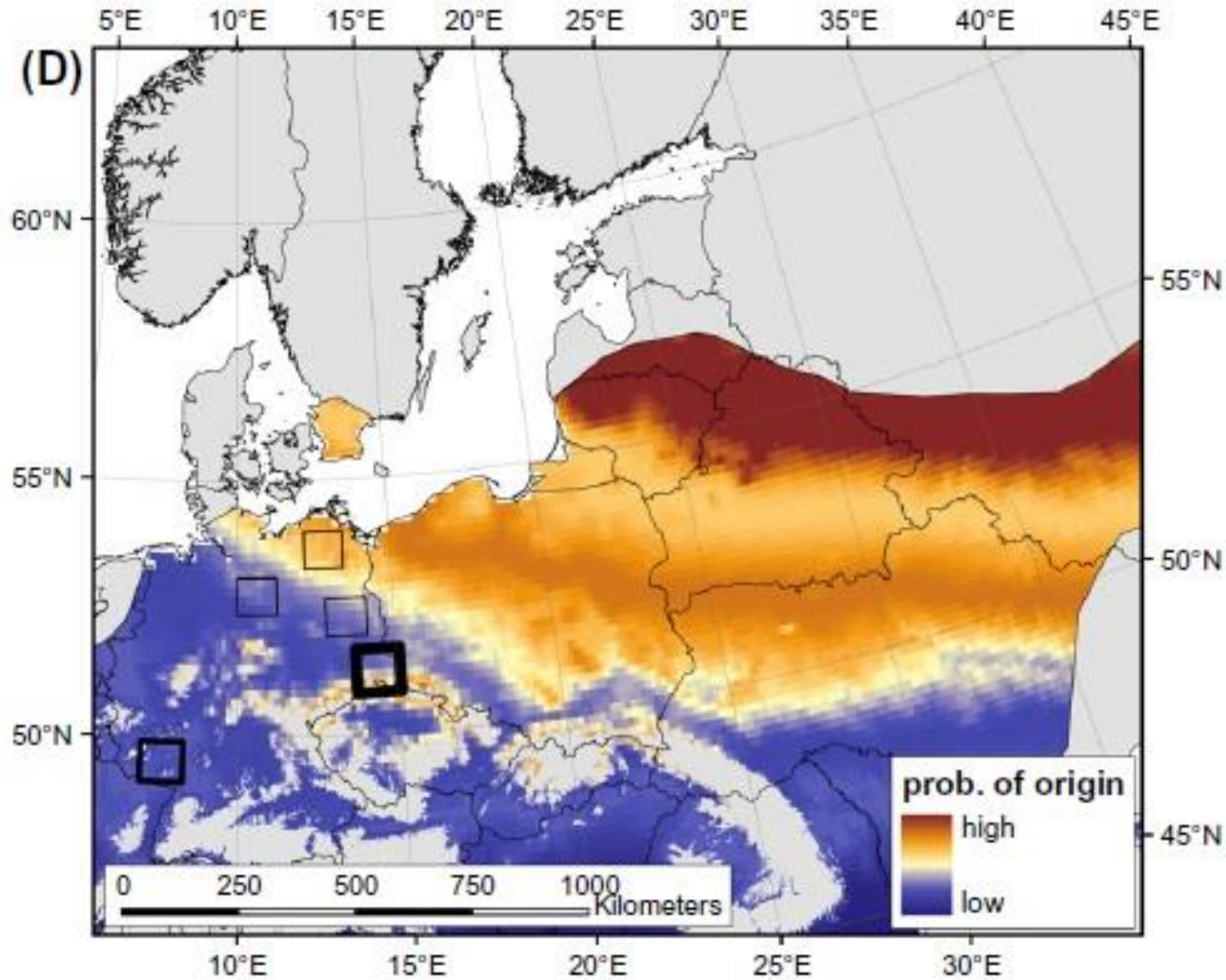
Biological Conservation

journal homepage: [www.elsevier.com/locate/biocon](http://www.elsevier.com/locate/biocon)

The catchment area of wind farms for European bats: A plea for international regulations

Christian C. Voigt<sup>a,\*</sup>, Ana G. Popa-Lisseanu<sup>a</sup>, Ivo Niermann<sup>b</sup>, Stephanie Kramer-Schadt<sup>a</sup>

# Origin of the bats





# Pre & post cons monitoring (other countries)

**South Africa**

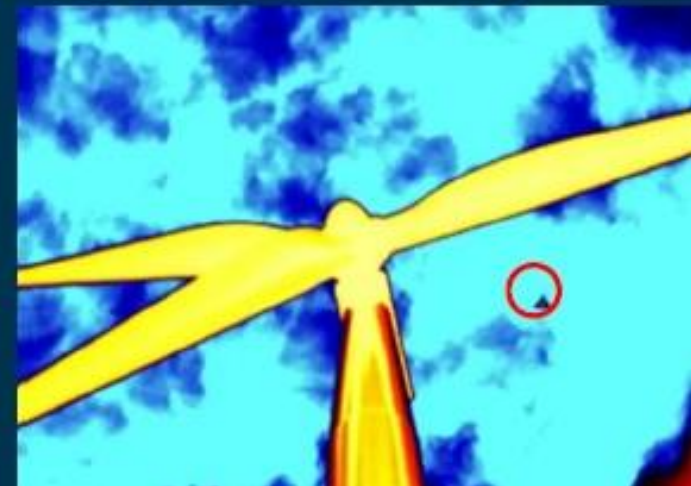
**Balkans (Serbia)**

**UK**

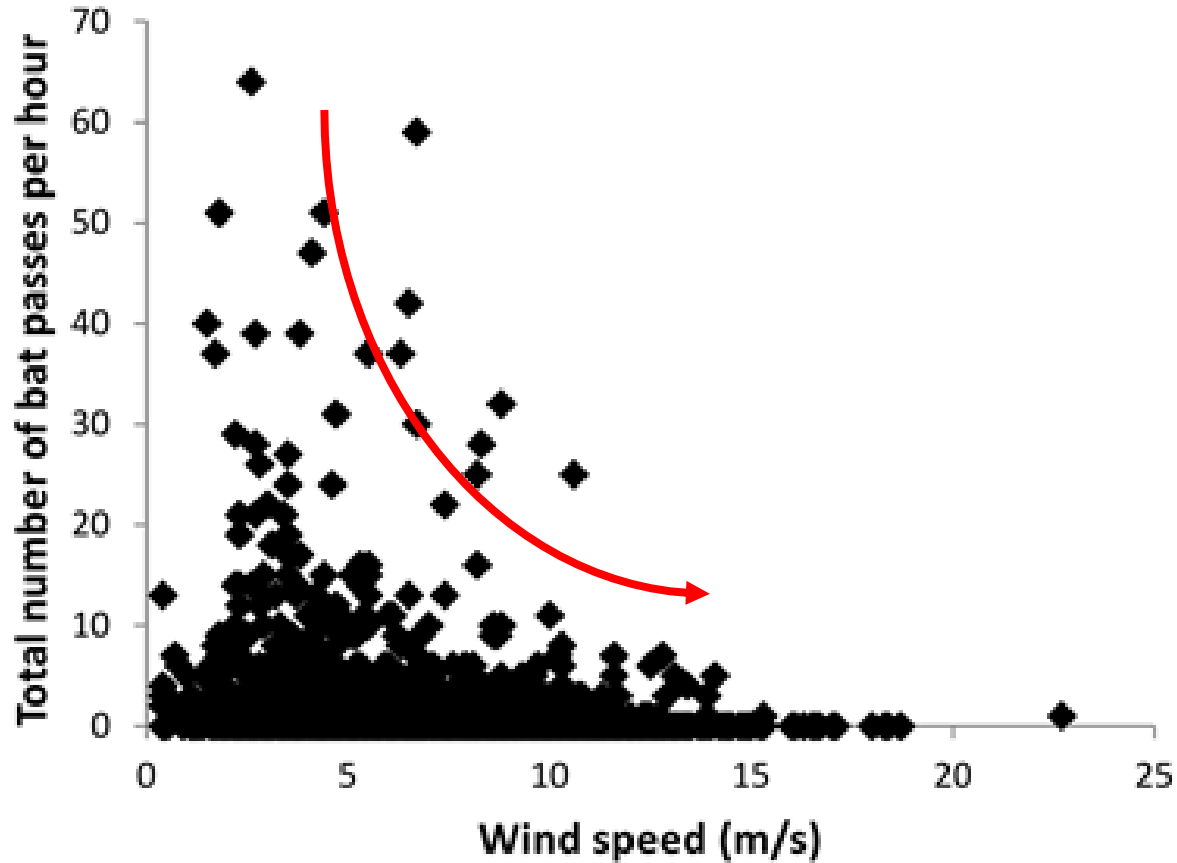


# Are Bats Attracted to Turbines?

- Bats rely on vision, air currents, & echolocation
- Bats may not be able to discriminate turbines from trees
  - Tall cylindrical “trunks” = towers
  - Visually conspicuous “crowns” = nacelle
  - Radially extending “branches” = blades
- Bats may expect important resources when arriving at these “trees”
  - Roosts, conspecifics, &/or prey



# Effect of wind speed



# Post-cons Monitoring & Mitigation

- **WIND FARMS**

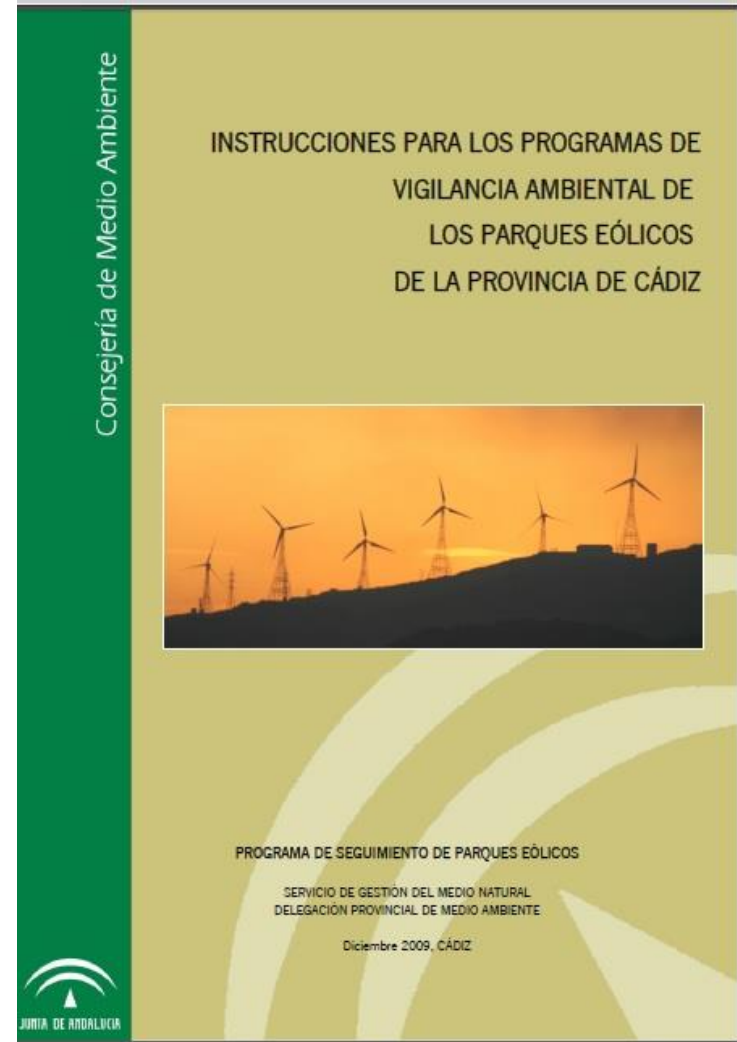
- a) From 8:00 am to

- b) 16:00-20:30 pm

- according to season

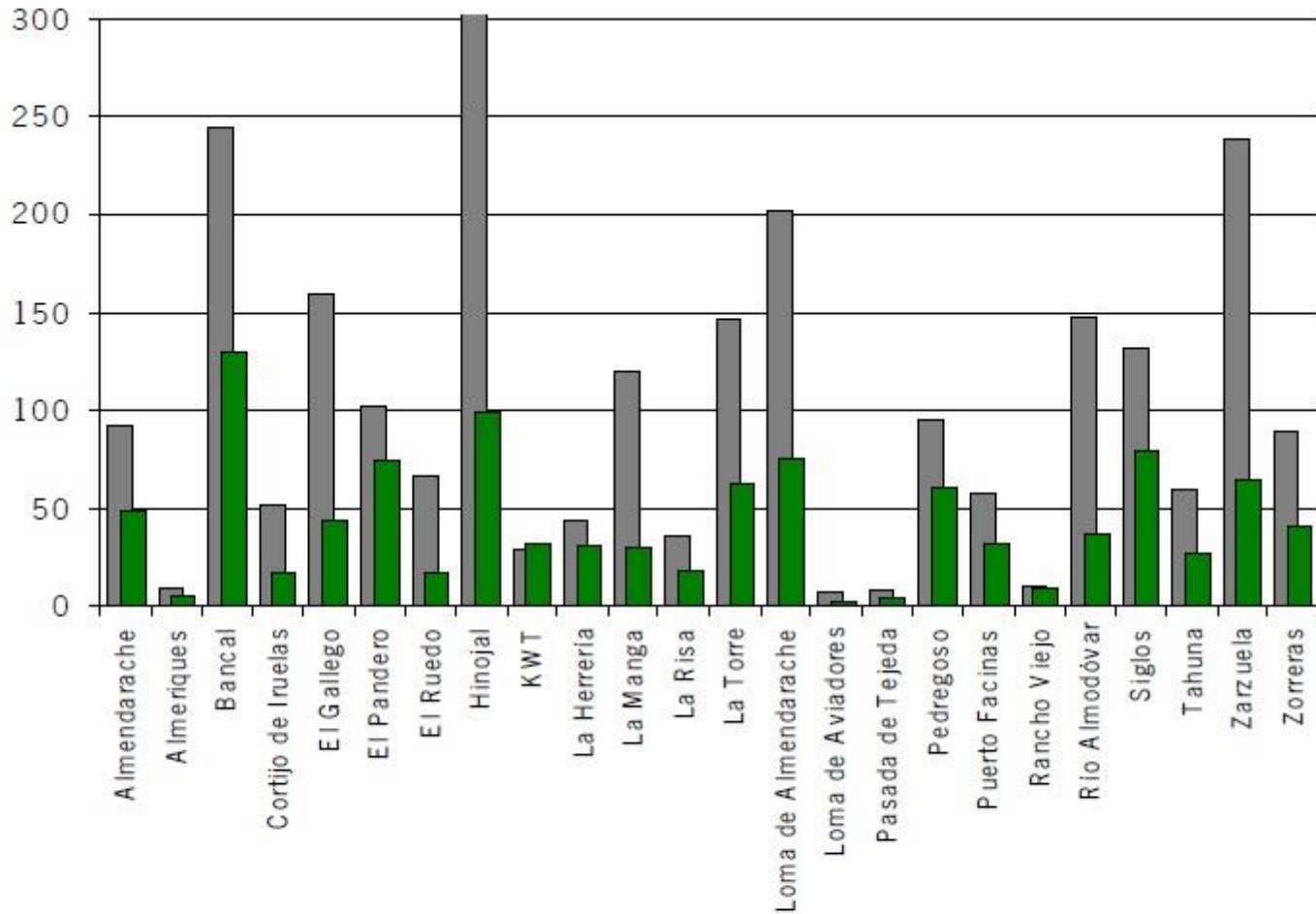
- (9-12 Daylight hours /day)

- b) Fatalities, birds use, control for collision risk situations.

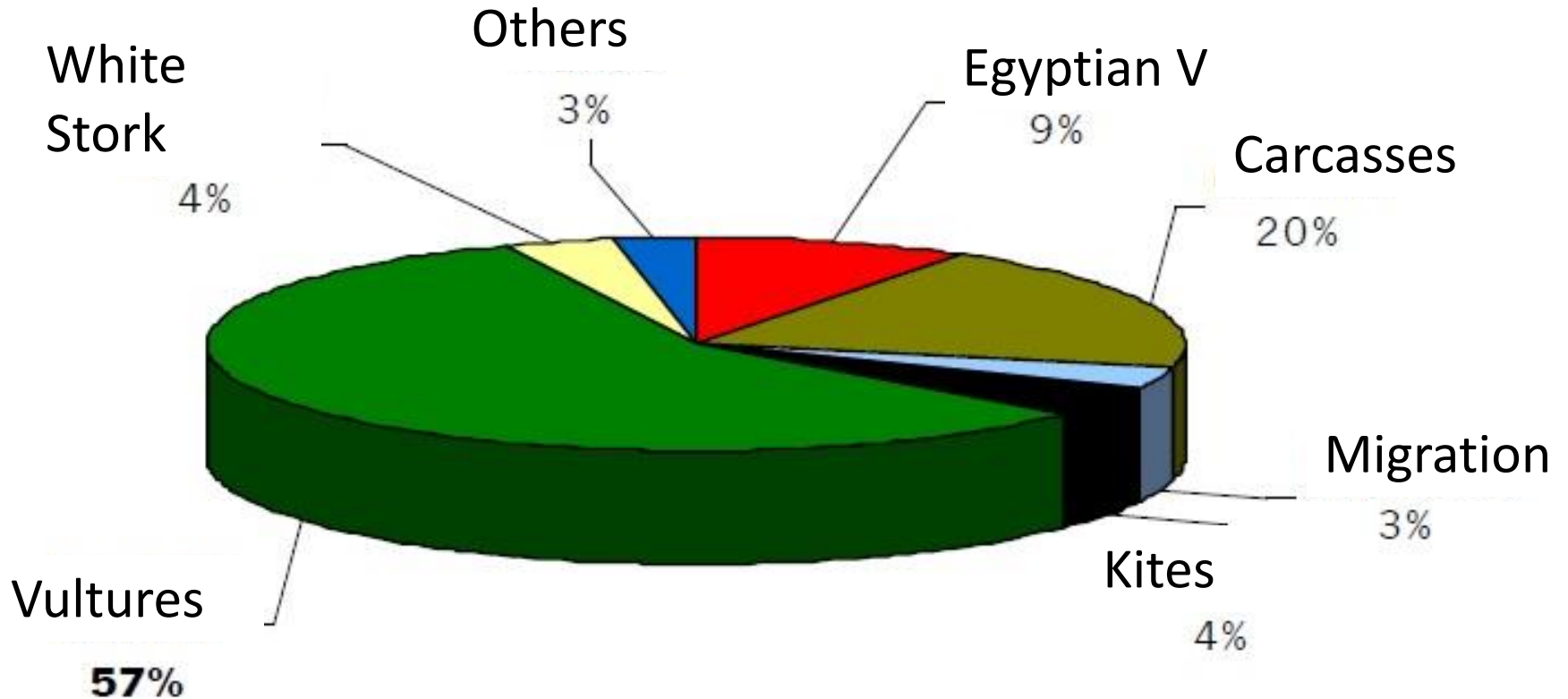




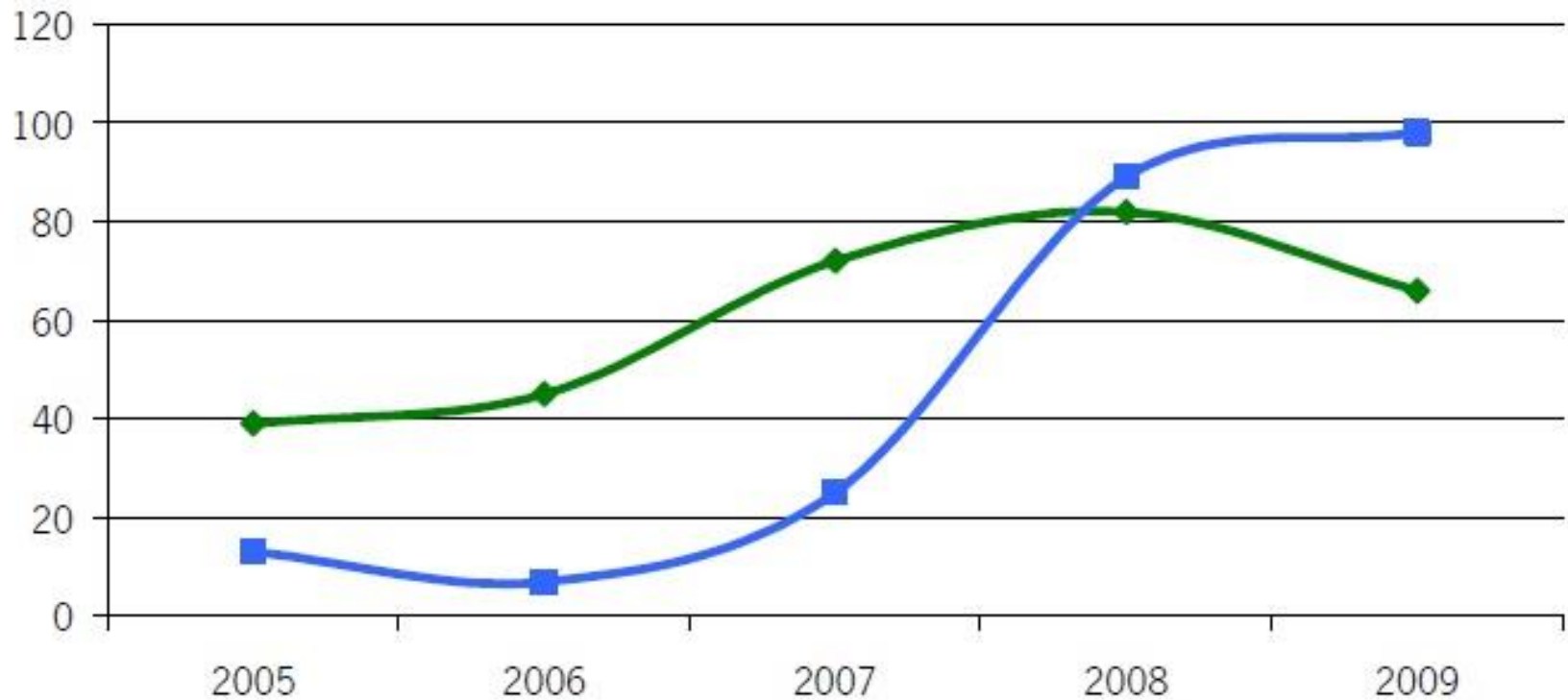
# Shut-down (observers)



# Shut-down (observers)



# Shut-down (observers)



Number of collisions (Gvulture)

# Radar?





# DT Bird

2 modules:  
Disuasion  
Stops



# WT Bird

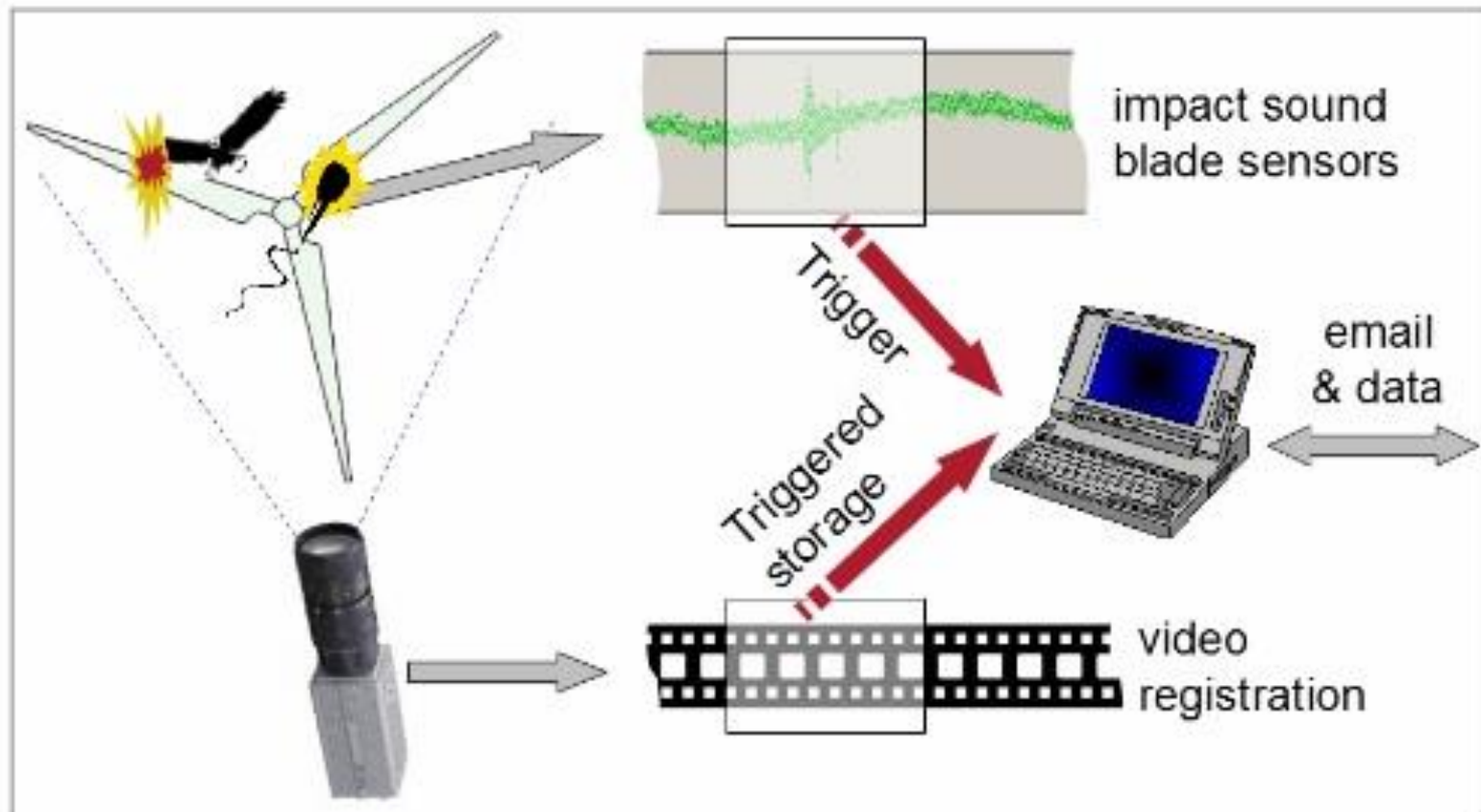


Figure 1: Principle of WT-Bird operation

# Bladeless wind turbines



**Thank you!!!**

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