

Impactos dos parques eólicos na avifauna

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Departamento de Biologia Animal



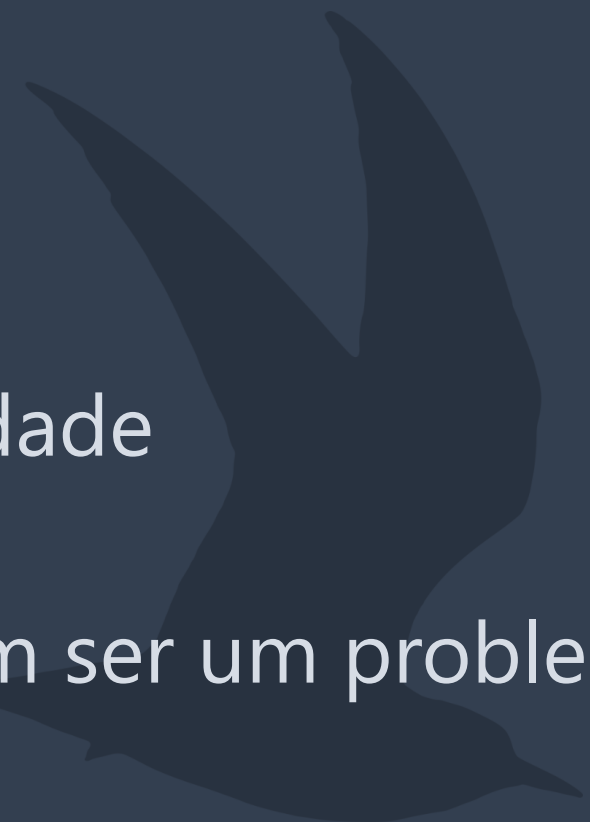
Ciências
ULisboa

Maria Dias, 2025
marias@ciencias.ulisboa.pt



Sumário

- A crise climática e a crise da biodiversidade
- Porque é que os parques eólicos podem ser um problema para as aves (e não só)?
- Como resolver o problema
- O caso das eólicas *offshore* em Portugal

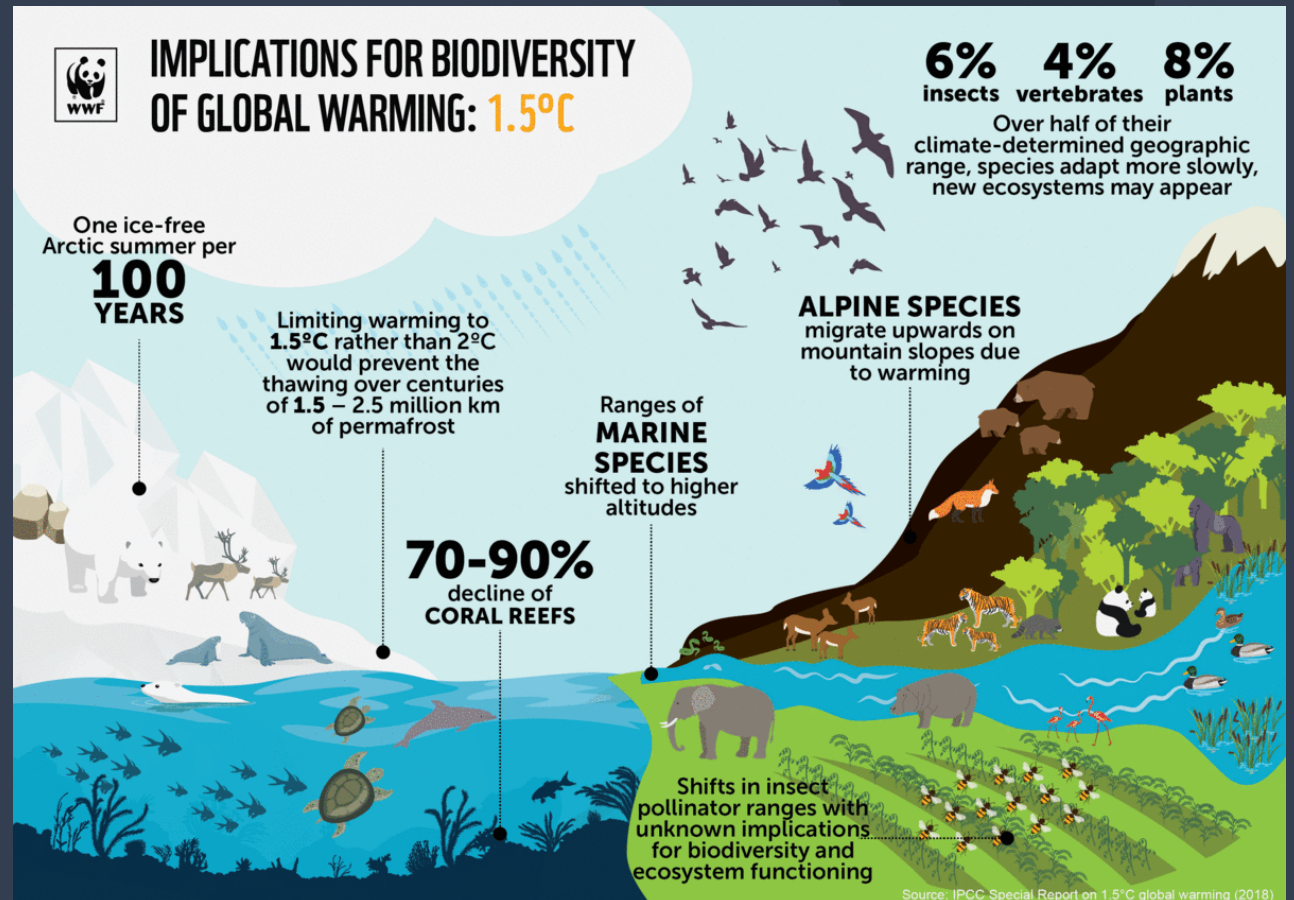


A crise da biodiversidade



10-26-2023

Climate change and biodiversity loss are one indivisible global health crisis



A crise da biodiversidade

Animais migradores

THE FIVE THREATS TO BIODIVERSITY



Land and Sea use Change

(Including habitat loss
and degradation)

Example:
Agricultural land use
which is responsible
for **80%** of the global
deforestation



Pollution

Make the
environment
unsuitable for
survival directly and
indirectly



Species overexploitation

Example:
Overfishing
which may decimate
global fish
populations by 2050



Climate Change

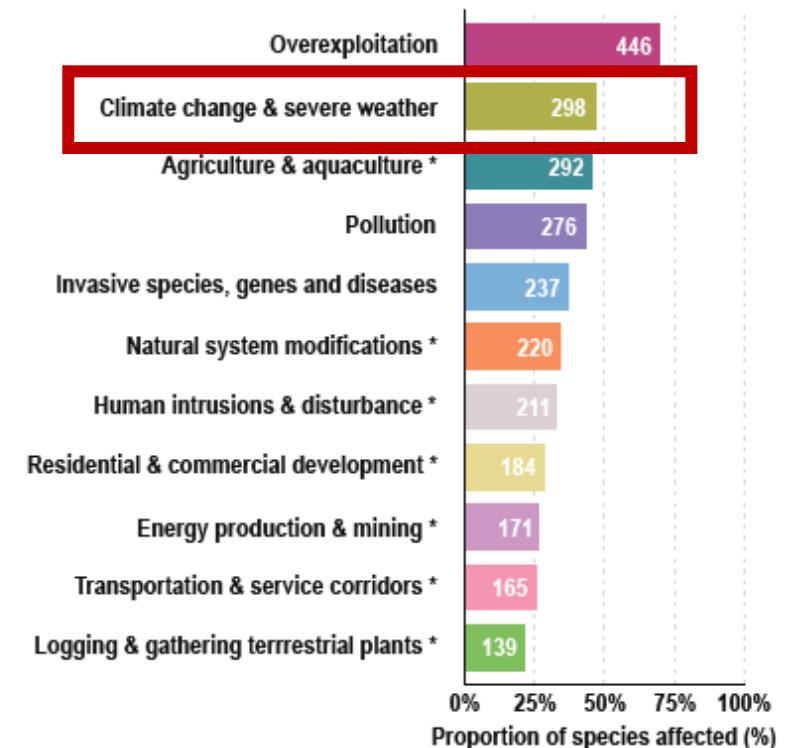
Forcing the animal to
shift range or
confounding the
signals that trigger
seasonal events and
more



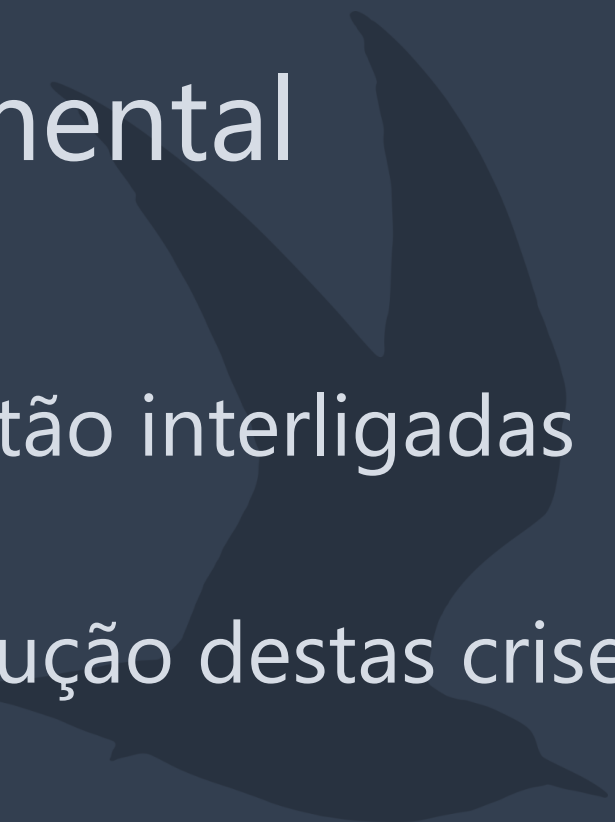
Invasive species and disease

Compete with native
species for space,
food and other
resources; sometimes
spread disease that
native species have
no immunity of

a) CMS-listed species

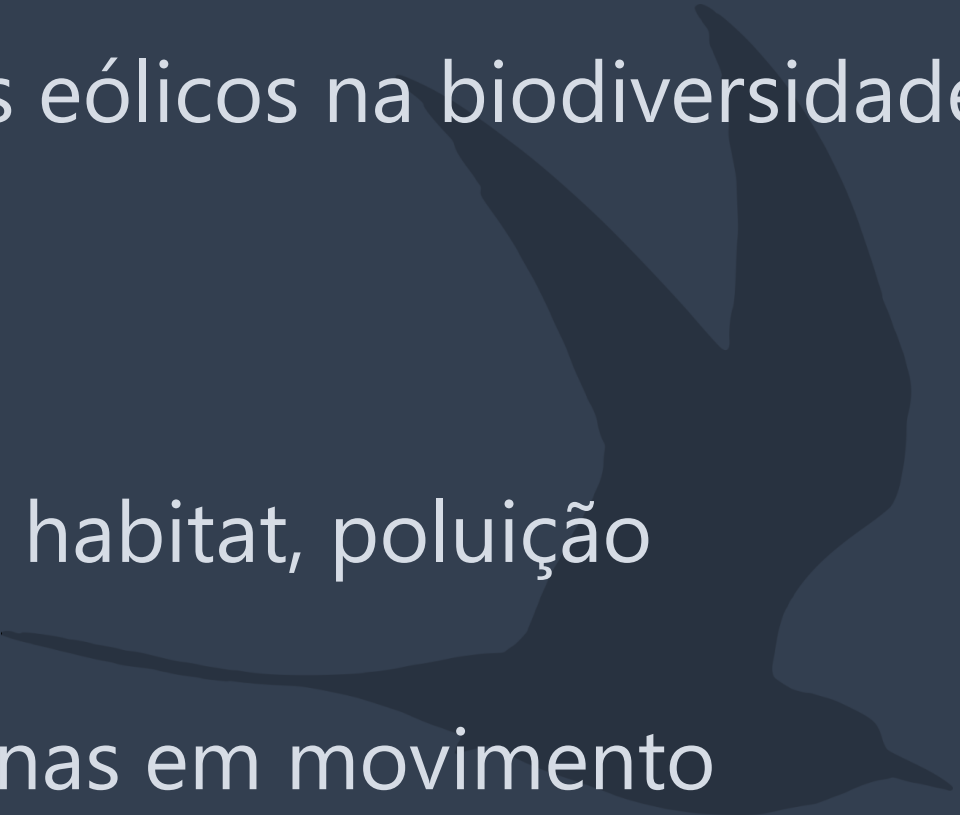


Transição energética é fundamental



- Crises climática e da biodiversidade estão interligadas
- Transição energética faz parte da resolução destas crises
- Pode (e deve) ser feita sem piorar a crise da biodiversidade
- *(Porque é que haveria de piorar?)*

Principais impactos dos parques eólicos na biodiversidade



- Fase de construção
 - Perturbação, destruição de habitat, poluição
- Fase de funcionamento: turbinas em movimento
 - Que tipo de espécies afeta mais?

Principais impactos dos parques eólicos na biodiversidade





Colisão

Efeito *displacement*

Why wind turbines endanger bats

Researchers have known for a while that wind turbines are a bigger threat to bats than to birds. About 90 percent of the bats killed near turbines in a recent study showed signs of internal hemorrhaging caused by quick changes in air pressure, known as barotrauma.



1. Bats should be able to avoid the blades of turbines using echolocation. In the study, only half of the dead bats had been hit by blades, and they may have been hit after they hemorrhaged.

2. Turning turbines create low-pressure areas near the tips of the blades. When a bat flies into these areas, the air in its lungs is at a higher pressure than the surrounding air. It expands and can rupture tiny vessels around the lungs. In effect, the bat's lungs explode.

3. The effect is similar to a scuba diver who gets the bends when the air pressure in his lungs has not had a chance to equalize with the pressure at the surface. Birds do not have the same problems. Their lungs are different than those of mammals.

Sources: Current Biology, National Geographic, Science Daily

Press graphic by Tim Faherty

Current Biology



Volume 18, Issue 16, 26 August 2008, Pages R695-R696

Correspondence

Barotrauma is a significant cause of bat fatalities at wind turbines

Erin F. Baerwald , Genevieve H. D'Amours, Brandon J. Klug, Robert M.R. Barclay

Science

NEWS CAREERS COMMENTARY JOURNALS

Bats: Gone With the Wind

How are wind turbines killing thousands of bats? It's not the blades

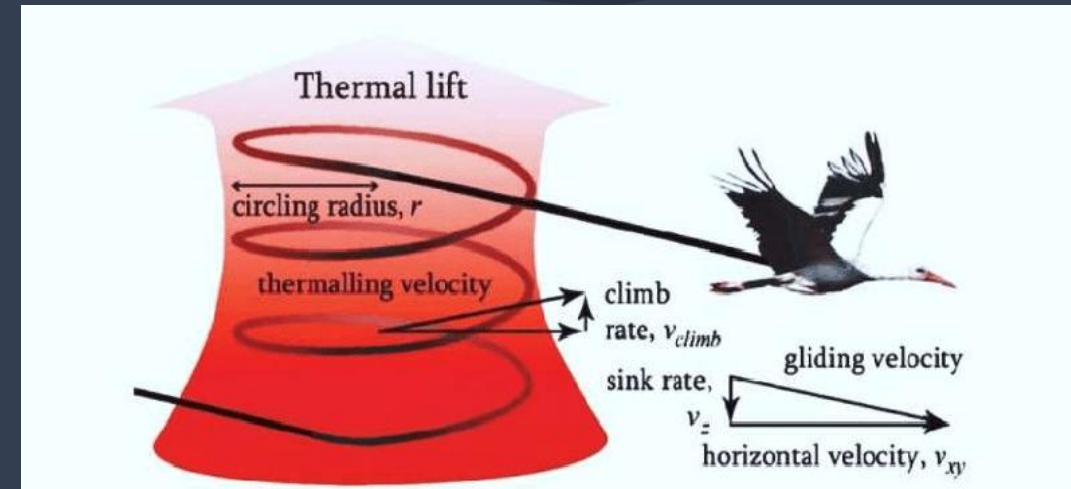
25 AUG 2008



Morcegos: barotrauma

Mortalidade por colisão

- Aves e turbinas partilham o mesmo recurso: o vento
- Aves planadoras são particularmente afetadas
- Risco depende muito das espécies (tempo em voo, altura de voo, comportamento)
- Algumas alturas do ano são particularmente problemáticas: e.g. a migração, reprodução



Mortalidade por colisão nas aves



Mortalidade por colisão

nature

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[nature](#) > [news](#) > article

News | Published: 13 March 2012

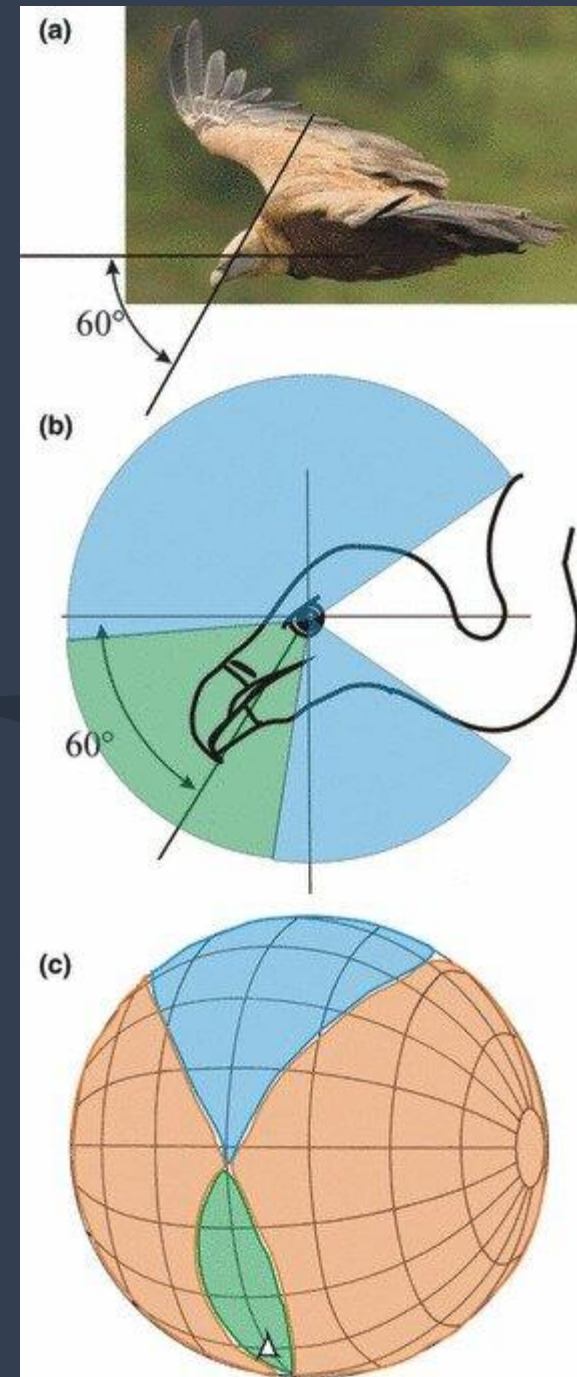
Vultures blind to the dangers of wind farms

[Ed Yong](#)

[Nature](#) (2012) | [Cite this article](#)

681 Accesses | 1 Citations | 133 Altmetric | [Metrics](#)

Collisions with turbines a result of visual adaptation for foraging.



Afastamento (*displacement*)



ÁREAS OUTRORA USADAS PARA
ALIMENTAÇÃO PASSAM A SER EVITADAS



AVES EM MIGRAÇÃO ENCONTRAM UMA
BARREIRA AO SEU MOVIMENTO

THE FIVE THREATS TO BIODIVERSITY



Land and Sea use Change

(Including habitat loss
and degradation)

Example:
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which is responsible
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Climate Change

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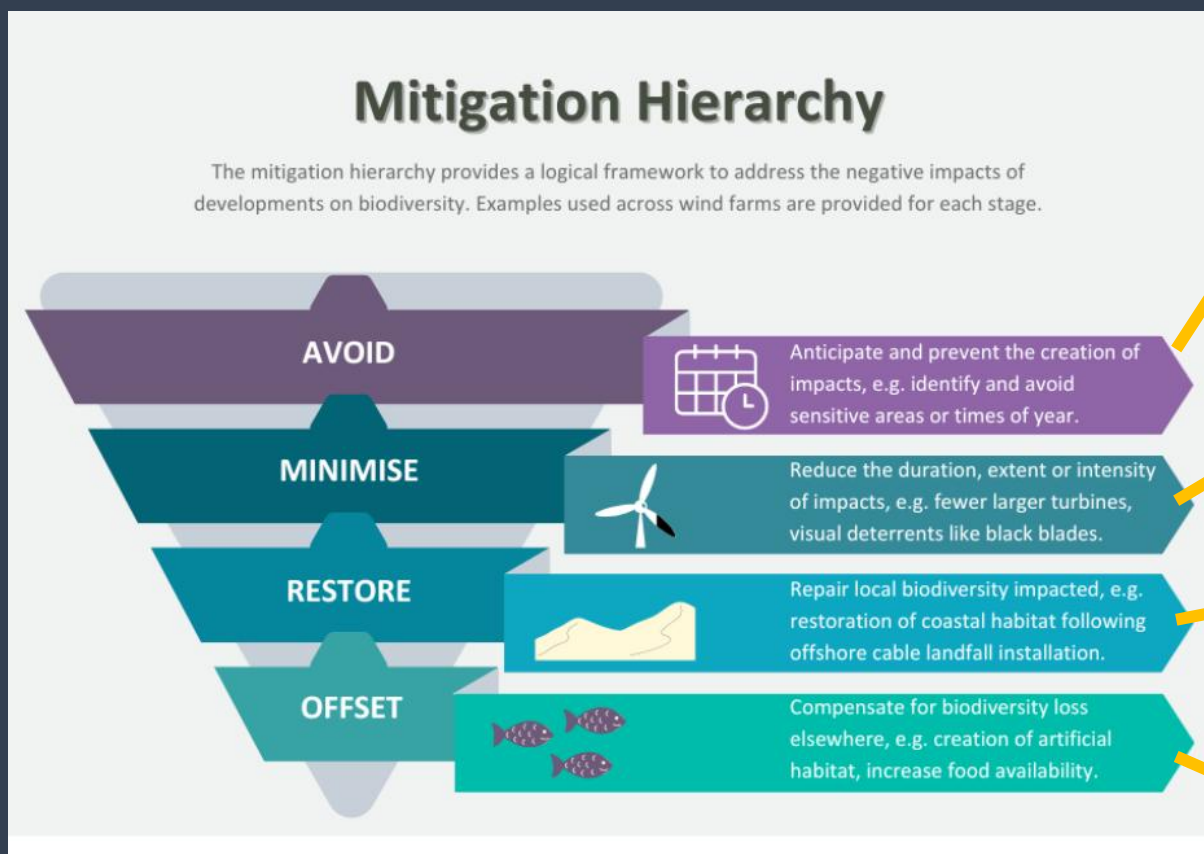


Invasive species and disease

Compete with native
species for space,
food and other
resources; sometimes
spread disease that
native species have
no immunity of

- Perda direta de habitat ou da sua qualidade
- Habitat de alimentação, reprodução, deslocação (e.g. migração)
- Diminuição sucesso reprodutor, dispêndio extra de energia

Os impactos podem ser evitados



EVITAR:
Bom planeamento,
evitar áreas sensíveis

MINIMIZAR:
e.g. Estrutura do
parque, design e
cores das turbinas

RESTAURAR:
Reparar danos

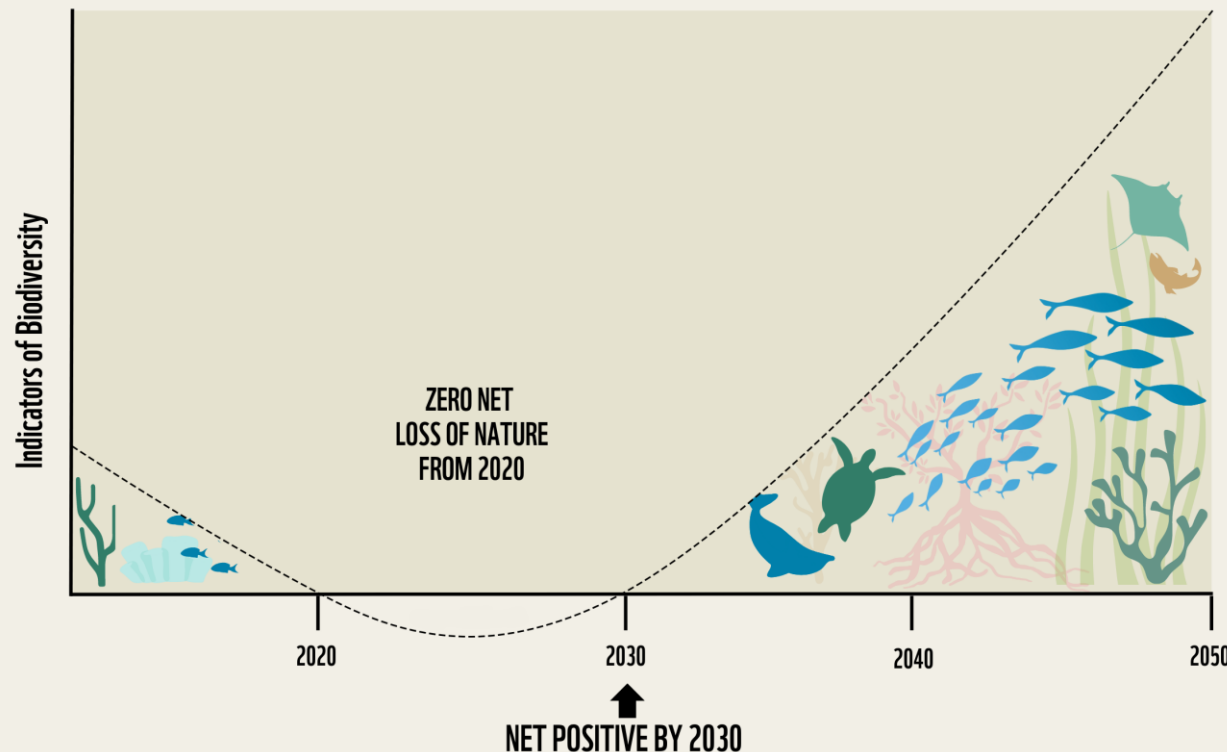
COMPENSAR:
Promover a
biodiversidade (e.g.
noutros locais)

MONITORIZAR

Conceitos de *nature positive* e *net gain*

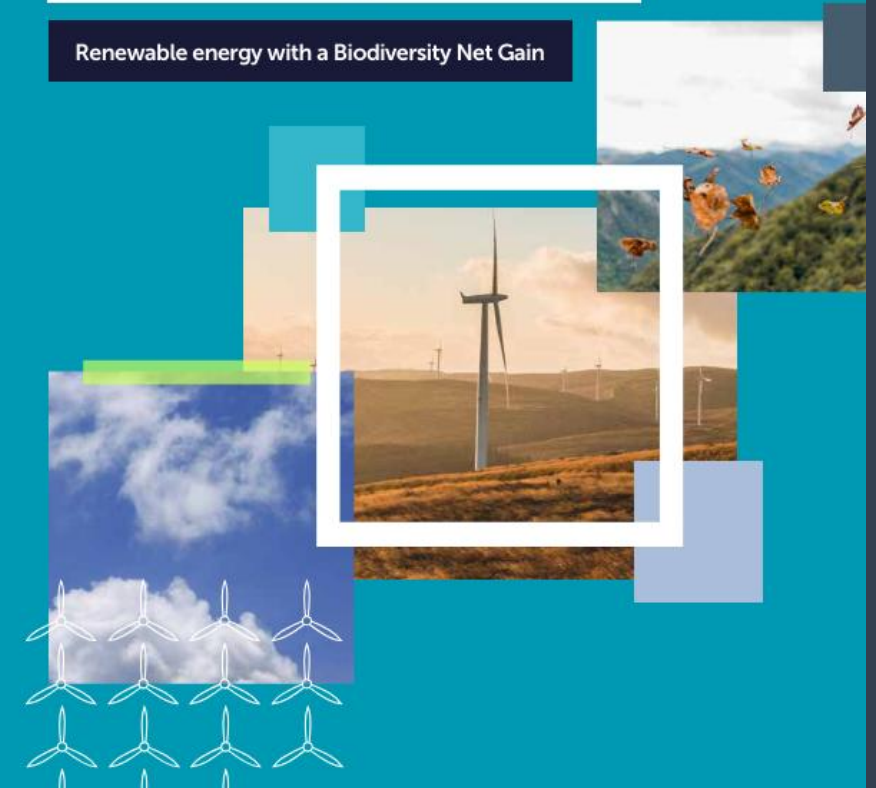


Global Goal for Nature: Nature Positive by 2030



Positive for the planet

Renewable energy with a Biodiversity Net Gain



Planear é a chave

Sensitivity mapping



BirdLife
INTERNATIONAL

Select a query geometry and then delineate the search area on the map



Enter a buffer distance and select metric

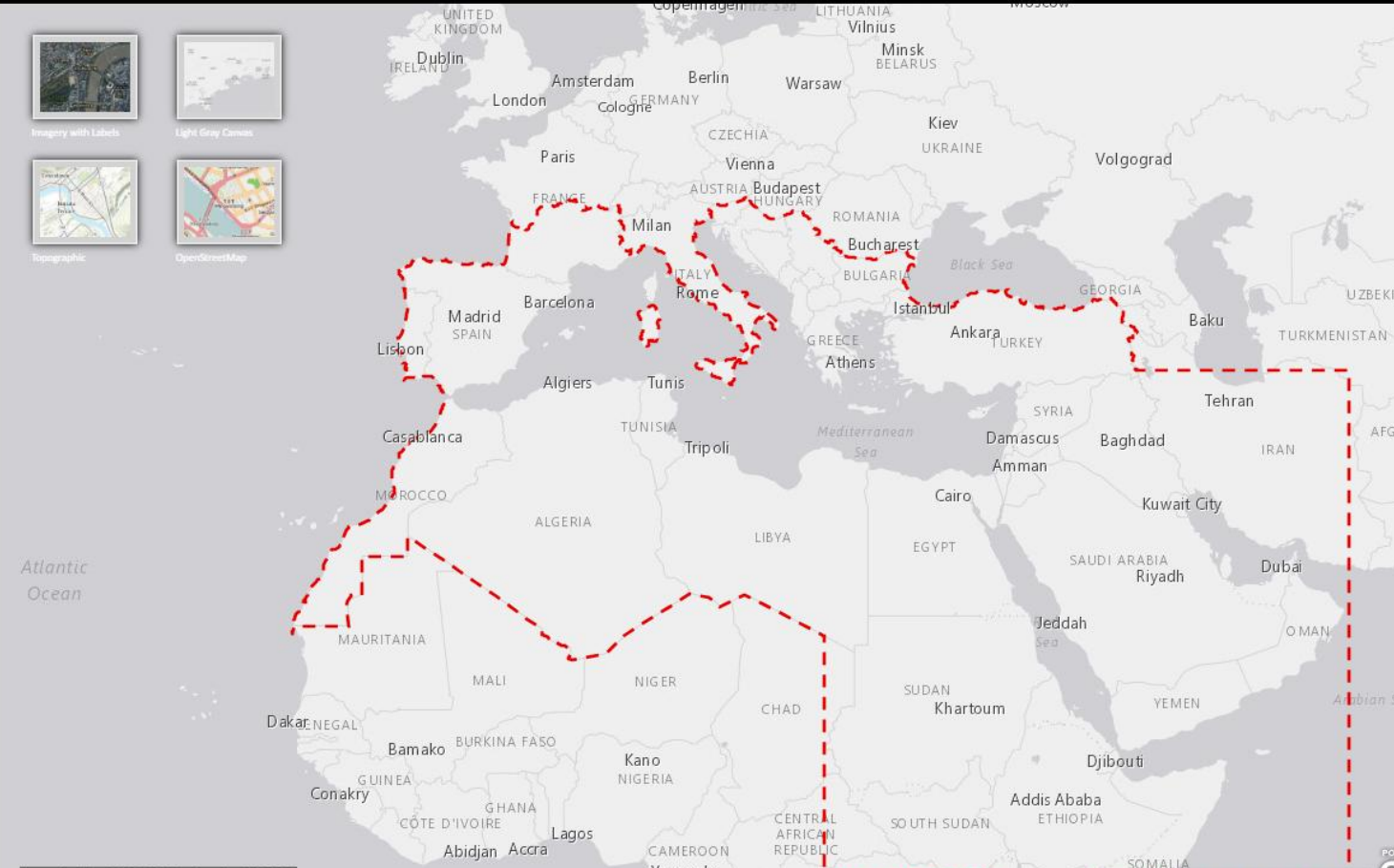
Distance: Kilometers

Enter X coordinate (longitude) in decimal degrees

Enter Y coordinate (latitude) in decimal degrees

Apply CoordinatesShow/Hide AssessmentNew Query

☒ Important Bird Areas supporting soaring birds
☒ Important Bird Areas for other birds
☒ Soaring bird observation locations
☒ Protected Areas
☒ Soaring bird satellite tracks

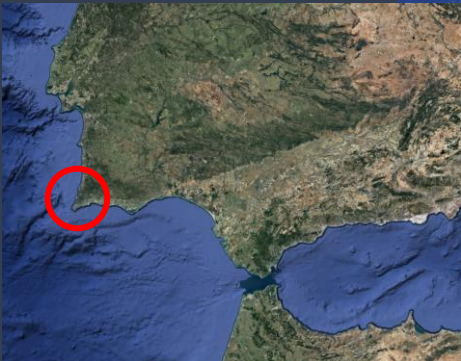


Longitude: 53.706 Latitude: 44.889

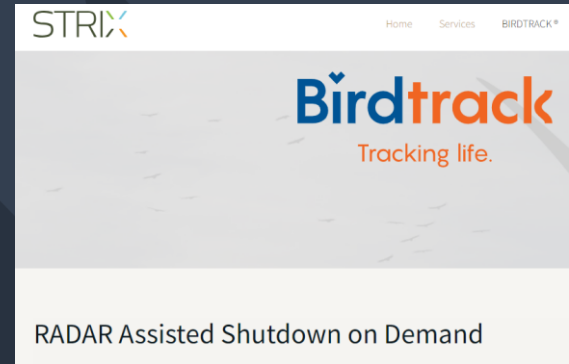
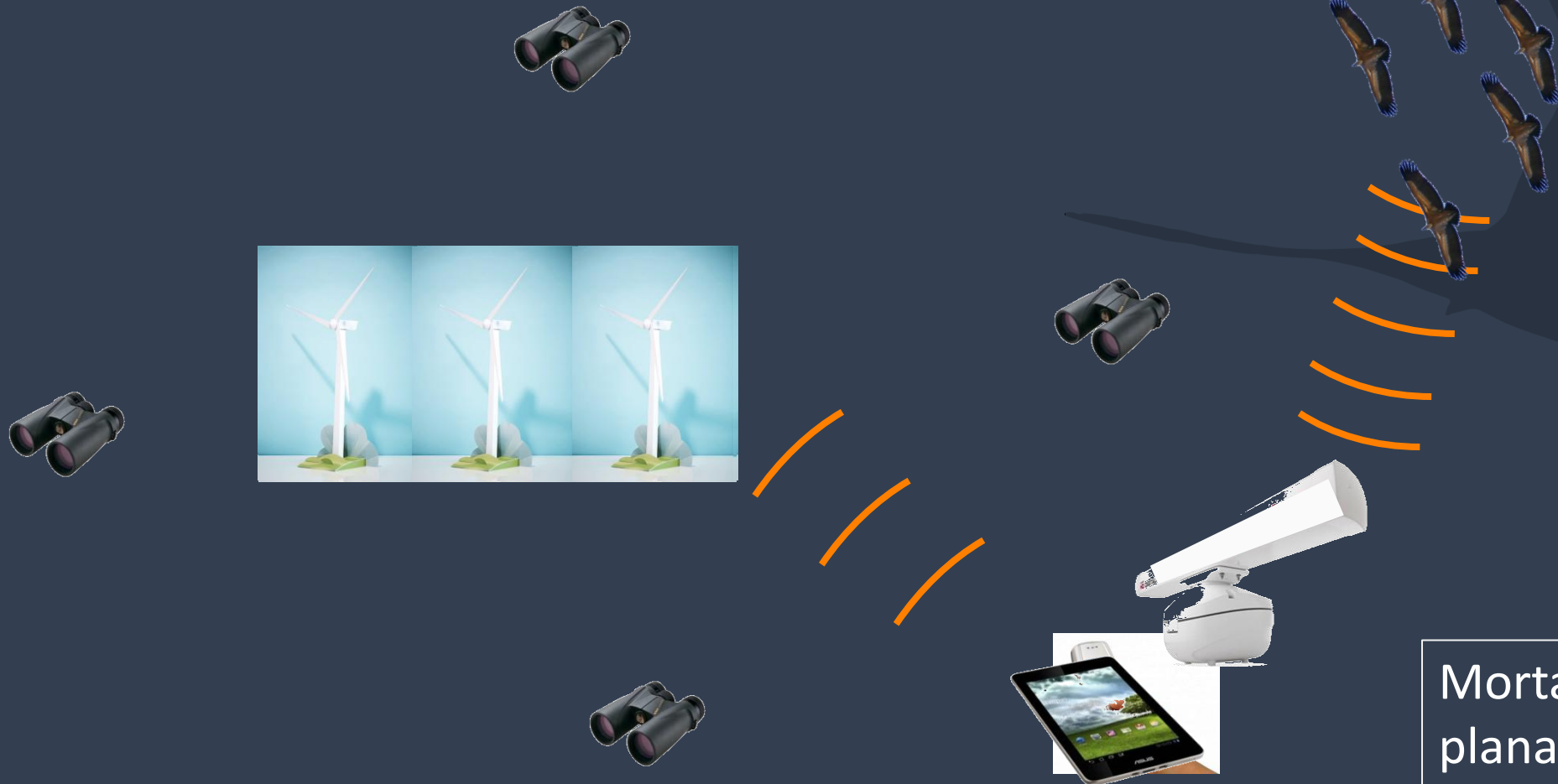
Soaring Bird Sensitivity Mapping Tool
A planning tool for wind energy and other sectors

Further Information 

Minimização: *shut down on demand*



Minimização: *shut down on demand*



Mortalidade zero de aves
planadoras (2010-2014)

Restore & offset



Conservation Letters

A journal of the Society for Conservation Biology

Open Access

POLICY PERSPECTIVE | [Open Access](#)

The biodiversity bank cannot be a lending bank

Sarah A. Bekessy, Brendan A. Wintle, David B. Lindenmayer, Michael A. McCarthy, Mark Colyvan, Mark A. Burgman, Hugh P. Possingham

On-Site

- Avoid
- Mitigate
- Enhance

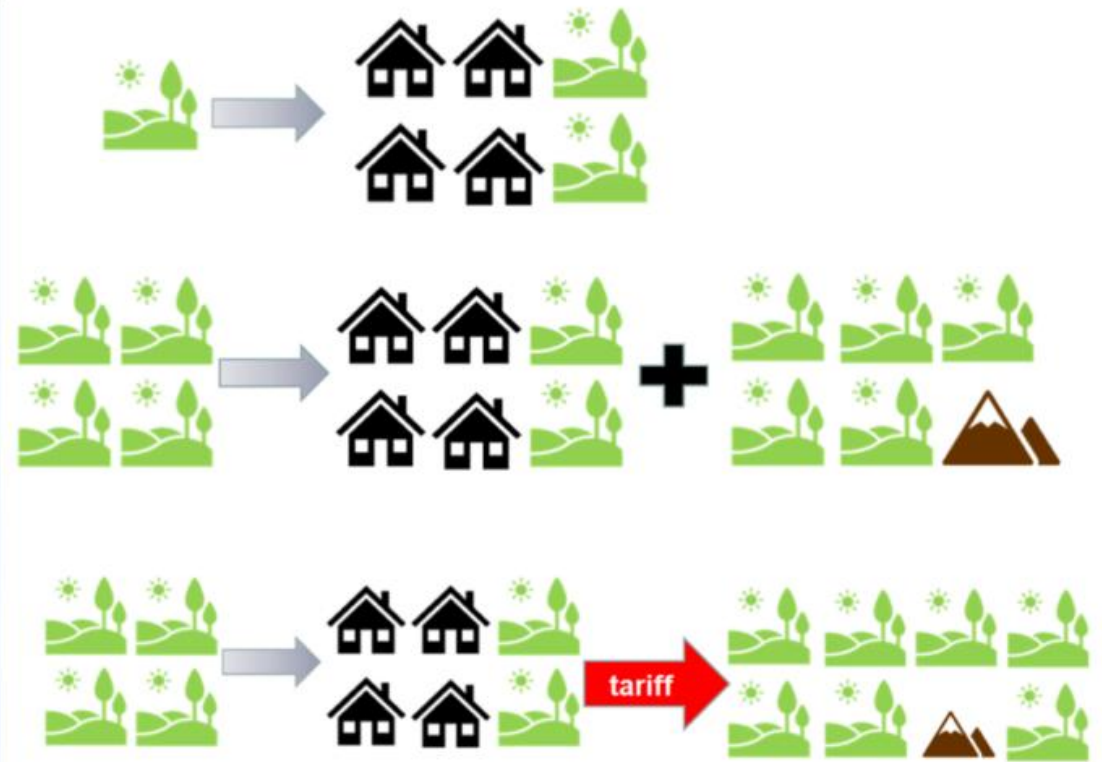
Off-site

- Local compensation

Off-site

- statutory biodiversity credits to fund habitat creation according to local and national conservation and natural capital priorities

Mitigation Hierarchy



As eólicas *offshore* em Portugal

Mapping seabird and marine biodiversity sensitivity to marine wind farm expansion in Portugal



João L. Guilherme, Beatriz Morais, Hany Alonso, Joana Andrade, Ana Almeida, Nuno Barros & Maria P. Dias*



Apoio:



OCEANO AZUL
fundação

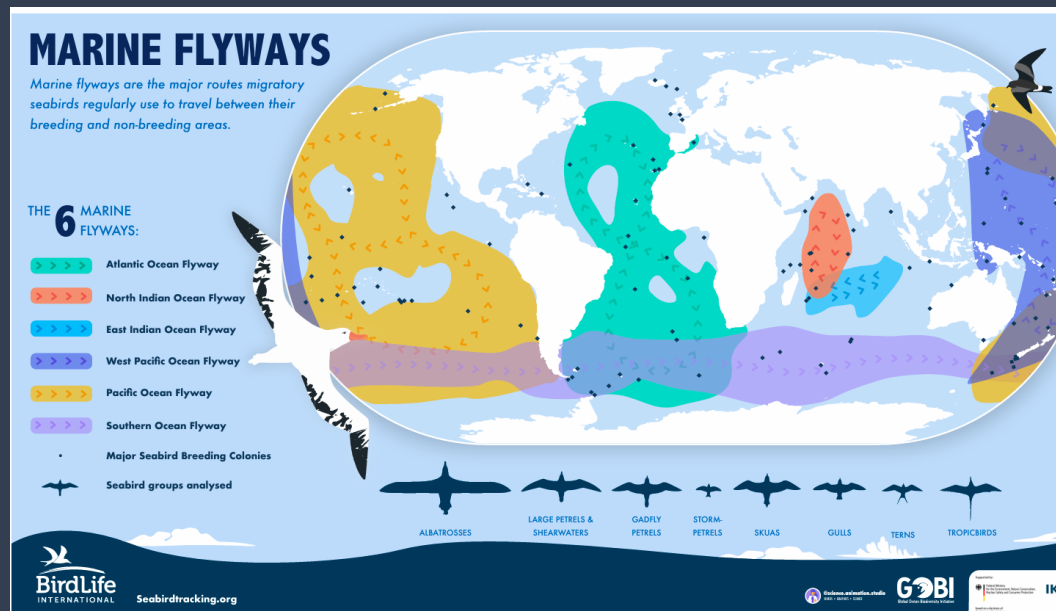


Fundação
para a Ciência
e a Tecnologia
UIDB/00329/2020

A importância de Portugal para as aves marinhas

Portugal está localizado no centro de duas grandes rotas migratórias de aves marinhas e costeiras:

- East Atlantic Flyway
- Atlantic Ocean Marine Flyway



A importância de Portugal para as aves marinhas

Ocorrem com regularidade cerca de 70 espécies de aves marinhas e costeiras

Algumas das espécies em risco de extinção

Populações inteiras de algumas espécies de aves cruzam as nossas águas



A importância de Portugal para as aves marinhas

As aves marinhas: 1/3 das espécies em risco de extinção

Bycatch nas
pescas

Espécies
invasoras
(gatos e ratos)

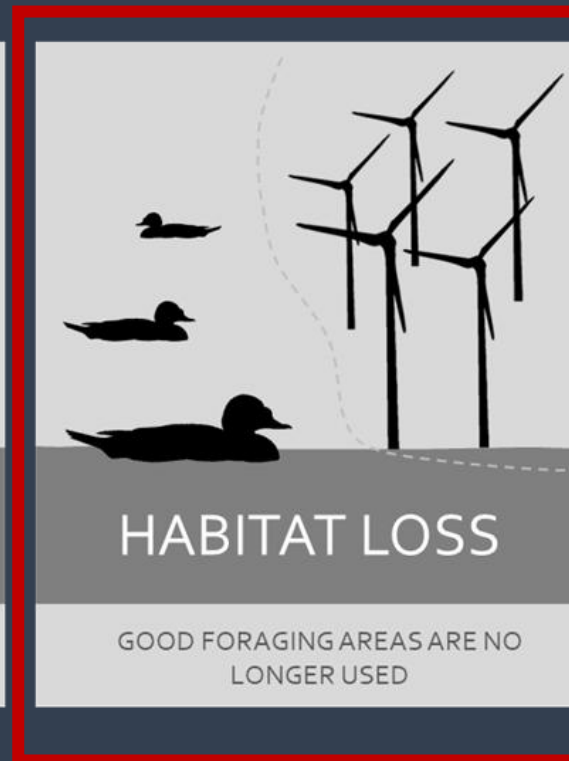


Eólicas: um
problema
emergente

Poluição,
alterações
climáticas

As eólicas *offshore* e as aves

Estudos no Norte da Europa: confirmam efeito de mortalidade e *displacement*



Muito difíceis de avaliar no mar

Parecem ser os mais relevantes para as aves marinhas

Como detetar a colisão no mar?

Radares

Sensores de colisão

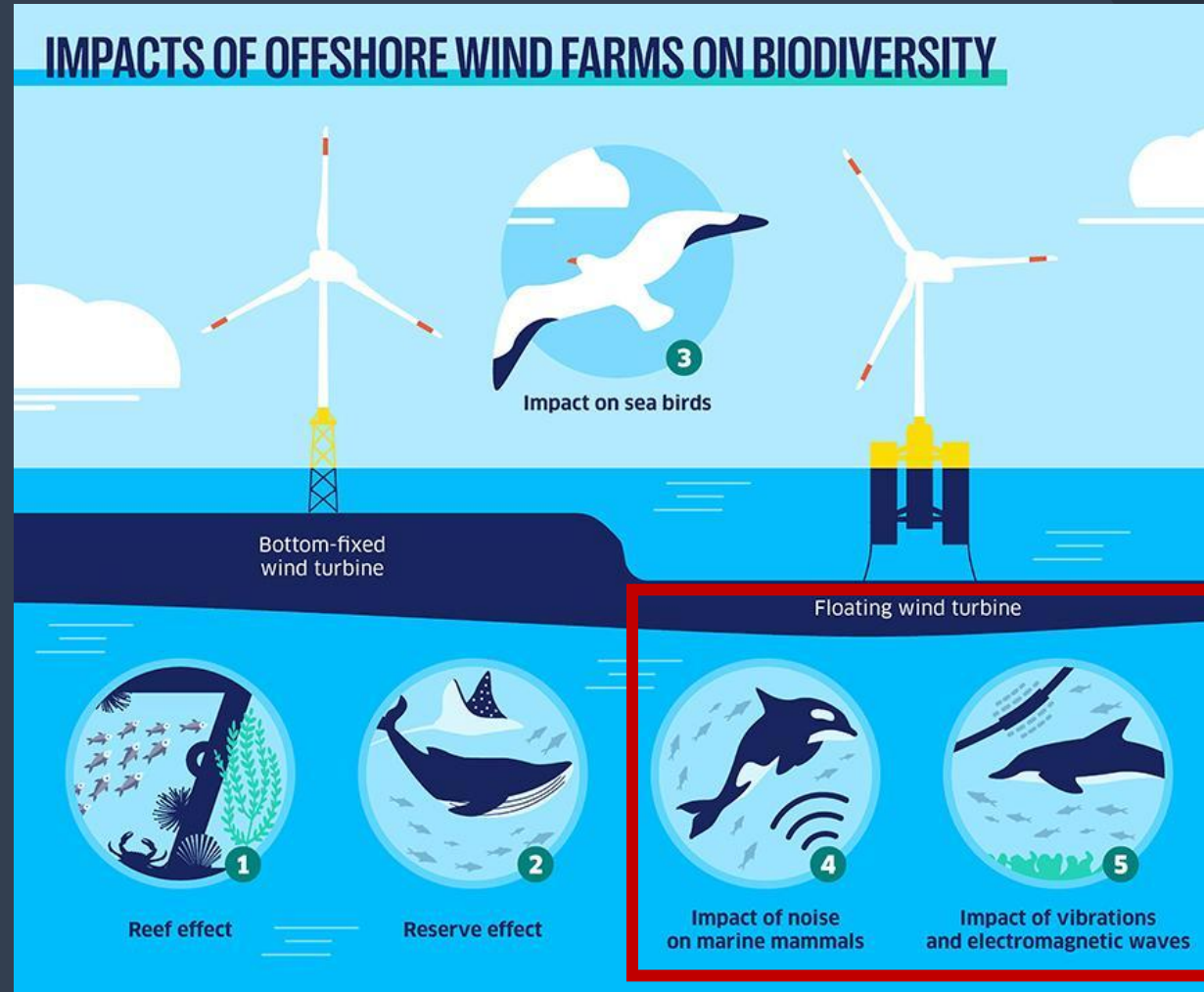
Como evitar



As eólicas *offshore* e biodiversidade

Positivos

- Efeito "recife"
- No take zone (Área Protegida Marinha)



Negativos

- Aves marinhas
- Mamíferos marinhos

A expansão dos parques eólicos *offshore* em Portugal

Sensitivity mapping



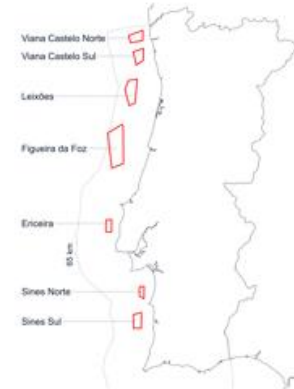
Shorebirds at sea



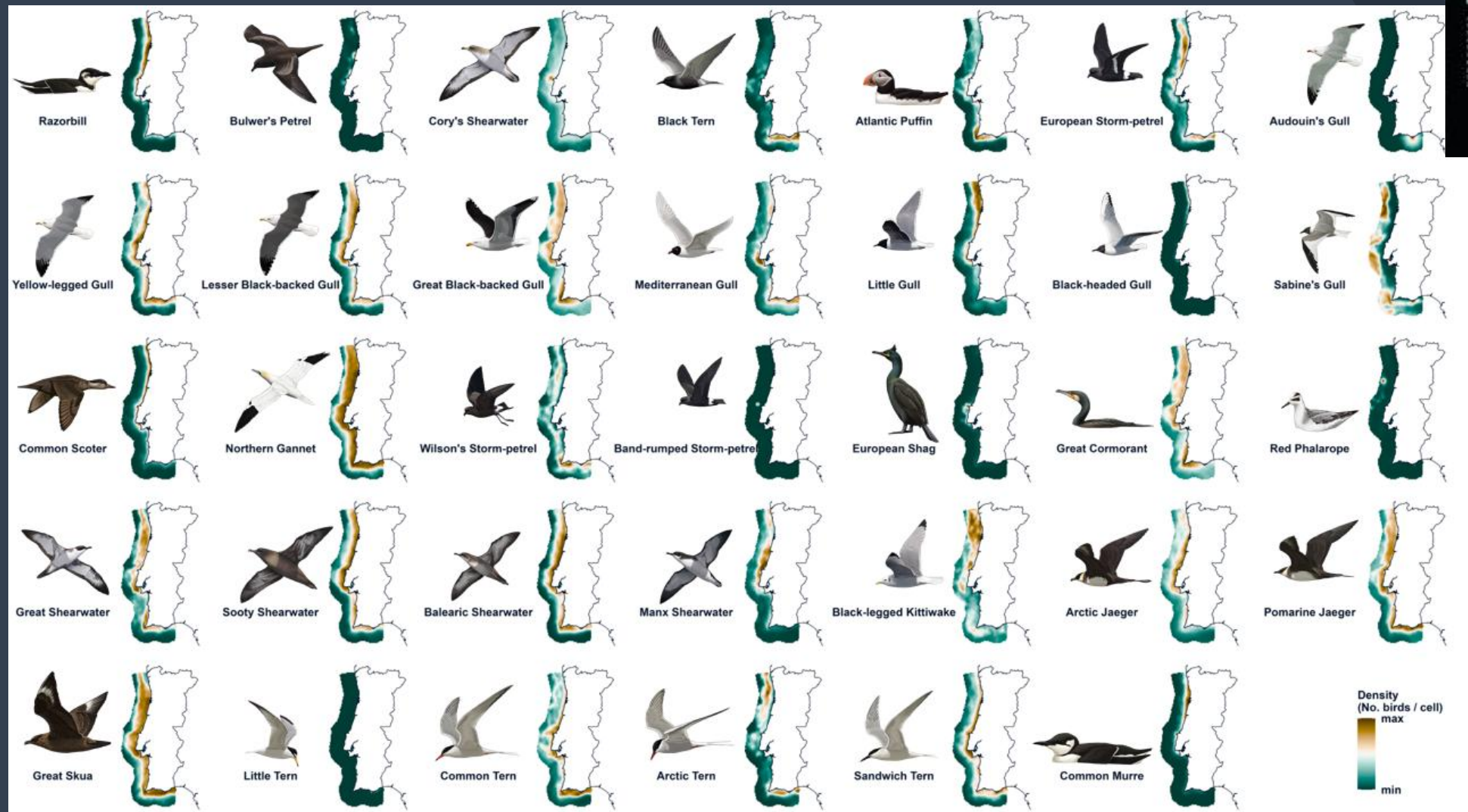
Marine mammals



Protected areas



Sensitivity mapping



34 espécies

Sensitivity mapping

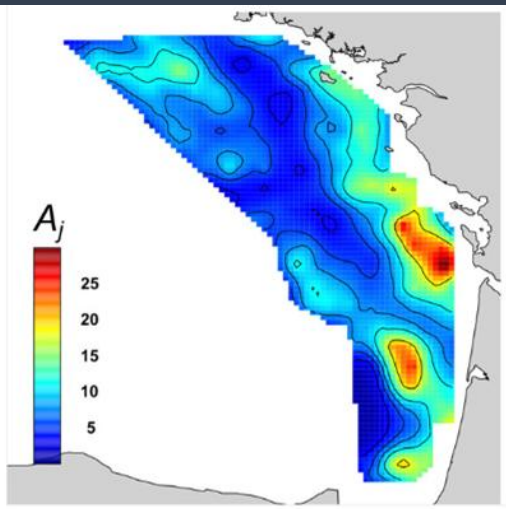
OPEN ACCESS Freely available online

PLOS ONE

Mapping Seabird Sensitivity to Offshore Wind Farms

Gareth Bradbury^{1*}, Mark Trinder², Bob Furness², Alex N. Banks³, Richard W. G. Caldow³, Duncan Hume⁴

¹Wildfowl & Wetlands Trust (Consulting) Ltd., Slimbridge, United Kingdom, ²MacArthur Green, Glasgow, United Kingdom, ³Natural England, Exeter, United Kingdom, ⁴Marine Management Organisation, Newcastle, United Kingdom



x Species Sensitivity Index (SSI)

Journal of Environmental Management 119 (2013) 56–66

Contents lists available at SciVerse ScienceDirect

Journal of Environmental Management

journal homepage: www.elsevier.com/locate/jenvman



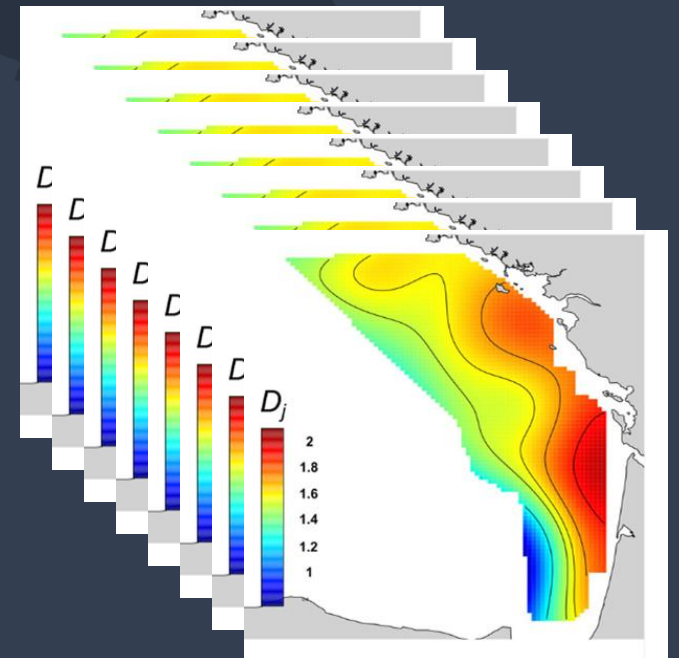
Assessing vulnerability of marine bird populations to offshore wind farms

Robert W. Furness^{a,b,*}, Helen M. Wade^c, Elizabeth A. Masden^c

^aMacArthur Green Ltd, 95 South Woodside Road, Glasgow G20 6NT, UK

^bCollege of Medical, Veterinary and Life Sciences, University of Glasgow, Glasgow G12 8QQ, UK

^cEnvironmental Research Institute, Centre for Energy and the Environment, North Highland College, University of the Highlands and Islands, Ormlie Road, Thurso, Caithness KW14 7EE, UK



Sensitivity mapping

Species Sensitivity Index (SSI)



Collision Vulnerability

- .Time flying at collision risk
- .Time flying at sea
- .Nocturnal flight activity
- .Flight maneuverability

Collision Sensitivity Index (CSI)



Conservation score

- .Global
- .European
- .National



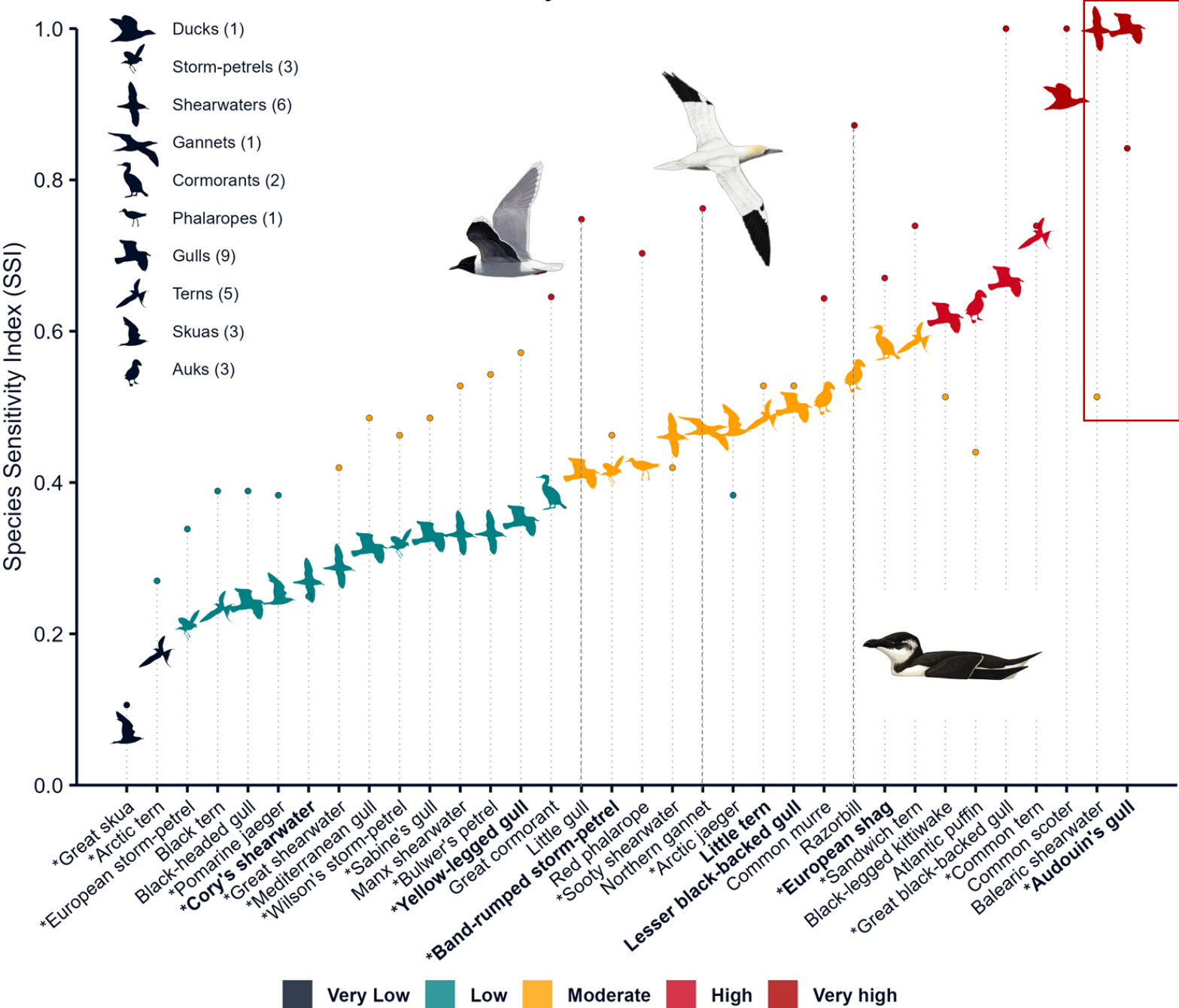
Displacement Vulnerability

- .Disturbance by wind farms
- .Disturbance by boats
- .Habitat flexibility

Displacement Sensitivity Index (DSI)

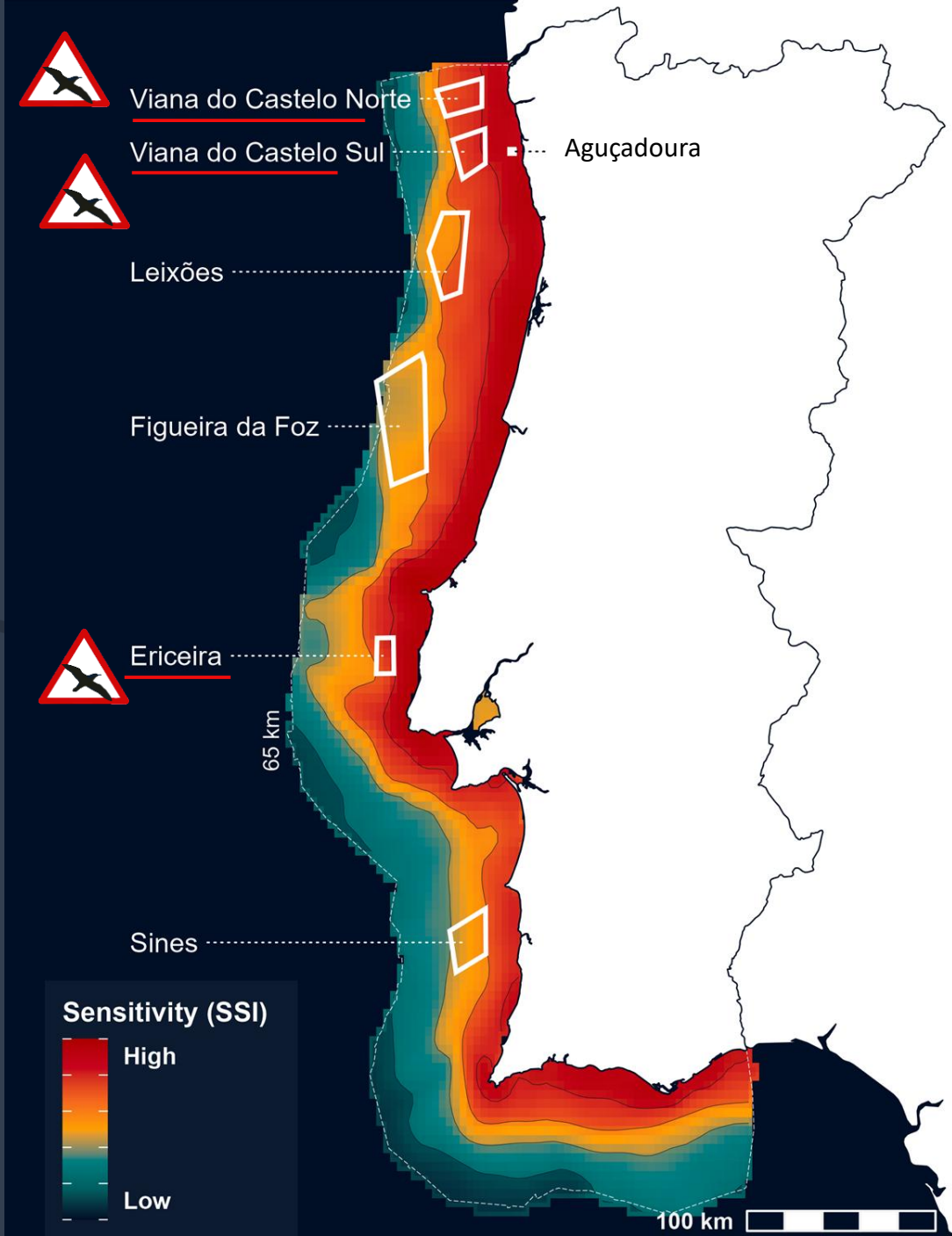
Species Sensitivity Index (SSI) = $\max$ (CSI, DSI)

Seabird sensitivity to marine wind farms



Mapa das zonas mais sensíveis na costa portuguesa

- Informar decisões sobre localização e delineamento de novos empreendimentos
- Linhas orientadoras para Estudos de Impacto Ambiental
- Identificar lacunas de conhecimento
 - Estruturas de apoio na costa
 - Aumento do tráfego marinho



Fundamental compreennder os impactos locais

Before

After

Long-term monitoring



<https://blog.youwindrenewables.com/>

BACI

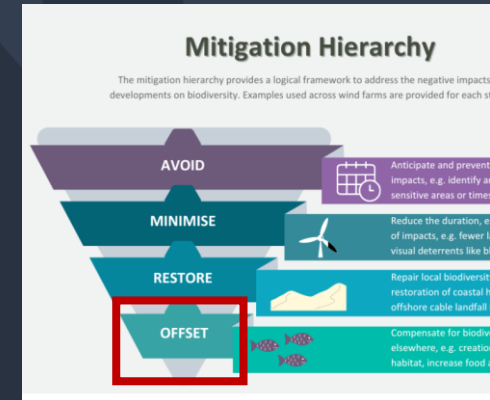
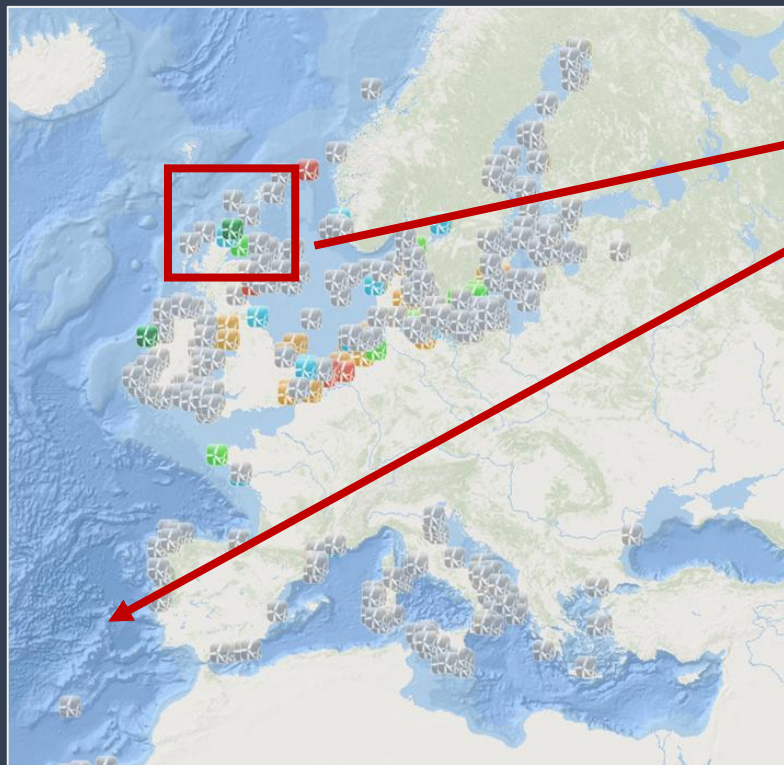
*Before-After-
Control-Impact*

MONITORIZAR

Fundamental compreender os impactos cumulativos

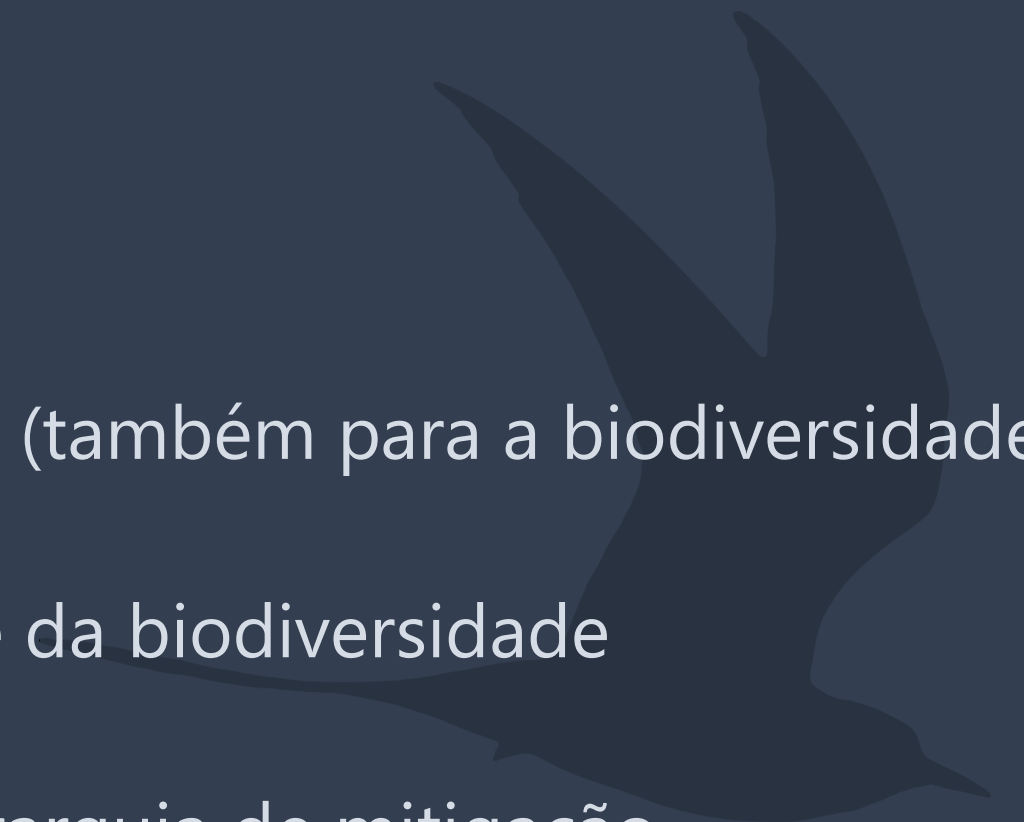
Dos vários parques
(rota migratória)

Com outros impactos



Em resumo



- Transição energética é essencial (também para a biodiversidade!)
 - Pode ser feita sem piorar a crise da biodiversidade
 - Soluções existem – seguir a hierarquia de mitigação
 - Muitos dos impactos são evitáveis com um bom planeamento – sai também mais barato a longo prazo
- 

Obrigada pela vossa atenção

Dúvidas?

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