

Population trend modelling of European upland birds due to lead shot ingestion



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REACH Regulation



REACH aims at improving protection of human health and the environment from chemical risks

Demonstrate safe use of lead in ammunition for

- Workers
- Consumers
- Environment
 - Aquatic compartment (surface water)
 - Sediment compartment
 - Terrestrial compartment
 - Secondary poisoning of lead
 - direct ingestion of lead shot



Lead Shot in Small Game Hunting Areas



Lead shot ingestion in wetlands

A lot of scientific literature on waterfowl

Lead shot ingestion by upland birds

Little is known of its effects on

- Population size
- Population growth
- Extinction rate

Plus pesticides, bait poisons,...

Effect of these multiple chemical stressors on populations is unknown

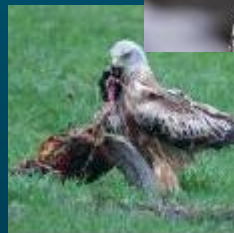
Question:

How might lead shot ingestion change populations of susceptible species?

Susceptible species



Granivores



Scavengers

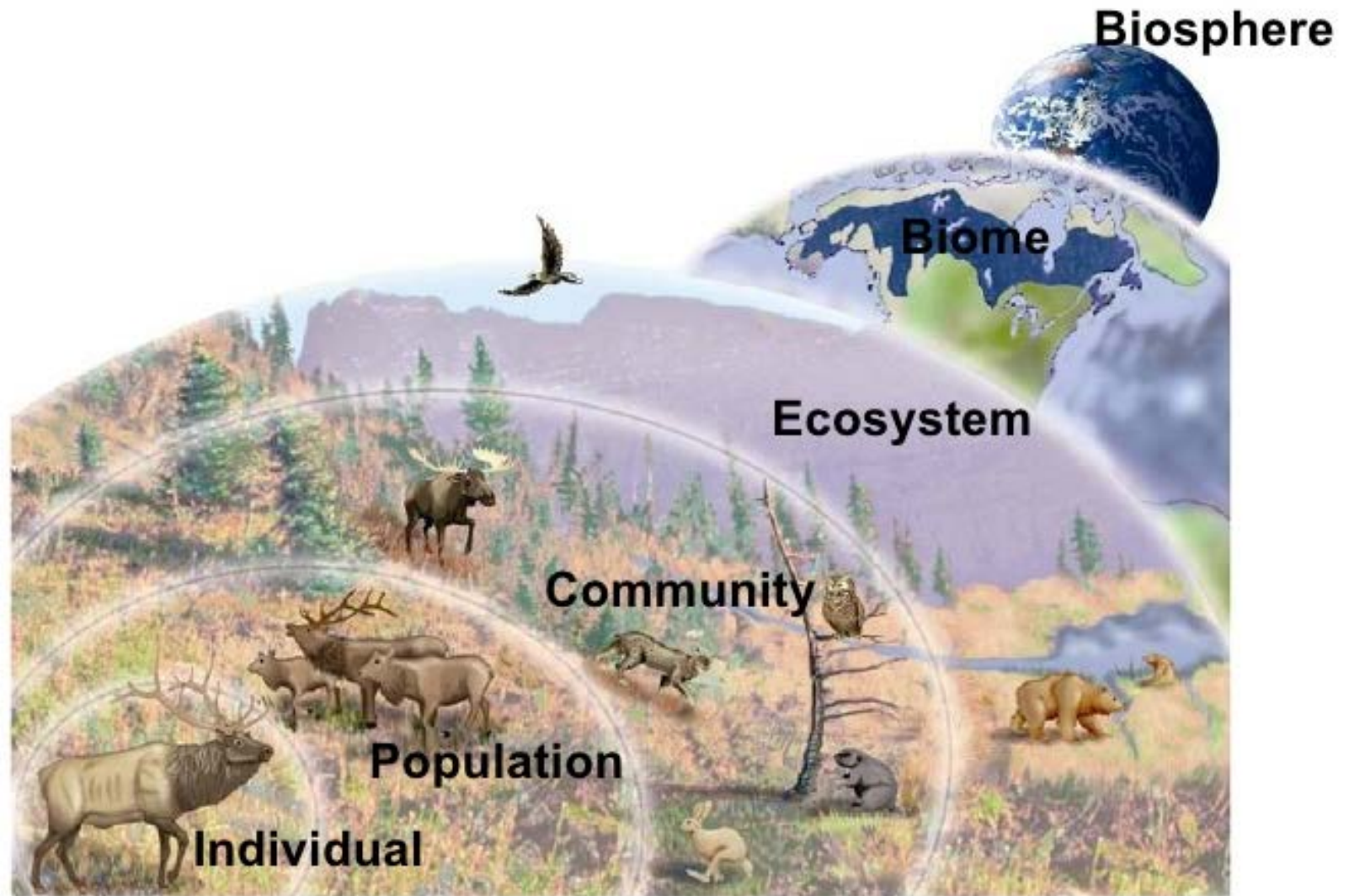
Study Objective

Demonstrate how population models can be used to evaluate effect of lead shot ingestion (and other stressors) on *susceptible* upland bird populations in Europe using

- pathology reports that diagnose cause of death
- population models

Methods

Levels of Organisation



Study Areas and Species

Define reasonable worst-case EU small game hunting scenario

Data for Population Model Parameters:

- Grey Partridge
 - Continental Europe
- Common Buzzard
 - Germany
- Red Kite
 - Wales

Data for Lead Shot Effects (highest impacted areas):

- Grey Partridge
 - England and France
- Common Buzzard
 - England
- Red Kite
 - England

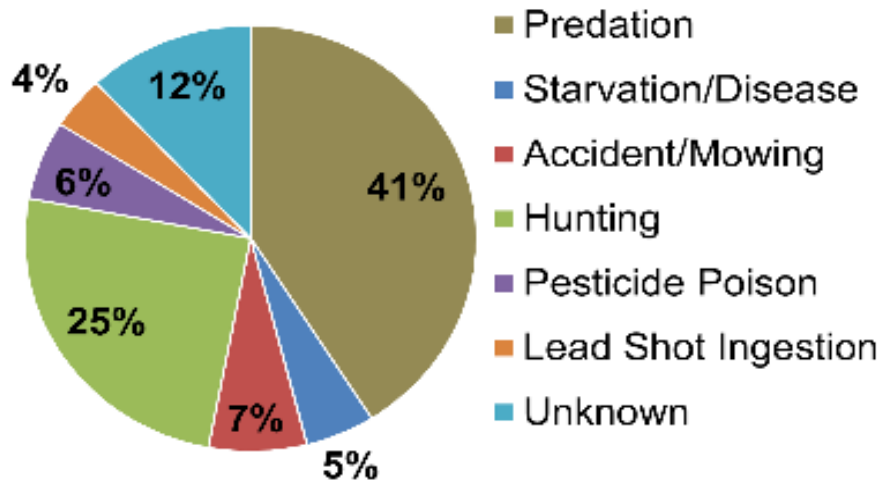


Causes of Death for Grey Partridge

Grey Partridge

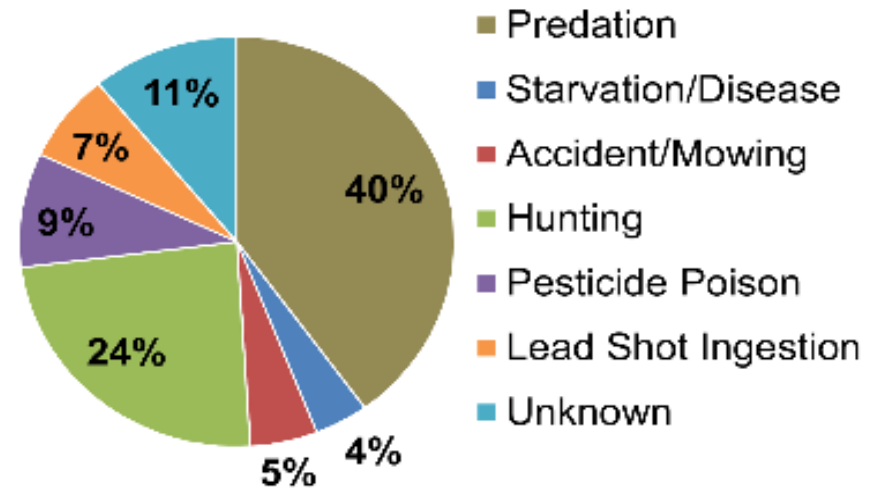
Direct Reported Causes

UK, France: n=775



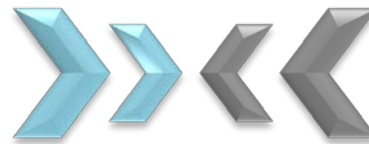
Grey Partridge

Ultimate Causes



Direct Reported: From pathologist

= Lower Bound



Mid point=
Best estimate

Ultimate Cause: Based on % elevated subclinical lead even if reported as died of another cause

= Upper Bound

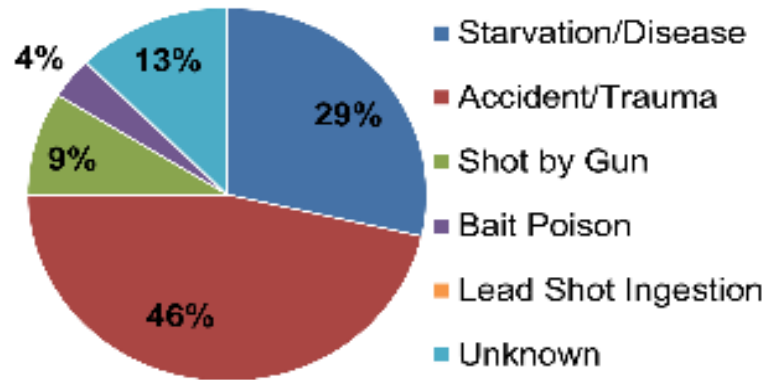
Causes of Death for the Raptors

(a)

Common Buzzard

Direct Reported Causes

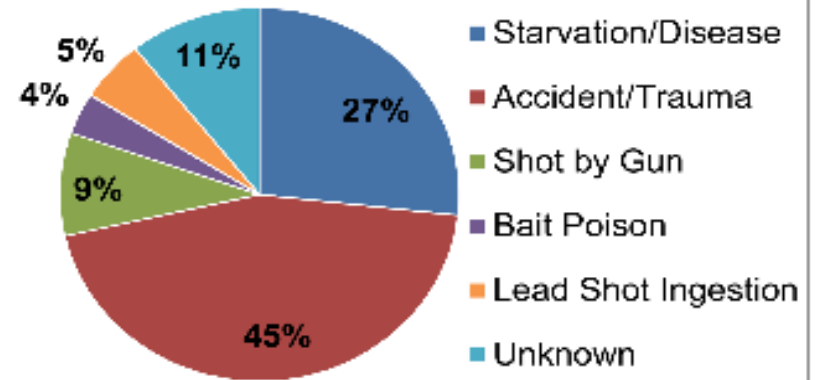
UK: n=56



(b)

Common Buzzard

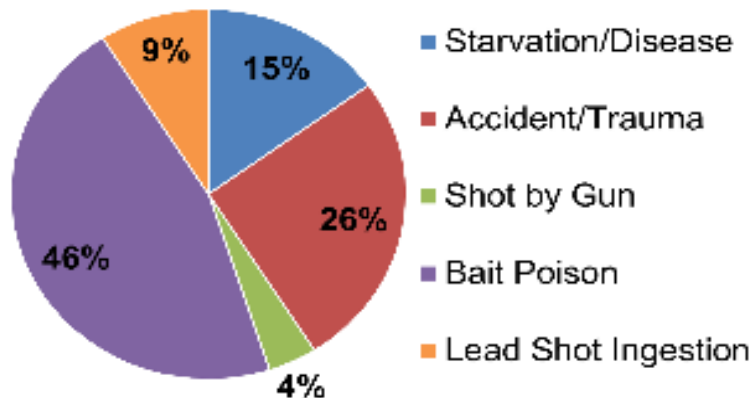
Ultimate Causes



Red Kite

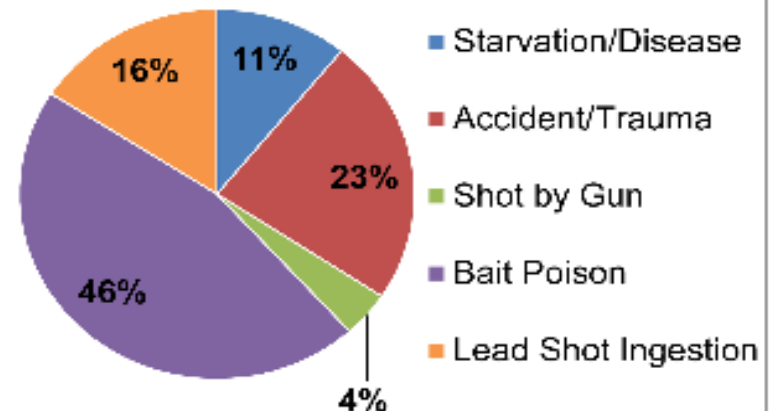
Direct Reported Causes

UK: n=44



Red Kite

Ultimate Causes



Grey Partridge Population Model

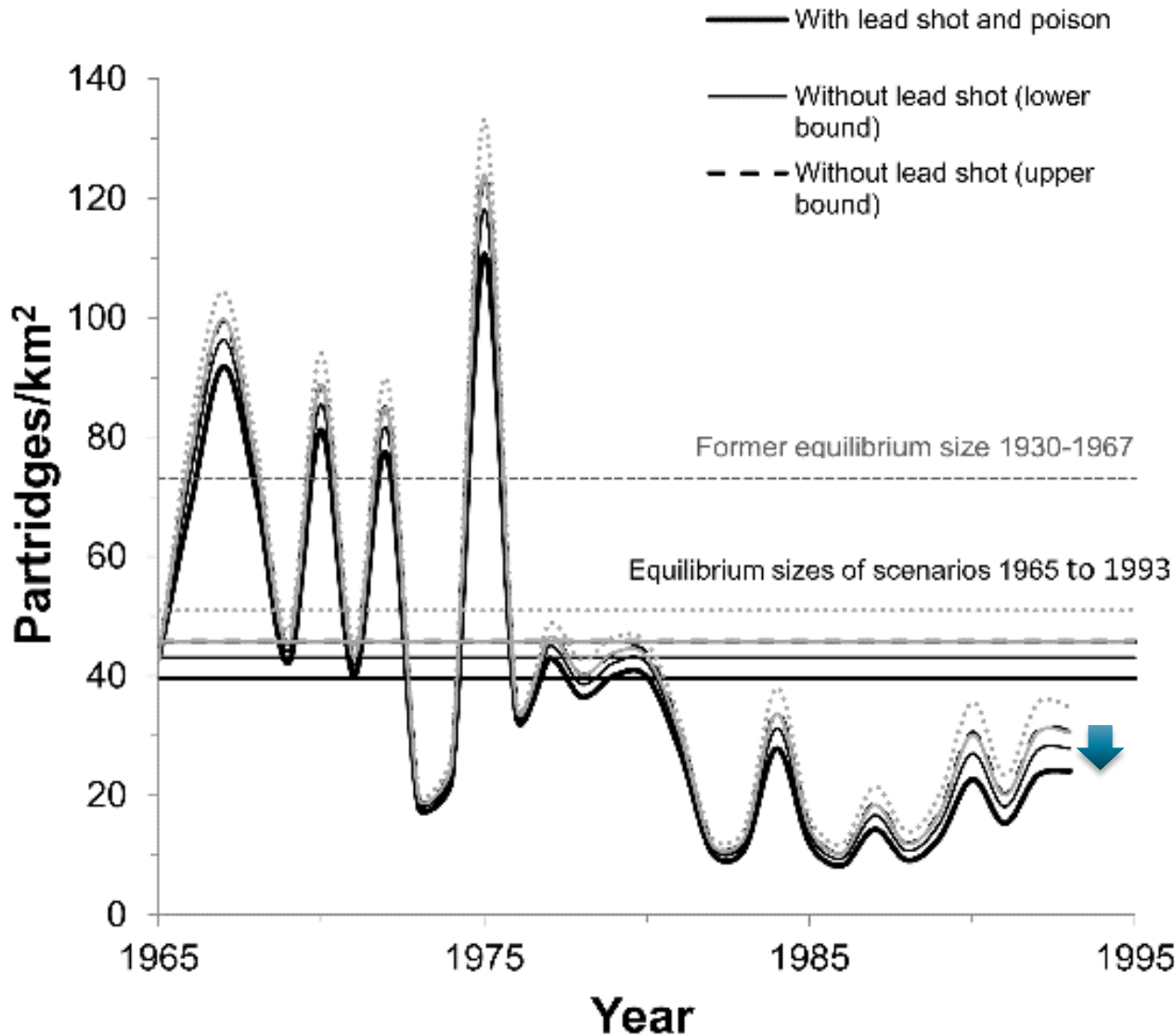
- Used Published Model: DeLeo et al. 2004
- Population Viability Analysis Model
 - Developed for European continent from 1965 to 1993
 - Seasonal model (spring, summer, autumn/winter)
 - Spring population growth rate and survival are density dependent

Common Buzzard Population Model : Red Kite Population Model :

- Matrix Population Viability Analysis Model in PopTools
 - Age-structured, pre-breeding matrix
 - Annual time step
 - Density dependence of survival, fertility

Results

Grey Partridge

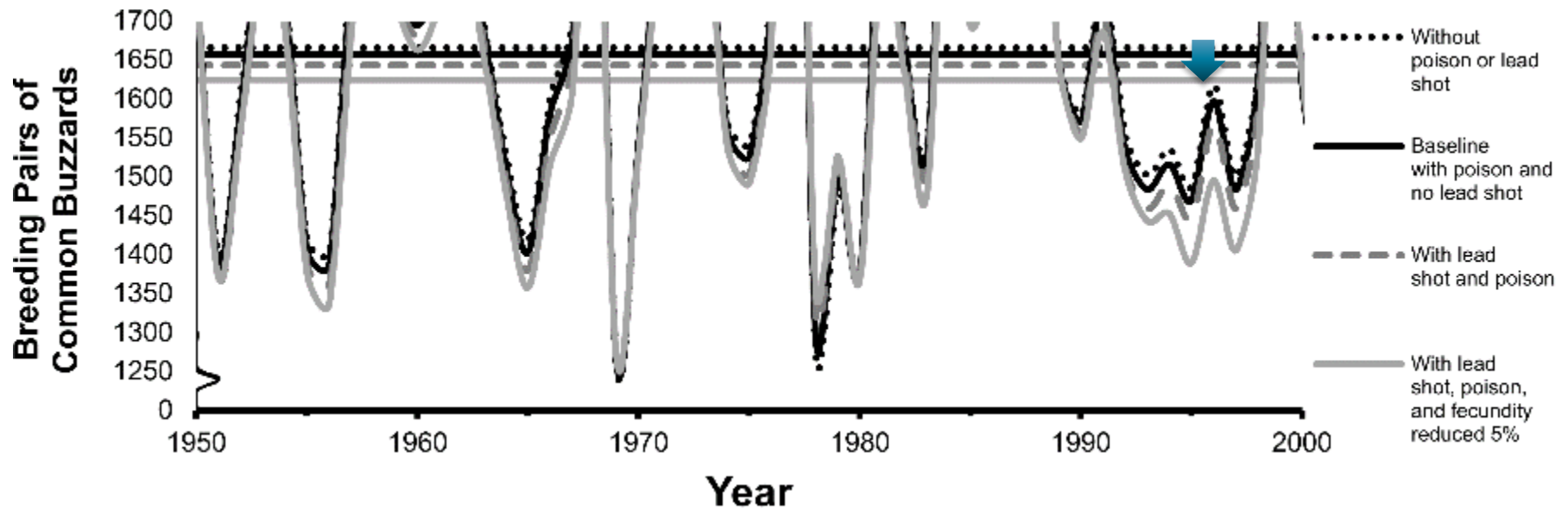


Reduction in steady-state population size is **10%**

Wildlife managers often accept **25%** reduction in steady-state population size

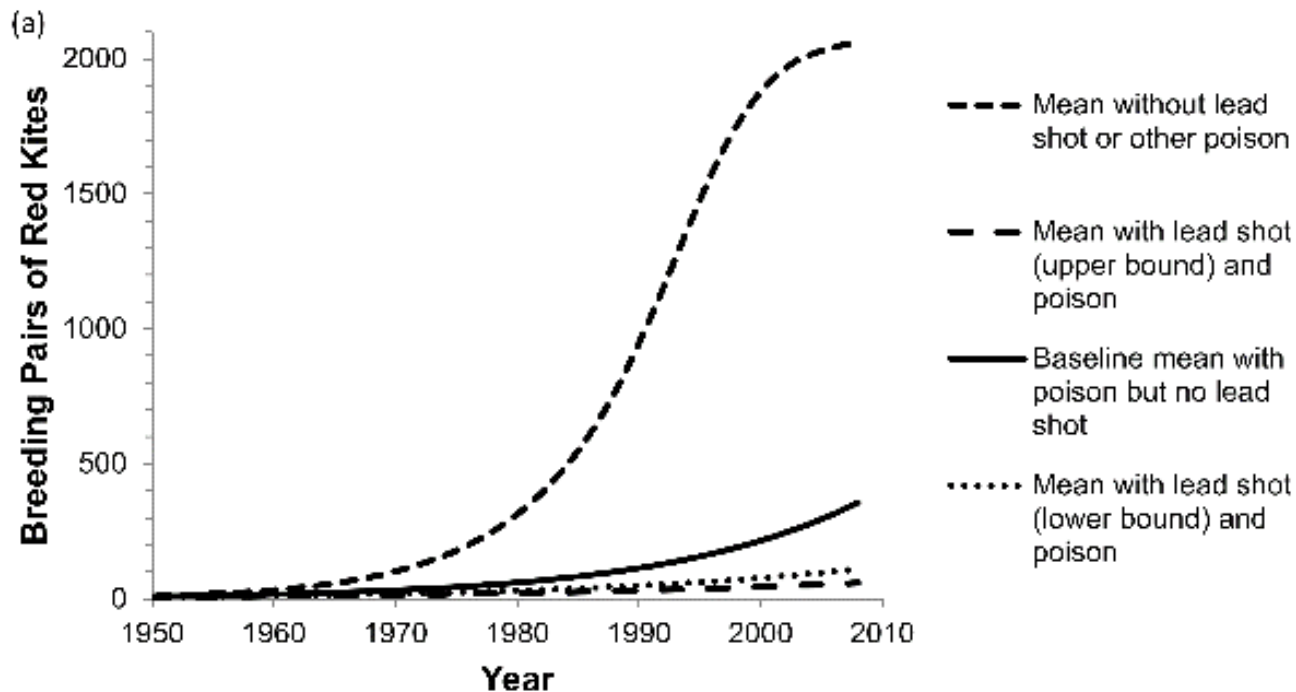
Common Buzzard

Reduction in steady-state population size is <1%



Red Kite

Population is growing in all scenarios



Adding lead shot ingestion reduces annual growth rate from **6.5 to 4%**

Conclusions

- Lead shot can cause poisoning of individual birds
- **No significant impact on population level**
- These models have much uncertainty but demonstrate an approach to quantify impacts with reasonable worst-case assumptions taken where relevant

More information?



- Publication in revision in Plos One

Meyer CB, Meyer JS, Francisco AB, Holder J, Verdonck F.

Can ingestion of lead shot and poisons change population trends of three European upland birds: grey partridge, common buzzard and red kite?

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