



Showing the value of ecotoxicological studies to raptor conservationists

WG4 & cross-WG Virtual Meeting
22 April 2021

TAKING FORWARD A EUROPEAN RAPTOR SAMPLING PROGRAMME & THE ERBF ADVICE HUB

Pablo Sánchez Virosta, Silvia Espín and Chris Wernham

Showing the value of ecotoxicological studies to raptor conservationists

Threats to raptors include:

- habitat alteration or destruction
- intentional killing
- electrocution
- climate change
- intentional and unintentional **poisoning** (including **contaminant exposure**)

McClure et al. 2018



Population declines demand investigation into their **causes** and **potential conservation interventions**

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Raptors were among the **first wildlife species** known to be **affected** by anthropogenic **pollutants**



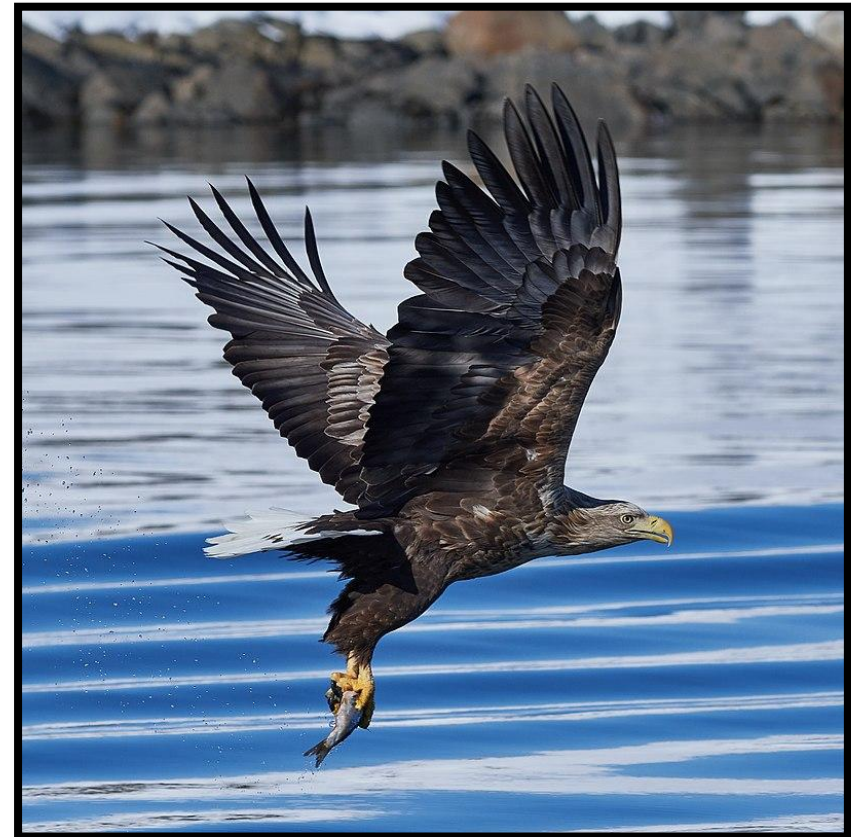
Pesticide and/or contaminant related declines in raptor populations have been widely documented in Europe and North America in the 20th Century

Peregrine falcon (*Falco peregrinus*)

Bald eagle (*Haliaeetus leucocephalus*)

White-tailed sea eagle (*Haliaeetus albicilla*)

Sparrowhawk (*Accipiter nisus*)



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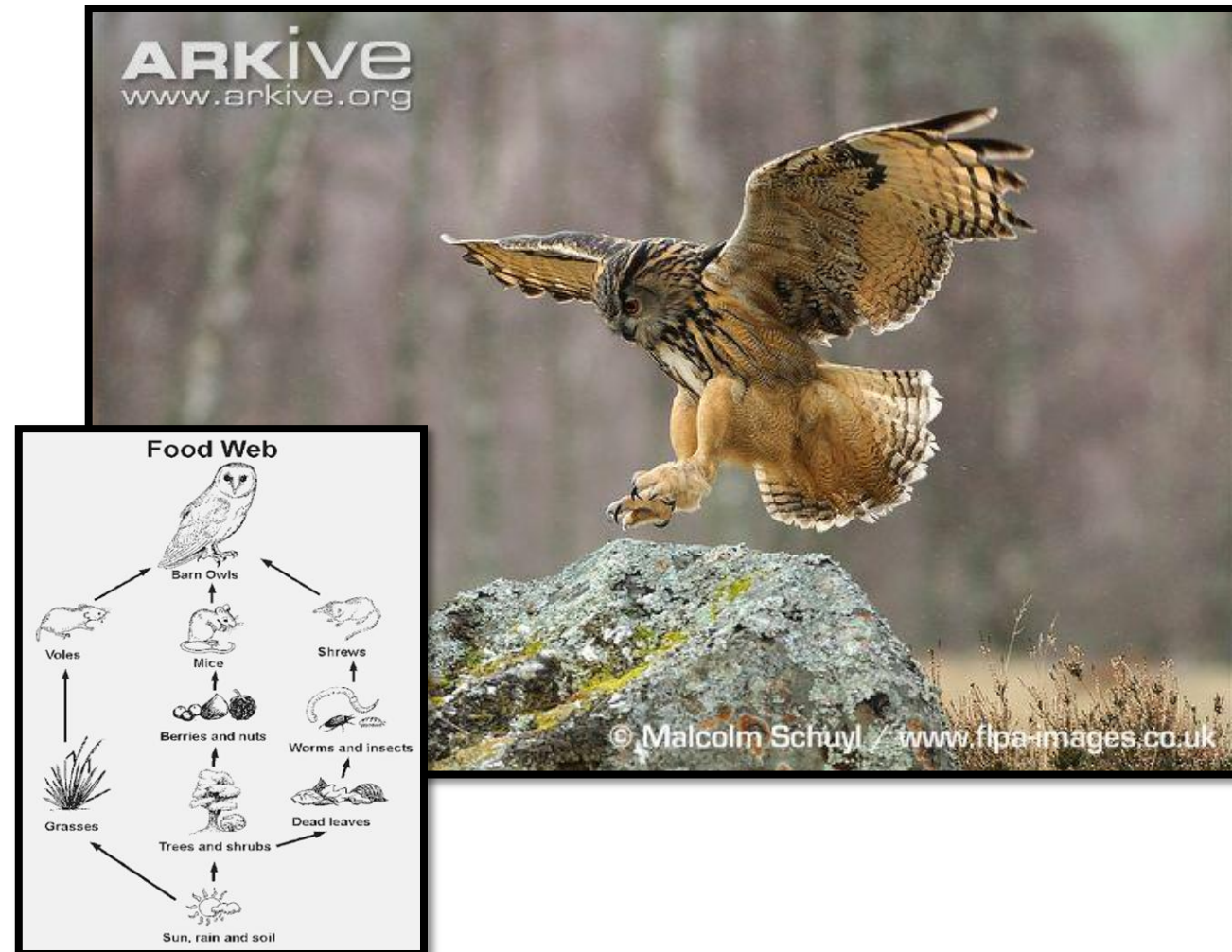
Persistent, bioaccumulative contaminants can be transferred, and in some cases biomagnified, along food chains and **accumulated** in high concentrations by **apex predators**



The **vulnerability of raptors** to environmental contaminants is in part due to their trophic position at the **top of food chain**



Also vulnerable to **poisoning** because of **facultative scavenging** and increased likelihood that sick and moribund prey are likely to be caught (e.g. anticoagulant rodenticides)





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Classic examples

Organochlorine compounds (DDT/PCBs)

A classic paper by Ratcliffe (1967) was published in *Nature* describing decreases in eggshell thickness in raptors in Britain following the use of DDT



Letters to Nature

Nature **215**, 208-210 (8 July 1967) | doi:10.1038/215208a0

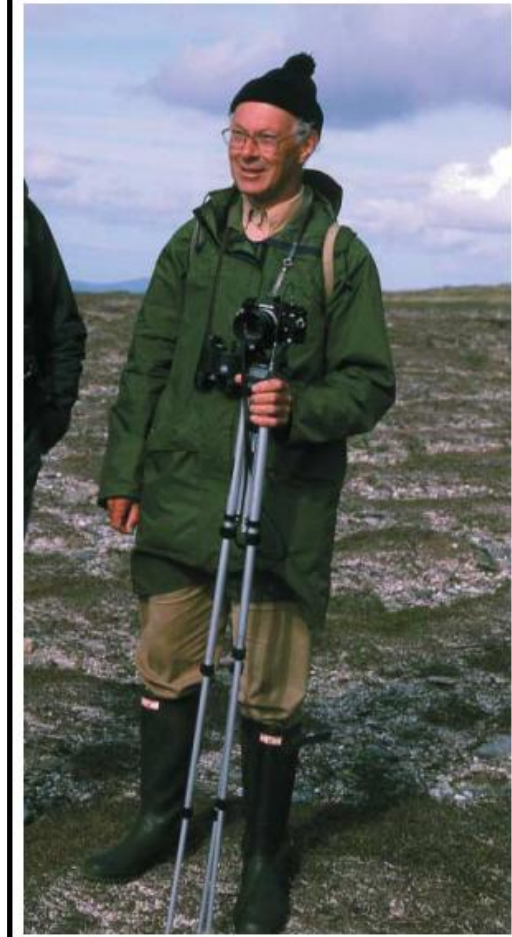
Decrease in Eggshell Weight in Certain Birds of Prey

D. A. RATCLIFFE

1. The Nature Conservancy, Monks Wood Experimental Station, Abbots Ripton, Huntingdon.

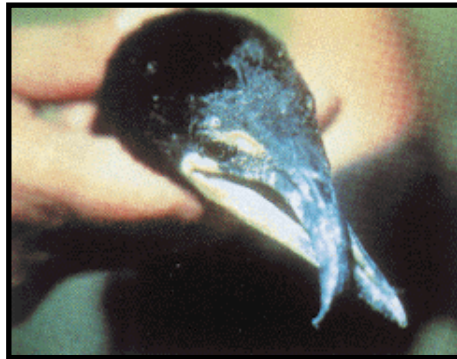
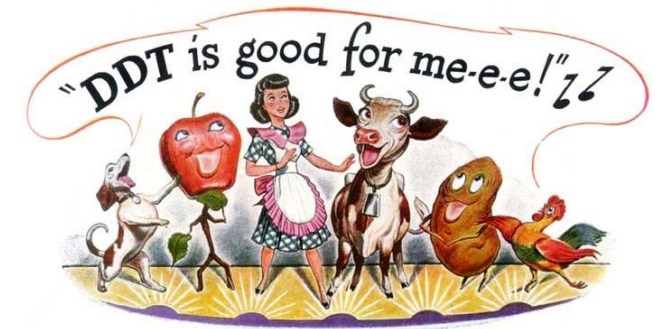
THE incidence of broken eggs in nests of peregrine falcon *Falco peregrinus*, sparrowhawk *Accipiter nisus* and golden eagle *Aquila chrysaëtos* in Britain has increased considerably since 1950. In 109 peregrine eyries examined in 1904–50, there were only three instances of egg breakage, compared with forty-seven in 168 eyries examined in 1951–66. Two of thirty-five golden eagle eyries examined in 1936–50 contained broken eggs, compared with twelve out of forty-eight examined in 1951–63. One breakage was found in twenty-four sparrowhawk nests in 1943–50, but eight in twenty-seven nests in 1951–60. Peregrines have been witnessed eating their own eggs¹, and most recent egg breakages in all three species appeared to involve parental destruction.

**Derek Almey Ratcliffe,
1929–2005**



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Classic examples Organochlorine compounds (DDT/PCBs)



Deformities



Mortality



Eggshell thinning

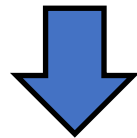
**Organochlorine pollutants are now restricted in their use or banned in many countries
(still detected due to their high persistence)**

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Classic examples

Lead (Pb)

Pb intoxication (caused by ingestion of Pb shots and ammunition fragments in unretrieved game) is an ongoing concern for raptor populations



Described as the most important source affecting birds, and raptors in particular (Krone, 2018)



Fig. 2 Lead shot regulations in Europe. Regulations are partial in some specific wetlands of international importance (Ramsar sites, Special Protection Areas for Birds), total in all wetlands or total in all types of habitats

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Classic examples

Lead (Pb)

Depending on Pb levels reached in organs, Pb can cause effects that range from subclinical to lethal



Pb affects the vascular, nervous, renal, immune and reproductive systems, haematological parameters, and impacts behaviour and survival
(Monclús et al., 2020)



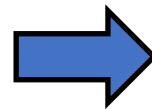
California condors (*Gymnogyps californianus*) were brought to the brink of extinction, in part, because of Pb poisoning, and Pb poisoning remains a significant threat today
(Finkelstein et al., 2012)



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Classic examples

Poisoning of *Gyps* vultures with diclofenac



Diclofenac: non-steroidal anti-inflammatory drug (NSAID) given to cattle

Cattle carcasses used to feed vultures
Gyps vultures ingest diclofenac when feeding on them
and suffer renal failure, loss of flight and death

- The vulture population in the Indian subcontinent was decimated (90% decrease since 1990s in 3 *Gyps* species: Indian white-backed vulture *Gyps bengalensis*, Indian vulture *Gyps indicus*, and Slender-billed vulture *Gyps tenuirostris*)



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Poisoning of *Gyps* vultures with diclofenac

First diclofenac intoxication in a wild avian scavenger in Europe (Herrero-Villar et al., 2021)

Fledgling of **Cinereous vulture** (*Aegypius monachus*)
found dead in the nest in September **2020**

Diagnosis: Fatal gout caused by **diclofenac intoxication**

First case of diclofenac poisoning in Spain (and in Europe)



Supports the need to **closely monitor** vulture populations
and carry out strict **regulatory measures**

(Herrero-Villar et al., 2021)



Photo: Agents Rurals de Catalunya

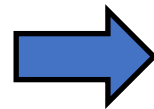
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Potential new threats to raptors Contaminants of emerging concern (CECs)

Information on the exposure and effects of CECs on raptors is urgently needed

Perfluoroalkyl substances (PFASs)
Novel flame retardants (NFRs)
UV-filters
Neonicotinoids
Chlorinated paraffins
Parabens
Bisphenols

(González-Rubio et al., 2021)



Reported in
European
raptors



Understanding potential **biological** and **physiological effects** of **CECs** is essential to informing management strategies that can better protect raptors from increasing anthropogenic pressures



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In the EU, industrial chemicals, plant protection products, pharmaceuticals, and biocides are regulated



Lack of any monitoring of their effectiveness in protecting against environmental pollution



Raptors can be powerful sentinels of marine and terrestrial environmental contamination



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Ecotoxicological studies needed to evaluate exposure to contaminants and related adverse effects

Biomonitoring programs

- Assess **spatio-temporal trends** in contaminant concentrations and investigate associated effects on populations
- Provide **early warning** of the potential impacts in humans, protected wildlife species and on the wider environment
- **Track the success of mitigation** in reducing exposure



Health is the intersection of humans, the environment, and animals - both wildlife and domestic

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Importance of bringing people from different arenas together

Raptor conservation and monitoring studies **benefit** from more **ecotoxicological research** to **understand and mitigate** against drivers of decline



**Raptor
conservationists**



Ecotoxicologists

Ecotoxicology benefits from **monitoring studies** to get **samples and essential contextual data** for contaminant interpretation

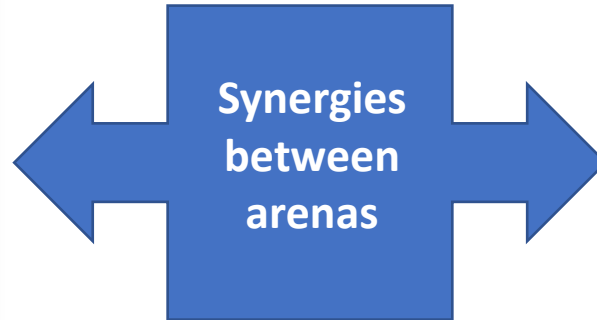
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Importance of bringing people from different arenas together



Raptor conservationists

Population size, distribution & trends



Ecotoxicologists

Contaminants & associated health effects

To be effective, policy and conservation action must be informed by scientific understanding of the threats raptors face and the range of potential conservation interventions



Thank you for your attention

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References

- Finkelstein et al., 2012. Lead poisoning and the deceptive recovery of the critically endangered California condor. *Proc Natl Acad Sci USA* 109, 11449–11454
- González-Rubio et al., 2021. A review on contaminants of emerging concern in European raptors (2002–2020). *Science of the Total Environment* 760, 143337
- Herrero-Villar et al., 2021. First diclofenac intoxication in a wild avian scavenger in Europe. *Science of the Total Environment* 782, 146890
- Krone, 2018. Lead poisoning in birds if prey. *Birds of Prey: Biology and Conservation in the XXI Century*, 251–271
- Mateo & Kanstrup, 2019. Regulations on lead ammunition adopted in Europe and evidence of compliance. *Ambio* 48, 989–998
- McClure et al., 2018. State of the world's raptors: Distributions, threats, and conservation recommendations. *Biological Conservation* 227, 390–402
- Moncús et al., 2020. Lead contamination in raptors in Europe: A systematic review and meta-analysis. *Science of the Total Environment* 748, 141437