

# Raptor mortality in wind farms of southern Spain: mitigation measures on a major migration bottleneck area

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Conference on Wind Energy  
and Wildlife impacts

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# Study area

## Strait of Gibraltar



Views of the Earth, Copyright © 2006 by Christoph Hormann <http://earth.imagico.de/>



# Migration across the study area

## Strait of Gibraltar



More than 4.500



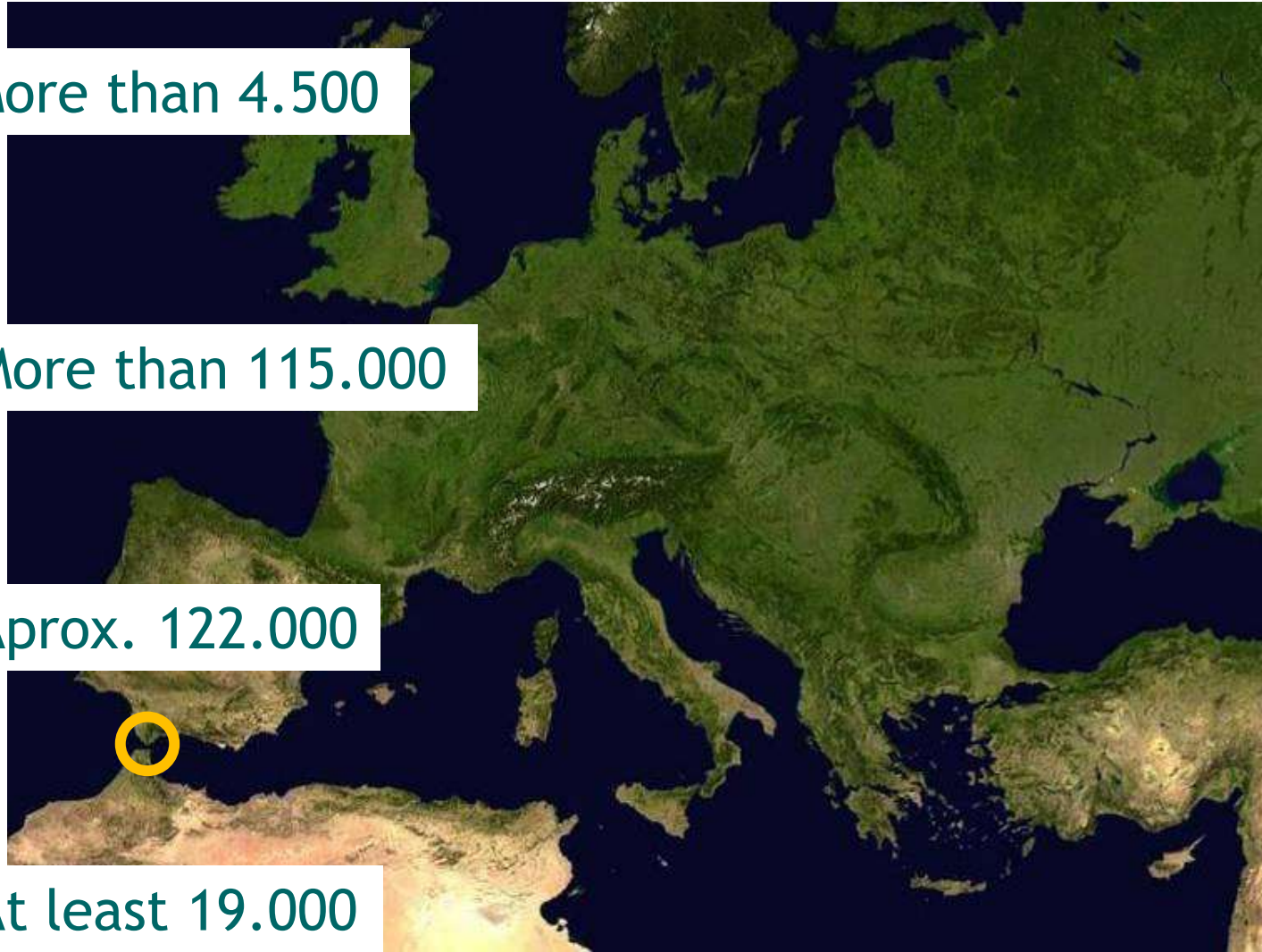
More than 115.000



Aprox. 122.000



At least 19.000





# Breeding species at the study area



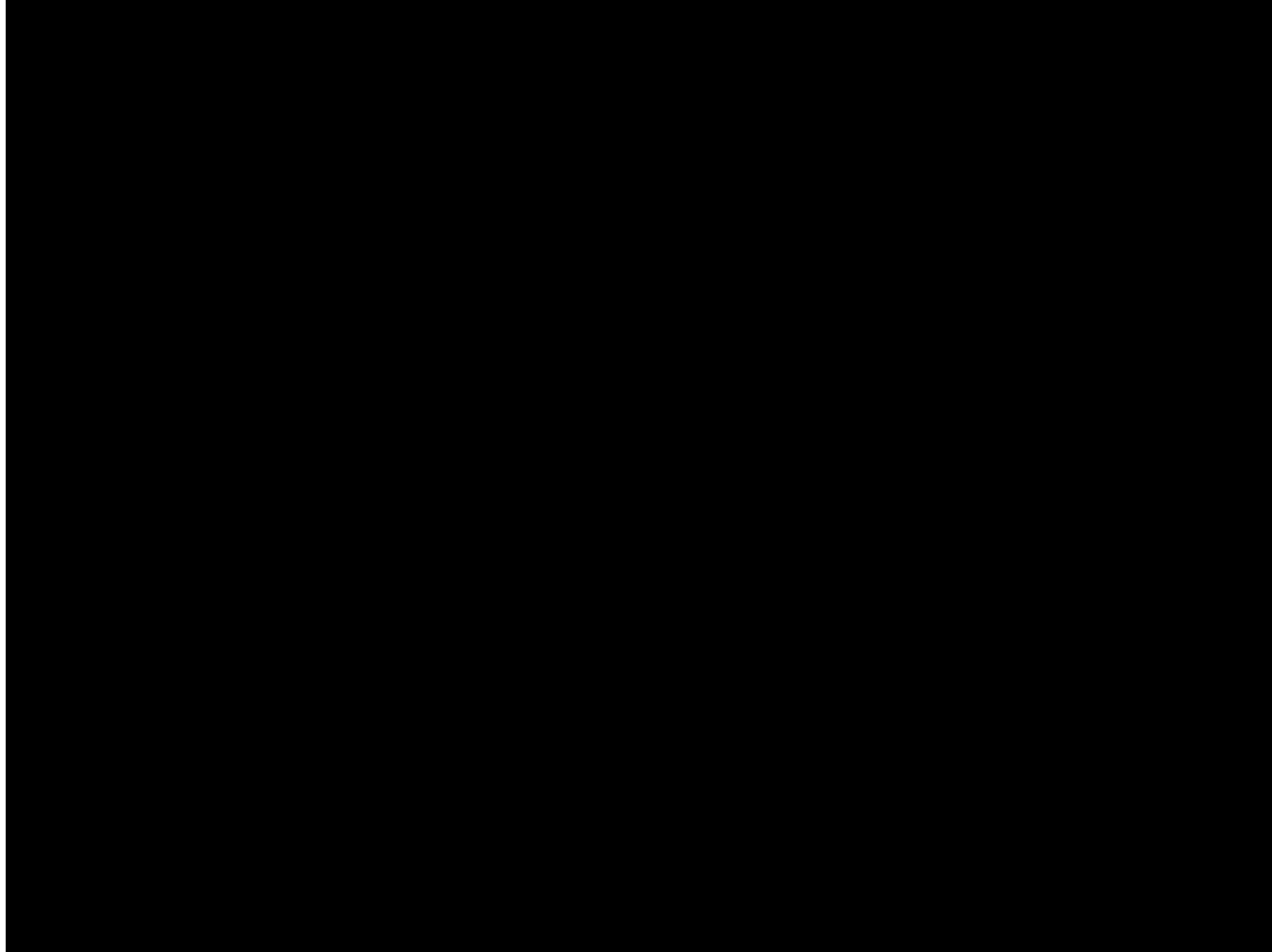
5 breeding pairs  
*Neophron percnopterus*  
(Endangered)

# Breeding species at the study area



12 breeding pairs  
*Circaetus gallicus*  
(Vulnerable)

# Breeding species at the study area



20-25 breeding pairs *Circus pygargus* (Vulnerable)

# Breeding species at the study area

211 breeding pairs  
*Gyps fulvus*





# Importance as a dispersal area

10-17 birds every winter





# Wind farms in Tarifa



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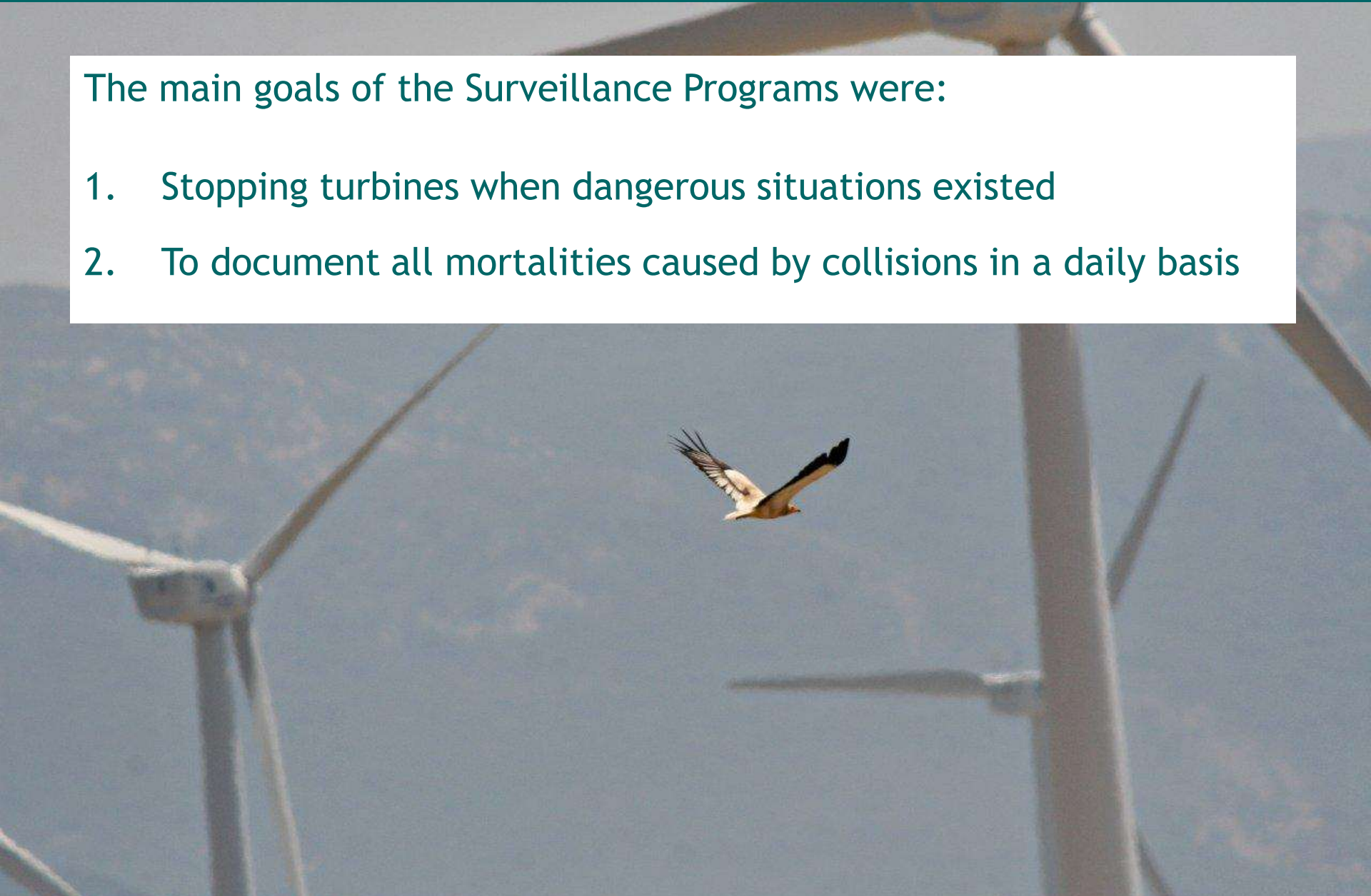




# Fundación MIGRES Surveillance Program

The main goals of the Surveillance Programs were:

1. Stopping turbines when dangerous situations existed
2. To document all mortalities caused by collisions in a daily basis



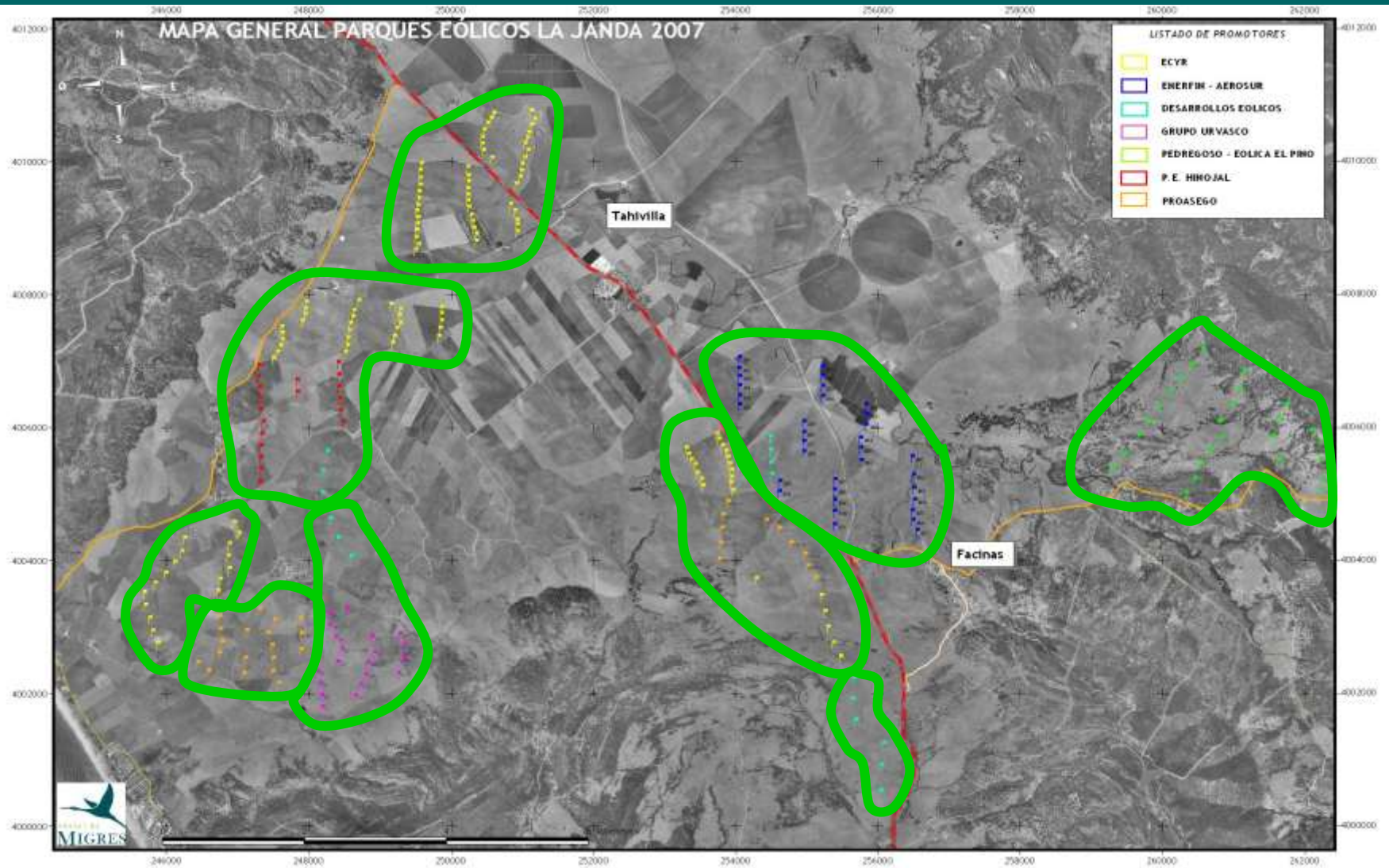
# Collisions



Tarifa, Southern Spain

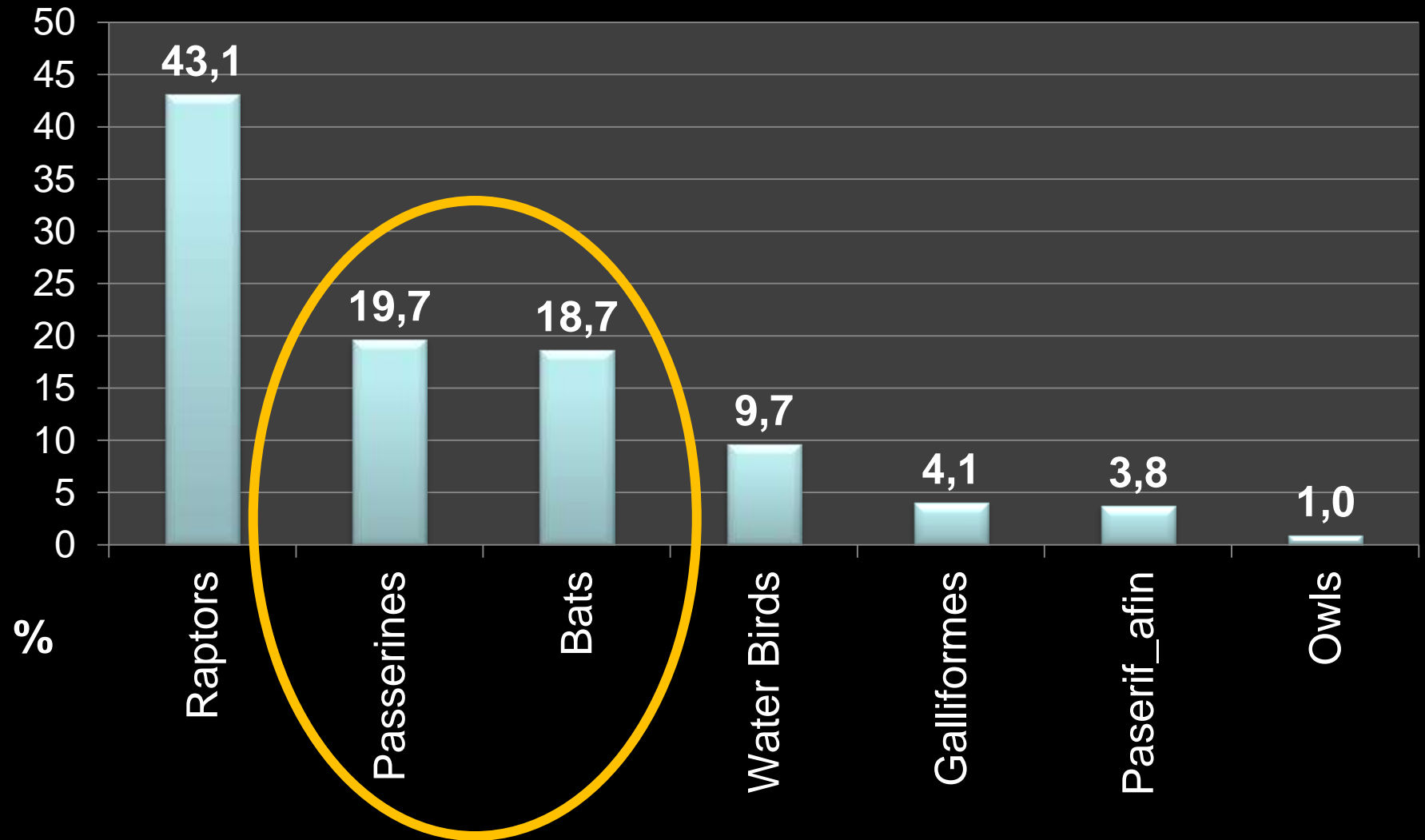


# Collisions



Tarifa, Southern Spain

# Collisions (from 1993-2010; n=2991)



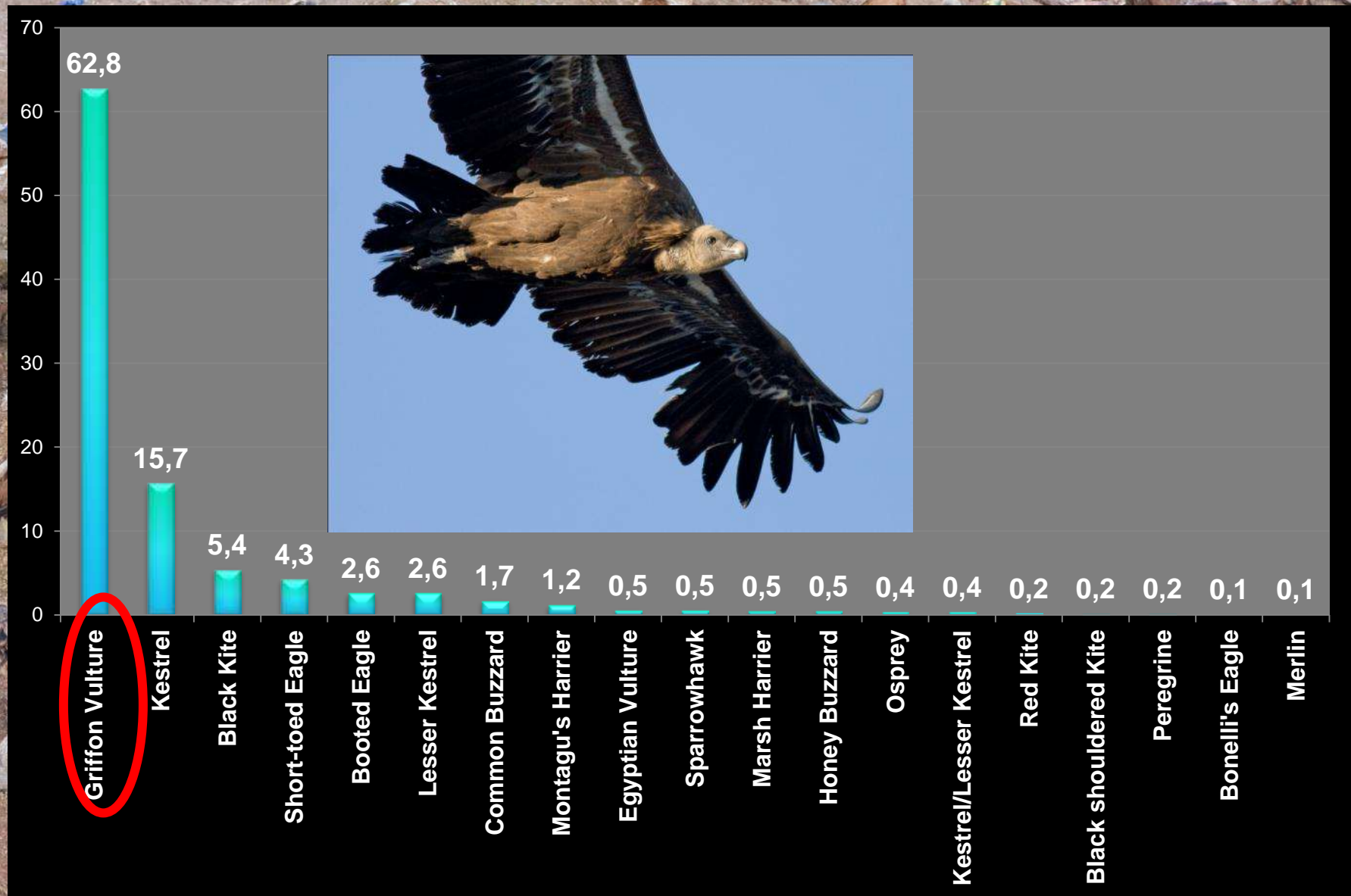


# Raptor collisions (n=1291, 18 species )

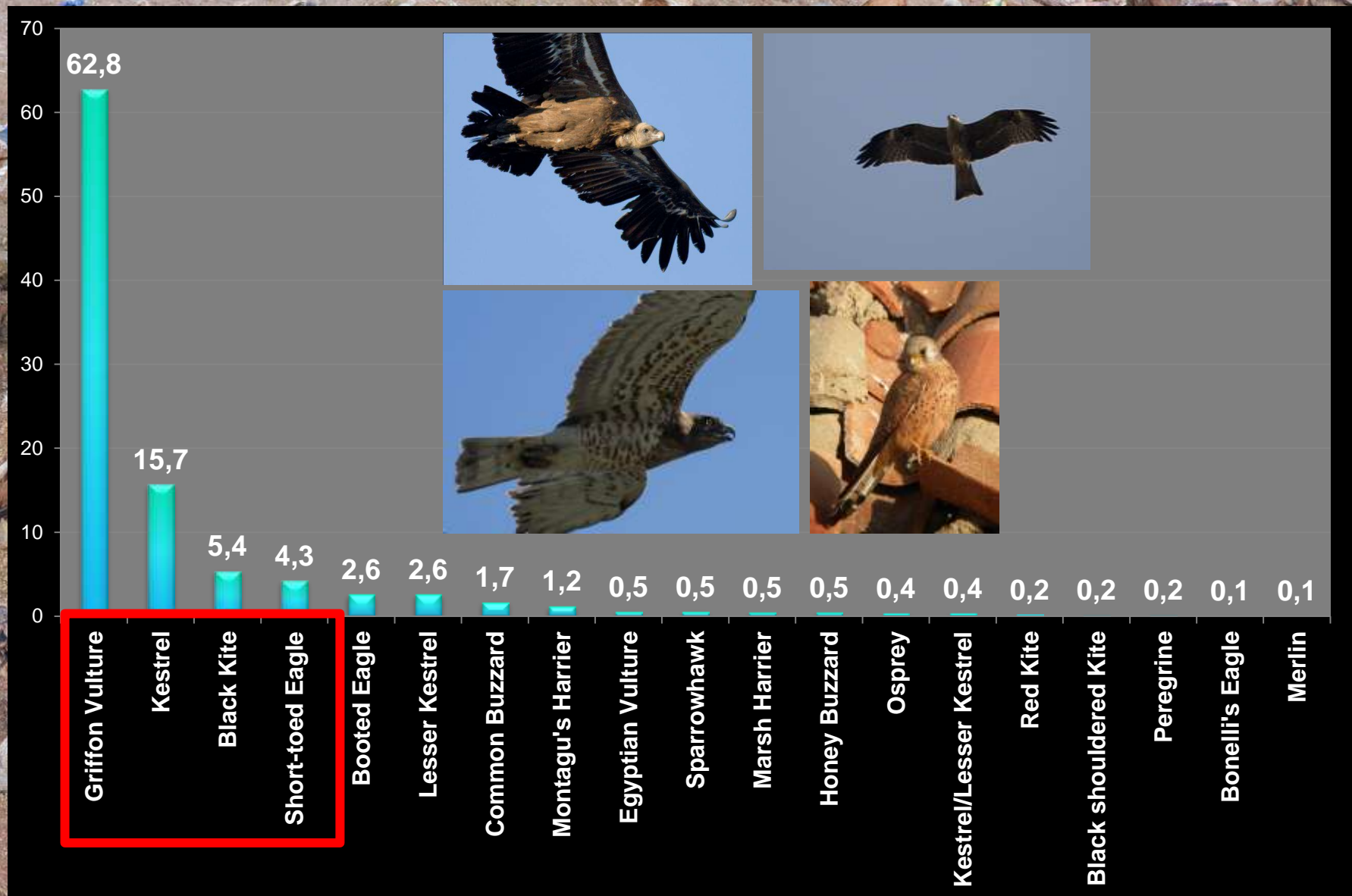




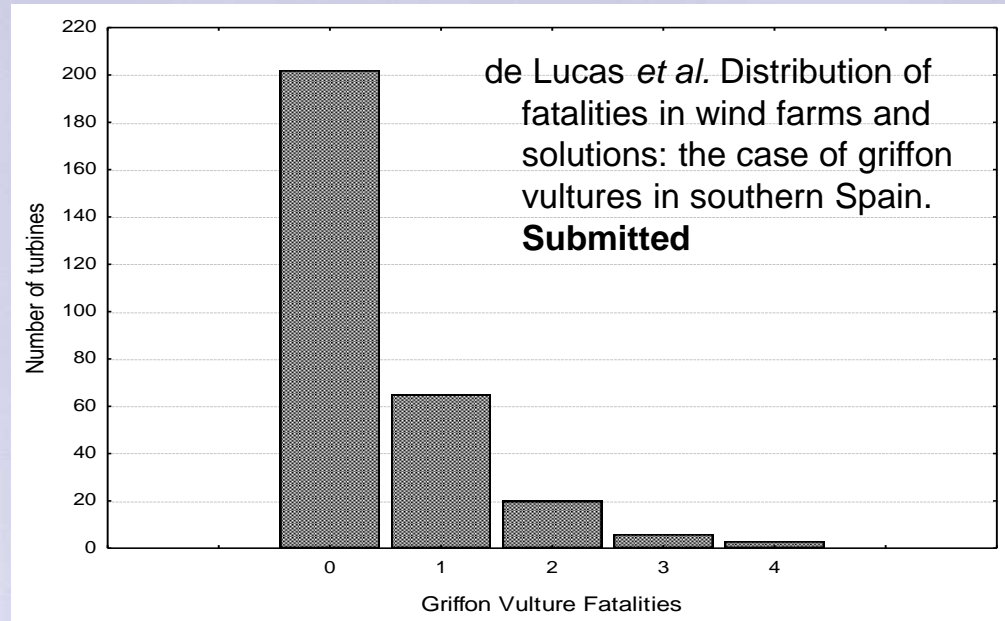
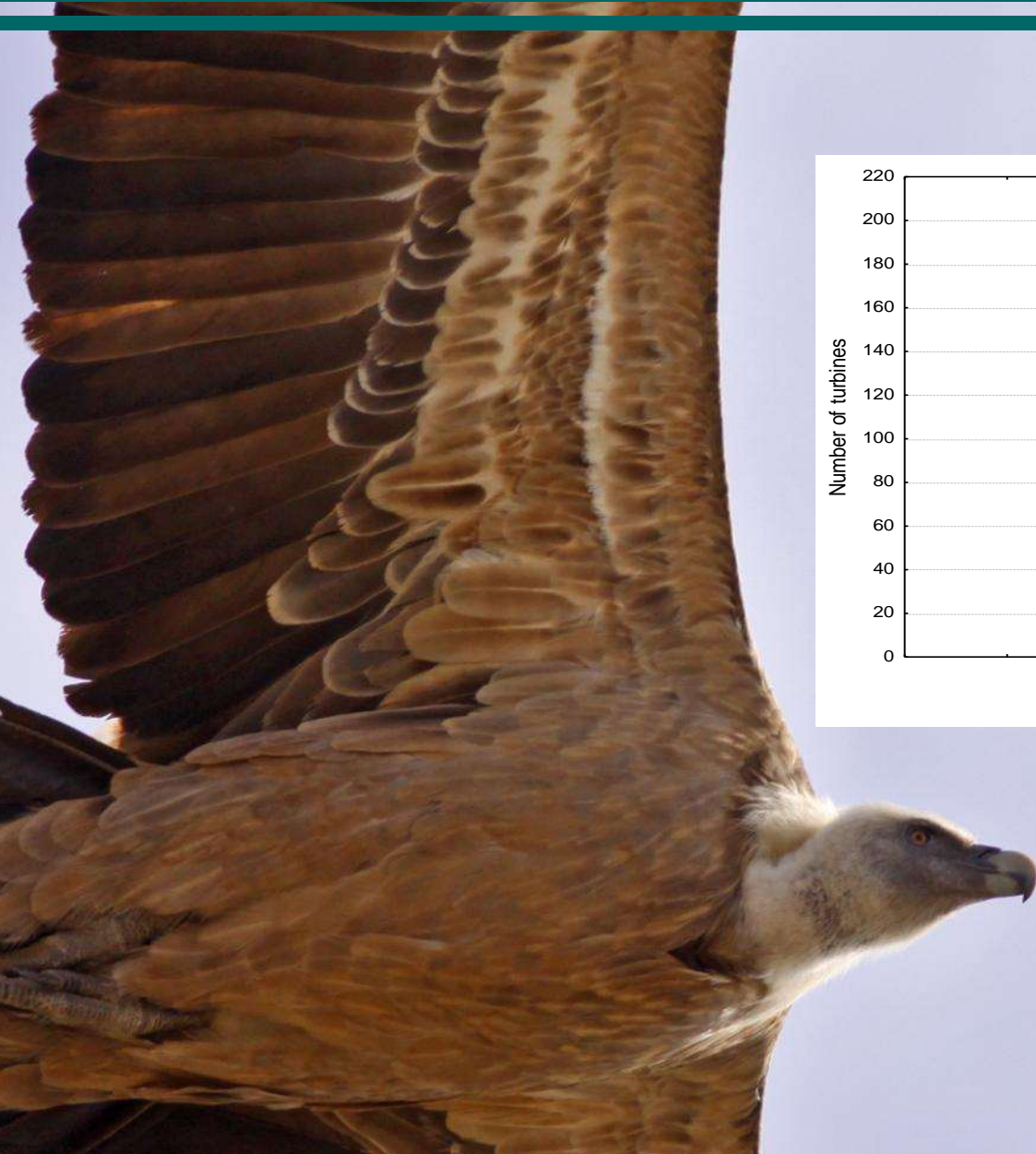
# Raptor collisions (n=1291, 18 species )



# Raptor collisions (n=1291, 18 species )

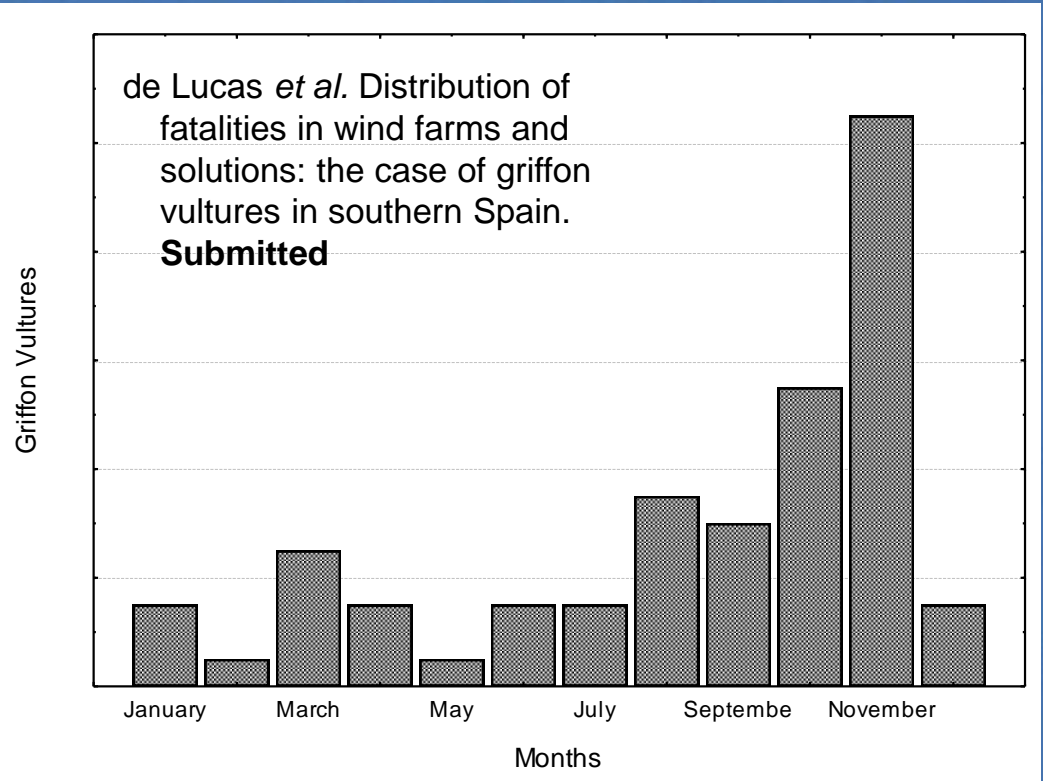


# Distribution of Griffon Vulture of fatalities





# Temporal distribution of GVult fatalities



# Selective Stopping Program

A large griffon vulture is shown in flight, its wings spread wide, revealing the intricate structure of its feathers. The bird is positioned on the left side of the frame, flying towards the right. The background is a clear, light blue sky.

**2006-2007** No stopping Program

**2008-2009** 49% of reduction

de Lucas *et al.* Distribution of fatalities in wind farms and solutions: the case of griffon vultures in southern Spain. **Submitted**

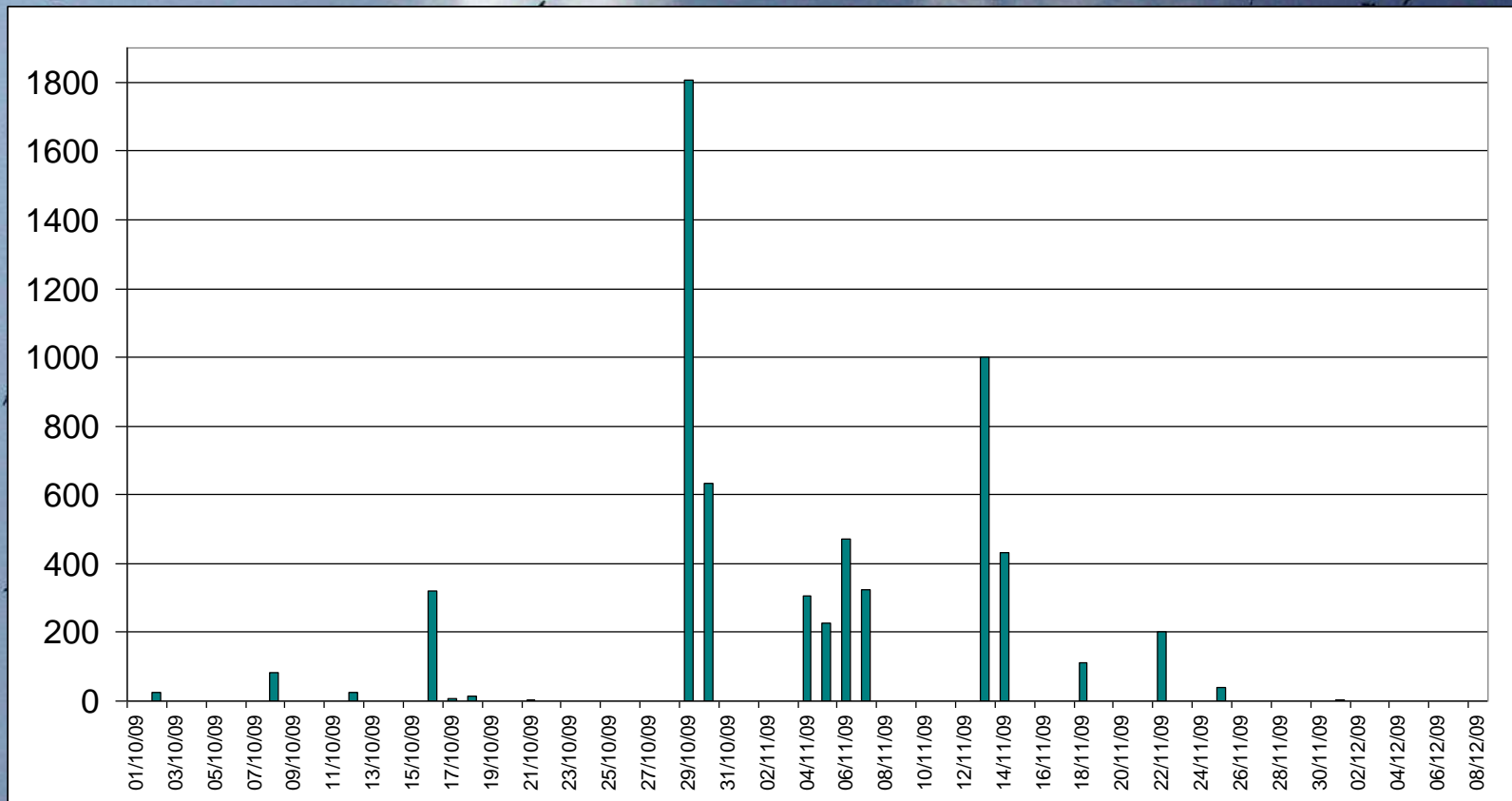
# Griffon Vulture migration





# Griffon Vulture migration

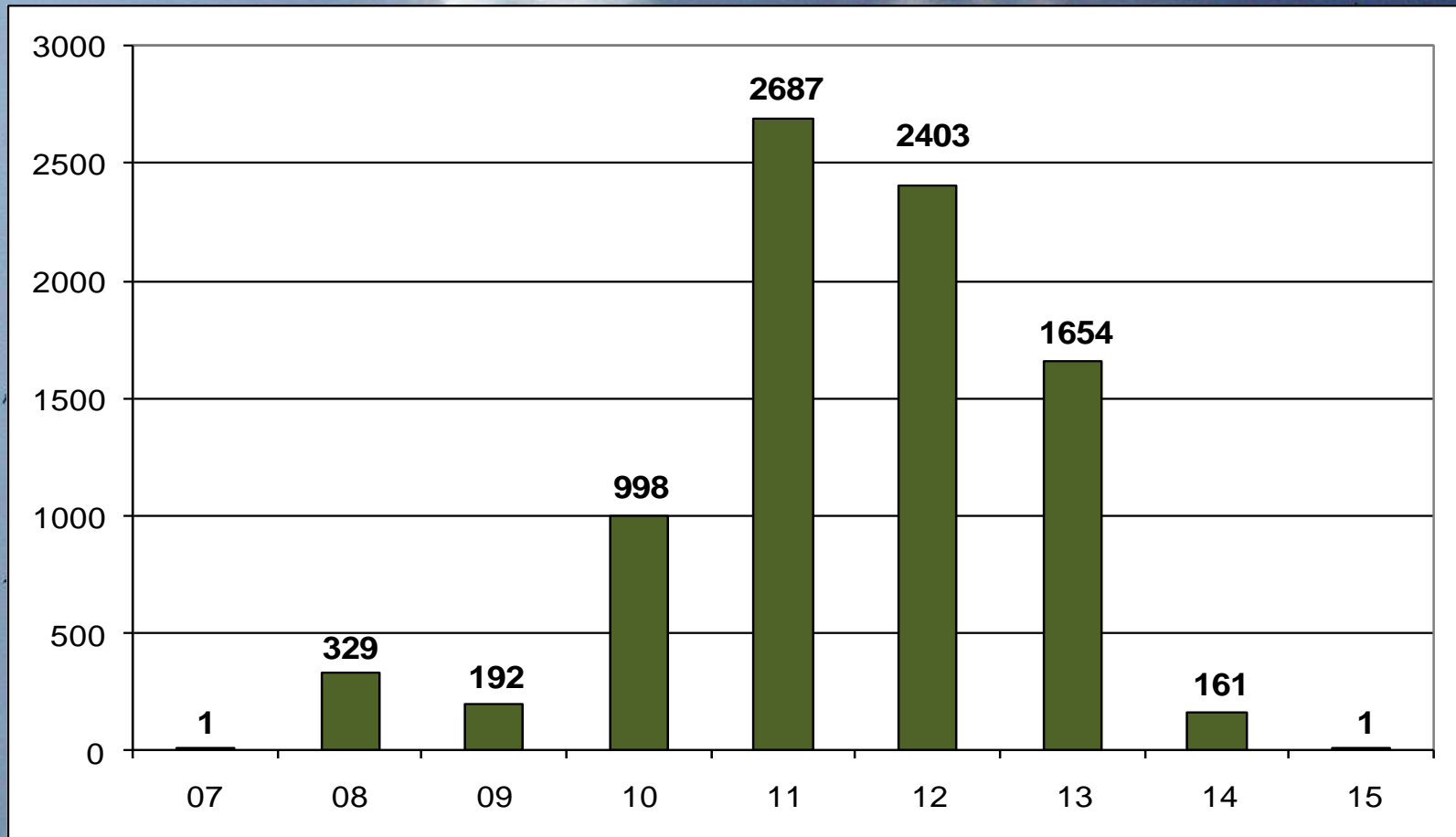
Number of Griffon Vultures crossing per day (n= 6.039)



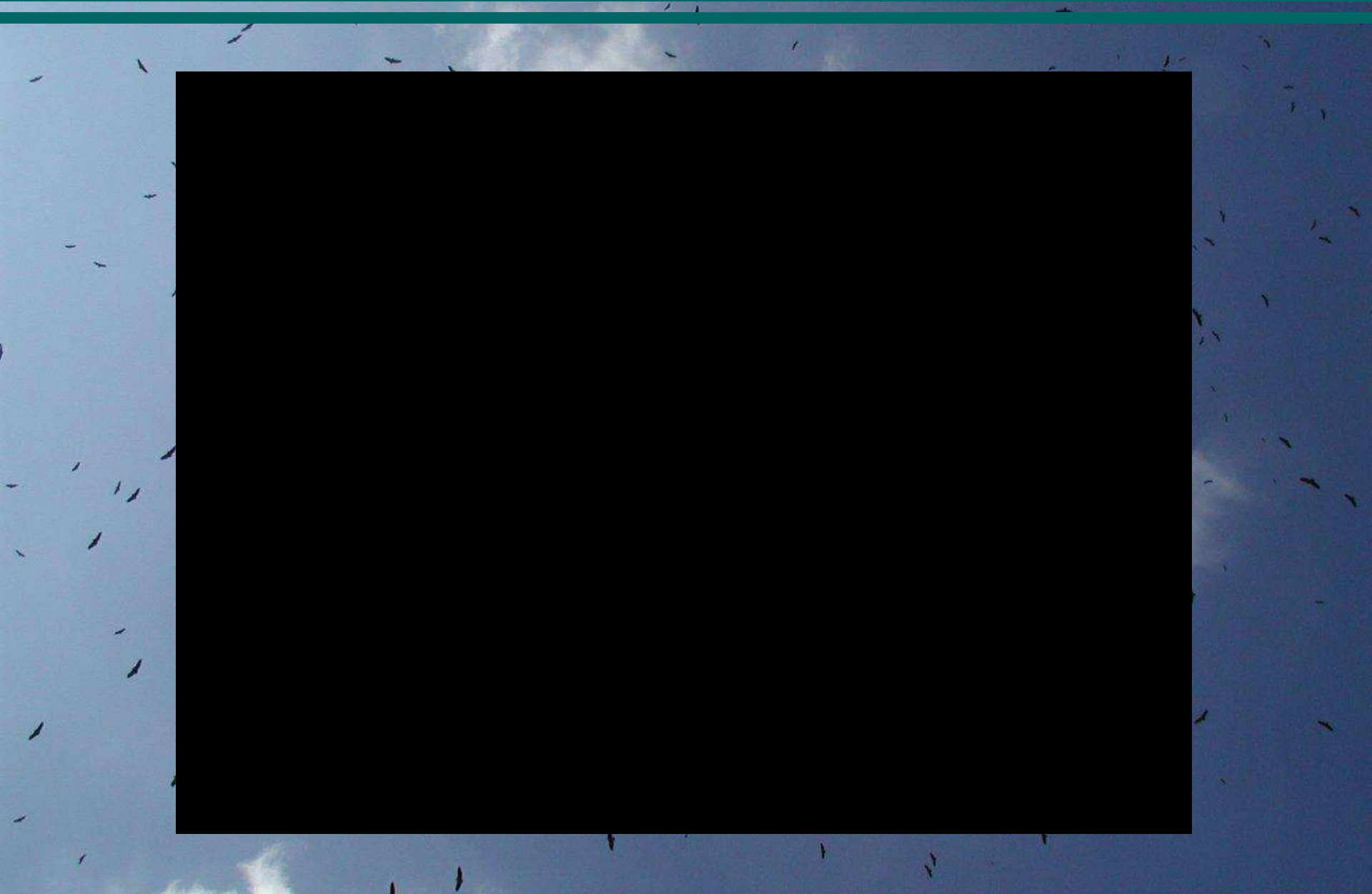


# Griffon Vulture migration

Time (UTC) at which Griffon Vultures cross the strait



# Griffon Vulture migration

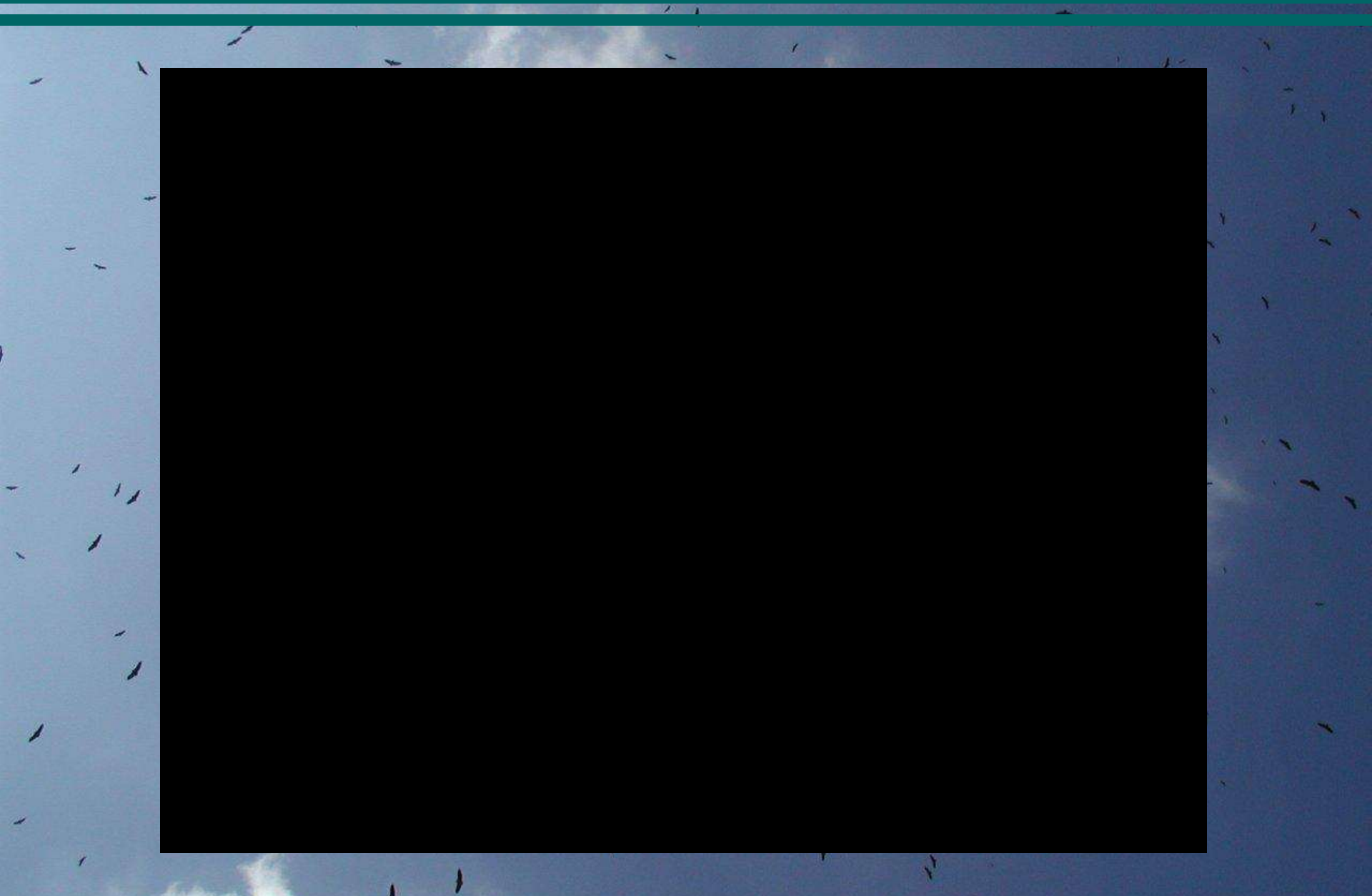


# Griffon Vulture migration





# Griffon Vulture migration



# Selective Stopping Program

**2010:** We monitored Vulture migration

Increased the number of observers during the migratory period (9 to 13)

Daily warnings to the observers in the wind farms



# Selective Stopping Program

**2006-2007** No stopping Program

**2008-2009:** 49% of reduction

**2010:** 41% of reduction with  
respect to 2009

Muñoz *et al.* **in prep.** Combining migration  
monitoring with selective stopping as  
a mitigation measure to reduce  
Griffon Vulture fatalities on a major  
migration bottleneck area





# Conclusions

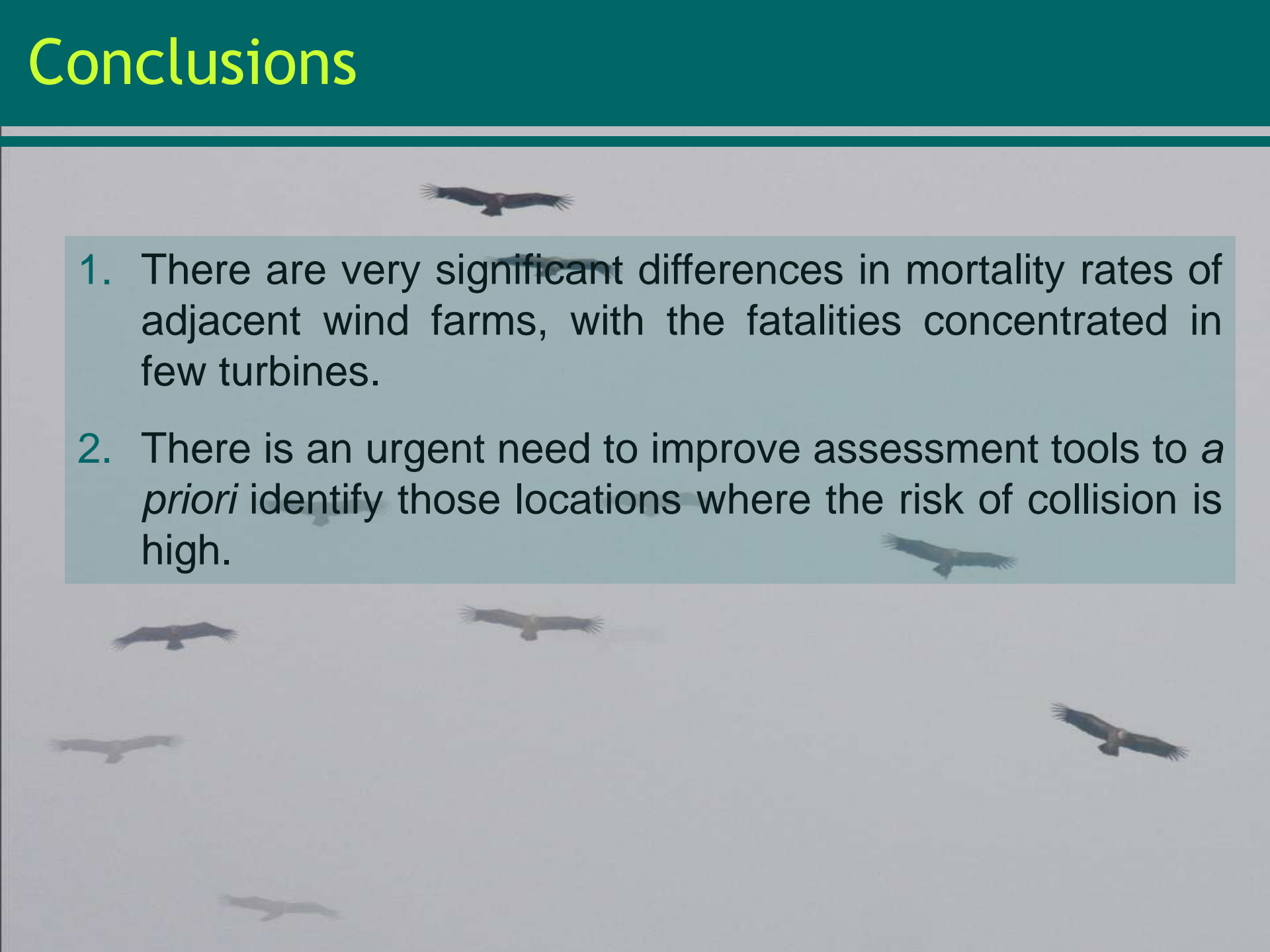


# Conclusions

1. There are very significant differences in mortality rates of adjacent wind farms, with the fatalities concentrated in few turbines.

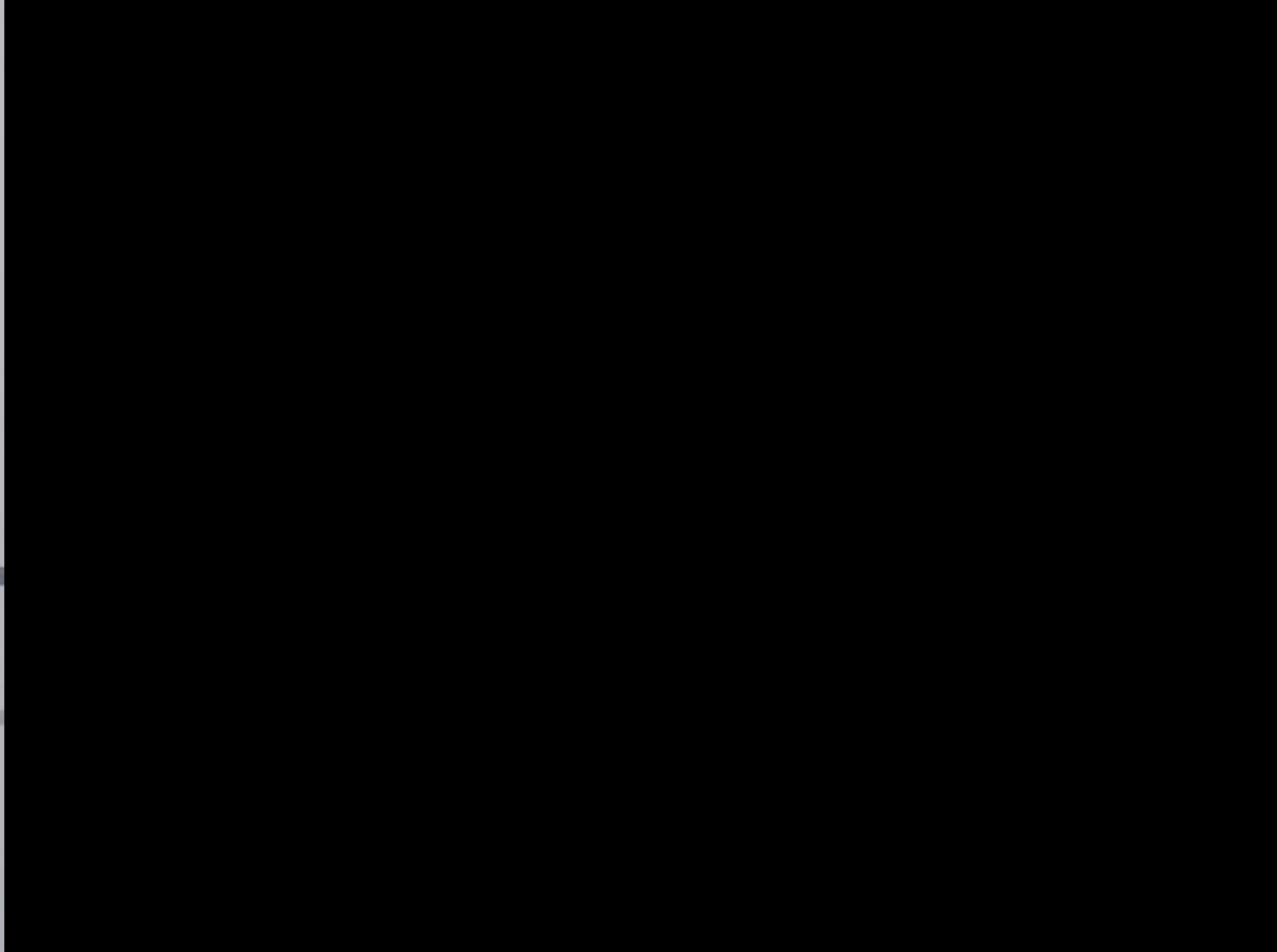


# Conclusions

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- The background of the slide features a light blue sky with several bald eagles in flight. One eagle is prominently visible at the top center, with its wings spread wide. Other eagles are scattered across the lower half of the slide, some in flight and others appearing as faint silhouettes. The overall tone is serene yet emphasizes the presence of wildlife.
1. There are very significant differences in mortality rates of adjacent wind farms, with the fatalities concentrated in few turbines.
  2. There is an urgent need to improve assessment tools to *a priori* identify those locations where the risk of collision is high.



# Conclusions



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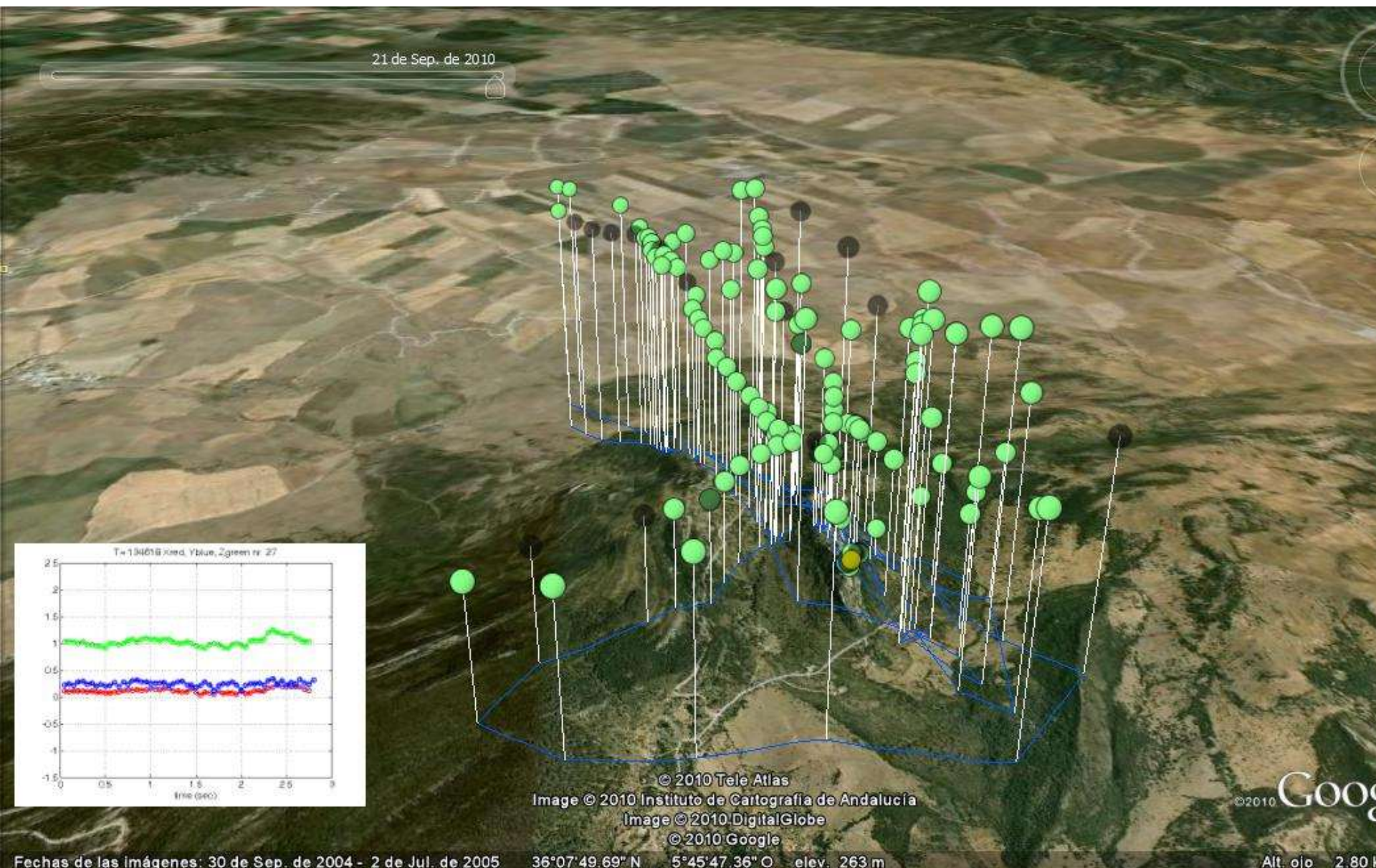


# Conclusions



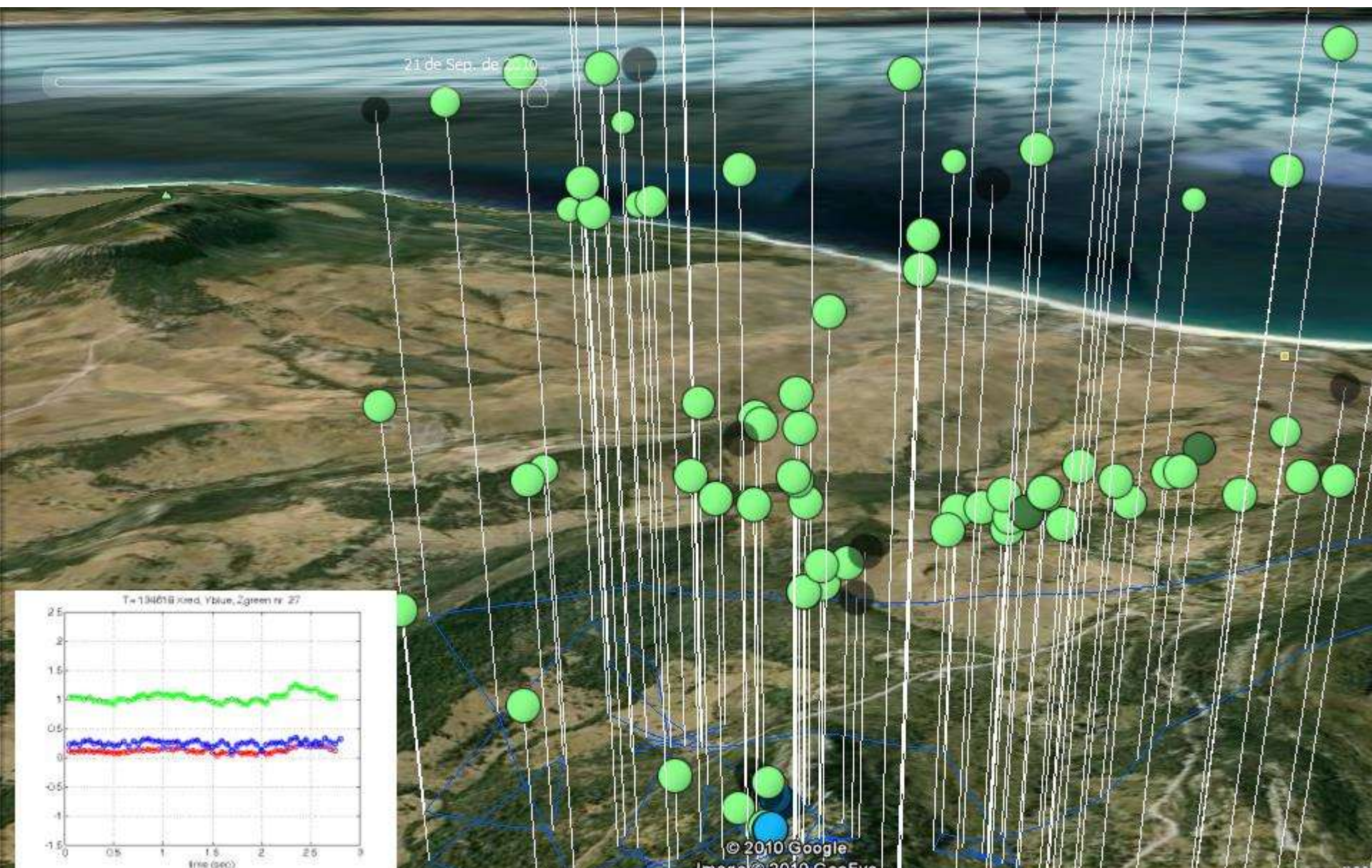


# Conclusions

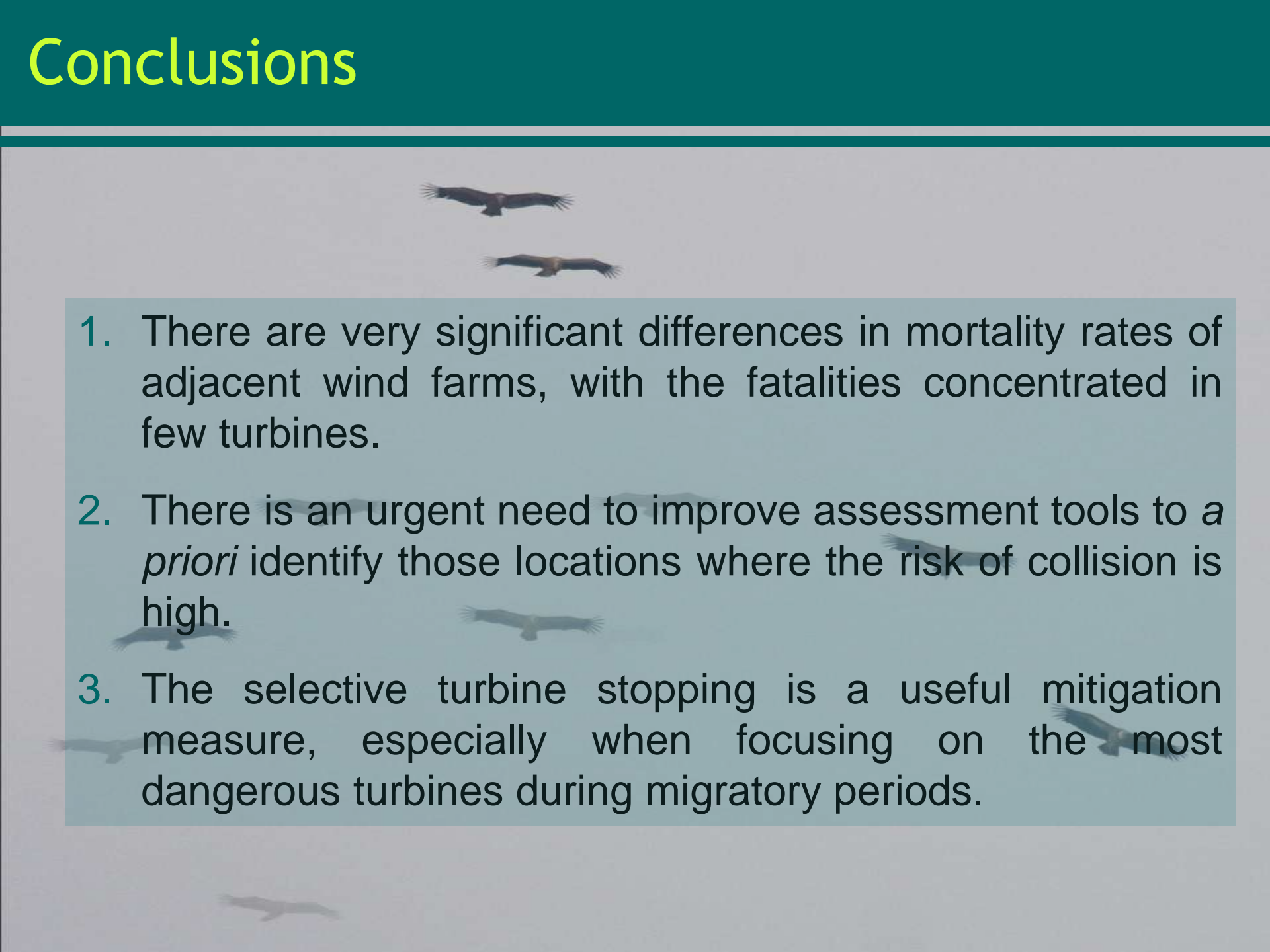




# Conclusions



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1. There are very significant differences in mortality rates of adjacent wind farms, with the fatalities concentrated in few turbines.
  2. There is an urgent need to improve assessment tools to *a priori* identify those locations where the risk of collision is high.
  3. The selective turbine stopping is a useful mitigation measure, especially when focusing on the most dangerous turbines during migratory periods.



# Thank you very much for your attention

Special thanks to Stephen Daly, John Wright , Juan Luis Muñoz, Claude Gavilán and Teo Todorov for their photographs



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