Mitigating bird collisions with power lines & how to monitor results

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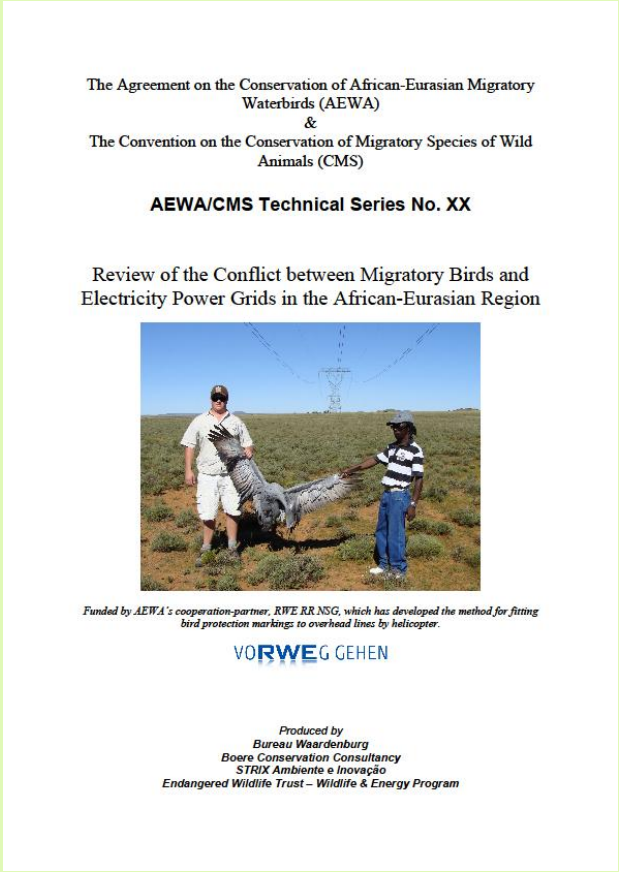
Bird collisions with power lines

- Annually 10s of millions in African-Eurasian region alone
- Especially less maneuverable birds or species with rapid flight, such as geese, ducks, waders and cranes
- Visibility of wires is a key factor

UNEP/AEWA review and guidelines

- Adopted in 2012 by 130 governments from the African-Eurasian region


The Agreement on the Conservation of African-Eurasian Migratory Waterbirds (AEWA)
&
The Convention on the Conservation of Migratory Species of Wild Animals (CMS)

AEWA/CMS Technical Series No. XX

Review of the Conflict between Migratory Birds and Electricity Power Grids in the African-Eurasian Region

Funded by AEWA's cooperation-partner, RWE RR NSG, which has developed the method for fitting bird protection markings to overhead lines by helicopter.

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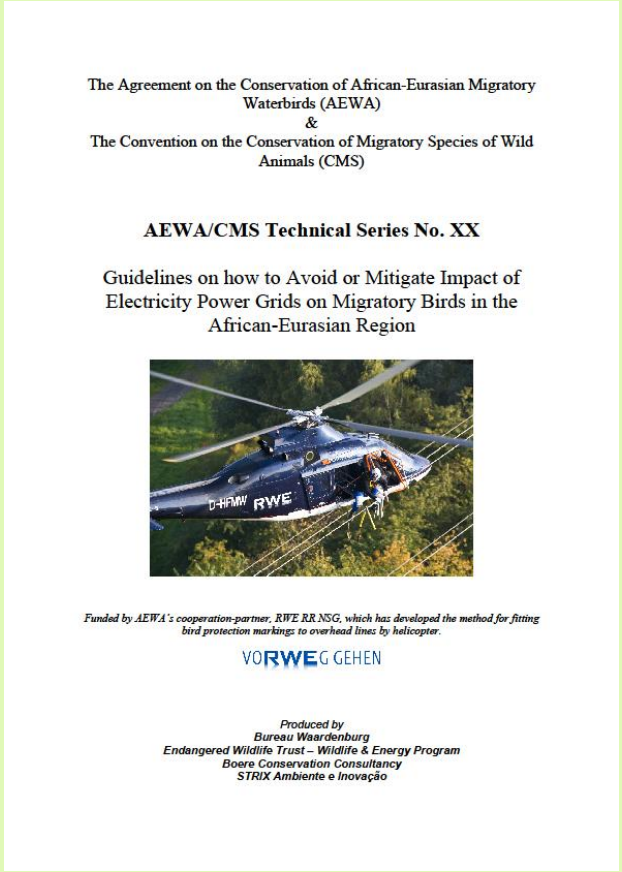
The Agreement on the Conservation of African-Eurasian Migratory Waterbirds (AEWA)
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Guidelines on how to Avoid or Mitigate Impact of Electricity Power Grids on Migratory Birds in the African-Eurasian Region

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http://www.buwa.nl/solutions-to-avoid-collisions.html

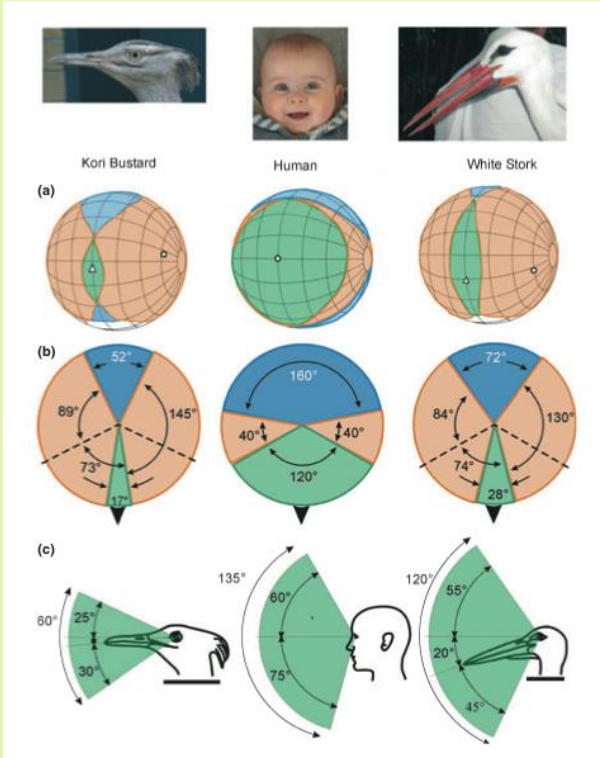
Mitigating bird collisions

- Underground cabling
- Efficient network planning / line routing
  - preferably not in Natura 2000, Ramsar sites, IBAs
  - away from areas rich in species susceptible to collisions
  - should be based on recent available ornithological knowledge
  - grouping with other infrastructure
- Line modifications; presenting less of an obstacle
  - horizontal separation
  - removing of earth wire
- Wire marking
  - improve visibility

Bird vision

Martin 2011 (Ibis 153: 239-254)

- Birds have small blind spots
  - but might be blind in direction of travel, if head/eye moved in certain way
- Birds have small binocular fields
  - distance perception might be weak
- Highest visual acuity and colour vision in lateral visual fields
  - Birds frontal vision for detecting movement rather than spatial detail
- Birds in flight in open habitat might predict ‘no obstacles ahead’



Wire markers - considerations

- As large as possible, protrude both above and below line
- Spacing not more than 5-10 m apart
- Rich in contrast compared to relevant background
- Color is less important than contrast
- Movement of the device is likely of importance
- Nocturnally visible through illumination or ultraviolet radiation

Wire markers - efficiency pig tails

- Studies in the Netherlands (Koops 1987) conclude:
  – distance between markers is important, size less important

Object size	Distance between markers	One or two earth wires, alternating?	Species studied	Reduction %
50 cm aviation balls	50-70 m	two, alternating	all species	39%
20 cm	15 m	two, alternating	all species	55%
10,5 cm	10 m	two, alternating	all species	70%
10,5 cm	5 m	one	pigeons	60-67%
10,5 cm	5 m	two, alternating	pigeons	84%
10,5 cm	5 m	two, alternating	all species	90%
10,5 cm	5 m	two, alternating	mute swan	<25%

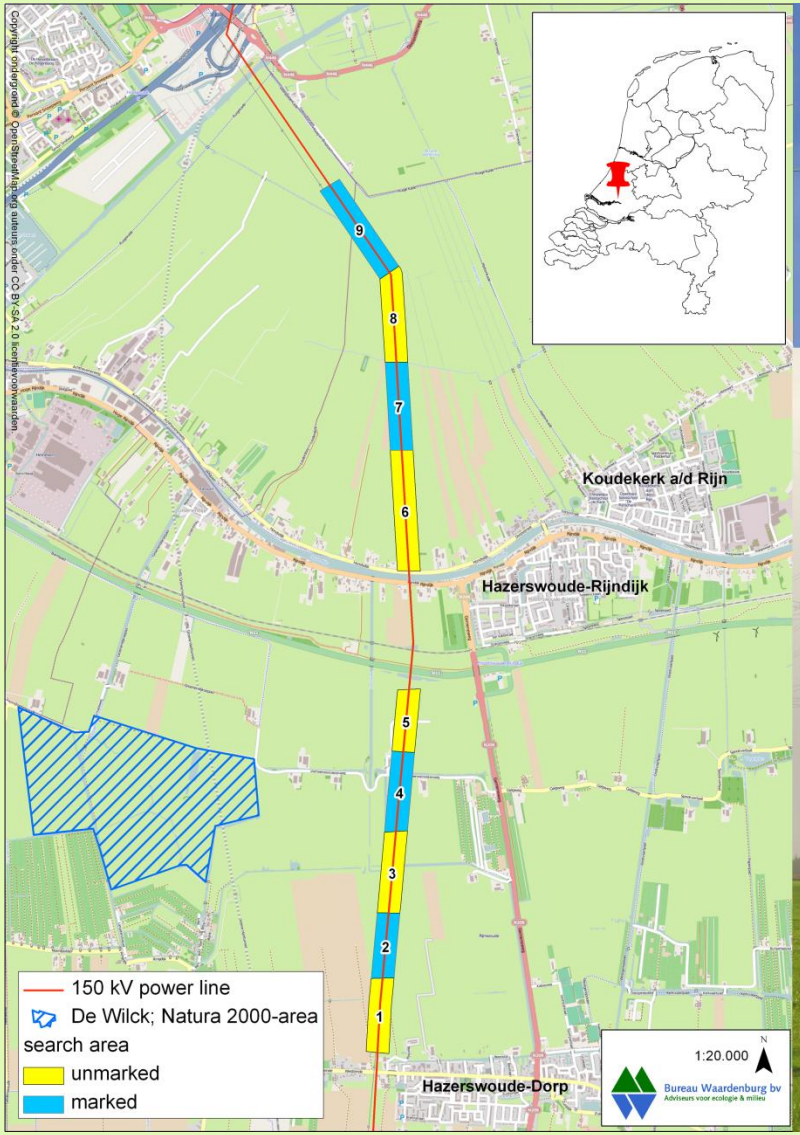
Wire markers - efficiency

- Many studies, but difficult to compare due to different:
  - study area, study duration, study lay-out
    - open grasslands vs forested areas
    - multiple year vs single season
    - BACI vs CI
  - species studied
    - single species study (bustards, cranes, racing pigeon, etc.)
    - mainly diurnal species vs all species
    - breeding birds vs year-round
  - power line type and lay-out
    - low voltage vs high voltage (number of traverses/wires)
    - towers with/without guy wires
  - statistical tests
    - corrections for search and disappearance bias?
    - reduction as %, rate, number of birds

Wire markers - efficiency

- Recent reviews conclude:
  - Barrientos *et al*. 2011 (Conservation Biology 5: 893-903)
    - Meta analysis of 21 studies: wire marking reduces bird mortality by 55-94%
  - Jenkins *et al*. 2010 (Bird Conservation International 20: 263-278)
    - “Any sufficiently large form of marker, which thickens the line at that point by at least 20 cm, over a length of at least 10-20 cm, placed with regular interval for at least every 5-10 m on either earth wires or the conductors, is likely to lower general collision rates by 50-80%.”
  - Prinsen *et al*. 2011 (UNEP/AEWA guidelines)
    - “Comparison studies of two different marking devices under the same conditions revealed that only thin plastic strips were not as effective as the alternatives. Beyond this, the difference in effectiveness between widely ranging devices was negligible.”
- However, few markers proved to reduce nocturnal collisions

Mitigating bird collisions at night ?



Methods: collision victim searches

- **B**efore-**A**fter-**C**ontrol-**I**mpact design (BACI)
- 2 winters (B and A)
- 9 sections, 4 km length
- 5 sections unmarked (C), 4 marked (I)
- Twice weekly searches, 40 m both sides
- Search efficiency & disappearance rate experiments

Methods: flight behaviour at day

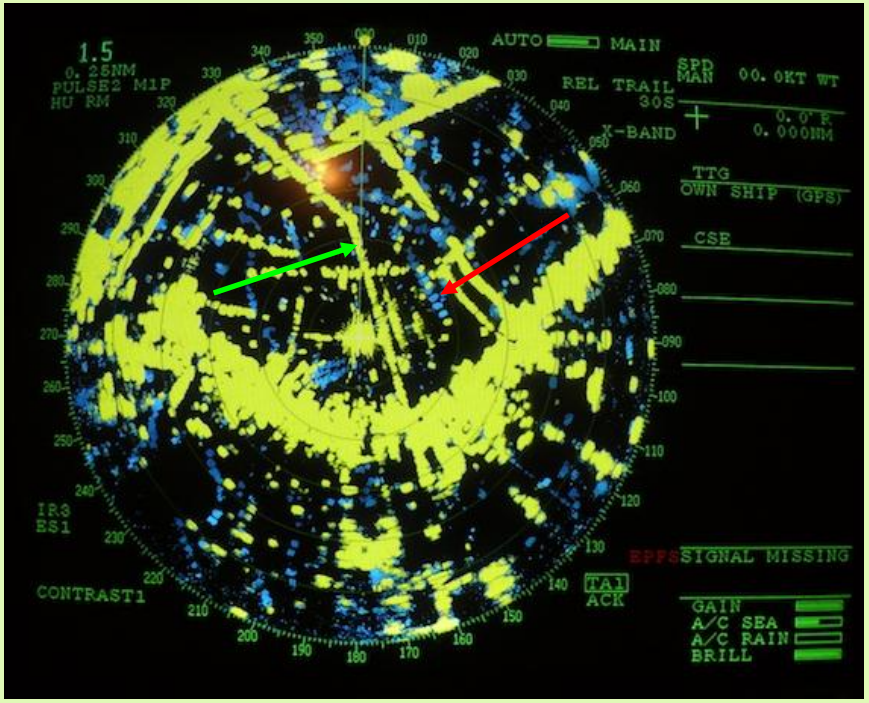
- Observations at dusk and dawn
- Flight height
- Passage position relative to wires
- Reaction

Methods: flight movements at night

- Observations with horizontal and vertical radars

Methods: flight movements at night

- Observations with horizontal and vertical radars
- Flight paths (horizontal radar)
- Passage frequency (vertical radar)
- Altitude (vertical radar)



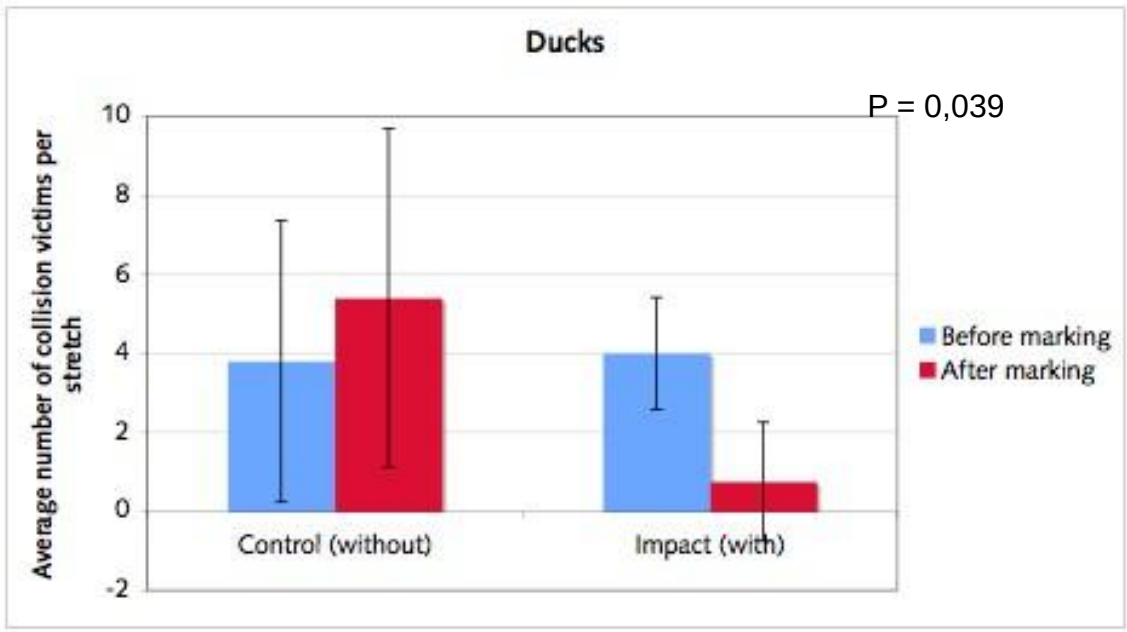
Results: collision victims

	Number of victims (n)	Number of species (n)	Collision rate for similar period (birds/km/day)
Before marking (3 months period)	250	33	0,94 (unmarked)
After marking (5 months period)	320	34	0,77 (unmarked) 0,48 (marked)



Results: reduction of collision victims

Species (group)	Reduction	Significant
Diurnal species (gulls, geese, pigeons, etc.)	67%	yes
Nocturnal species - Ducks	80%	yes
Nocturnal species - Lapwing	48%	no
Nocturnal species - Common Coot	none	-



Results: flight behaviour

Marked versus unmarked spans:

- **Night**: no difference in passage frequency (ducks)

- **Day**: birds adjust flight height (geese, gulls and corvids).
  - At larger distance from the earth wire (above or below)
  - Adjustment made at an earlier stage

Conclusions

- Most wire markers are effective…
- …but few markers are also effective at night
- Monitoring of collision victims should include:
  - good spatial coverage; 40-50 m both sides with search radius <10 m
  - good temporal coverage; 1-2x / week
  - search detection and scavenger removal experiments
- Monitoring of flight movements (flux) is important
  - to put collision rates in perspective
  - calculate collision risk (%) which can be extrapolated to other studies
  - use remote techniques such as radar for nocturnal movements

Thank you for your attention!

For more information:
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Project website:
http://www.buwa.nl/en/effective-marking-of-power-lines.html