

# LEAD EXPOSURE IN CARNIVORES IN NAMIBIA DUE TO THE USE OF LEAD BULLETS IN WILDLIFE



- STUDENT: LIAM REID
- SUPERVISOR: DR MARK JAGO  
& DR JOHN YABE

# BACKGROUND TO PROJECT

- Lead toxicity caused by the ingestion of Pb ammunition fragments in carcasses and offal is a threat to scavengers across the globe
- It has been found in Botswana that scavenging birds—such as the vulture accumulate lead in their bodies.
- Lead has been detected in carnivores across the globe.
- Lead is a known neurotoxin and may have neurological effects on species exposed as well as reducing fertility and possibly causing death.



# Lead poisoning

- Oral consumption is the major route – is a cumulative toxin
- Excreted by kidneys and in milk
- Lead crosses placental barrier – abortion
- Crosses blood-brain barrier- cerebral oedema and haemorrhage
- Accumulates in bone (bone is a sink for lead) – growth plates
- Inhibits sulfhydryl groups of enzymes
- Affects red blood cells (increased fragility; depression of bone marrow)
- Endothelial and peripheral nerve damage in brain
- Immunosuppression: inhibits antibody production

# RESEARCH QUESTIONS TO BE INVESTIGATED / RESEARCH OBJECTIVES

- To answer the question – are Namibian carnivores facing this problem?
- To determine if there are detectable traces of lead in the bones of carnivores in Namibia –possibly linked to consumption of game meat shot with lead bullets.



# SIGNIFICANCE OF THE PROJECT

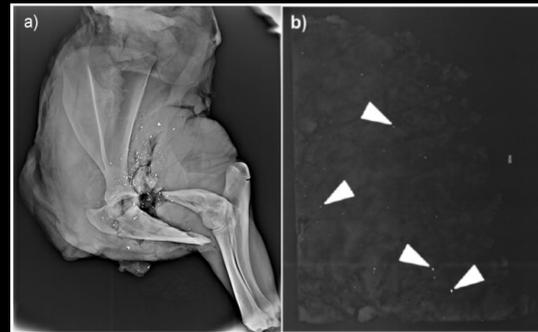
- Preserve carnivores and scavengers

Global status	Common name	Namibian status
Endangered	African Wild Dog	Critically Endangered
Vulnerable	Cheetah	Endangered
Vulnerable	Lion	Vulnerable
Vulnerable	Leopard	Vulnerable
Vulnerable	Black-footed Cat	Vulnerable
Least Concern	Spotted Hyena	Vulnerable
Near Threatened	Brown Hyena	Near Threatened



# SIGNIFICANCE OF THE PROJECT

- Possible exposure in human population



# RESEARCH DESIGN

- Collect- bones of carnivores/scavengers around Namibian farms, game reserves.
- Samples- bone ( jackal, cheetah, hyena, leopard.)
- Nitric acid sample digestion for lead extraction
- Test-for presence of lead using sample inductively Coupled Plasma - Mass Spectrometry (ICP-MS) analysis
- Positive(t+) for lead suggests exposure to lead. Possibly from ingestion of lead bullets from shot carcasses.



# METHODOLOGY



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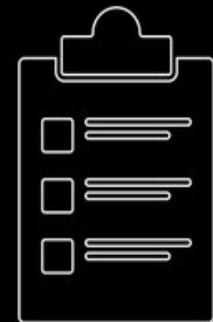


# METHODOLOGY



# DATA ANALYSIS

- Data records- pertaining to sample, species, gender, location.
- Raw data- lead concentration in bones
- Descriptive statistics- mean, median, mode, min, max.
- Species differences



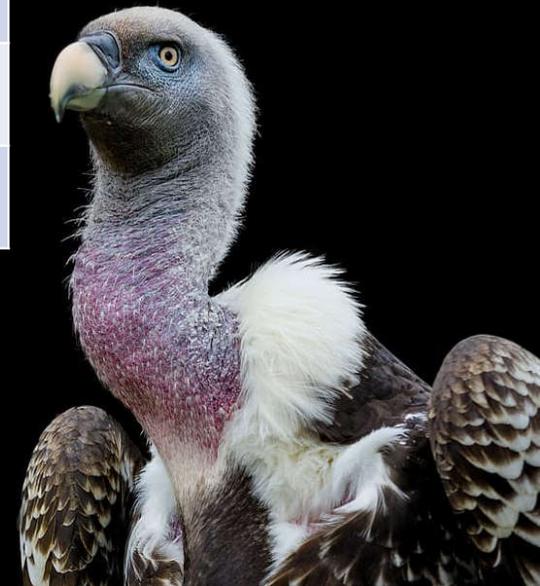
# EXPECTED RESULTS

- Expect to find positive results
- Expect to find higher [pb] in scavengers- jackal, hyena.
- Expected benefits- this information can be used to encourage use of other forms of bullets and be used for further studies.



# SAMPLE SHEET – Digested

	Long bone	Skull bone	Total
Cheetah	11	13	24
Jackal	8	6	14
Leopard	3	2	5
Hyena	1	2	3
	23	23	46



# TIME LINE OF PROJECT

	2021	Aug – June 13	July 14- Aug 4	Aug- Oct	Oct 21
Literature review and preparation	Yellow	Light Blue	Light Blue	Light Blue	Light Blue
Data Collection	Light Blue	Yellow	Light Blue	Light Blue	Light Blue
Data Analysis	Light Blue	Light Blue	Yellow	Light Blue	Light Blue
Dissertation write up	Light Blue	Light Blue	Light Blue	Yellow	Light Blue
Presentation	Light Blue	Light Blue	Light Blue	Light Blue	Yellow

- >1 Year.
- Collection until June
- Digestion June 15-23
- Test for 3 weeks (Japan)
- Completion by end of academic year 2022

# RESULTS

- All bone samples tested positive for Pb.
- 2 samples not tested
- Maximum [pb] = 14,59 mg/kg (cheetah skull)
- Minimum [pb] = 0,17 mg/kg (hyena skull)
- Overall average [Pb] = 2,95 mg/kg
- WHO- “THERE IS NO KNOWN SAFE LEAD CONCENTRATION”. Blood lead concentrations as low as 3.5 micrograms/dL may be associated with decrease intelligence, behavioural and learning difficulties.

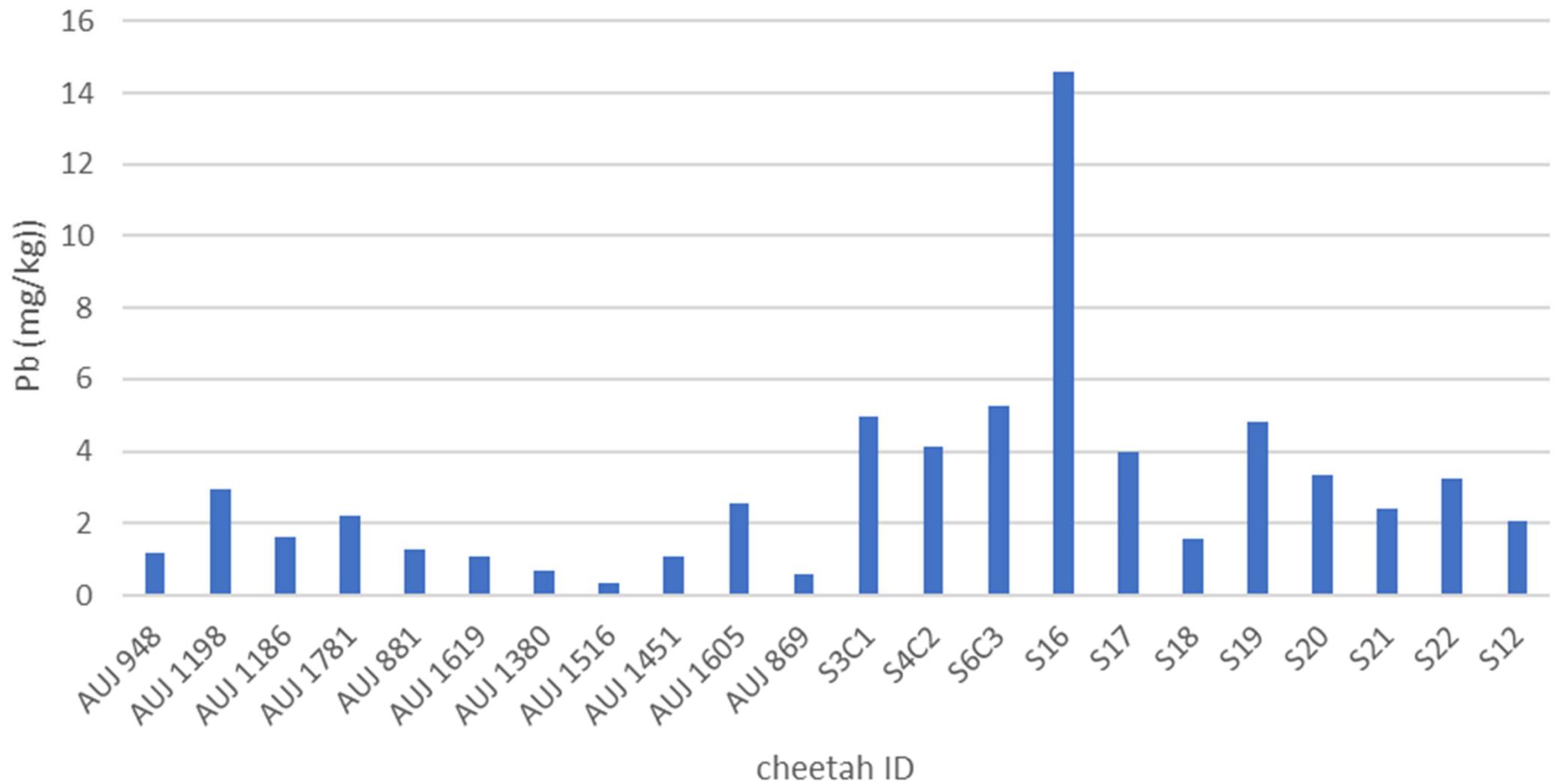


# SPECIES COMPARISON

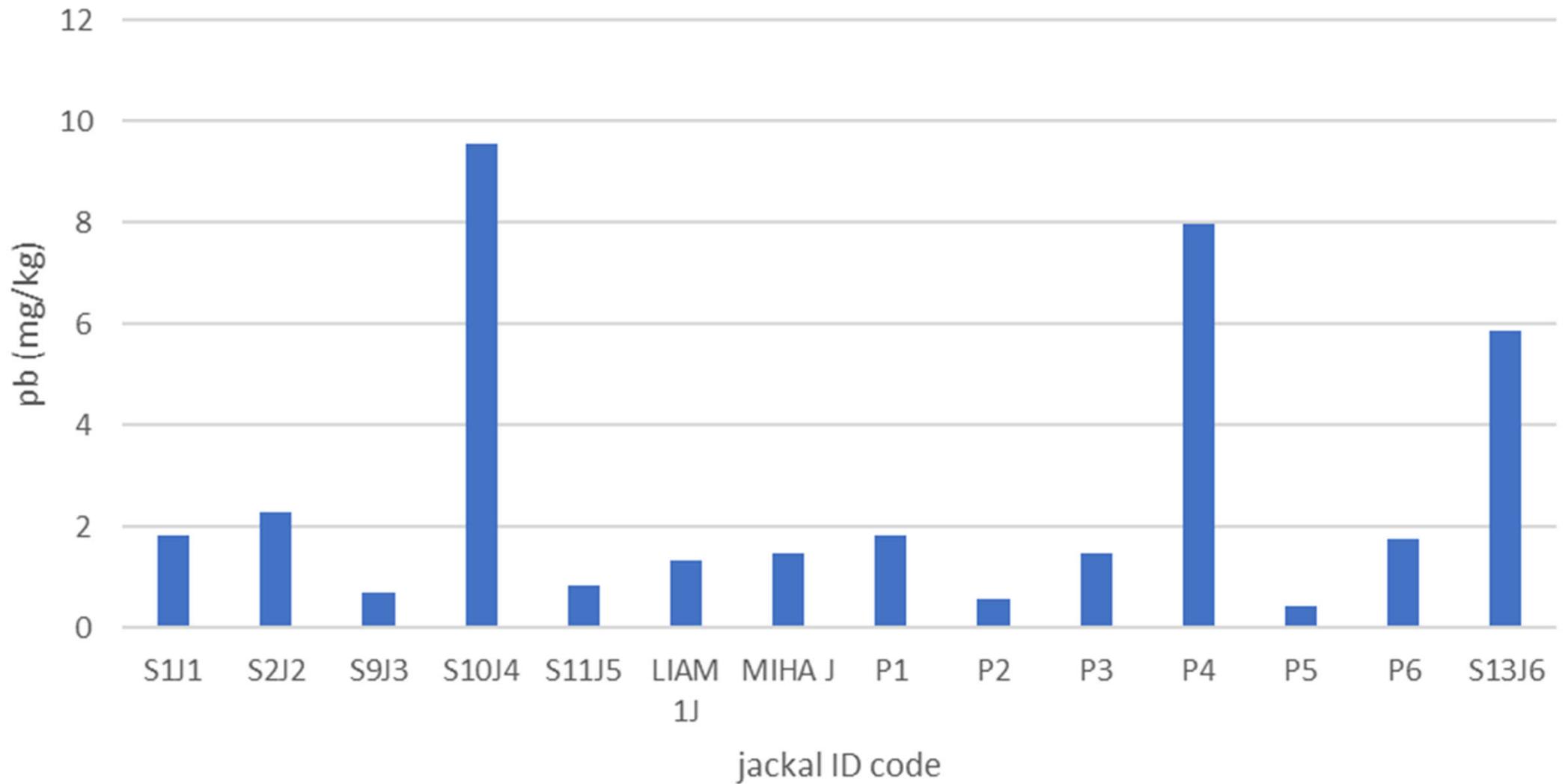


- Average [Pb] in bones collected per species:
- Cheetah = 3,00 mg/kg
- Jackal = 2,70 mg/kg
- Leopard = 4,33 mg/kg
- Hyena = 1,44 mg/kg

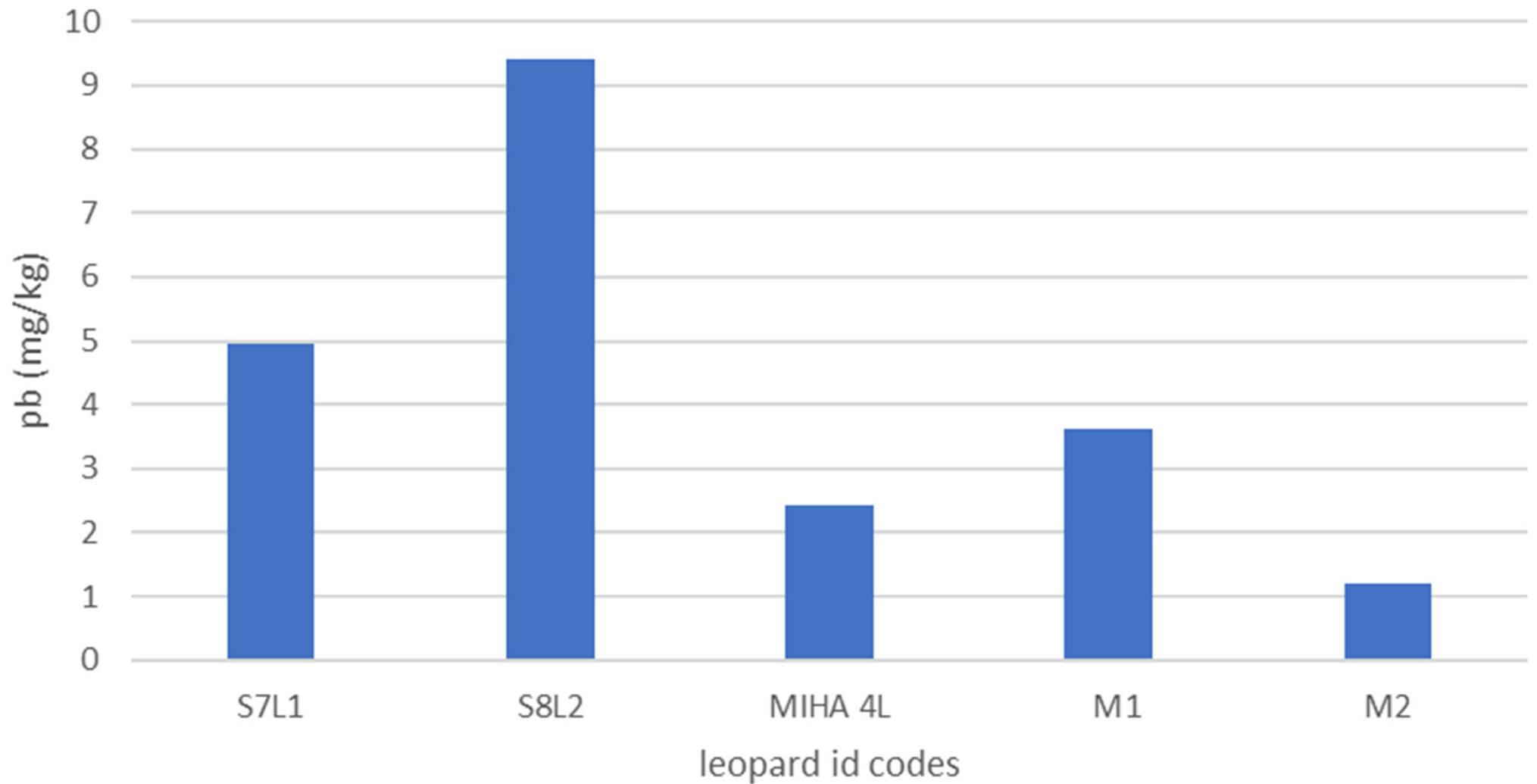
## concentration of lead in cheetah bones



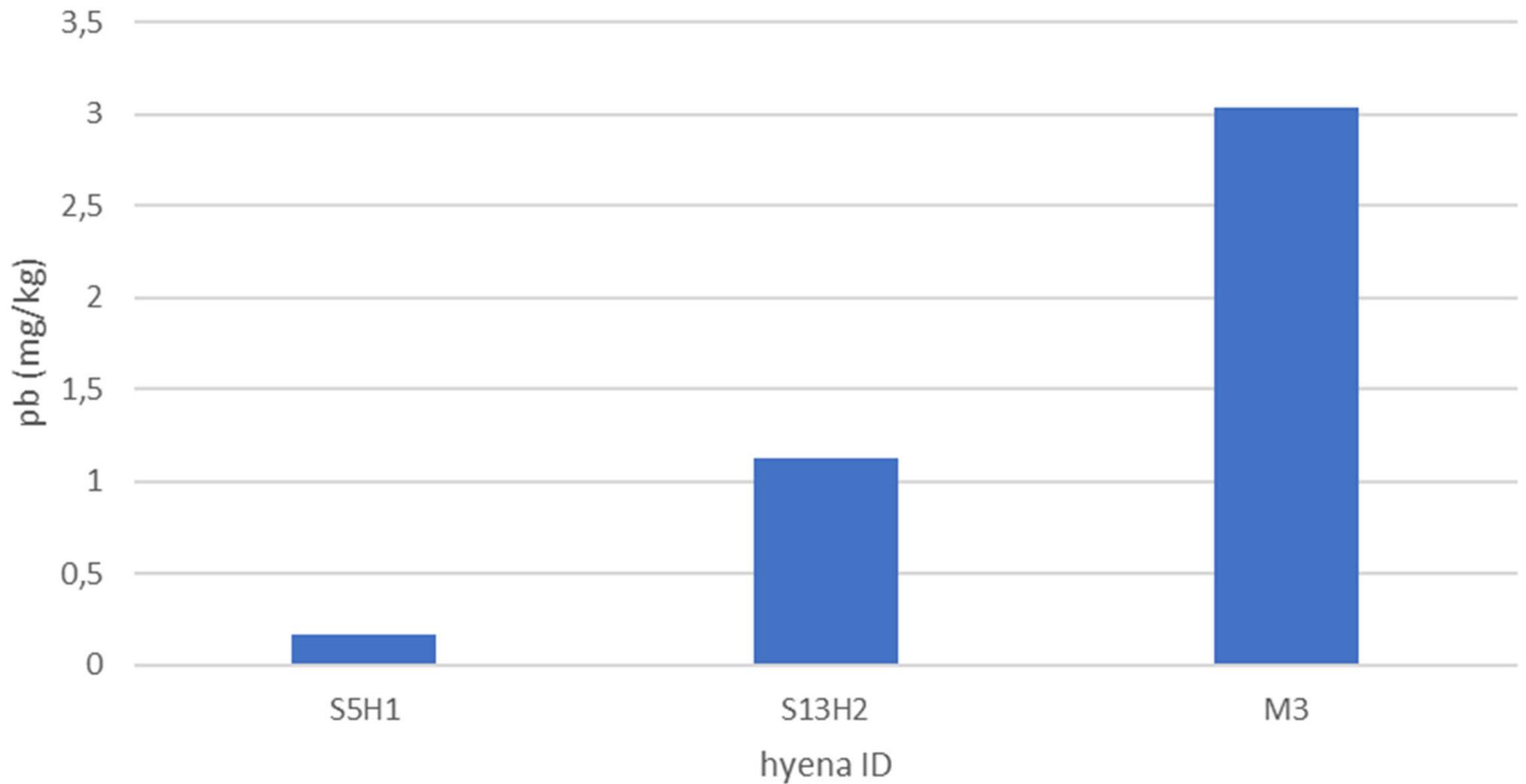
# concentration of lead (mg/kg) in jackal bone samples



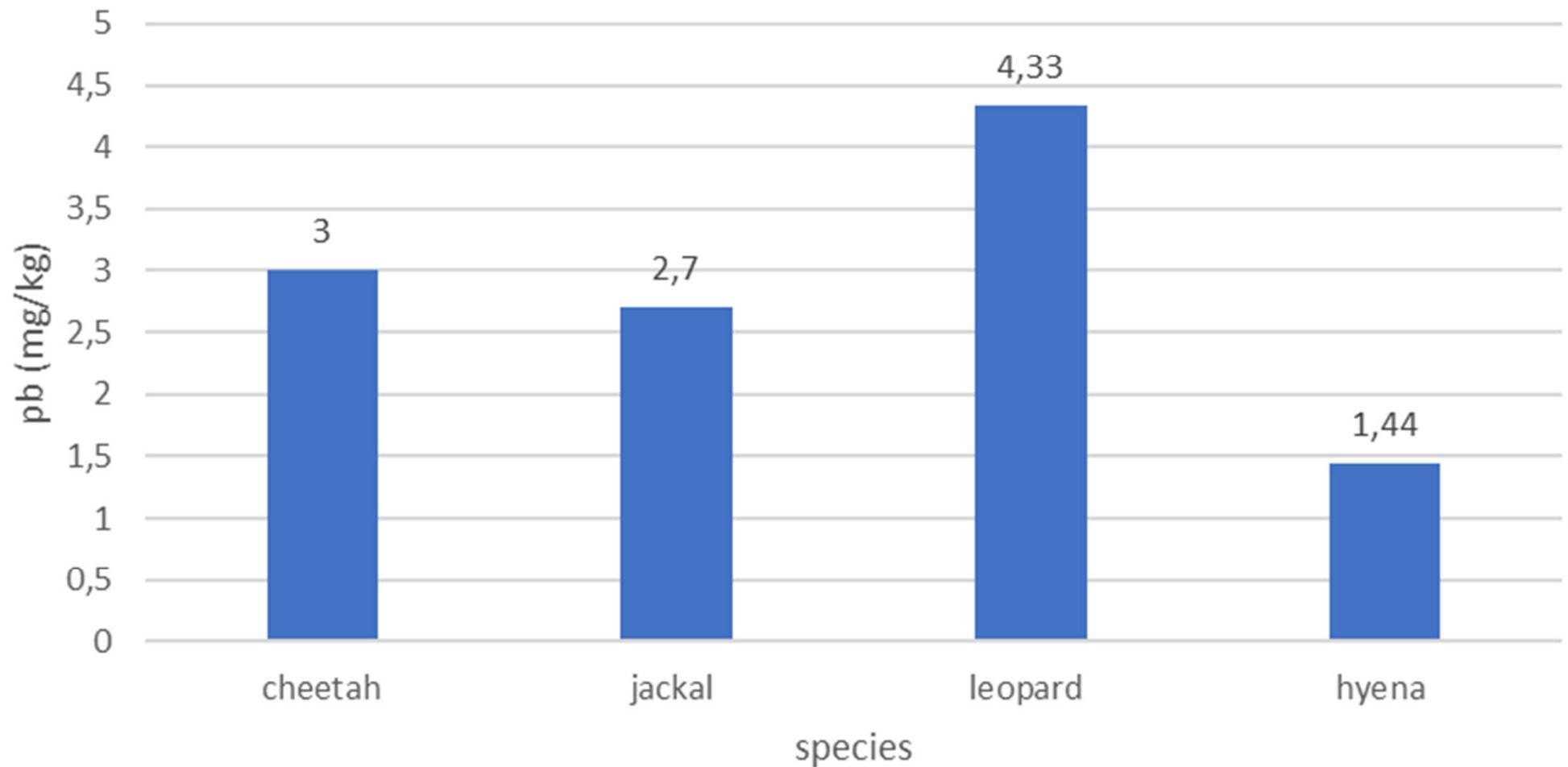
## lead concentrations (mg/kg) in leopard bone samples



## lead concentrations (mg/kg) in hyena bone samples



## Average pb concentrations (mg/kg) detected in each species



# Pb concentration (mg/kg) of long bones of carnivores

	Cheetah	Hyena	Jackal	Leopard
Min	0,33	3,04	0,42	1,21
Max	2,96	3,04	7,96	3,61
Average	1,42	3,04	2,09	2,42

# Pb concentration (mg/kg) of skull bones of carnivores

	Cheetah	Hyena	Jackal	Leopard
Min	1,59	0,17	0,71	4,92
Max	14,59	1,12	7,96	9,42
Average	4,58	0,65	3,51	7,20

# INTERESTING FINDINGS

- The Pb concentration was not significantly higher in bones of scavenging compared to non scavenging carnivores.
- Overall the Pb concentration was higher in skull compared to long bone
- Hyena Etosha
- Leopard cub
- CCF Samantha

# CONCLUSION

Lead was detected in the bones of carnivores in Namibia using ICP-MS after digestion.

Confirming chronic exposure to Pb in Namibian carnivores

This information can be used and built upon in future studies investigating lead exposure in Namibian animals

For example- species differences, investigating possible high exposure areas in Namibia, human exposure.



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A leopard with a distinctive spotted pattern is resting on a dark, textured log. The leopard's head is turned slightly to the right, and its eyes are looking forward. The background is dark, making the leopard's fur stand out.

**THANK YOU FOR YOUR  
ATTENTION.**

**ANY QUESTIONS?**



