GROUND-HORNBILLS: the 'canary in the coal mine' for lead toxicosis

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Pb LEAD TASK TEAM South Africa

UNIVERSITEIT VAN PRETORIA
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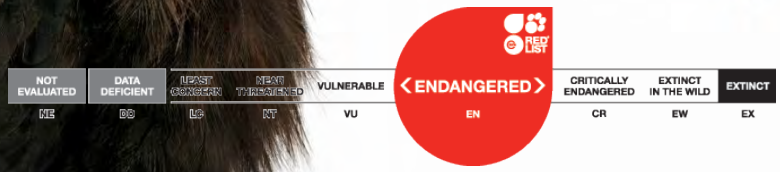
MABULA
GROUND HORNBILL
PROJECT

Bucorvus leadbeateri

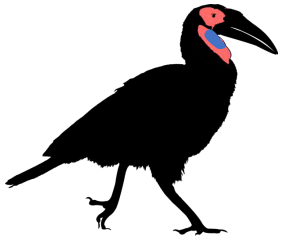
Bucorvus abyssinicus



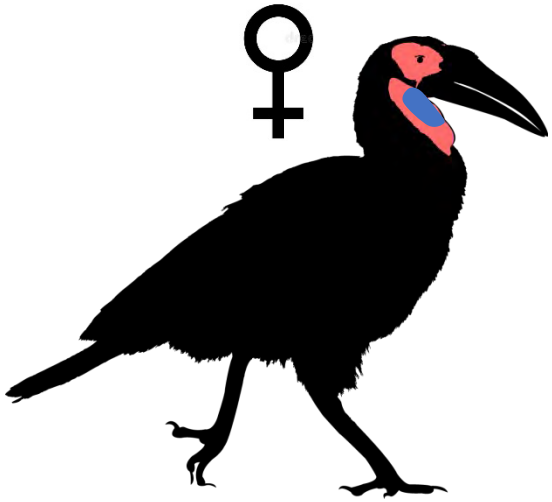
Top-order predator

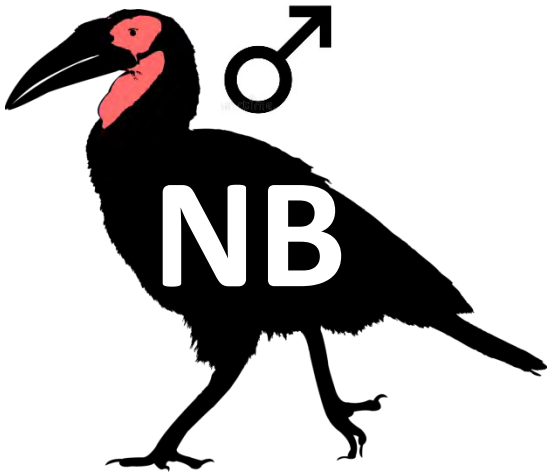
Culturally important

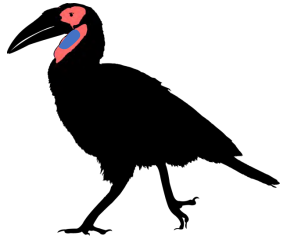
Umbrella/ Flagship species



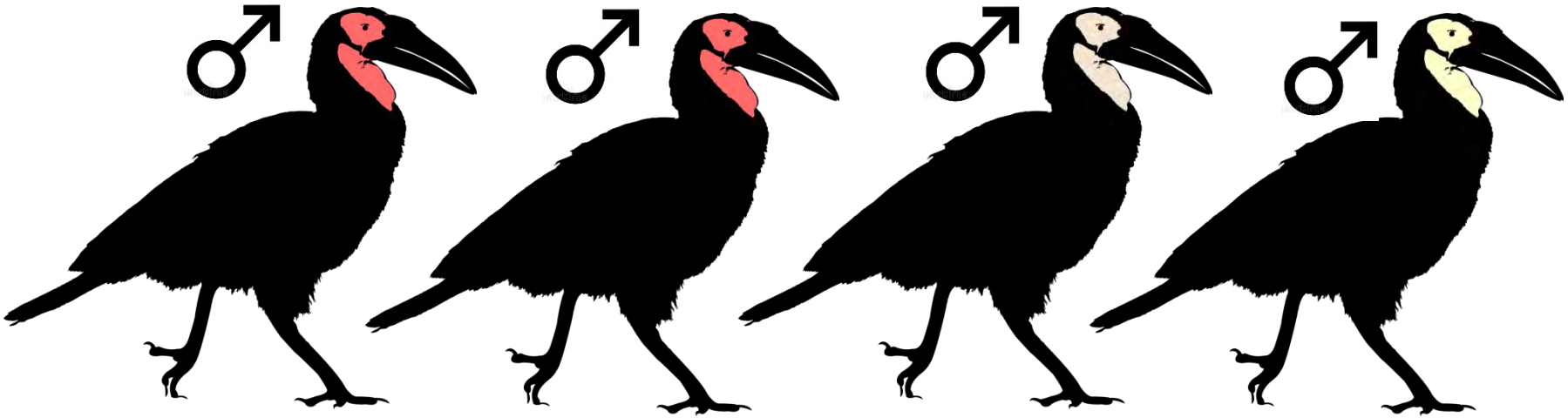
Skewed mortality





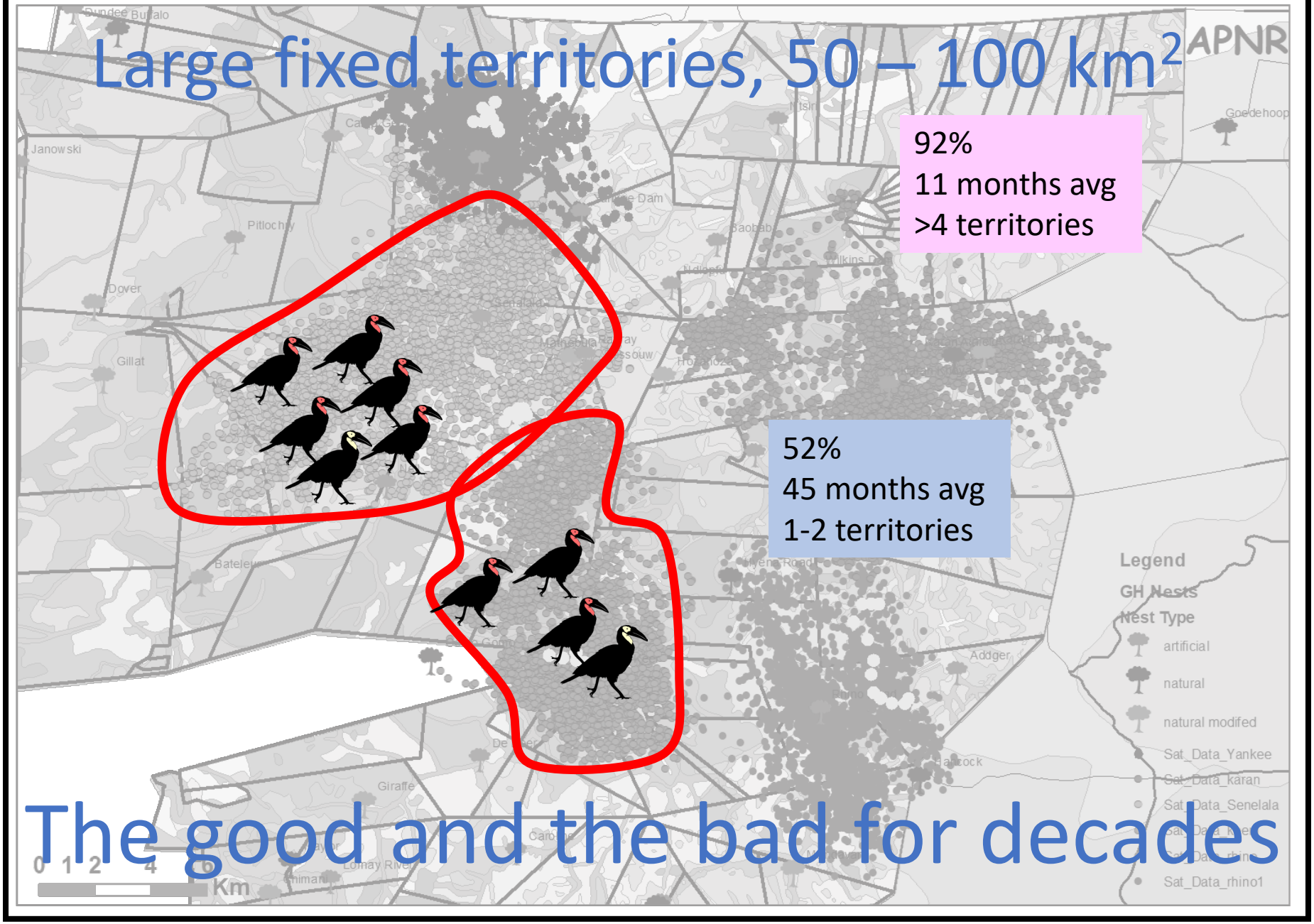


Blue males



Defend territory, provision female and chick

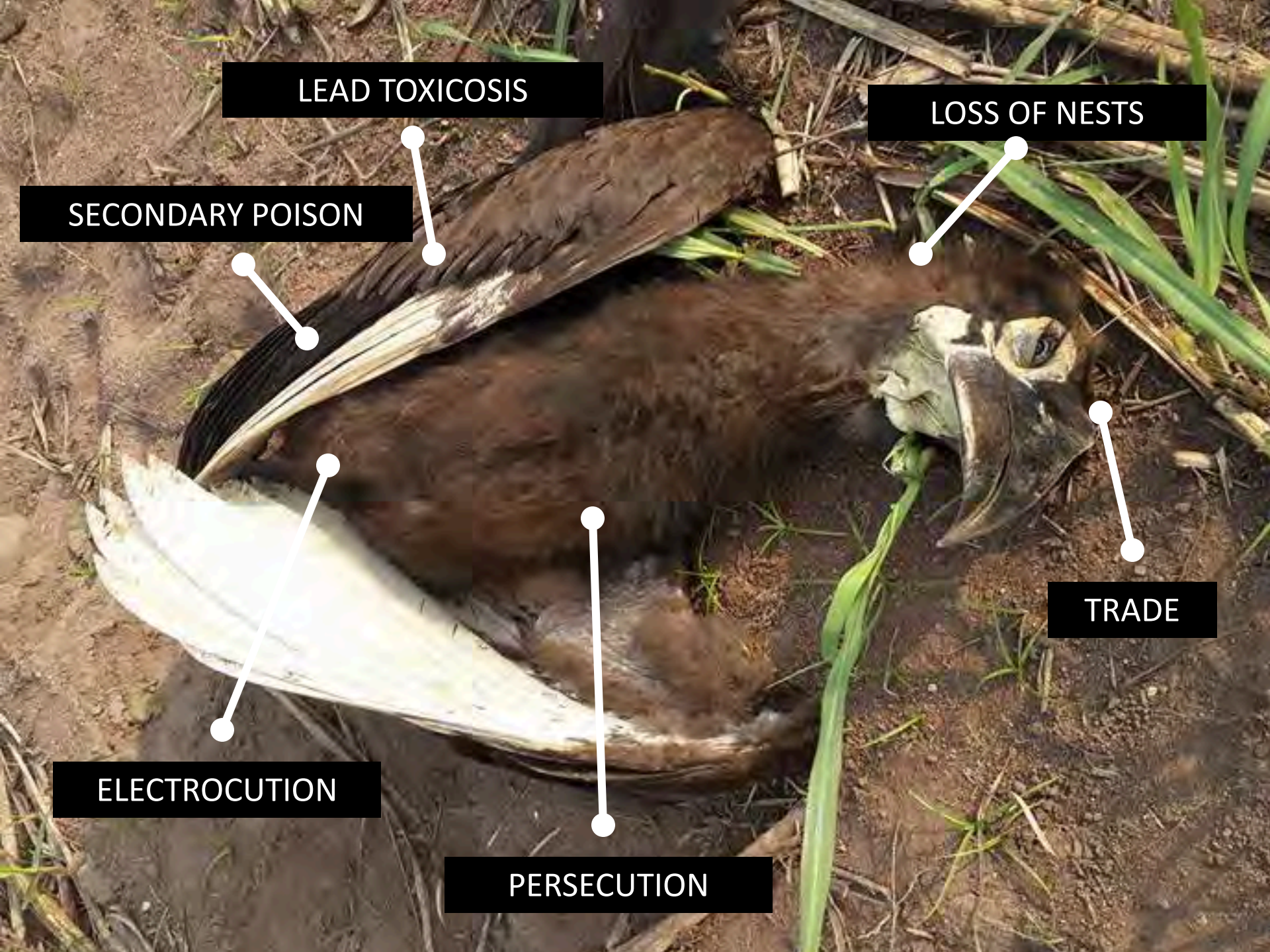
Large fixed territories, 50 – 100 km²



The good and the bad for decades

Carstens 2018, Zoghby et al 2016, Wilson & Hockey 2013, Wyness 2011, Theron et al 2013.

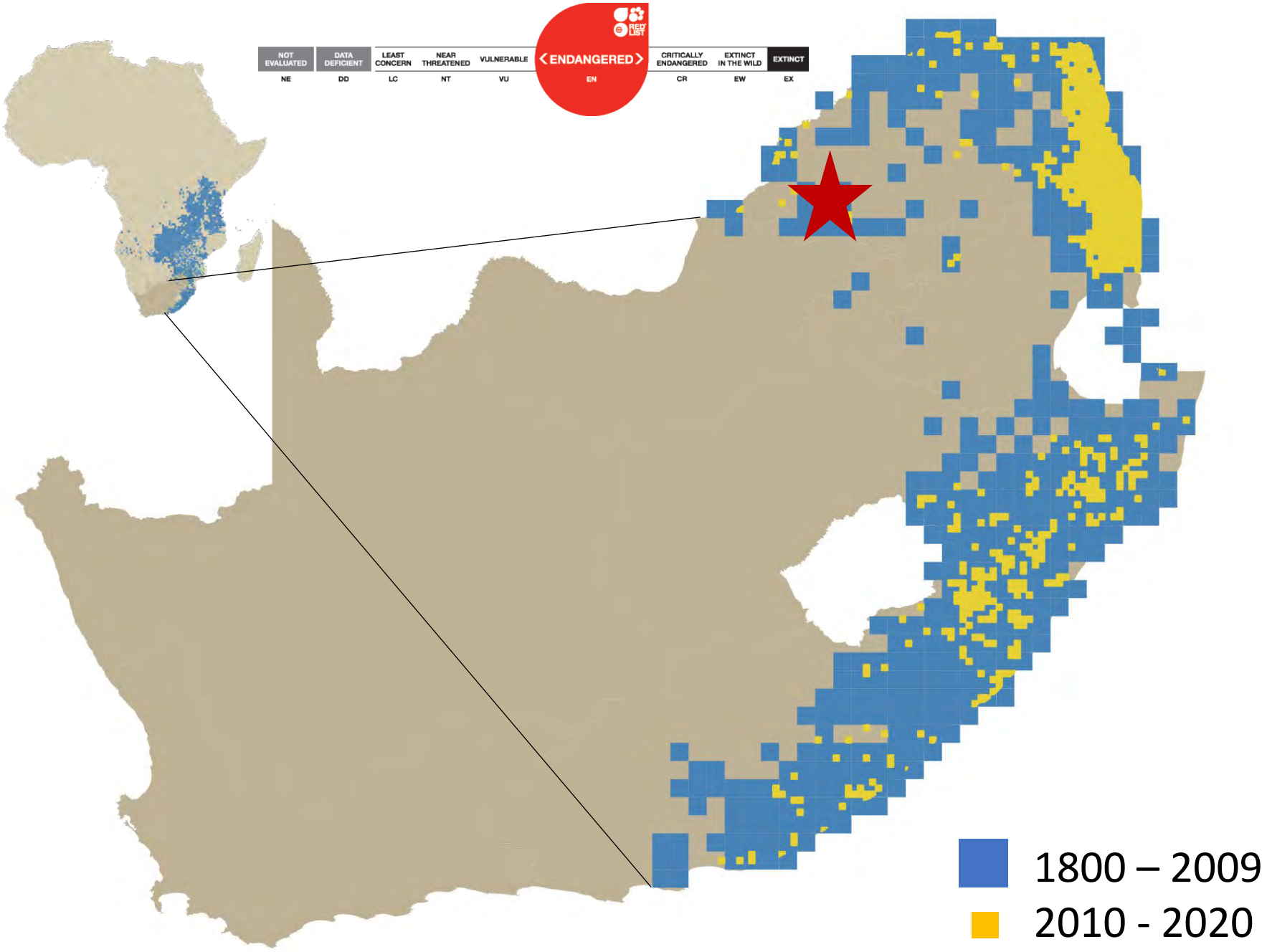
THE PROBLEM: US & THEM


LEAD TOXICOSIS
LOSS OF NESTS
SECONDARY POISON
TRADE
ELECTROCUTION
PERSECUTION

life history strategies

Long lifespan	¬ 70 years
Large body size	1m tall
Low productivity	Max 1 per group per year
Late maturity	¬10 in captivity – later in wild
Large spatial requirements	Average 80 – 100 km^2
High parental investment	Extensive learning phase 3 – 5 years
Low natural mortality	<1% after 5 years
Cooperative breeding	Alpha pair + male helpers
Group living	2-12

TIME + SPACE


NOT EVALUATED
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EXTINCT IN THE WILD
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EXTINCT
EX
RED LIST
1800 – 2009
2010 - 2020


‘bush-schools’

COST OF PRODUCTION/ CHICK

Harvest:	R5000
Rearing and care of captive socialising birds	R90000
Reintroduction:	R10000
Monitoring	R10000
	R125 000

Minimum – assuming nothing goes wrong…..

GROUND-HORNBILL CASE STUDY

Journal of Avian Medicine and Surgery 29(4):340–344, 2015
2013

Lead Toxicosis in a Southern Ground Hornbill *Bucorvus leadbeateri* in South Africa

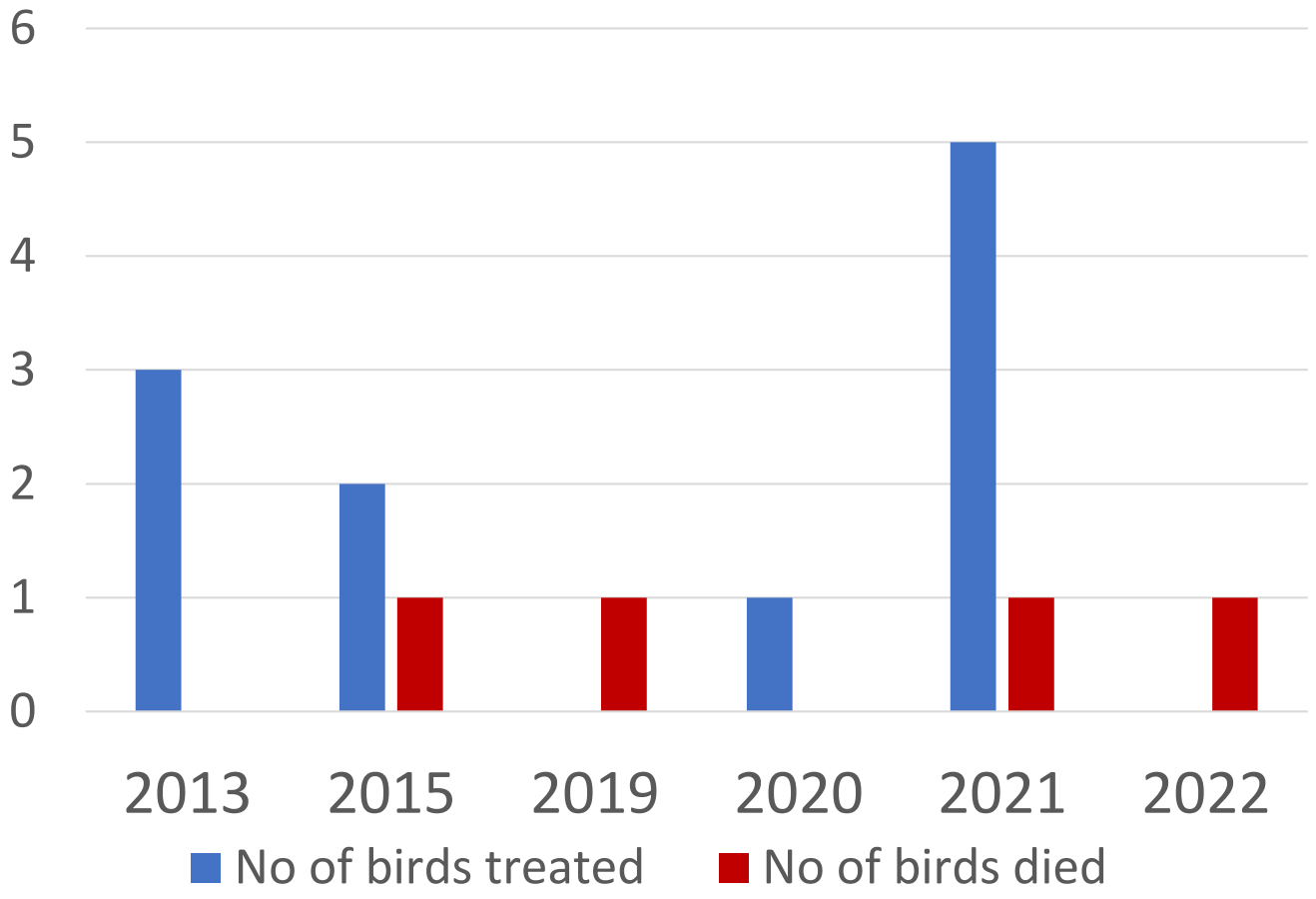
Katja N. Koeppel, Dr Med Vet, MSc, Cert Zoo Med, and Lucy V. Kemp, MSc

Abstract: The southern ground hornbill (*Bucorvus leadbeateri*) has been classified as globally vulnerable and, in South Africa, regionally endangered, with a negative population trend. Factors contributing to the population decline in South Africa are poisoning, electrocution, and illegal capture for trade, coupled with slow reproductive rates and extensive habitat requirements. Lead toxicosis is a previously undescribed threat for the population. An adult southern ground hornbill presented with acute lead toxicosis due to lead particles in the gizzard, which required intensive treatment. Two other hornbills were likely exposed. The source of the lead in these cases was likely a carcass of a porcupine that was killed with lead shot. This report highlights the importance of the use of lead-free ammunition within the habitat of the southern ground hornbill in South Africa.

Key words: toxicosis, lead, endangered species, South Africa, avian, southern ground hornbill, *Bucorvus leadbeateri*

4 mortalities BUT multiple group breakdowns – REINTRODUCTION FAILURE

1 in a provincial reserve/ rest are in hunting areas



The poison in the bullet

- Adult SGH from a hunting farm in 2015
- Blood-lead concentration: 232 µg/dL (100 x clinical level for SGH)
- Patient survived after full chelation treatment


Acq. Date:09.07.2019
Acq. Time:10:24:55 AM
Exp. Index:2232
100%

Clinical signs of lead toxicosis

- Neurological signs
- Gut stasis
- Immuno suppression
- Gastrointestinal upset
- Abnormal calcium metabolism

Blood (µg/dl)
<4,4 background
5-10 mild to moderate
11-40 clinical poisoning
> 40 severe clinical poisoning

Bone ?
>1 ug/g DW

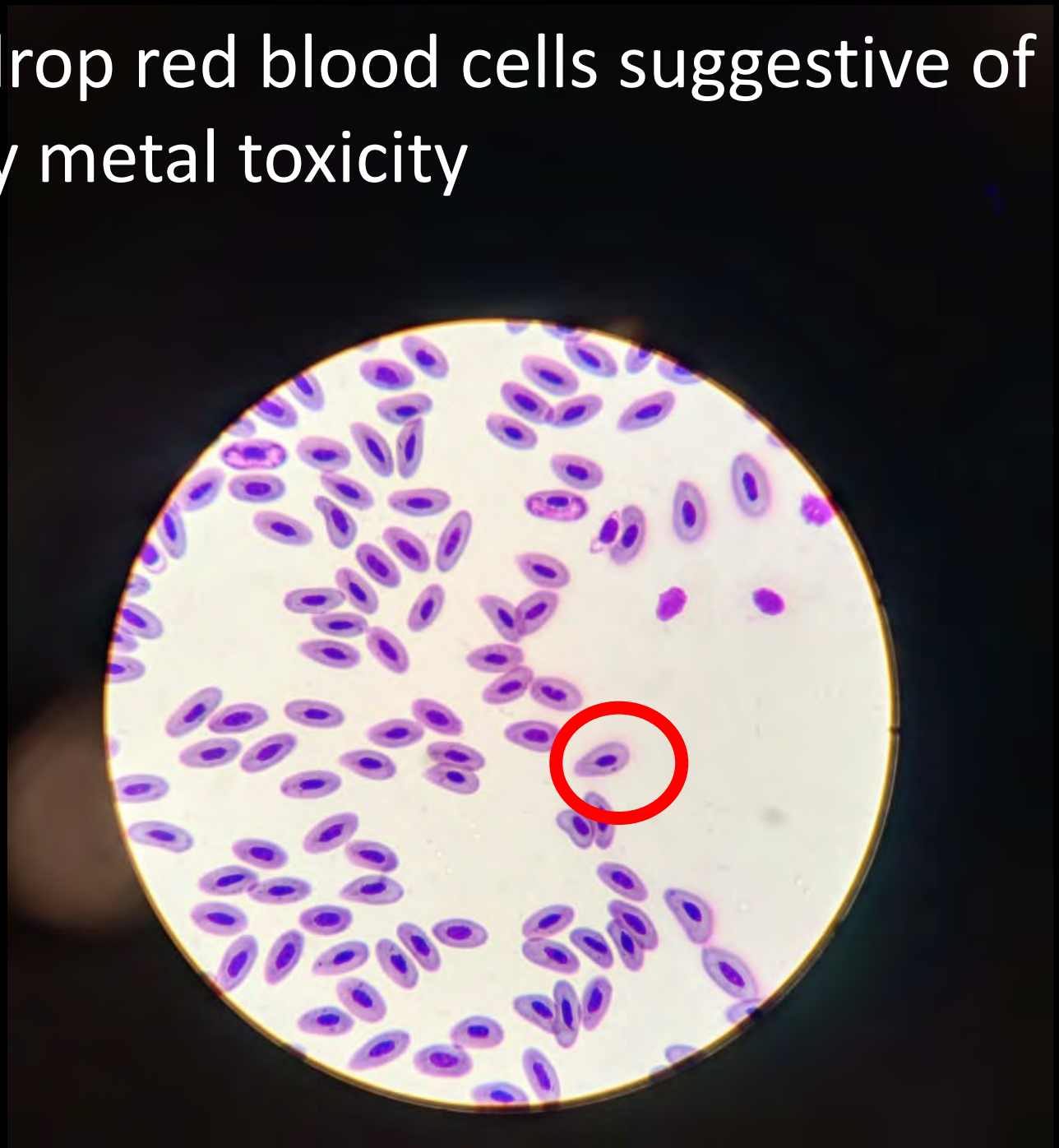
Liver/Kidney
>2 ug/g clinical poisoning

Van Heever et al, 2019, Interpretation of Lead values in Falconiforms

Range	Interpretation
Blood (µg/dL)	
<10	Background
10–20	Mild to moderate subclinical effects
20–50	Significant subclinical effects
50–100	Clinical poisoning
>100	Severe clinical poisoning
Bone (µg/g dw[a])	
<10	Background
10–20	Subclinical to clinical poisoning
>20	Severe clinical poisoning
Liver (µg/g ww[b])	
<2	Background
2–6	Subclinical poisoning
6–10	Clinical poisoning
>10	Severe clinical poisoning

[a] dw = dry weight.
[b] ww = wet weight.

Teardrop red blood cells suggestive of heavy metal toxicity



CHELATION TREATMENT

- SGH with blood lead values higher than 10 µg/dL require immediate veterinary treatment
- Lethal blood lead level is 40 µg/dL

Injectable

35 mg/kg Ca EDTA
(Kyron)

Twice daily IM for 5 days

5-day rest period (time to clear the system)
Retest then if needed repeat full 5 days

Oral

30 mg/kg Dimercaptosuccinic acid (Vtech)

Once daily for 10 days

STRESS!! AND TAMING.

Retest 24 hours after last treatment then if needed repeat full 5 days

CHELATION TREATMENT

- SGH with blood lead values higher than 10 µg/dL require immediate veterinary treatment
- Lethal blood lead level is 30 µg/dL
- 35 mg/kg Calcium EDTA
  - Daily for 5 days
  - 2-day rest period (time to clear the system)

Warwick Tarboton

***LEAD TOXICOSIS TREATMENT BEST PRACTICE GUIDELINES**

‘CANARY-IN-THE-COALMINE?’

Not an obligate scavenger!
Takes less than ¼ of a grain-of-rice fragment

- **Single greatest cause of reintroduction failure = Californian Condors**
- **Clinical signs < vultures**
- Subtle clinical signs (behaviour change) from as low as 5 µg/dL (drooping wings, lethargy).
- Liver and kidney levels of >120 ug/dL (12 ppm) have been associated with death due to toxicosis

I DIDN'T KNOW!

- most people are responsible and willing to change
  - will always be a die-hard minority that will deny the evidence and resist change
- social media campaign
  - facts only, non-judgemental
  - just make suggestions for personal choice

WHAT ARE THE EFFECTS OF LEAD?

LEAD IS A NEUROTOXIN

other neurotoxins include
- *botulism*
- *tetanus (lockjaw)*
- *mercury*
- *arsenic*
- *and the venom of scorpions, cobras, mambas and black widow spiders!*

If a large amount of metallic lead is ingested, death can be rapid (acute poisoning); if a small amount of lead is ingested, death may occur after several weeks of chronic ill-health.

NO LEVEL OF EXPOSURE TO LEAD IS CONSIDERED SAFE!!

LEAD ACCUMULATES OVER TIME, DOES NOT DEGRADE AND CAN REMAIN POISONOUS FOR THOUSANDS OF YEARS.

Lead exposure has been associated with lower intelligence scores, poor school performance in children, shortened concentration spans and lowered lifetime earnings.

Lead can cause loss of libido and fertility in men, and menstrual disturbances and spontaneous abortion in woman.

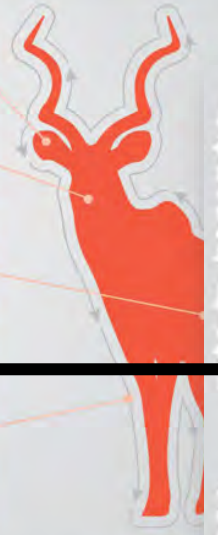
LESS SEXY AND LESS SMART! *NOW WHO WANTS THAT?!!!*

Lead can CAUSE HEARING LOSS, especially in children.

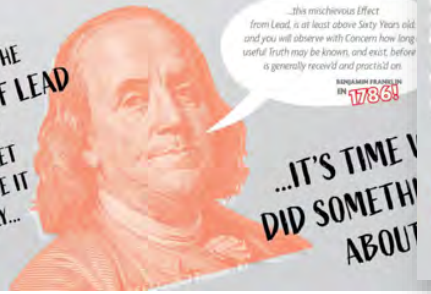
Absorbed lead is stored in the teeth and bones, where it accumulates over time and INTERFERES WITH IMPORTANT BODY FUNCTIONS that rely on calcium.

Lead can also DAMAGE and modify the function of KIDNEYS, THE LIVER, NERVES AND THE GUT.

Lead interferes with haemoglobin production in the blood, which DIMINISHES the blood's ability to TRANSPORT VITAL OXYGEN throughout the body.



LEAD HAS ALSO BEEN LINKED WITH:
- AGGRESSION
- HYPERACTIVITY
- VIOLENT BEHAVIOUR
- STUNTED GROWTH IN CHILDREN



WE'VE KNOWN ABOUT THE DANGERS OF LEAD FOR AT LEAST 300 YEARS. YET STILL WE USE IT RECKLESSLY...

...this mischievous Effect from Lead, is at least above Sixty Years old, and you will observe with Concern how long useful Truth may be known, and exist, before it is generally receivd and practis'd on.

BENJAMIN FRANKLIN IN 1786

...IT'S TIME DID SOMETH ABOUT

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LESS SEXY AND LESS SMART! *NOW WHO WANTS THAT?!!!*

HOW DO WE EXPOSE WILDLIFE TO LEAD?

FISHING

Lead fishing sinkers discarded in waterbodies can ***POISON CROCODILES, WATERBIRDS AND FISH.*** *These animals swallow them because they think they are stones to aid digestion.*

CROCS IN LAKE ST LUCIA, IN KZN, HAVE EXTREMELY **HIGH BLOOD LEAD** LEVELS THAT ARE **100x** HIGHER THAN WHAT'S TOXIC FOR HUMANS!

THESE ARE THE **HIGHEST RECORDED LEVELS OF LEAD IN THE BLOOD** FOR ANY VERTEBRATE ANYWHERE IN THE **WHOLE WORLD!**

THOUSANDS OF TONS OF LEAD SINKERS ARE SOLD IN SOUTH AFRICA EACH YEAR, MOSTLY TO **REPLACE SINKERS** THAT HAVE BEEN LOST IN THE WATER WHILE FISHING.

NEARLY ALL FISHING SINKERS (WEIGHTS) ARE MADE OF **LEAD** *(Pb)*

Larger lead sinkers are often **swallowed by crocodiles** that think they are stones to assist with digestion. Lead in mother crocs can be **passed on to the eggs and embryos,** affecting reproduction in the next generation.

Smaller fishing sinkers (e.g. split shot) are **swallowed by birds** such as ducks and geese that **mistake the sinker for food or stones.**

This makes them **ill or kills them**, and they pass up the food chain to **crocodiles, eagles and scavengers** that feed on these sick or dead birds and fish.

A SINGLE **SPECIMEN CARP** ANGLING COMPETITION AT **ROODEKOPPIES DAM** RESULTED IN APPROX. **1.97 TONS OF LEAD** LEFT IN THE DAM!

...AND WHAT ABOUT US?

Lead is most easily absorbed by the body when it is **inhaled**. This can happen lead is melted down to make sinkers or ammunition at home.

Users of indoor shooting ranges that are poorly ventilated and employ powder discharges are exposed to MUCH higher levels of lead.

Lead dust from fishing sinkers contaminates tackle boxes, tables and other surfaces in the home, leading to **skin absorption** or inhalation.

Large concentrations of accumulated lead in a waterbody can **contaminate drinking and irrigation water,** posing a severe threat to humans.

BE LEAD-WISE

- DO NOT let children handle lead sinkers or ammunition.
- Use gloves, masks and well-ventilated rooms when re-loading ammunition.
- Use outdoor shooting ranges or well-ventilated indoor ranges.
- Wash your hands thoroughly with soap and water if you've handled anything made of lead, especially before eating.

HOW DO WE EXPOSE WILDLIFE TO LEAD?

HUNTING & SPORT SHOOTING

BEFORE LAWS WERE INTRODUCED IN NORTH AMERICA TO RESTRICT THE USE OF LEAD IN AMMUNITION, **3 MILLION** DUCKS AND GEESE **DIED** FROM LEAD POISONING EVERY YEAR!

WATERFOWL, RAPTORS (BIRDS OF PREY) AND GROUND HORNBILLS **ARE AT GREATER RISK OF LEAD EXPOSURE THAN OTHER BIRDS.**

Lead shot *that falls in wetlands or on the ground may be* ***ingested by ducks, gamebirds & cranes.***

WATERBIRDS have very **muscular stomachs** which grind and erode metallic lead. The lead is then quickly spread to other parts of the body via the blood stream.

The stomachs of RAPTORS are less muscular but they are **very acidic.**

GROUND HORNBILLS are at even higher risk as they have both very **muscular stomachs and high stomach acidity.**

IT DOESN'T TAKE MUCH!! Ground Hornbills have been poisoned by lead fragments as small as a **THIRD OF A GRAIN OF RICE.**

30 cm

Lead bullet fragments can travel **long distances** from the entry wound and may be too small to see except on x-rays. When hunting with lead ammunition, the **bullets and all tissues in a 30 cm radius** around the wound channel should be **removed** if the carcass is to be left in the veld.

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WHAT CAN YOU DO TO HELP?

*ALWAYS use **LEAD-FREE WEIGHTS** if you are a specimen shark angler or you fish where there are crocodiles.*

Where possible, **SWITCH TO LEAD-FREE** ammunition or tackle.

Use ONLY **LEAD-FREE AMMUNITION** in areas (e.g. **protected areas**) where vultures and other scavengers might die from feeding on toxic carcasses.

REMOVE vermin or poaching dogs **SHOT WITH LEAD** bullets from anywhere that vultures or other scavengers can get access to them.

Dispose of lead-contaminated meat by **BURNING** it or **BURYING** it deep.

*Only buy game meat from **REPUTABLE SOURCES** and ask for lead-free.*

Use **HOME-MADE FISHING WEIGHTS** (such as steel nuts, stones or baked clay), especially when aerodynamic performance of the weights is not essential, such as when boats or drones take bait out

Collect any discarded lead fishing weights, tackle or shot that you find, and take them home for **RESPONSIBLE DISPOSAL.**

***ENCOURAGE YOUR FRIENDS** to replace their lead ammunition and fishing tackle with alternatives that are safe for humans and wildlife.*

*Ask your favourite retailer to **STOCK NON-LEAD** fishing weights (nickel alloy, bismuth and tin) and ammunition.*

Demand that your hunting/fishing association adopts **POLICIES OR POSITION STATEMENTS** committing members to **HUNT/FISH RESPONSIBLY.**

DO NOT DISTRIBUTE lead-contaminated meat to anyone or LEAVE IT out in the veld.

DO NOT hunt with lead shot OVER WETLANDS.

DO NOT DONATE LEAD-CONTAMINATED MEAT to vulture restaurants or any other kind of predator/scavenger feeding.

CONTINUING TO USE LEAD
IN HUNTING, FISHING OR WILDLIFE MANAGEMENT
CANNOT BE CONSIDERED RESPONSIBLE, SUSTAINABLE OR ETHICAL.

HOW DO WE EXPOSE WILDLIFE TO LEAD?

WILDLIFE MANAGEMENT

CARCASSES OR PARTS OF CARCASSES THAT ARE CONTAMINATED WITH LEAD SHOT CAN **POISON SCAVENGERS** SUCH AS VULTURES AND HYAENAS.

SCAVENGERS ARE EXPOSED TO LEAD-TAINTED MEAT WHEN

- DOGS AND VERMIN shot by rangers or farmers are left in the veld.
- animals that are WOUNDED DURING CULLING operations using lead ammunition, evade retrieval and later die in the veld
- animals that have been SHOT BY POACHERS and left in the veld.

When lead ammunition is used for culling, the HEALTH AND LIVES OF PEOPLE who later consume the meat (even head and internal organs) are PUT AT RISK.

WHEN TRYING TO HELP CAN KILL

Lead-contaminated meat fed to **predators in bomas** can prove lethal to cheetahs, lions and wild dogs.

Lead-contaminated meat placed at **vulture restaurants** or otherwise **left in the veld** as food for scavengers can poison vultures and hyaenas.

LEAD-CONTAMINATED CARCASSES OR PARTS OF CARCASSES SHOULD EITHER BE **REMOVED**, **BURIED** DEEP OR **BURNED** BEFORE THEY CAUSE THE DEATHS OF SCAVENGERS

UNLESS CERTAIN THAT LEAD-FREE (MONOLITHIC) BULLETS WERE USED, BULLETS AND ALL TISSUES IN A **30 CM RADIUS AROUND THE WOUND CHANNEL** SHOULD BE REMOVED FROM ANIMALS POACHED USING RIFLES IF THE CARCASS IS TO BE LEFT IN THE VELD

Where lead bullets are used for law enforcement, the **lead should be removed** from the shooting range backstops and **recycled** to prevent ingestion of spent bullets by birds, or general environmental contamination.

OUTDOOR SHOOTING RANGES SHOULD **NOT** BE CREATED IN **IMPORTANT AREAS** FOR CRANES OR GROUND-HORNBILLS!!

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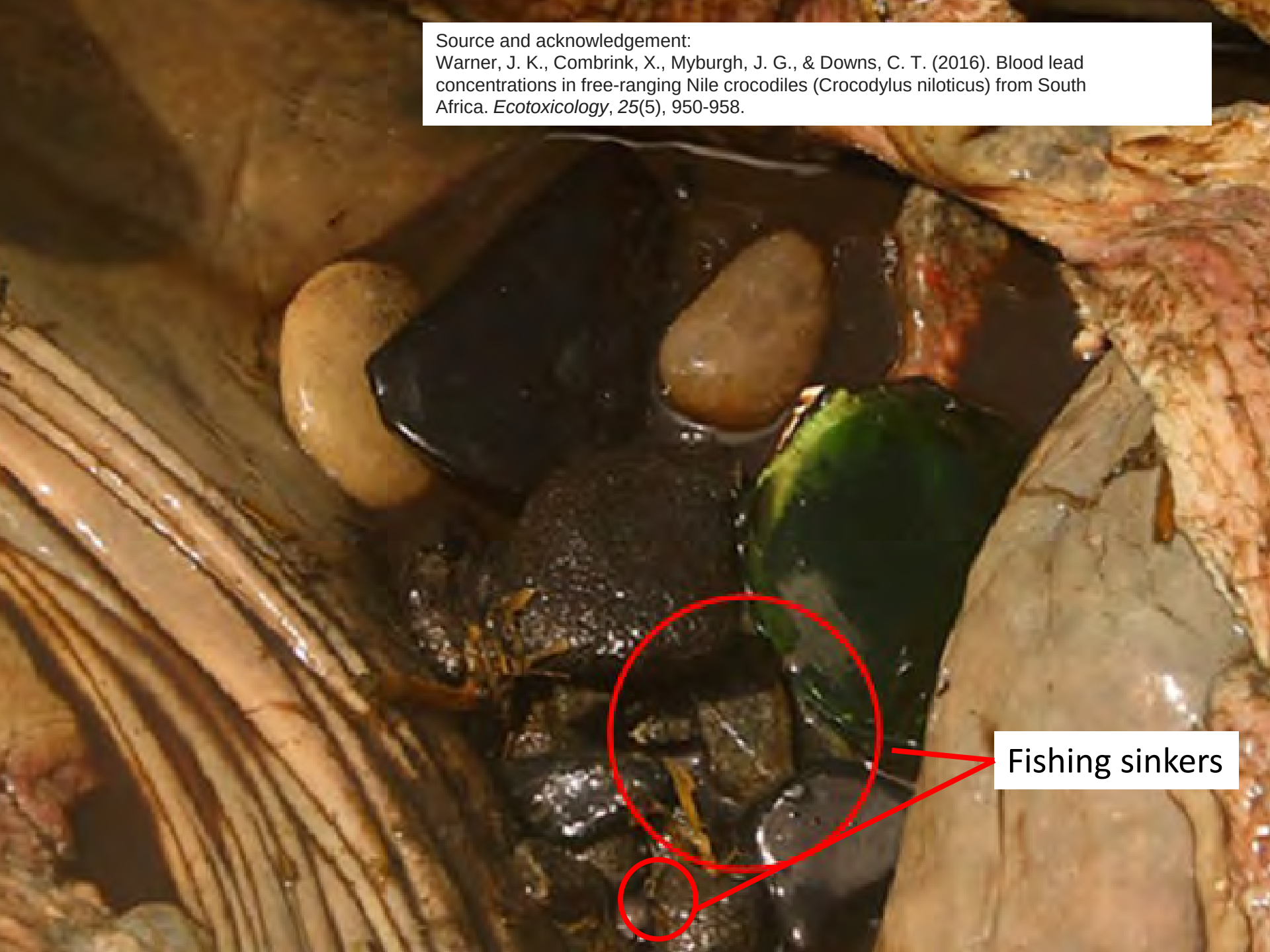
BENJAMIN FRANKLIN IN 1786!

...IT'S TIME WE DID SOMETHING ABOUT IT!


Less sexy & less smart?!
Now who want that?
IT IS ABOUT TIME WE DID SOMETHING ABOUT IT!

Source and acknowledgement:
Warner, J. K., Combrink, X., Myburgh, J. G., & Downs, C. T. (2016). Blood lead concentrations in free-ranging Nile crocodiles (Crocodylus niloticus) from South Africa. *Ecotoxicology*, *25*(5), 950-958.




ONCE YOU KNOW YOU CANNOT UNKNOW!!!
THANK YOU FOR YOUR TIME