Collision mortality minimization in powerlines
Comparing anti-collision devices

"Avifauna Protocols": 2003-2018

Cooperation between EDP Distribuição, Forest and Nature Conservation Institute, and 3 NGO's: SPEA, Quercus and LPN.

Objectives:

● to know the situation of powerline impact on birds in Portugal

● research for black spots in bird mortality

● mitigate the impact of powerlines

● to prevent impacts from new powerlines

Projecto
Linhas Eléctricas e Aves

Julieta Costa
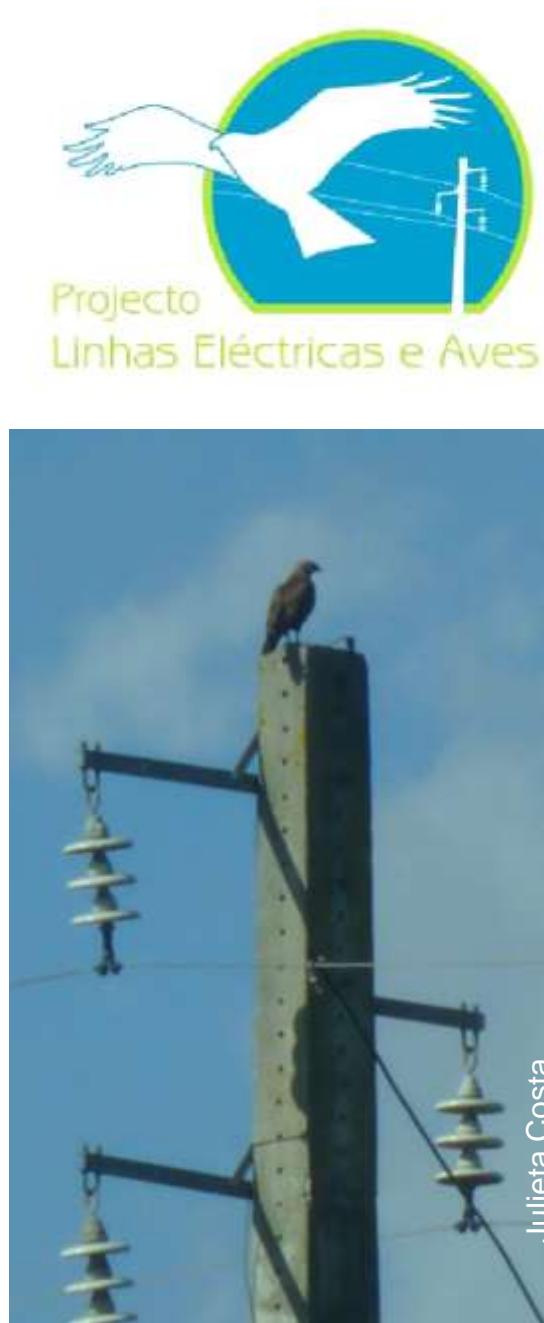
CTALEA:
Technical Commission for Powerline Follow-up

• **EDP Distribuição : president**

• **ICNF – Environmental Authority**

• **NGO's – SPEA, Quercus and LPN**
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•**Discussion and innovation forum**

•**Issued internal norm for powerline minimizationn and planning**

•**Discussed ICNF Guidelines for powerline impact assessment and mitigation**
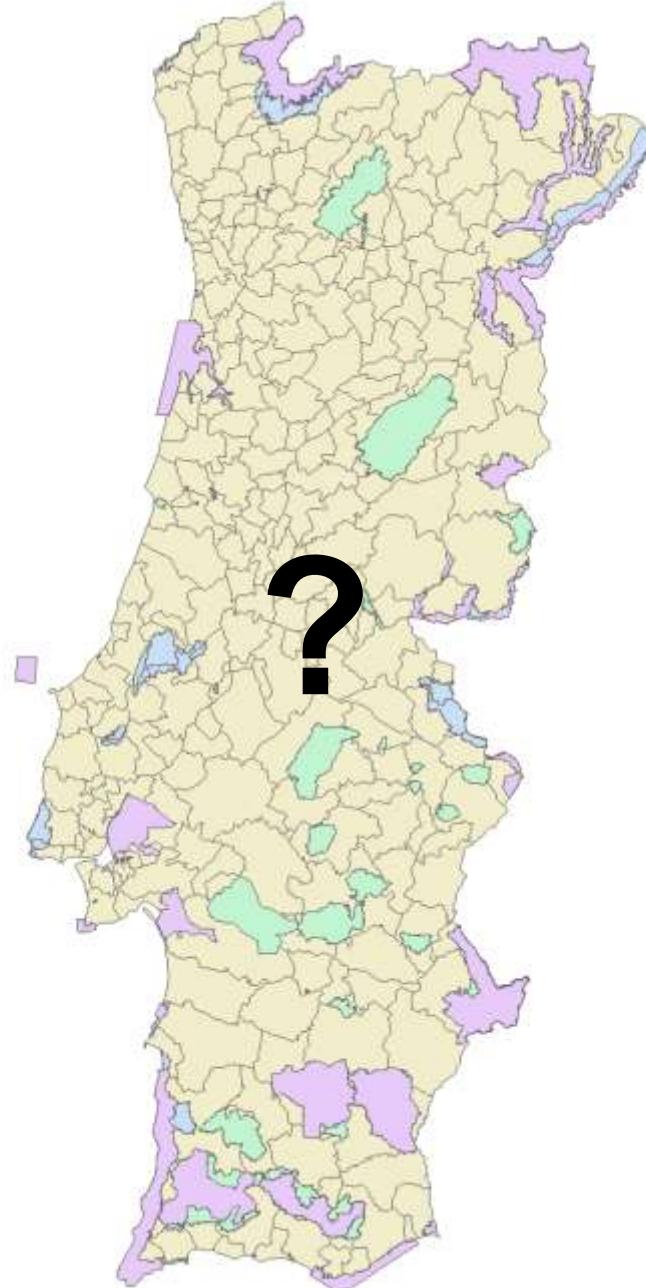
2003
situation in Portugal

- scarce information from some Protected Areas

- need to make a national level evaluation

- 8,555 km powerlines medium and high tension in Natural Parks

How does collision happens?
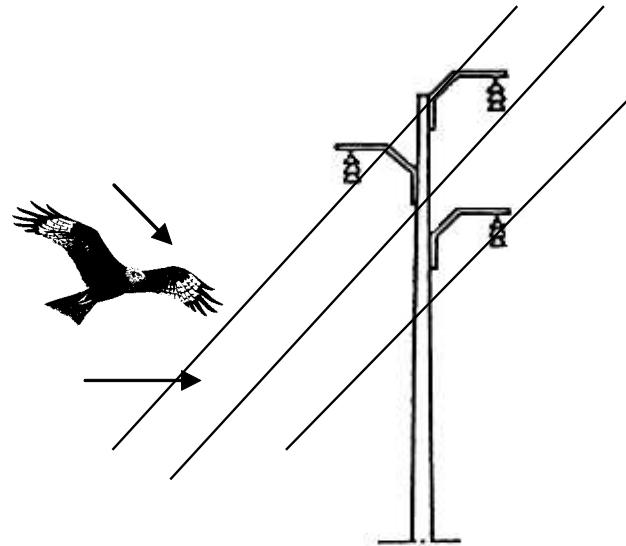
collision with conductor wires in all tensions.
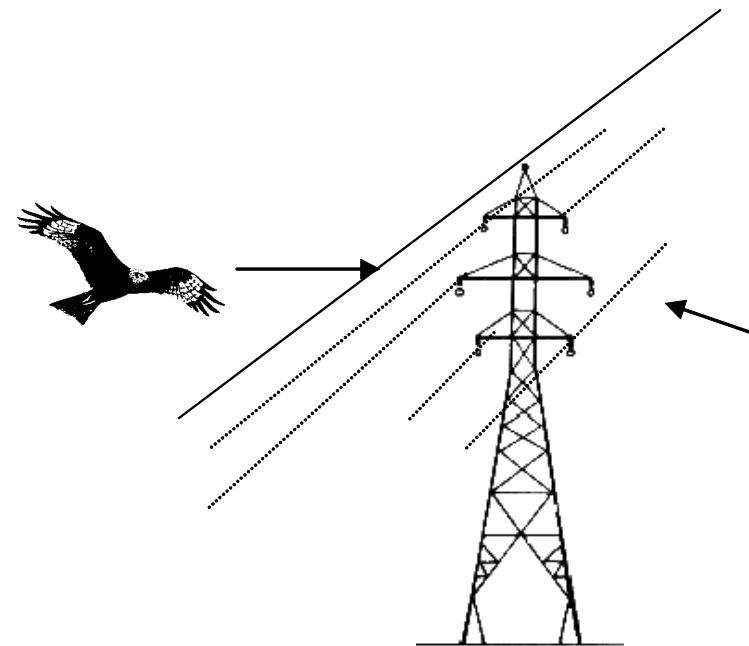
collision with upper wires or conductor wires in high and very high tension

External signs of collision

Phoenicopterus ruber IBA Mondego

Turdus philomelus PNSE

Pluvialis apricaria ZPE Castro Verde

Environmental factors

- fog
- orography
- habitats
- cross-arm tipology

Biological factors

- morfology
- ecology
- age and season

number of collision levels: mortality

3-level powerline

Delta configuration: medium- and high-tension   Vertical configuration
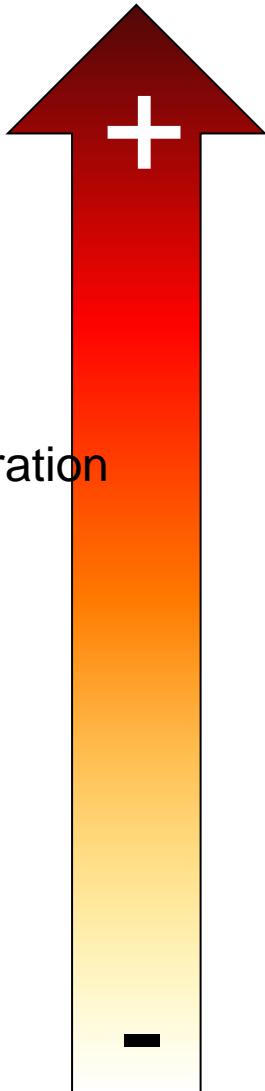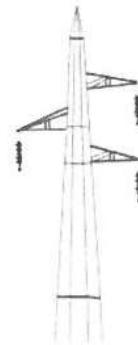
2-level powerline
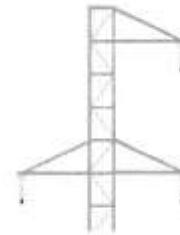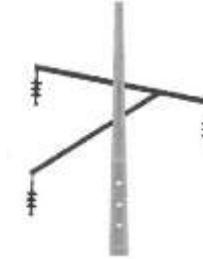
triangular   Half - N   canadian

1-level powerline

+

−

Habitats: mortality

- Scrubland

- Forest

- Agricultural patchy land

- Inland waters

< 3 ind./km

- Dry cereal land - steppeland

- Coastal waters
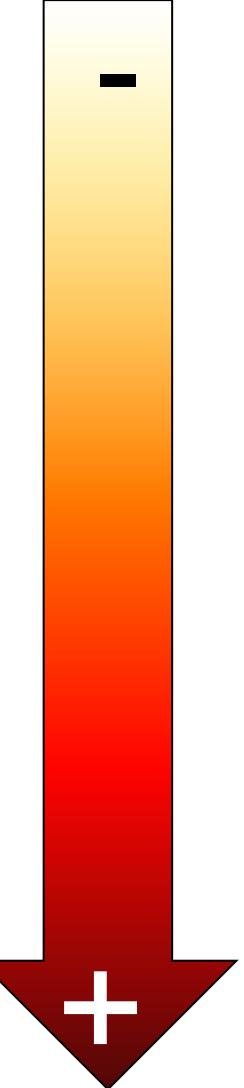
> 5 ind./km

−

+

Kruskal-Wallis test

Field methods; Standard methods (Scott *et al.*1972, Rensen *et al.*1975)

20 m wide

Line and pylon prospection

- 2 observers

- Walk at 2 km/h speed

- Zig-zag walk

- Look carefully at the ground

- Survey a width of 20 m along the line

- Collect and record birds, feathers and bones

Signs of bird mortality

carcasses

bones

feathers

• Feather identification guide:
Tracks and Signs of the Birds of Britain and Europe, de Roy Brown e*t al*, 2003

• Feather sites:
The feather Atlas for de Birds of the Western Palearctic

• Reference bone collection of the Archeo zooscience laboratory - Lisbon

Data Treatment: Lab

Anas platyrhynchus

Bone cleaning

- Carcass Boiling

- Scattering

- Enzimatic bath

- Cetone bath

- Hydroperoxide bath

- identification

Real Mortality Rate: calculation *

| Factor de erro	Factor de correcção
% that dies out of the suveyed area (MAP)	*2,0*
Factor of error from the observers (TPE)	*1,02 / 1,09 /1,15*
Dead birds taken by predators(RPN)	*2,22 /1,32*
% birds not found due to decay(NEO)	*1,56*

* Neves & Infante, 2005

$$TMR = TMO \; x \; \frac{1}{TPE} \; x \; \frac{1}{MAP} \; x \; \frac{1}{(1-NEO)} \; x \; \frac{1}{(1-RPN)}$$

TMR – Real Mortality Rate ; TMO – Observed Mortality Rate

Dangerousness Criteria for powerlines

|		Protected Area	km
A	Within an IBA or SPA	Évora	10
		Caia	14.0
B	Mortality of priority species	Douro Internacional	20.5
		S.ª Estrela	4.0
C	Mortality of priority species repeated	Tejo Internacional	3.0
		S.Mamede	7.0
D	Near high concentrations or nesting places	Estuário do Tejo	8.0
		Castro Verde	8.9
E	Cross habitats suitable for priority species	Vale Guadiana	17.0

Neves & Infante, 2005
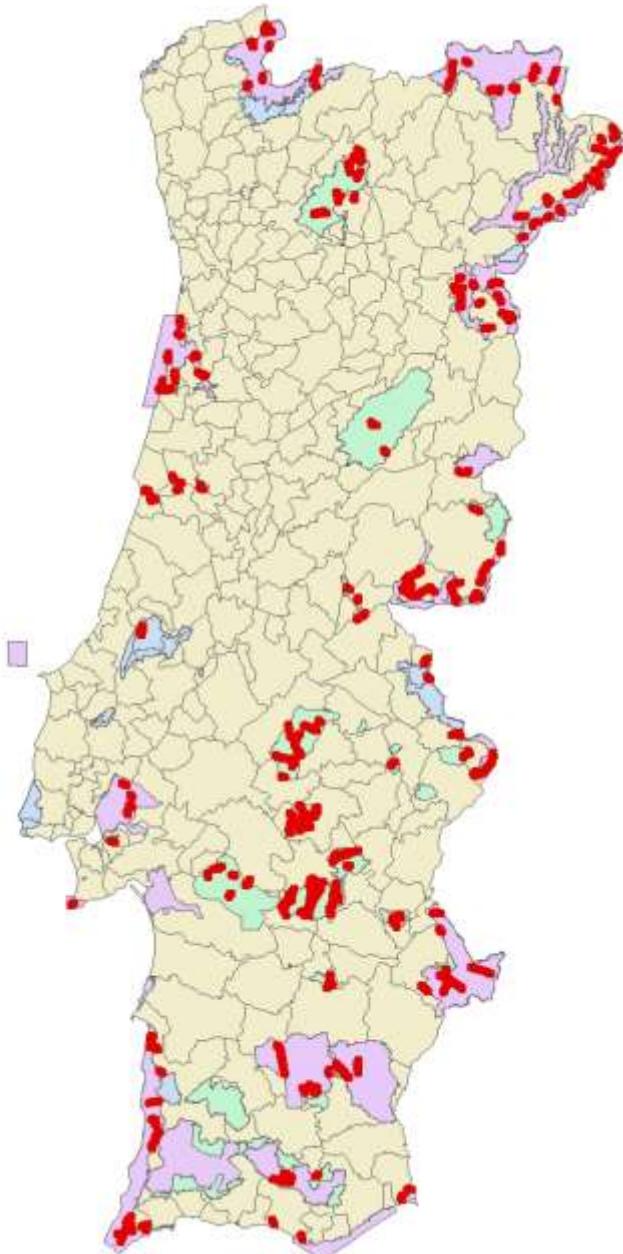
2018

\> 1400 km powerlines surveyed for collision

almost all Nature 2000 sites and natural Parks and reserves surveyed (SPA;IBA;Protected Areas)

450 km powerlines corrected

20% powelines in Classified Areas were surveyed

Ria Aveiro
11,95 ind./km

Madriz Pond
10,8 ind./km

Mondego estuary
11,6 ind./km
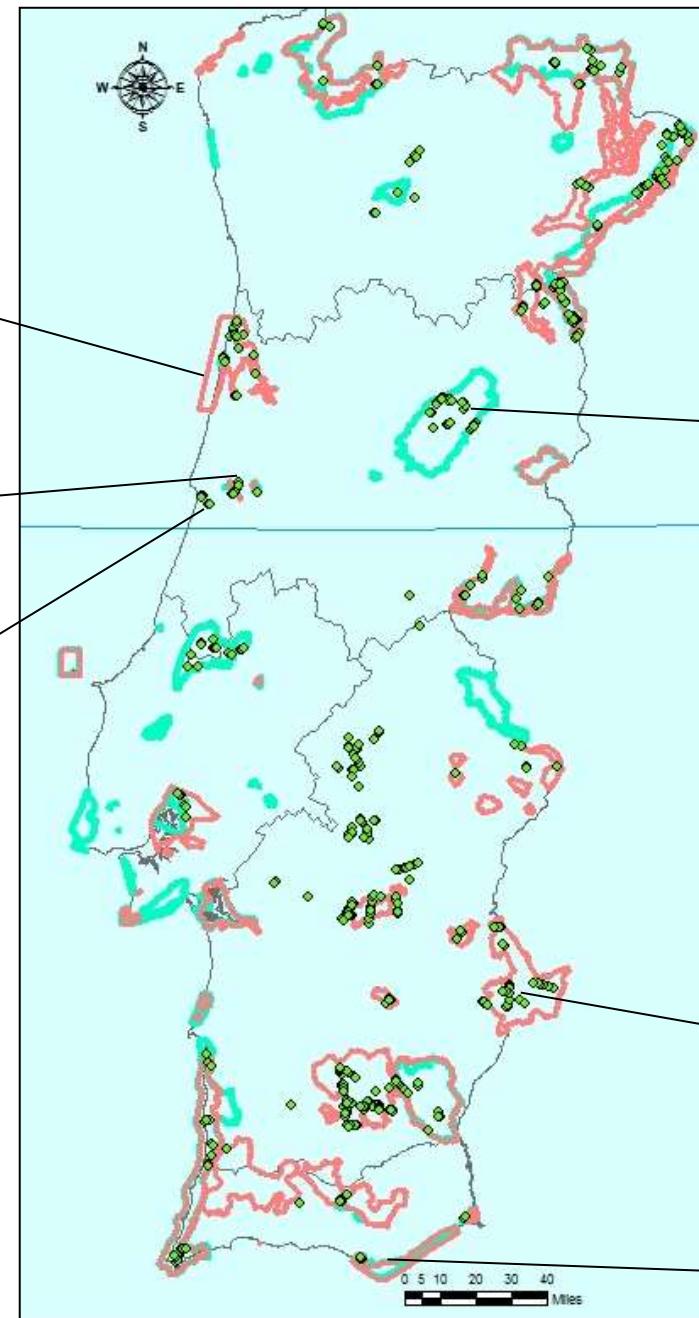
**Average mortality
3,27 birds/km/year**

Serra da Estrela
13,26 ind./km

Moura, Mourão, Barrancos
9,3 ind./km

Ria Formosa
19,4 ind./km

Many collisions are due to:

- Storks
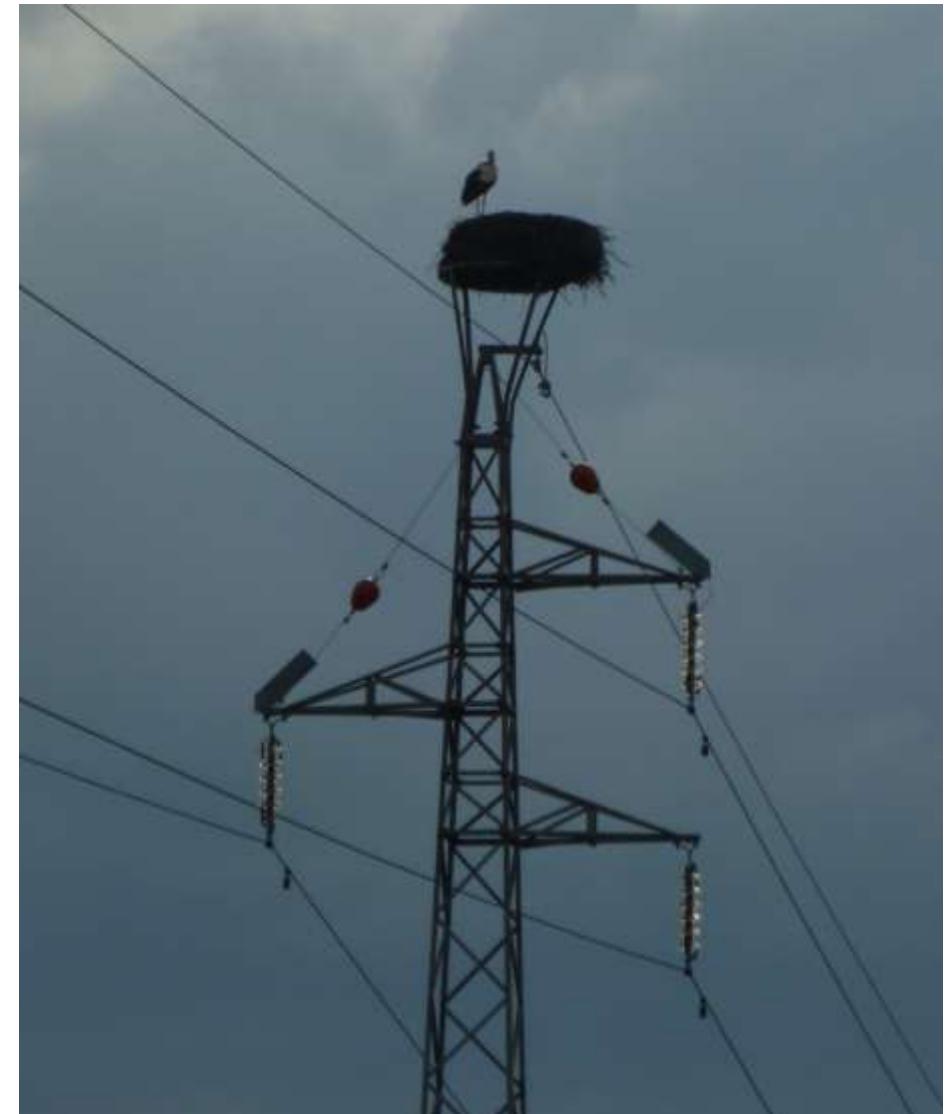
•**Birds that fly in flocks: lapwing, partridges, waders, doves, etc.**
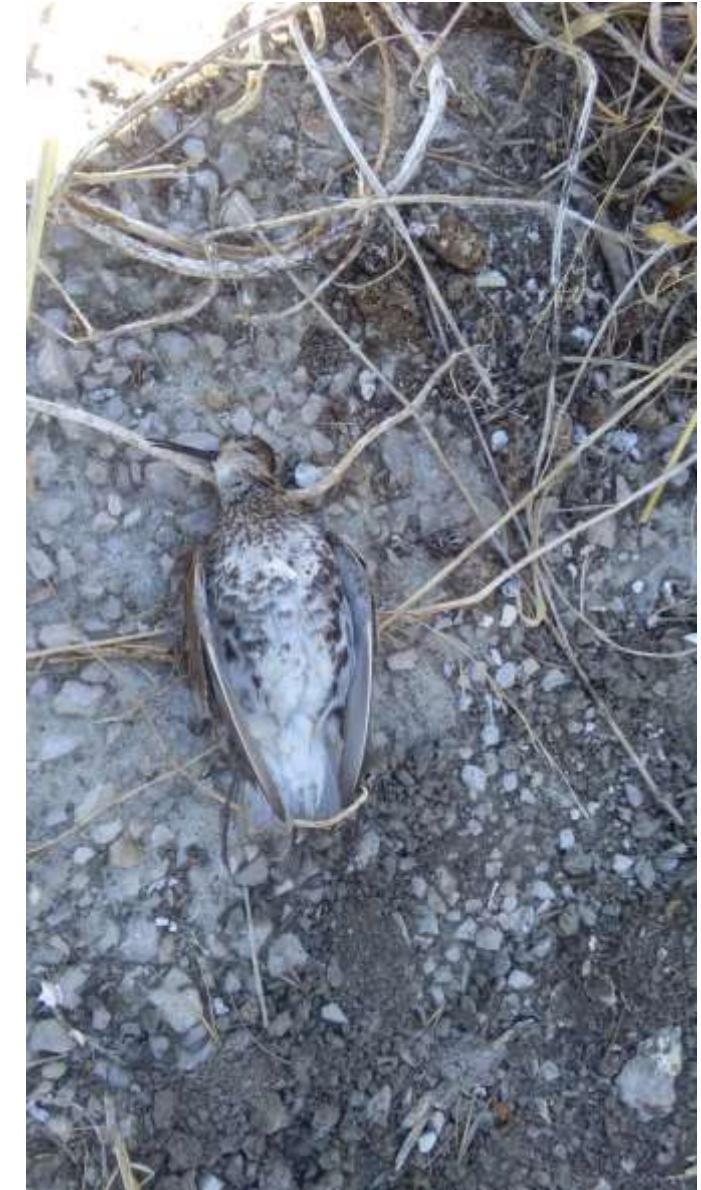
•**Passerines**

Action & Results

Numbers

- **2200** aves mortas

- **1460** km percorridos

- **462** km de linhas corrigidas

New way of powerline planning

- Internal Norm EDP Distribuição (2010)

- ICNF Guidelines for the evaluation of the impact of powerlines on Birds and its Mitigation (2010, under revision)

Collision: species

- **Higher species mortality:**

  - pigeon
  - Domestic dove
  - Red partridge
  - Corn bunt
  - Cattle egret
  - Song trush
  - White Stork

- **Annex I priority birds:**

  - Great Bustard
  - Little Bustard
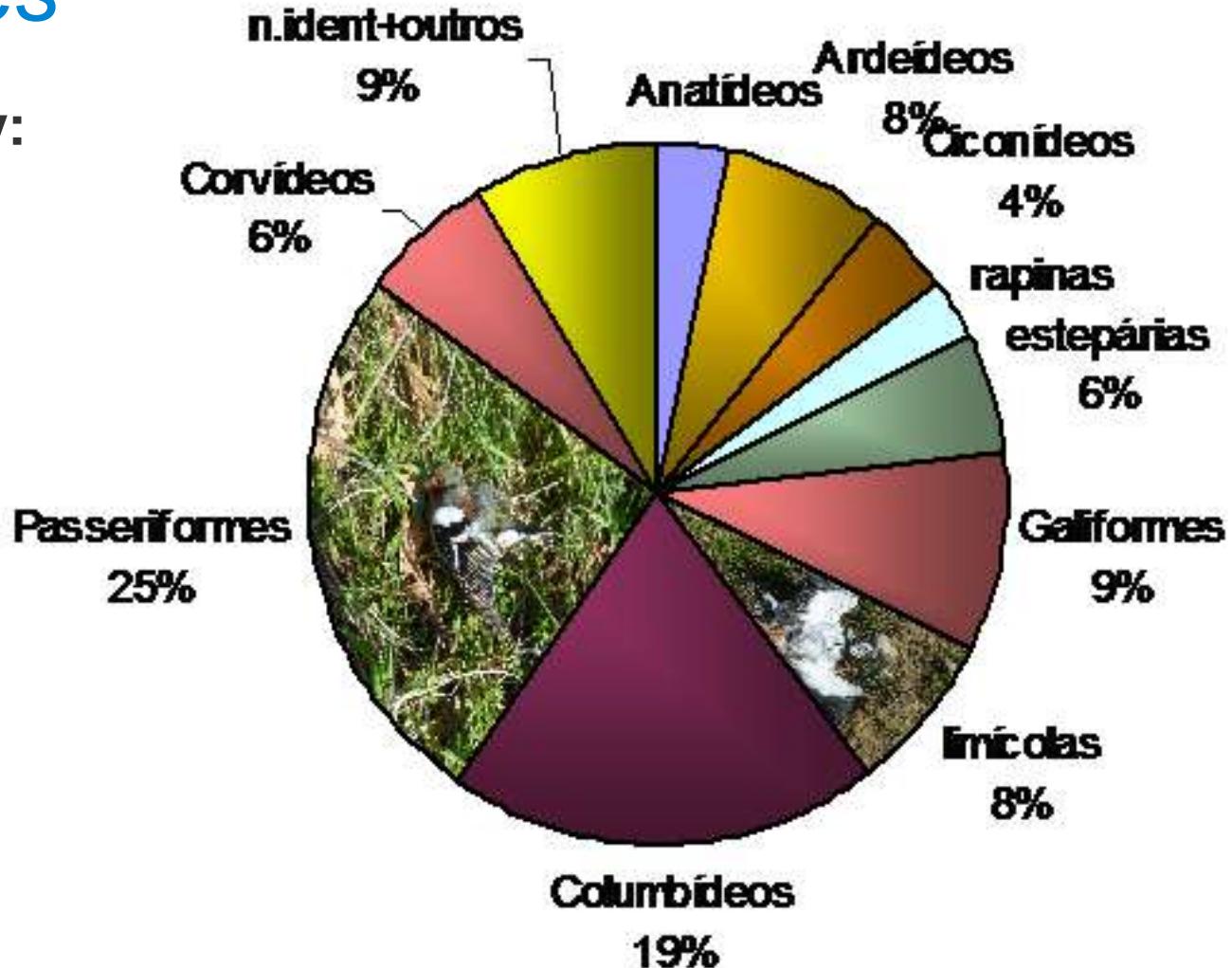
IMPACT Mitigation

First devices (2005): pigtails


Grey single spirals
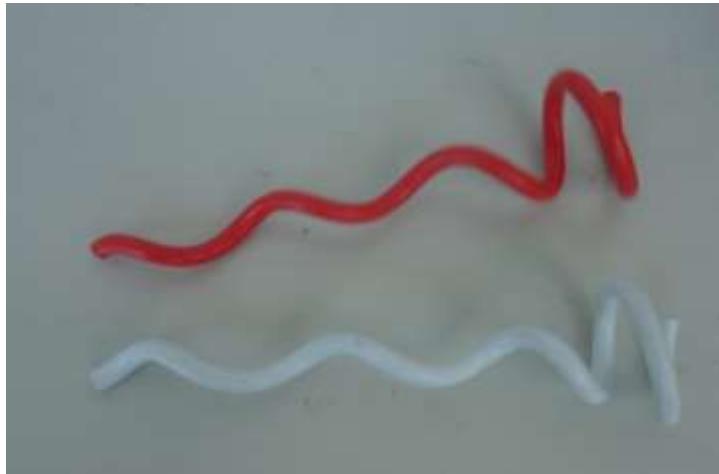
Red and white single spirals

- Not very visible
- Low efficacity

IMPACT Mitigation

"new technologies" and double spirals: 2009-present
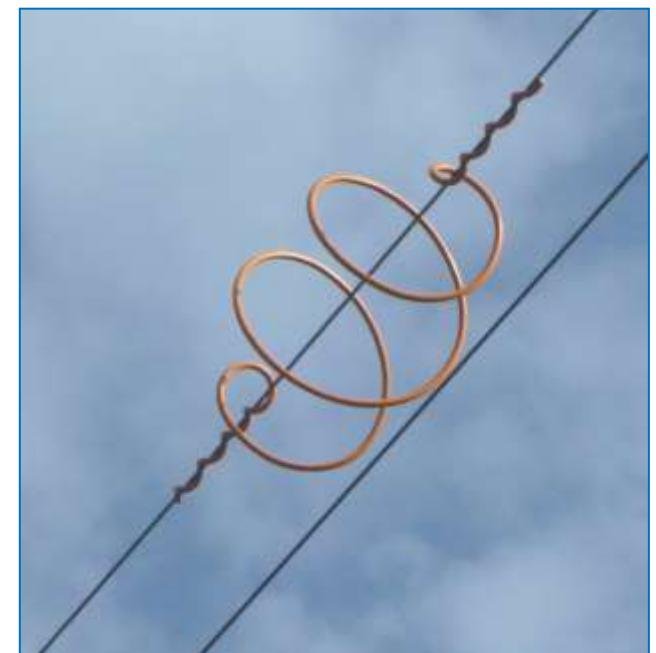
Assessment of efficacity

methods:

- BACI Model "Before-After-Control-Impact"

- Time or Spatial Comparison

Neves & Infante, 2005

BACI Model (Before and After)

BEFORE CORRECTION

AFTER CORRECTION

LINE 1,
mortality x

LINE1, expected mortality x'

LINE 1 was corrected,

observed mortality x''

LINE 2,
mortality y

LINE 2 was not corrected
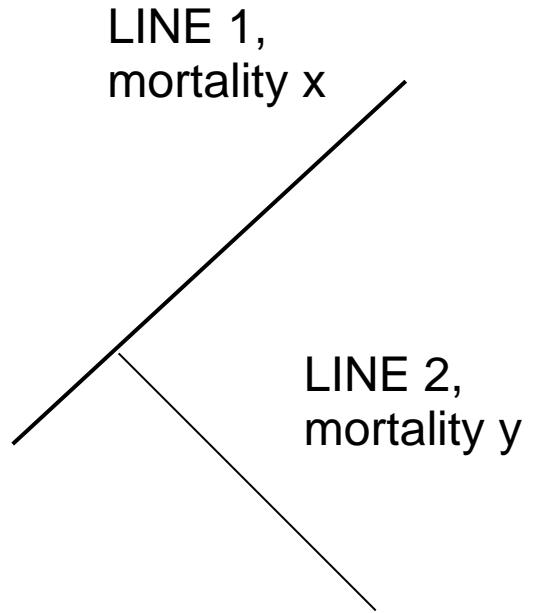
observed mortality y '
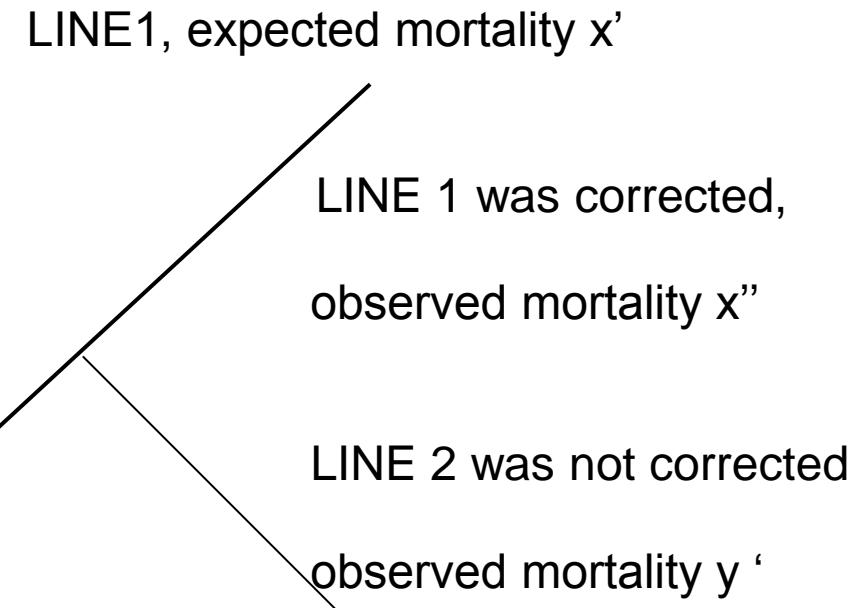
natural evolution of mortality in non-corrected line

y ————————————————→ y'

expected evolution of mortality in corrected line

x ————————————————→ x'

observed mortality ——→ **x''**

Time or Spatial Comparison

BEFORE CORRECTION

AFTER CORRECTION
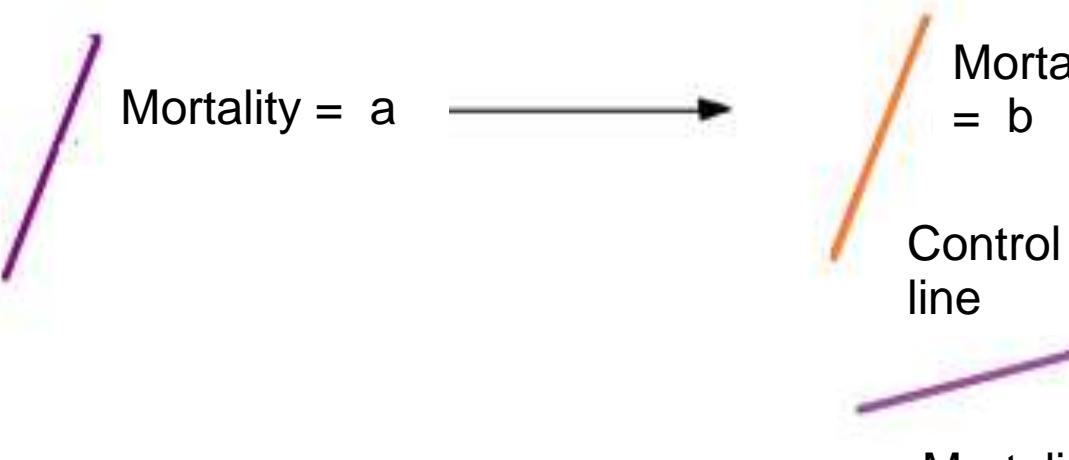
Mortality = a →

Mortality = b

Control line

Mortality = c

⇨ Assessment of Correction efficacity: time

⇨ Assessment of Correction efficacity: spatial

Assessment methods

- **Qualitative methods: ordination methods**

- **Wilcoxon test for paired samples**

Teste Wilcoxon para amostras emparelhadas (controlo temporal)			
Parâmetros	n	T	P=0,01
Valores	9	0	3
Conclusão	T < 3, Significativo para P=0.01		

Teste Wilcoxon para amostras emparelhadas (controlo temporal)			
Parâmetros	n	T	P=0,05
Valores	6	10	2
Conclusão	T >> 2, Não Significativo para P=0.05		

Teste Wilcoxon para amostras emparelhadas (controlo temporal)			
Parâmetros	n	T	P=0,05
Valores	8	17	5
Conclusão	T >> 5, Não Significativo para P=0.05		

Efficacity Comparison between signalling devices
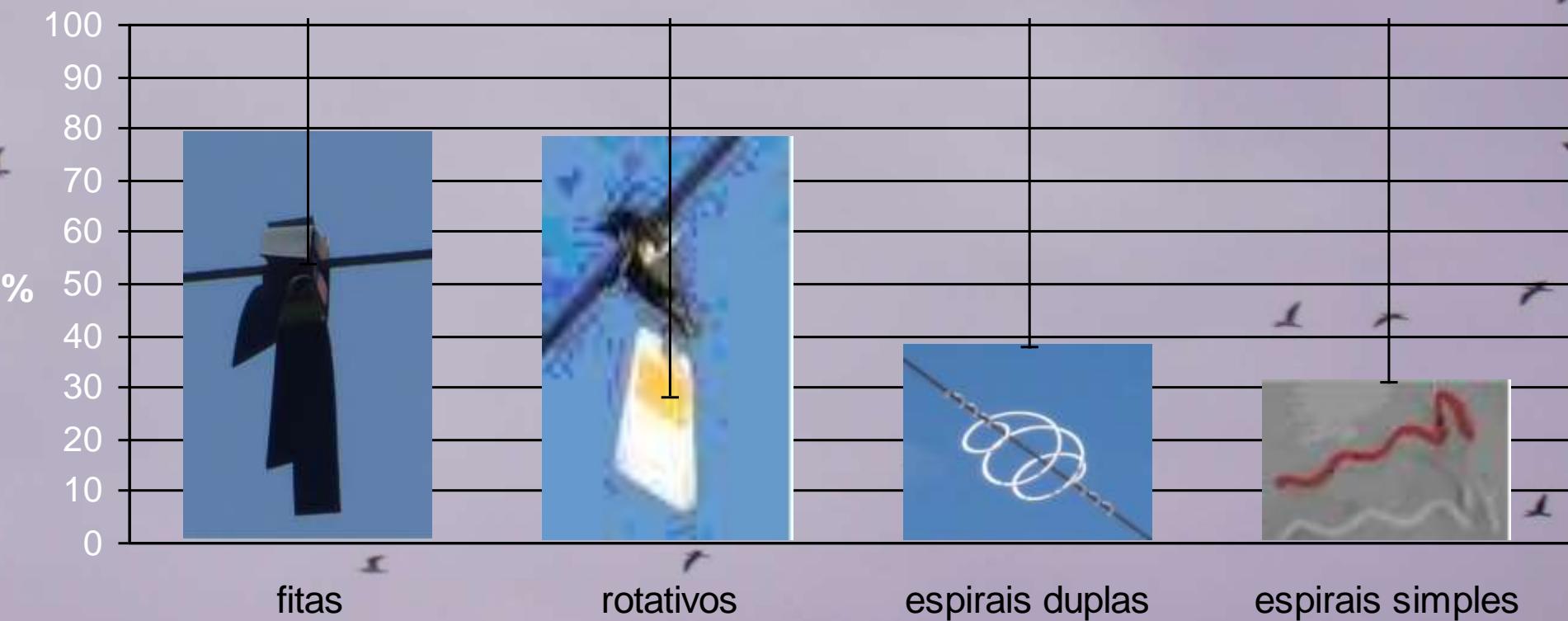
- Fire-flies are more efficient in mortality reduction that spirals

- However, due to restricted number of pairs available and high variability in mortality, most analyses are not significative.

Thankyou!

Special thanks to João Neves and many volunteers that have contributed to these studies

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