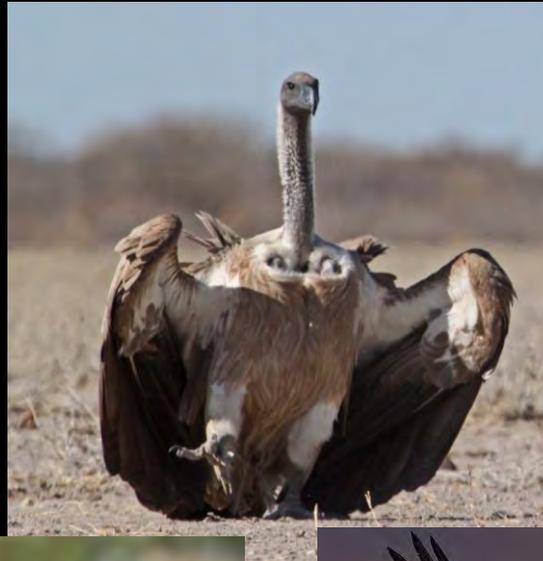


# RAPTORS BOTSWANA LEAD EXPOSURE IN VULTURES - BOTSWANA



# COMPARATIVE ECOLOGY

- Lappet-faced vultures
- White-headed vultures
- Cape vulture
- White-backed vulture
- Hooded vulture



# OBJECTIVES

- Comparative Ecology
  - Resource Partitioning
- Movements Patterns & Habitat Use
- Nesting Ecology
- Sources of Mortality



# Sources of Mortality?

- We, already aware of Poisoning - a big threat to vultures in Botswana?

*Poisons – Incidental, Carnivore /livestock conflict*  
*Intentional, Poaching or for body parts*  
27% of vultures we tagged poisoned over 4 years



# Beckie Garbett- PhD UCT

With a focus on lappet-faced vultures



# How about Lead Poisoning in Botswana ?



Nothing new.....

LEAD POISONING IN WILDFOWL'

P. J. S. Olney

1960



LEAD POISONING IN CANADA GEESE  
IN DELAWARE

George E. Bagley and Louis N. Locke

Patuxent Wildlife Research Center, Laurel, Maryland  
and

Gordon T. Nightingale

Bombay Hook National Wildlife Refuge, Smyrna, Delaware

Received 27 March 1967



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# Lead and scavenging raptors 1999 and 2009



ELSEVIER

Environmental Pollution 104 (1999) 341–350

ENVIRONMENTAL  
POLLUTION

Lead exposure and poisoning in bald eagles and golden eagles  
in the Canadian prairie provinces

M. Wayland<sup>a,\*</sup>, T. Bollinger<sup>b</sup>



Science of the Total Environment 407 (2009) 5555–5563

Contents lists available at [ScienceDirect](#)

Science of the Total Environment

journal homepage: [www.elsevier.com/locate/scitotenv](http://www.elsevier.com/locate/scitotenv)



Ingestion of lead from ammunition and lead concentrations in white-tailed sea eagles  
(*Haliaeetus albicilla*) in Sweden

B. Helander<sup>a,\*</sup>, J. Axelsson<sup>b</sup>, H. Borg<sup>c</sup>, K. Holm<sup>c</sup>, A. Bignert<sup>a</sup>



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# 2018 and 2012 and 2009



Contents lists available at ScienceDirect

Science of the Total Environment

journal homepage: [www.elsevier.com/locate/scitotenv](http://www.elsevier.com/locate/scitotenv)

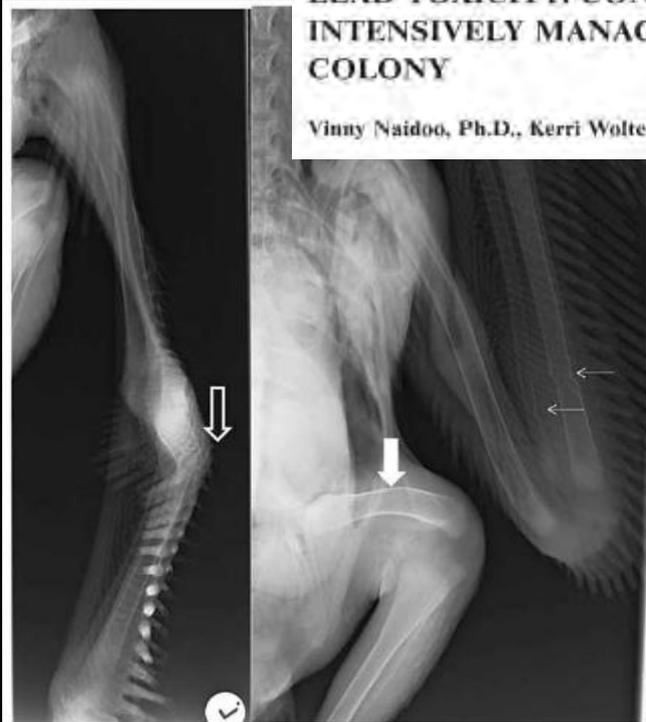
From sport hunting to breeding success: Patterns of lead ammunition ingestion and its effects on an endangered raptor

José M. Gil-Sánchez<sup>a\*,1</sup>, Saray Molleda<sup>b,1</sup>, José A. Sánchez-Zapata<sup>c</sup>, Jesús Bautista<sup>d</sup>, Isabel Navas<sup>e</sup>, Raquel Godinho<sup>f</sup>, Antonio J. García-Fernández<sup>e</sup>, Marcos Moleón<sup>g,2</sup>



## LEAD TOXICITY: CONSEQUENCES AND INTERVENTIONS IN AN INTENSIVELY MANAGED (*GYPS COPROTHERES*) VULTURE COLONY

Vinny Naidoo, Ph.D., Kerri Wolter, Ian Espie, M.Med.Vet., and Antoinette Kotze, Ph.D.



## LEAD BULLET FRAGMENTS IN VENISON FROM RIFLE-KILLED DEER: POTENTIAL FOR HUMAN DIETARY EXPOSURE

W. GRAINGER HUNT<sup>1</sup>, RICHARD T. WATSON<sup>1</sup>, J. LINDSAY OAKS<sup>2</sup>, CHRIS N. PARISH<sup>1</sup>, KURT K. BURNHAM<sup>1</sup>, RUSSELL L. TUCKER<sup>3</sup>, JAMES R. BELTHOFF<sup>4</sup>, AND GARRET HART<sup>5</sup>



Original article

### Blood lead levels for Eurasian black vultures (*Aegypius monachus*) migrating between Mongolia and the Republic of Korea

David Kenny<sup>a,\*</sup>, Young-Jun Kim<sup>b</sup>, Hansoo Lee<sup>c</sup>, Richard Reading<sup>a</sup>

<sup>a</sup>Denver Zoological Foundation, Denver, Colorado, USA  
<sup>b</sup>National Institute of Ecology, Singnoe-ri, Maseo-myeon, Seochon-gun, Changwon-do, South Korea  
<sup>c</sup>Korea Institute of Environmental Ecology Inc., Techno 1-ro, Yusonggu, Daejeon, South Korea

2015 and 2019  
and 2010

## Heavy metals in game meat

Antje Gerofke<sup>\*</sup>, Annett Martin, Daniela Schlichting, Carl Gremse and Christine Müller-Graf

Federal Institute for Risk Assessment, Max Dohrn-Str. 8-10, 10589 Berlin, Germany;  
[antje.gerofke@bfr.bund.de](mailto:antje.gerofke@bfr.bund.de)

## Bullet Fragments in Deer Remains: Implications for Lead Exposure in Avian Scavengers

- W. GRAINGER HUNT,<sup>1</sup> *The Peregrine Fund, Boise, ID 83709, USA*
- WILLIAM BURNHAM, *The Peregrine Fund, Boise, ID 83709, USA*
- CHRIS N. PARISH, *The Peregrine Fund, Boise, ID 83709, USA*
- KURT K. BURNHAM, *The Peregrine Fund, Boise, ID 83709, USA*
- BRIAN MUTCH, *The Peregrine Fund, Boise, ID 83709, USA*
- J. LINDSAY OAKS, *Department of Veterinary Microbiology and Pathology, Washington State University, Pullman, WA 99164, USA*

# Cannon Net Capture





In total we captured 566 vultures over 33 captures at 15 sites between 2012 and 2015 and tested them for blood lead levels



Used a Lead Care 2 system

$\mu\text{g}/\text{dl}$  = micrograms p/decilitre



- Background =  $<10 \mu\text{g/dl}$ . (Micrograms p/ decilitre)
- Elevated =  $\geq 10 - <20 \mu\text{g/dl}$ .
- Exposed =  $\geq 20 - <45 \mu\text{g/dl}$ .
- Diagnostic =  $\geq 45 \mu\text{g/dl}$ .

*Vulture News* 68

July 2015

**Blood lead levels in White-Backed Vultures (*Gyps africanus*)  
from Botswana, Africa**

**David Kenny<sup>1,2\*</sup>, Richard Reading<sup>1,2</sup>, Glyn Maude<sup>1,2</sup>, Peter Hancock<sup>2</sup>,  
Beckie Garbett<sup>2</sup>**

- 477 vultures blood lead level tested
- 147 vultures (30.8 %) exceeded background lead levels (10 ug/dl)

# MEAN $\pm$ SE BLOOD LEAD LEVELS

- Ikh Nart, Mongolia  $2.47 \pm 0.10 \mu\text{g/dl}$ ,  $n = 138$ .
- Republic of Korea  $7.36 \pm 1.05 \mu\text{g/dl}$ ,  $n = 63$ .
- Botswana, Africa  $8.94 \pm 0.76 \mu\text{g/dl}$ ,  $n = 239$ .



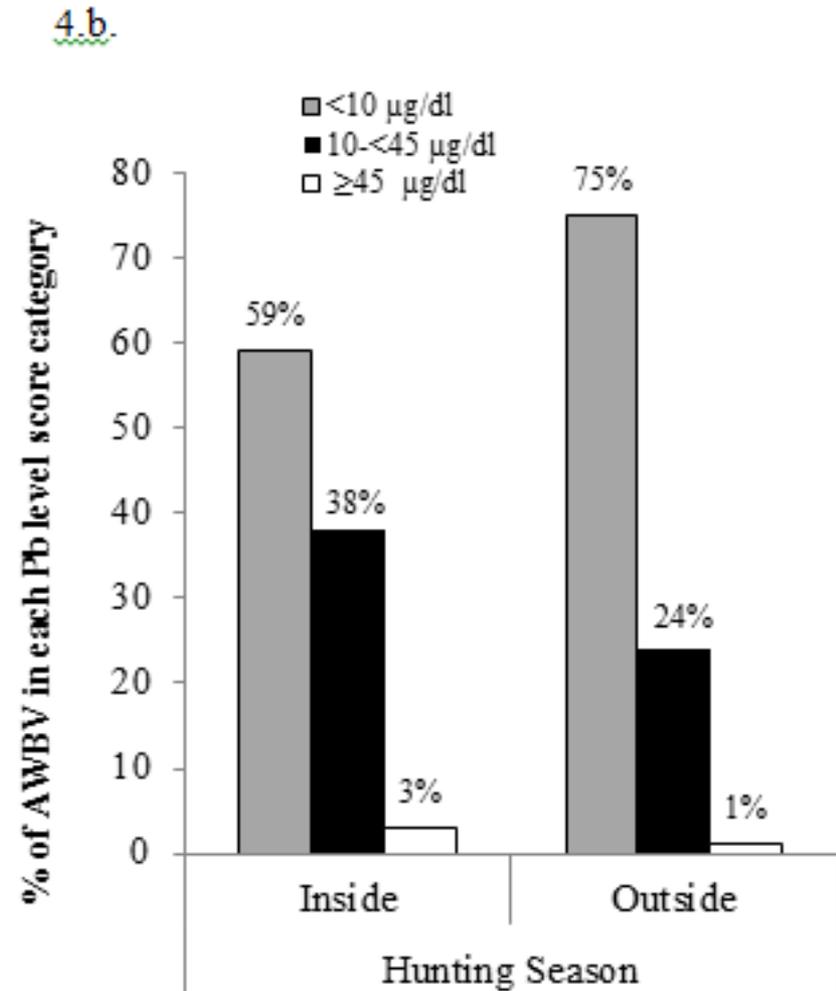
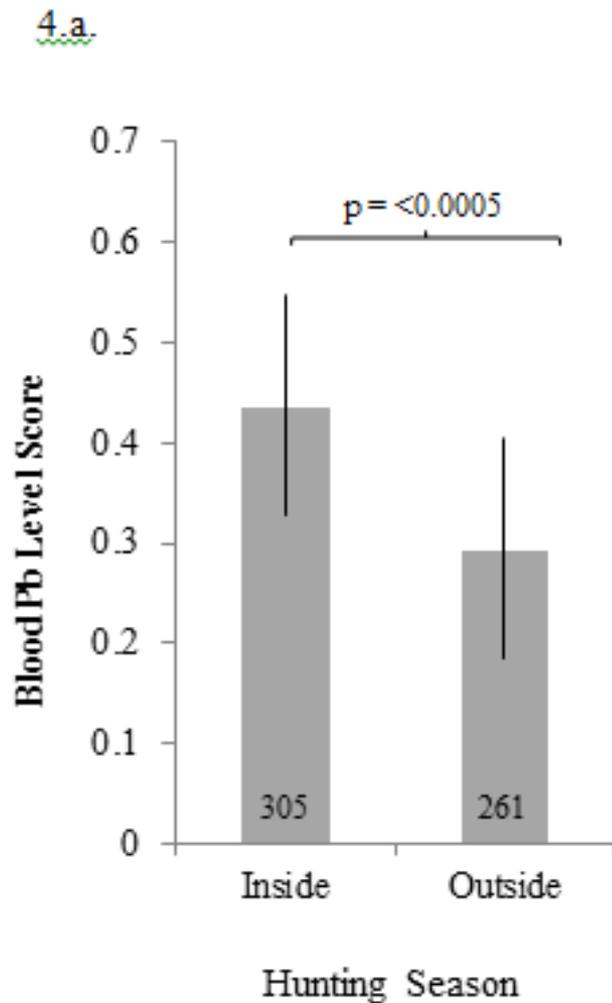
# Beckie Garbett PhD chapter Publication



Association between hunting and elevated blood lead levels in the critically endangered African white-backed vulture *Gyps africanus*

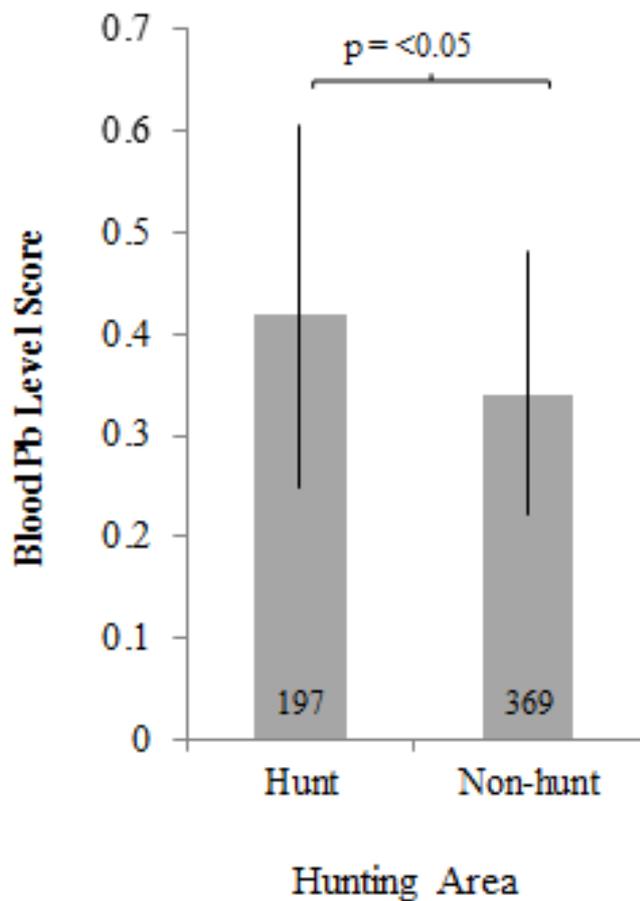


# Pb (Lead) levels and hunting season

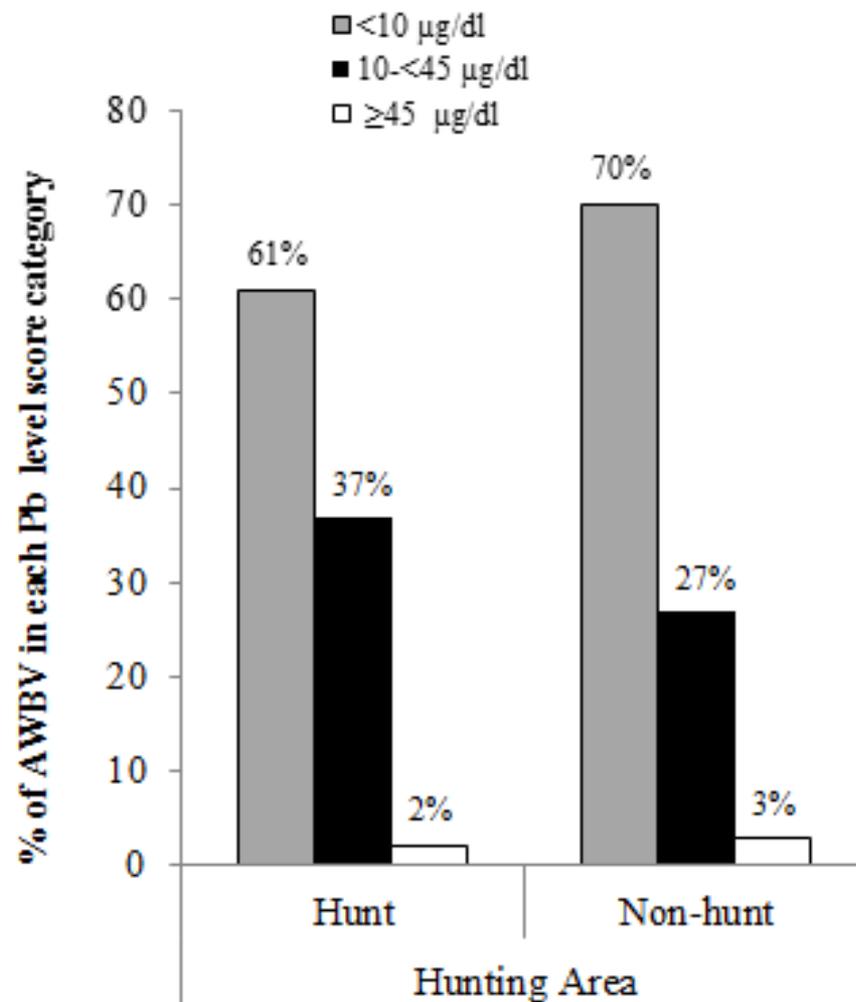


# By Area

5.a



5.b



# Bottom Line

- 566 vultures, 30.2% birds showed elevated Pb levels (10 to 45  $\mu\text{g}/\text{dl}$ ) and 2.3% showed subclinical exposure ( $\geq 45 \mu\text{g}/\text{dl}$ ).
- Higher blood Pb levels were associated with samples taken inside of the hunting season and from within hunting areas. There was a significant interaction between hunting season and areas, with Pb levels declining more steeply between hunting and non-hunting seasons within hunting areas than outside them.
- Consistent with the suggestion that elevated Pb levels are associated with recreational hunting. BUT NO DEFINITIVE PROOF
- Lead levels in Vultures actually increased after the hunting ban?

# Lead Fragments in Gut Piles



(Minnesota Department of Natural Resources, 2013)

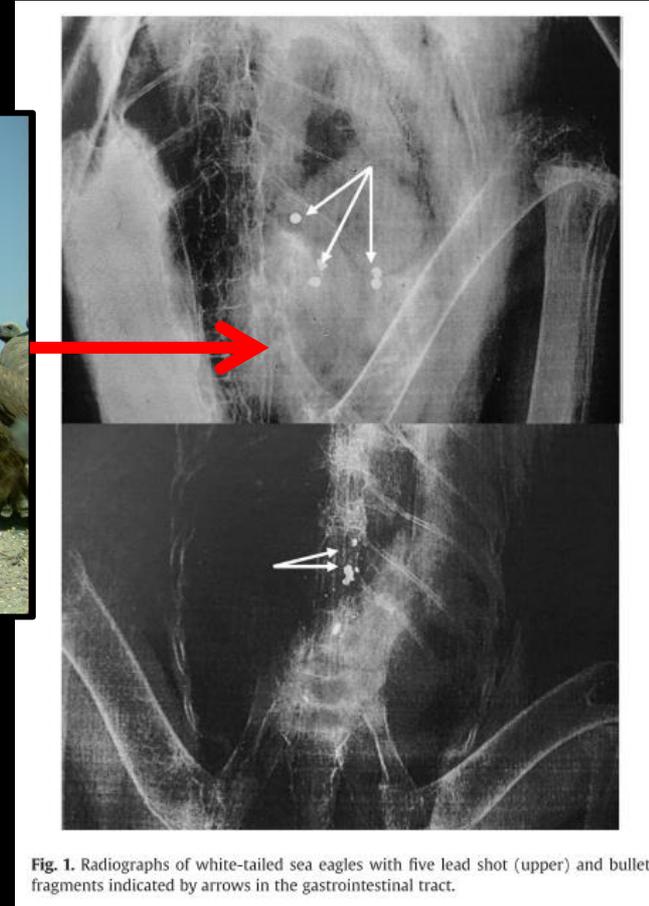


Fig. 1. Radiographs of white-tailed sea eagles with five lead shot (upper) and bullet fragments indicated by arrows in the gastrointestinal tract.

# LEAD FRAGMENTS



# SOURCES FOR LEAD

- Leaded gas.
- Fossil fuel.
- Water.
- Paint.
- Mining activities.
- Batteries.
- Spent ammunition.

# Break through papers lead by Linda van den Heever in 2019

Identifying the origin of lead poisoning in white-backed vulture (*Gyps africanus*) chicks at an important South African breeding colony: a stable lead isotope approach

Linda van den Heever · Marlina A. Elburg · Linda Iaccheri · Vinny Naidoo · Henriette Ueckermann · Grant Bybee · Hanneline A. Smit-Robinson · Melissa A. Whitecross · Andrew E. McKechnie

Blood and bone lead levels in South Africa's Gyps vultures: Risk to nest-bound chicks and comparison with other avian taxa.

Linda van den Heever, Hanneline Smit-Robinson, Vinny Naidoo, Andrew E. McKechnie.

## OUR 2015 PAPER RECOMMENDED

“First step in reducing lead levels in the avian scavenger environment would be to replace lead-based ammunition with non-lead substitutes (cooper and steel)”

## OUR 2017 PAPER RECOMMENDED

“Lead ammunition in Botswana is phased out as soon as possible to help protect this rapidly declining group of birds.”

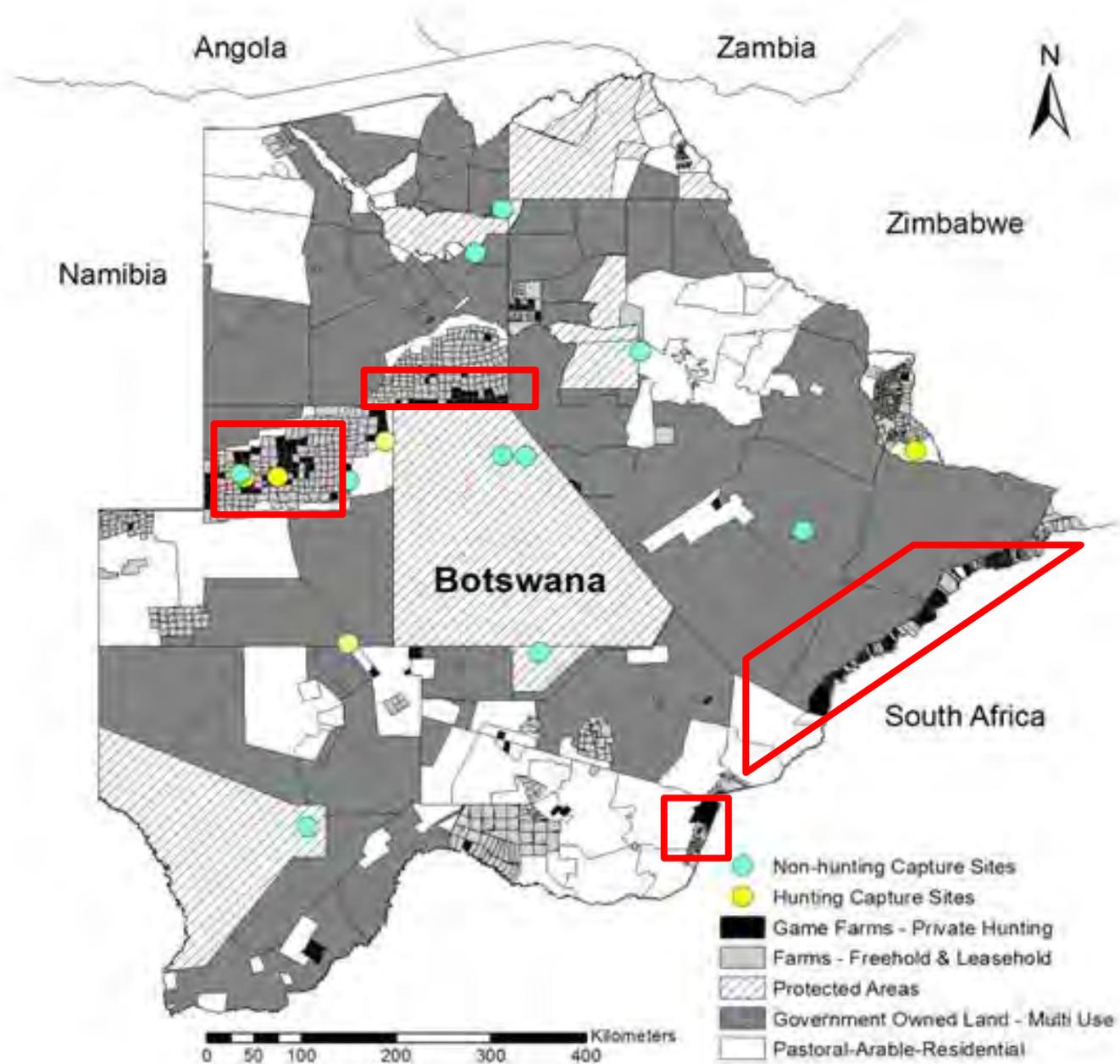
**BOTH OF THESE RECOMMENDATIONS  
STILL REMAIN A BIG PART OF THE  
SOLUTION TODAY.**

# Things to consider today lead ammunition related

Recreational Hunting has been back in Botswana since 2019 and every year has increased.

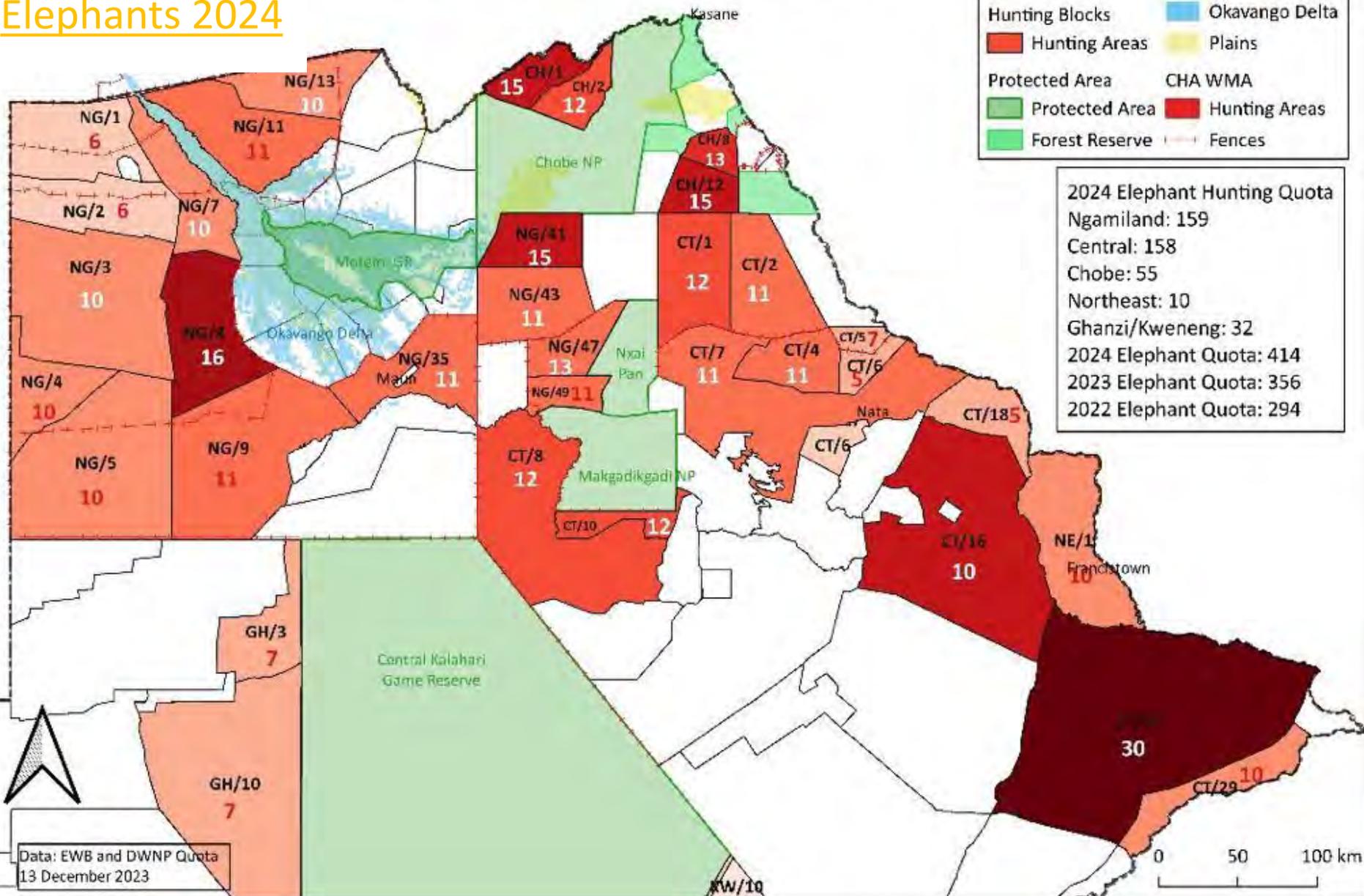
Illegal Hunting (poaching) made a big entry and jumped into the landscape around 10 years ago and has been increasing.

This means there is a lot more lead ammunition around than when our study was done



# Botswana Elephants 2024

## Botswana Elephant Hunting Areas and Quotas, 2024



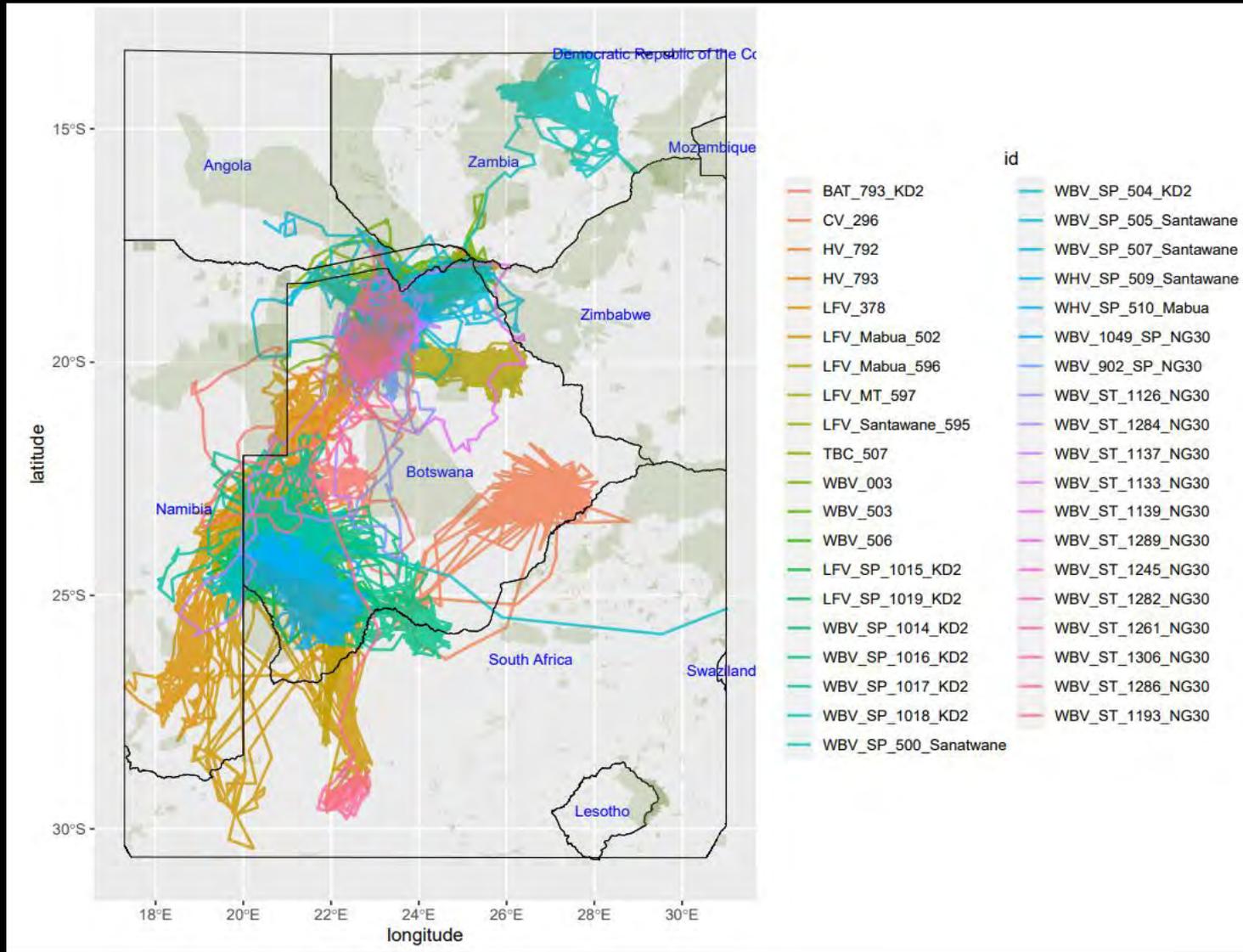
# Botswana 2024 Quota and Hunting

## “Lots of spent ammunition out there!”

### More than ten years ago?

- This is a total of 2 562 animals on quota (excluding elephants) across Botswana for 2024
- On top of this there is the hunting on all private farms
- Elephant hunting 414 plus the special quote
- Plus, citizen hunting
- And of course, all the illegal hunting (poaching) in which guns are used
- APU- DWNP , BDF chasing poachers and PAC- both DWNP and by communities
- Captive carnivores and feeding off- vultures often access food there.

# A regional issue- we are all in this together.



Any Questions?



