



# IAIA 21

VIRTUAL EVENT

**#iaia21**

# Reducing uncertainty in IA with continuous monitoring & adaptive management

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# Main goals

Reduce uncertainty in IA



How?

Using

Collision Risk Models  
(CRM) ?

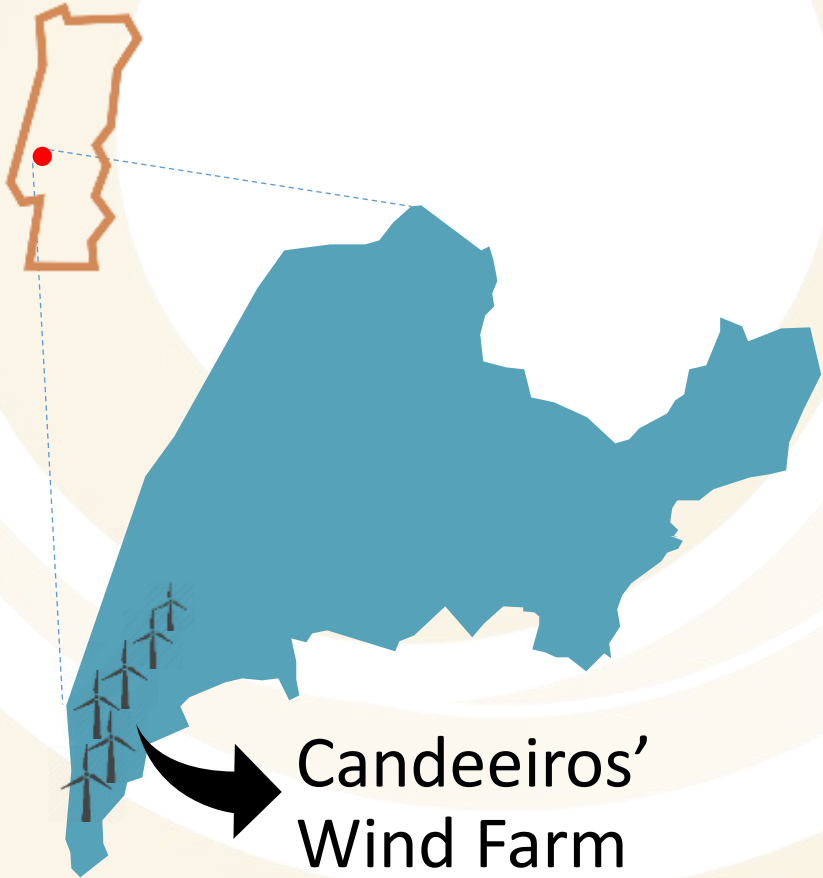


Can CRM provide  
useful information for  
IA?



# Case study

# Case study: Candeeiros' wind farm



Location

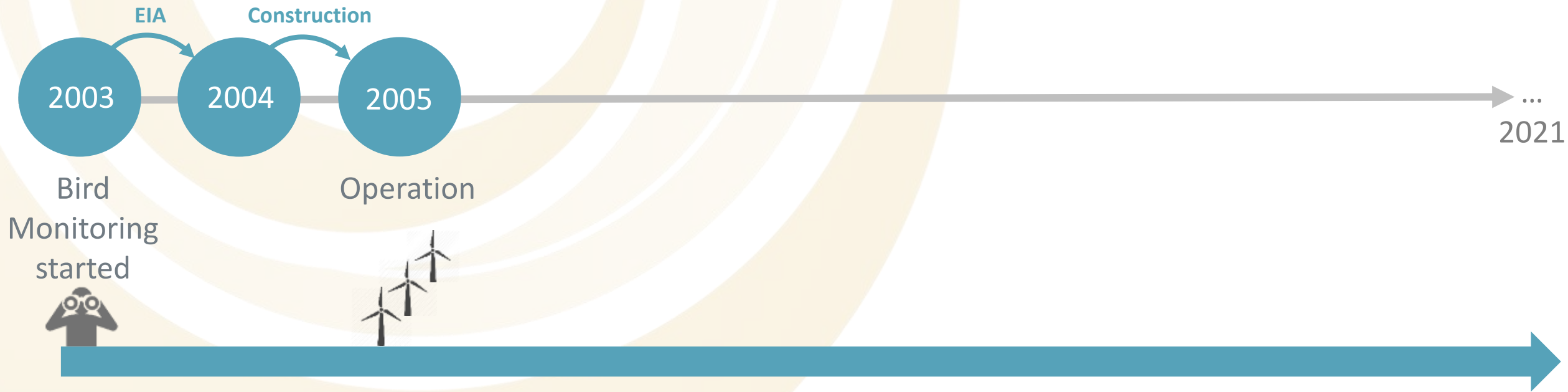
 Portugal

Number of turbines

37  → +5

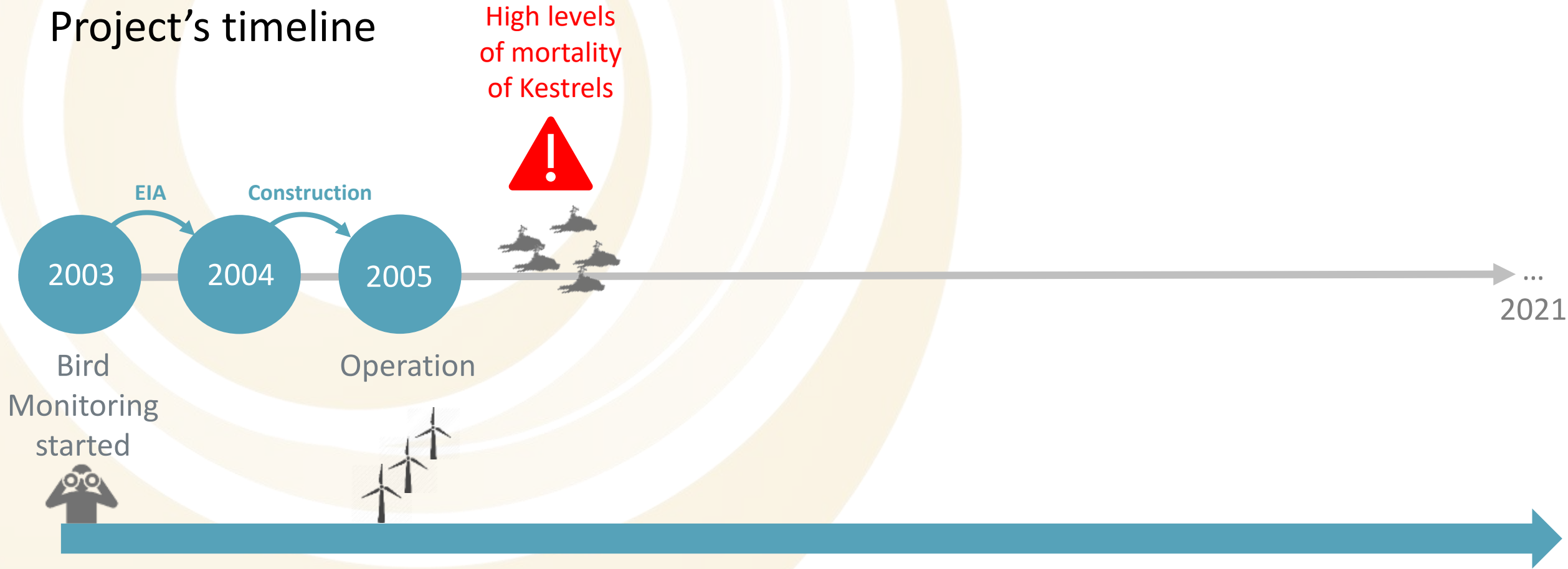
# Case study: Candeeiros' wind farm

## Project's timeline



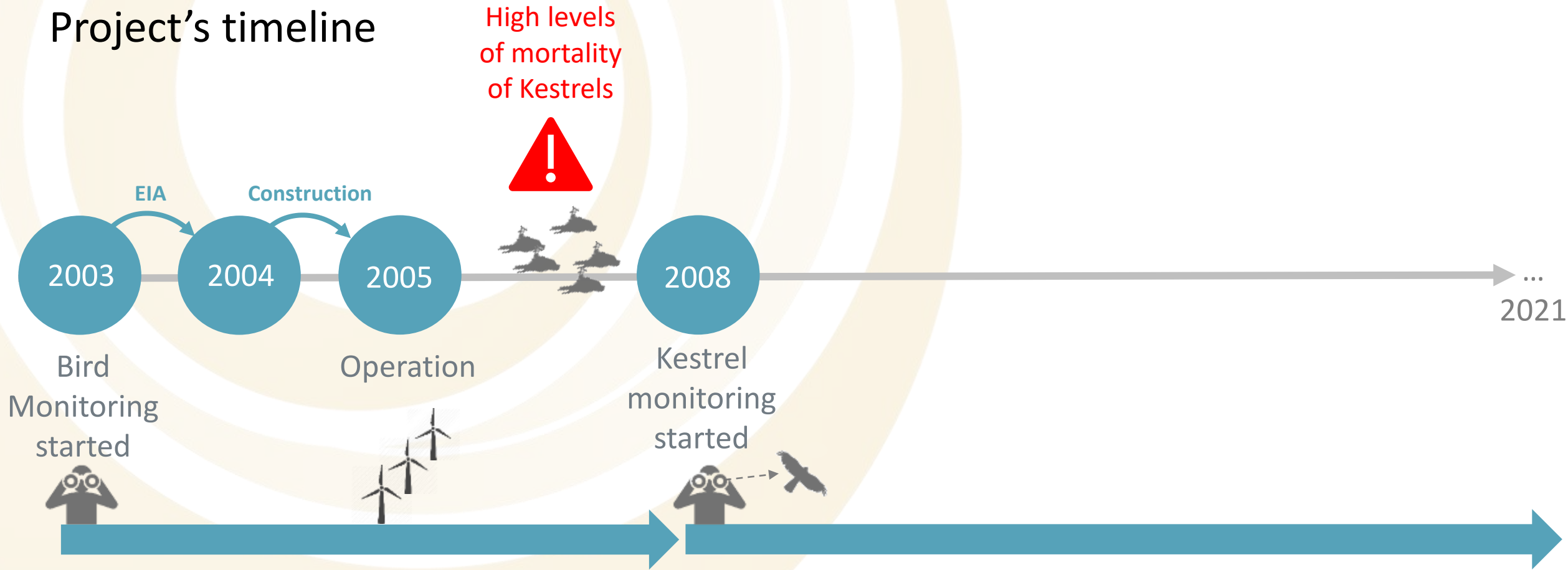
# Case study: Candeeiros' wind farm

## Project's timeline



# Case study: Candeeiros' wind farm

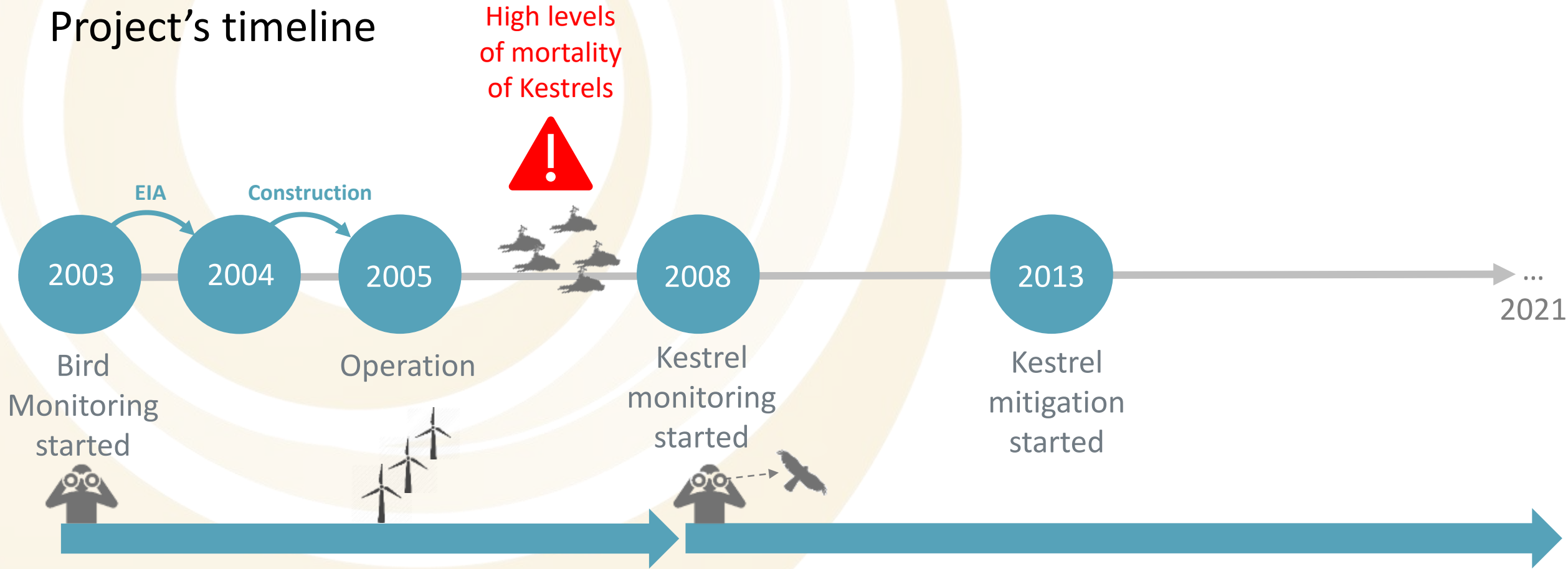
## Project's timeline





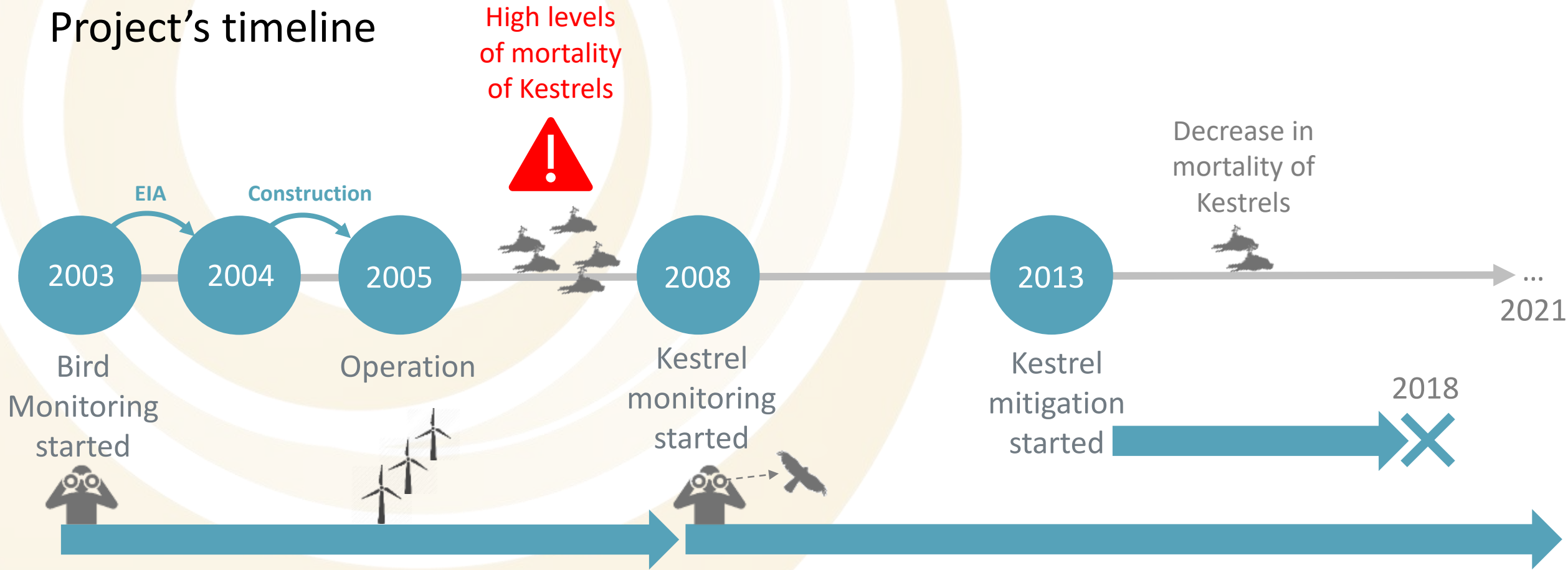
# Case study: Candeeiros' wind farm

## Project's timeline



# Case study: Candeeiros' wind farm

## Project's timeline





# Methodology

# Main Goals → Questions

Can CRM provide  
useful information for  
IA?

## Question 1

Would we have made different  
recommendations if we had used  
CRM?

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CRM?

## Question 2

Can CRM replace expensive  
carcass surveys and how  
reliable is the information?

# Main Goals → Questions

Can CRM provide useful information for IA?

## Question 1

Would we have made different recommendations if we had used CRM?



Traditional IA approach  
(no CRM)

VS.

IA approach  
with CRM

## Question 2

Can CRM replace expensive carcass surveys and how reliable is the information?



Traditional approach  
(no CRM)

VS.

CRM approach



Collision predictions  
with CRM

Fatality estimates from carcass surveys  
(using GenEst Fatality Estimator)



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# The collision risk model

Collision risk  
models  
(CRM)



## Band model:

- Band (2007)
- + modifications from Band (2012)
- + modifications by Masden (2015)

Predict

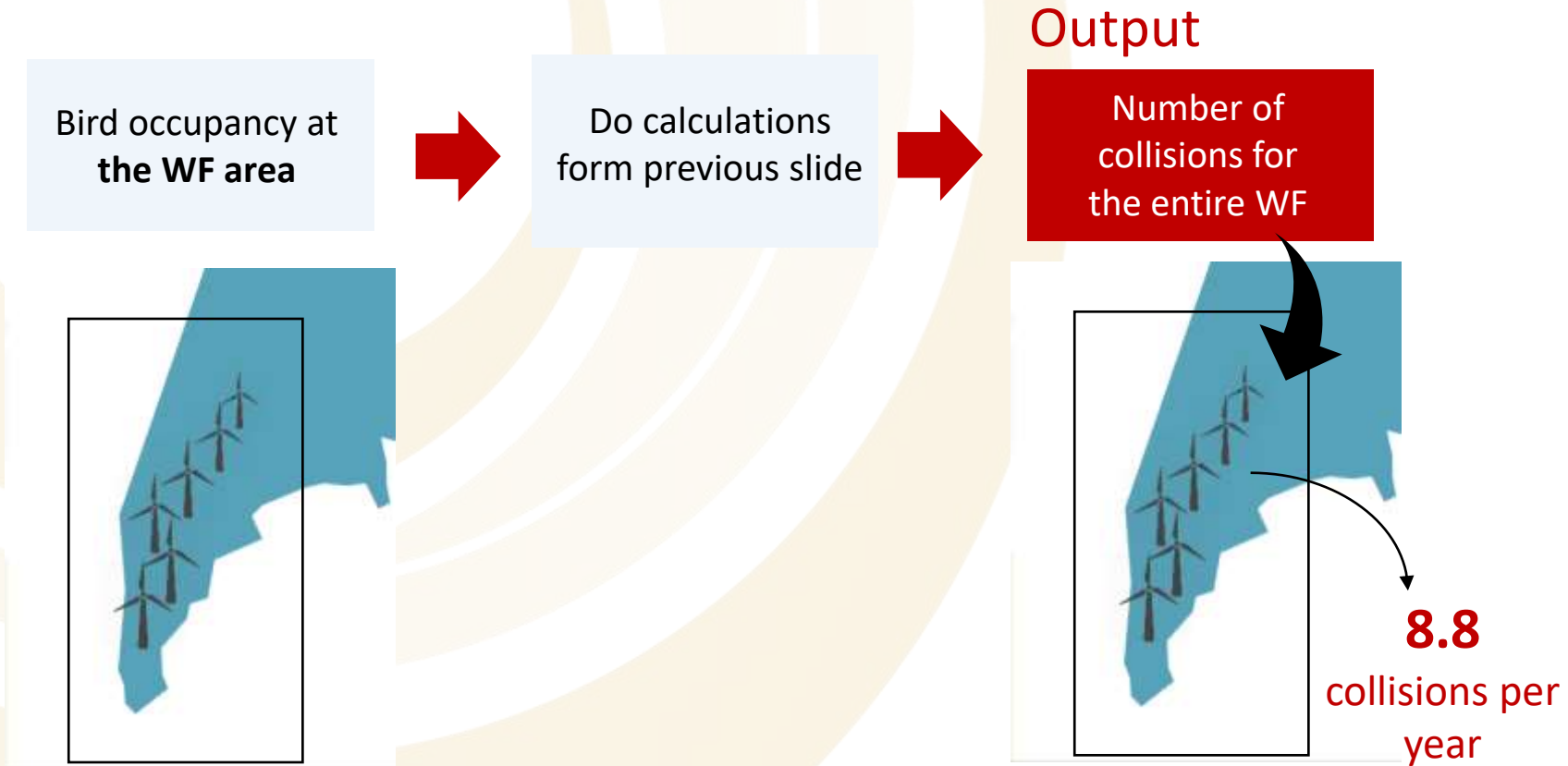


Number of  
collisions



# The collision risk model

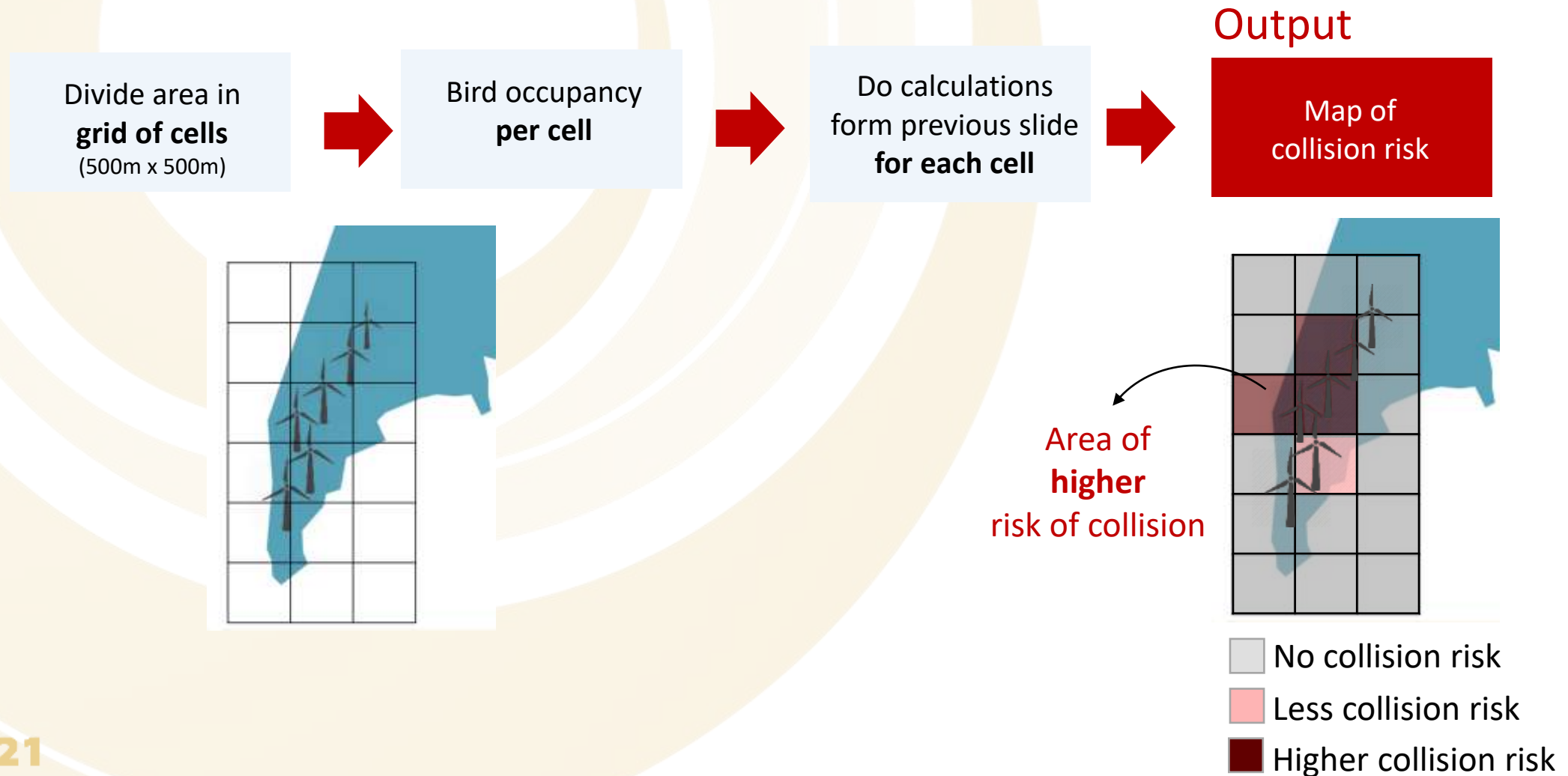
Band model → We used a “standard approach”





# The collision risk model

Band model → And a “spatial approach”





# Findings

# Can CRM provide useful information for IA?



## Question 1

Would we have made different recommendations if we had used CRM?

# Can CRM provide useful information for IA?

## Question 1

Would we have made different recommendations if we had used CRM?



Predicted impacts:

- Displacement
- Habitat loss
- Mortality due to collision

Birds of prey and soaring birds more susceptible

No target species

# Can CRM provide useful information for IA?

## Question 1

Would we have made different recommendations if we had used CRM?



Traditional approach



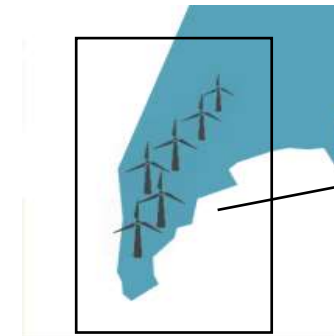
CRM approach

Predicted impacts:

- Displacement
- Habitat loss
- Mortality due to collision

Birds of prey and soaring birds more susceptible

No target species



Year 0

*Falco tinnunculus*

**8.0 collisions**

Predicted impacts:

- Kestrels mortality → **Kestrel as target species** would have been identified sooner

# Can CRM provide useful information for IA?

## Question 1

Would we have made different recommendations if we had used CRM?



Traditional approach



CRM approach

- Unexpected impacts verified
- Adjustment of monitoring plan (targeted to Kestrels)
- Proposal of mitigation measures as consequence of high mortality of Kestrels



- Kestrel mortality would not be unexpected
- Proposal of mitigation measures from the start of operation phase

# Can CRM provide useful information for IA?

## Question 1

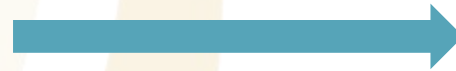
Would we have made different recommendations if we had used CRM?



Traditional approach



VS



CRM approach

Monitoring efforts are focused on fatality

High fatality of Kestrels revealed **UNEXPECTED** impacts

Trigger **REACTIVE** mitigation measures

Mitigation is a **CONSEQUENCE** response to the verified impact

CRM would have predicted impacts on Kestrels

Impacts would have been **ANTICIPATED**

Trigger **PROACTIVE** mitigation measures

Mitigation is **PREVENTIVE** response to the expected impact

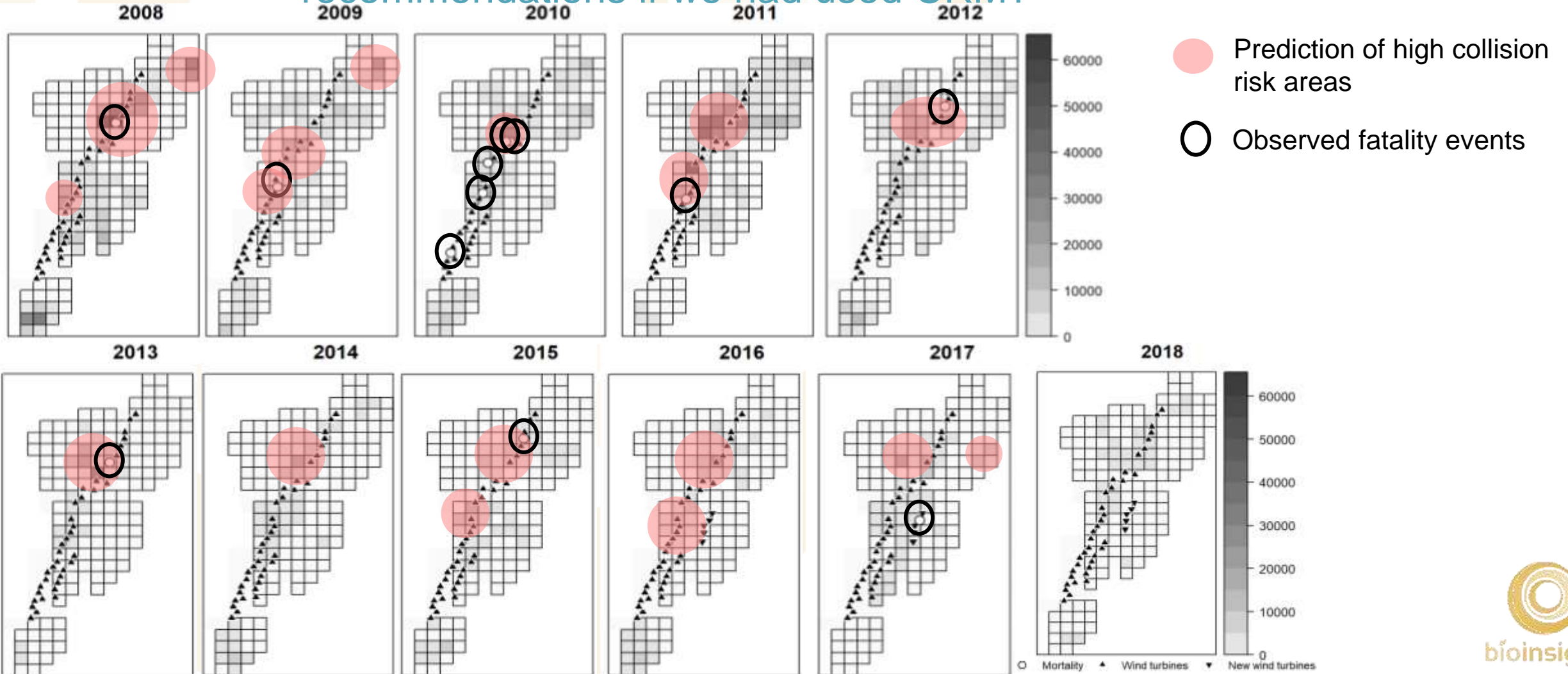


# Can CRM provide useful information for IA?



## Question 1

Would we have made different recommendations if we had used CRM?

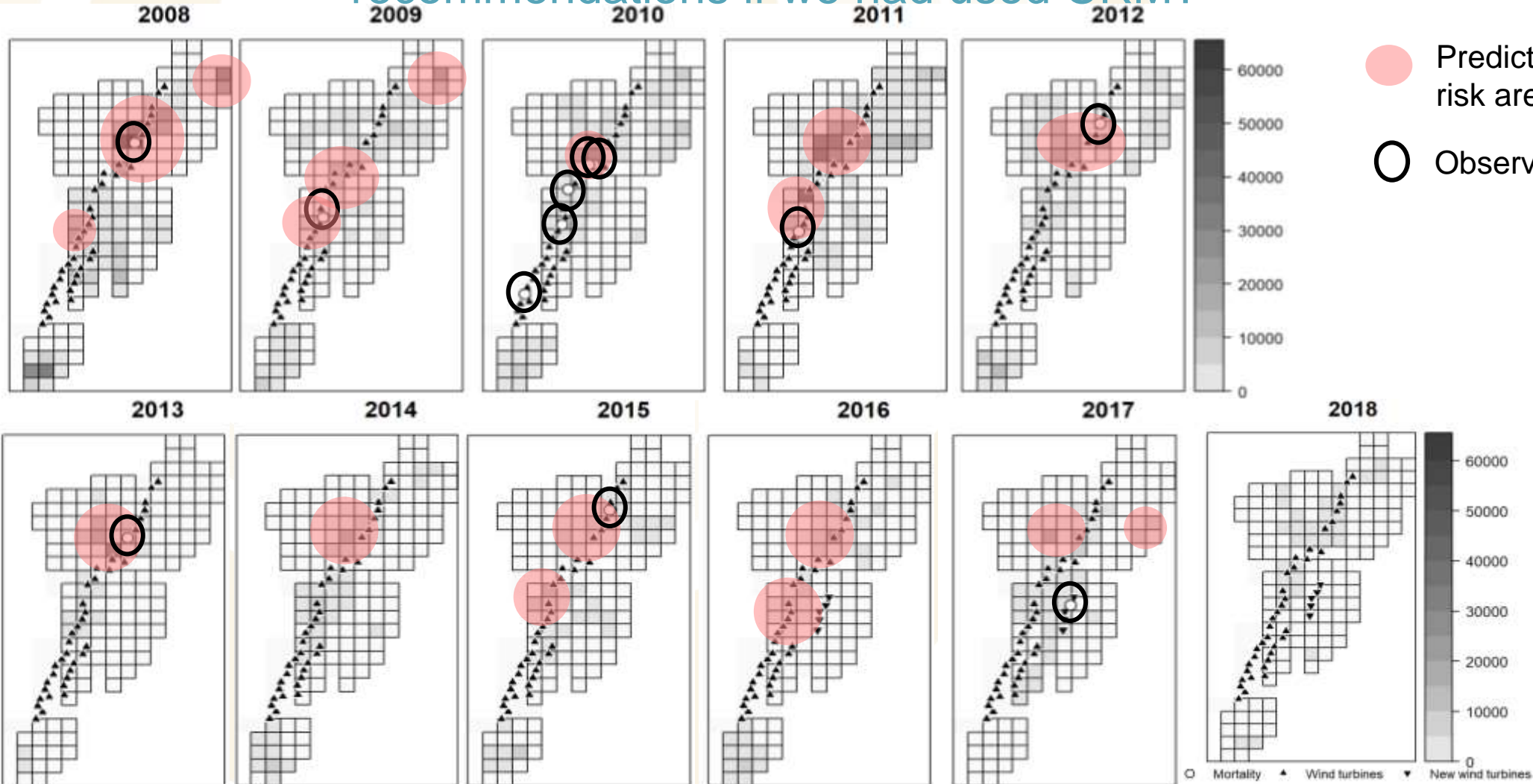




# Can CRM provide useful information for IA?

## Question 1

Would we have made different recommendations if we had used CRM?



**High risk areas**  
(systematically)



Middle section of  
WF raises more  
concern

# Can CRM provide useful information for IA?

## Question 1

Would we have made different recommendations if we had used CRM?

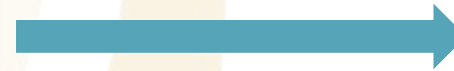


Traditional approach



VS

(spatial approach)



CRM approach

- Mitigation measures applied is based on turbines with higher fatality  
(however, changes every year)
- Mitigation is at turbine-level scale



- “Spatial” CRM can predict WHERE in the WF fatalities will be higher
- Can predict potentially problematic areas
- Will provide a general idea where mitigation measure will probably be applied
- Mitigation is at a larger scale level



# Can CRM provide useful information for IA?



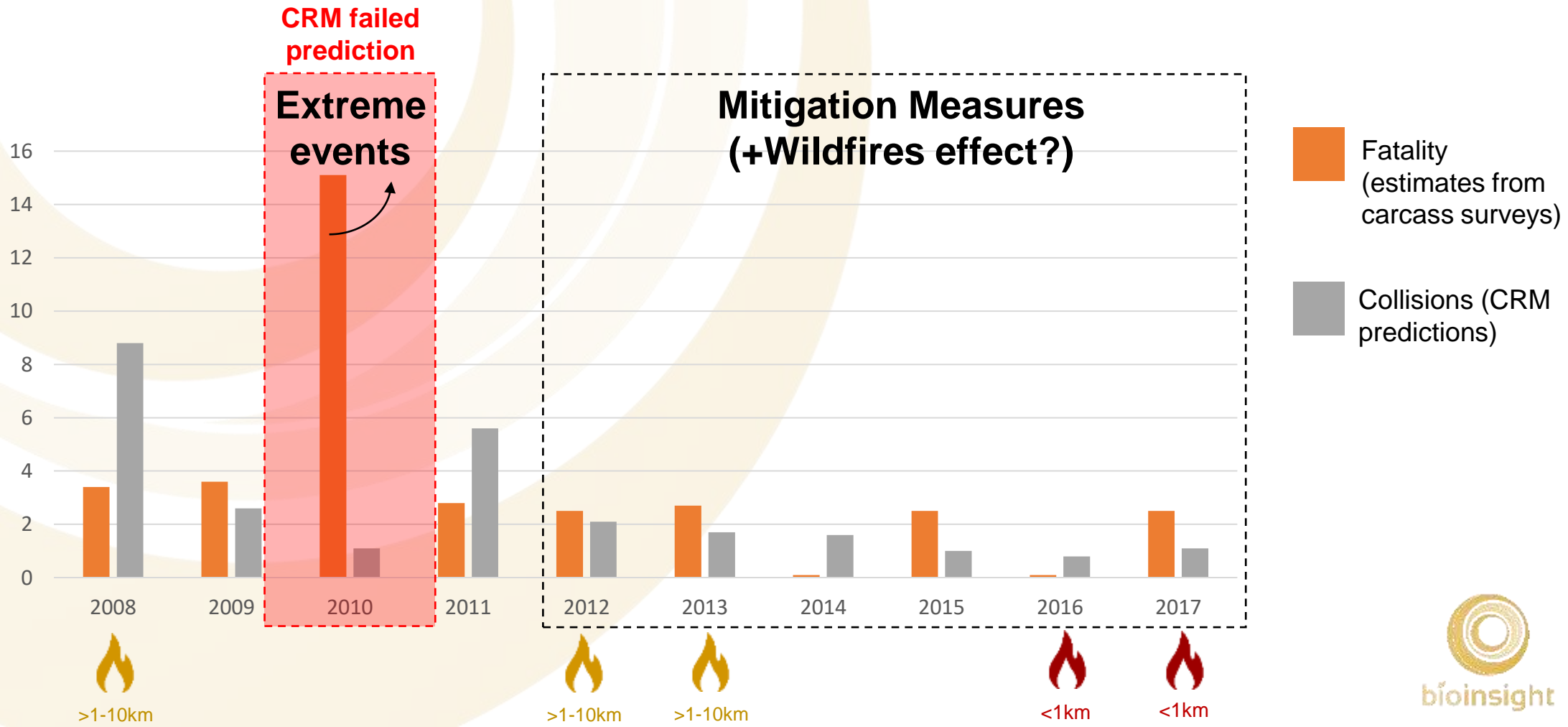
## Question 2

Can CRM replace expensive carcass surveys?

# Can CRM provide useful information for IA?

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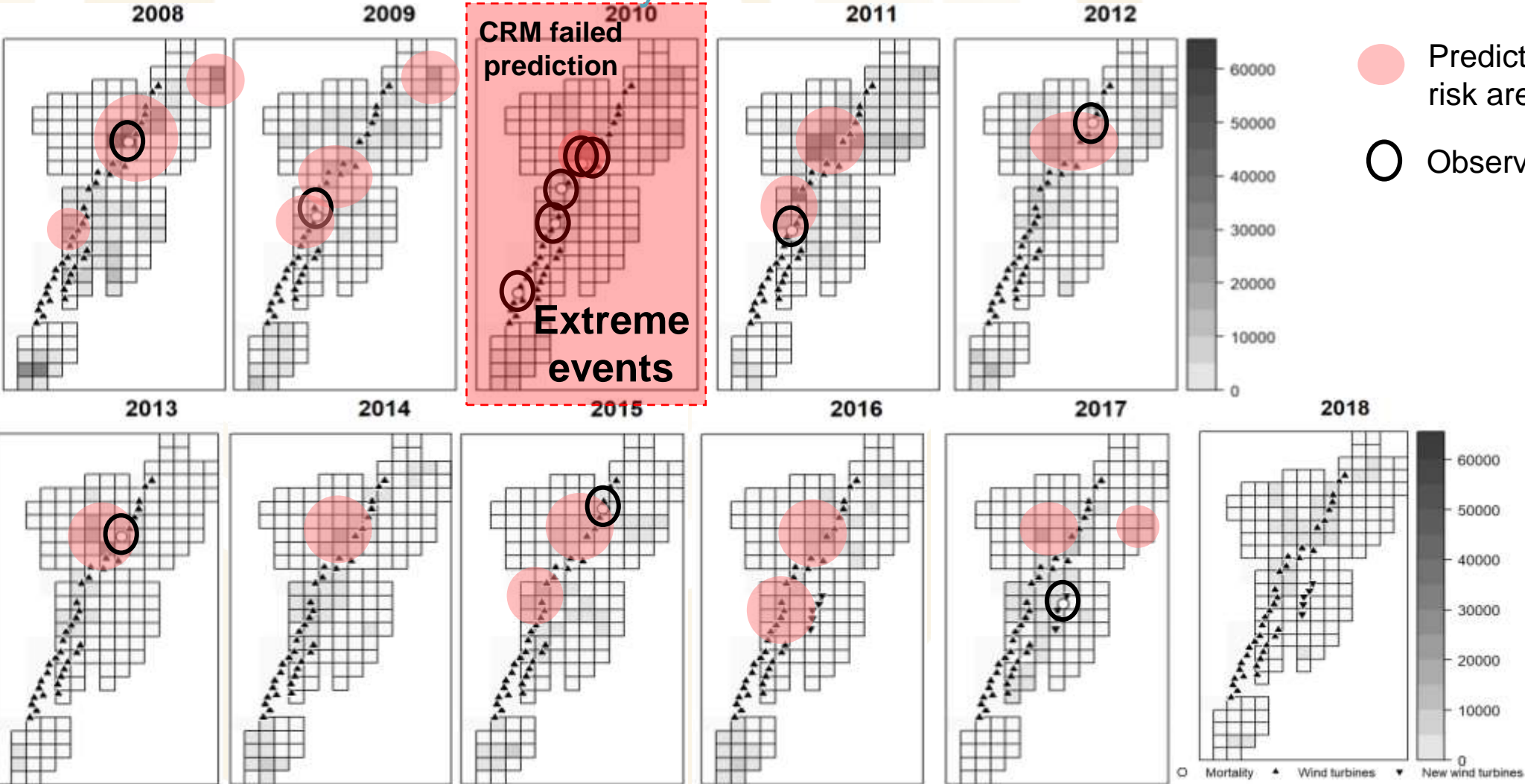
Can CRM replace expensive carcass surveys?



# Can CRM provide useful information for IA?

## Question 2

Can CRM replace expensive carcass surveys?



“Spatial”  
CRM  
approach  
predicted  
**67%**  
carcasses in  
high risk areas



# Can CRM replace carcass surveys?

## Question 2

Can CRM replace expensive carcass surveys?



Traditional approach


- Carcass surveys provides better estimates on mortality (detects extreme events of mortality)
- **But is very expensive**

VS



CRM approach

- CRM predicts number of collisions within a satisfactory range of accuracy → it would have not triggered different recommendations that the traditional approach
- **CRM fails to predict extreme events of mortality**



# Final considerations

# (Remember our) Main goals

Reduce uncertainty in IA



Using  
Collision Risk Models  
(CRM) ?



Can CRM provide  
useful information for  
IA?



# Final considerations

**YES**

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useful information for  
IA?

# Final considerations

Can CRM provide  
useful information for  
IA?

**YES**

- Can detect target species in pre-construction phase

# Final considerations

Can CRM provide useful information for IA?

**YES**

- Can detect target species in pre-construction phase
- Can predict number of collisions for birds of prey at a satisfactory level (in a context of IA)



**BUT**

- Does not fully replace carcass surveys (can't predict extreme events)



Need for **continuous monitoring**

# Final considerations

Can CRM provide useful information for IA?

**YES**

- Can detect target species in pre-construction phase
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**BUT**

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Need for **continuous monitoring**

# Final considerations

Can CRM provide useful information for IA?

**YES**

- Can detect target species in pre-construction phase
- Can predict number of collisions for birds of prey at a satisfactory level (in a context of IA)
- Spatial approach can identify critical areas

**BUT**

- Does not fully replace carcass surveys (can't predict extreme events)  
↓  
Need for **continuous monitoring**
- Not at turbine level

# (Remember our) Main goals

Reduce uncertainty in IA



Using



Collision Risk Models (CRM) ! + Monitoring + Adaptive management



CRM can provide useful information for IA!

# *Let's continue the conversation!*

Post questions and comments via chat in the IAIA21 platform.



**#iaia21**

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