

## Objective

Determine a standardized sampling location for total mercury concentrations ([THg]) along a Steller sea lion (*Eumetopias jubatus*, SSL) long bone to be used in future contaminant studies or archaeological work.

This research is performed in collaboration and cooperation with Unanga community organizations and funded by NSF-ARCSS/ASSP 1935816

## Introduction

- **Mercury** poses significant risk to human and wildlife health.
- High [THg] are found in pup fur of declining Western Aleutian SSL populations (abstract SMM2022536 Rea et al.).
- Contaminant monitoring, utilizing blood and fur, restricts retrospective analysis.
- **Bone** is well-preserved and provides past records of [THg].
- In humans, [THg] are greater and more variable in spongy vs compact bone (Rasmussen et al. 2013).
- Variability of [THg] in marine mammal bone are unknown.
- Bioaccumulation of [THg] may lead to more variability in adult pup bones.

## Results

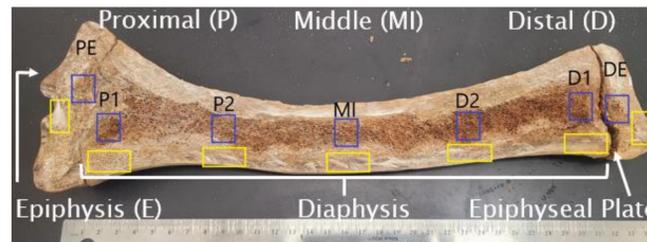


Figure 1: Longitudinal cross-section of an adult SSL tibia with sampling locations of **compact** (gold) and **spongy** bone (blue).

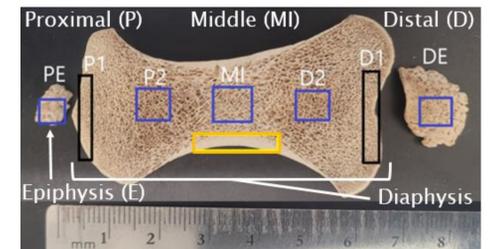


Figure 2: SSL pup femur longitudinal cross-section with sampling locations for **compact** (gold), **spongy** (blue), and **transition** bone (black).

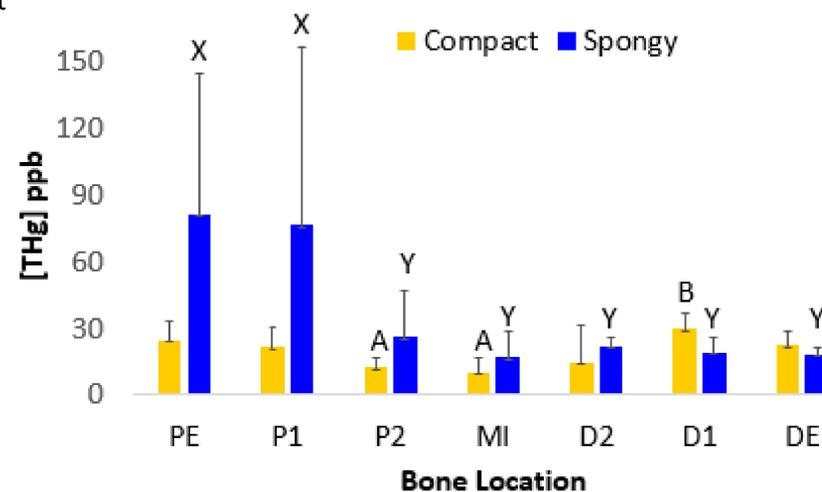


Figure 3: **Total mercury concentrations ([THg]) were most consistent in mid-diaphysis (P2, MI, D2)**, while locations near epiphyseal plate (PE, P1, D1, DE) were more variable. Spongy bone had greater and more variable [THg]. Letters indicate difference among compact (A,B) and spongy (X,Y) bone locations.

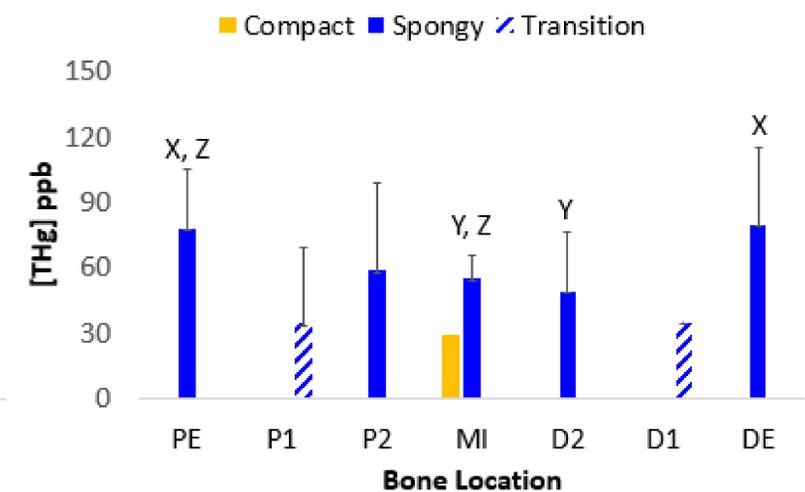


Figure 4: **Spongy bone [THg] were more consistent in the mid-diaphysis (P2, MI, D2) than near the epiphyseal plate (PE, P1, D1, DE)**. Spongy and transition bone had greater [THg] than compact bone and were not significantly different in SSL pup femurs. Letters indicate difference among spongy bone locations.

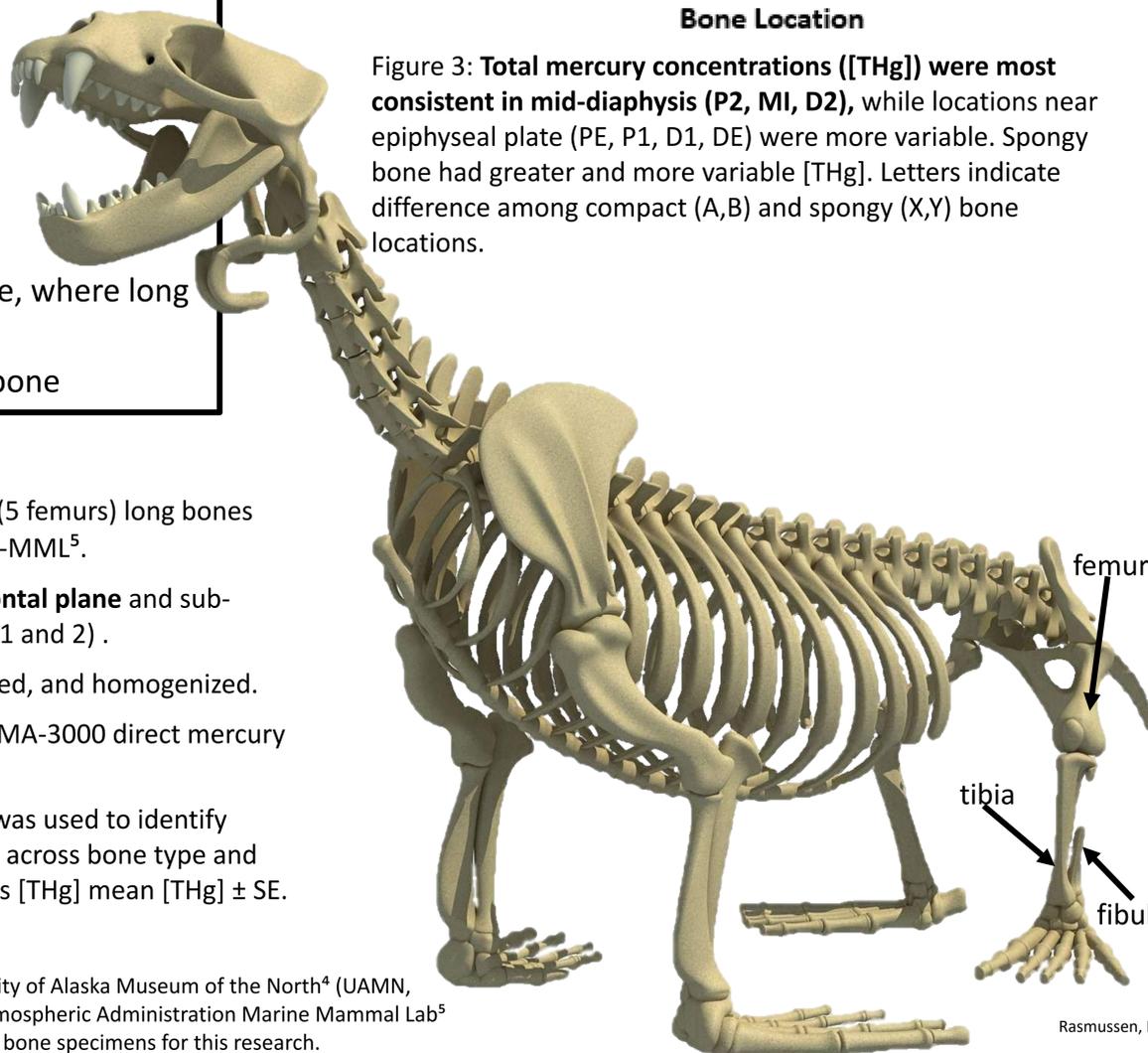
## Research Questions

(1) Do [THg] vary by bone type within an individual bone?

- **Compact**: solid structural support of long bone
- **Spongy**: porous, highly vascularized bone containing red marrow
- **Transition**: active area of bone proliferation in pups

(2) Do [THg] vary by location across a long bone?

- **Epiphysis**: ends of long bone
- **Epiphyseal plate**: line of cartilage, where long bone growth occurs
- **Diaphysis**: central shaft of long bone



## Key Findings

- (1) [THg] are greater in spongy vs compact bone in both adults and pups.
- (2) Regions near the epiphyseal plate have greater [THg] compared with mid-diaphysis.

## Implications for future research

- **Mid-diaphysis compact bone** exhibits the most uniform [THg] in both pup and adult long bones.
- Future studies should utilize the mid-diaphysis location when possible for consistent [THg] quantification.

## Methods

- SSL adult (3 tibias, 2 fibulas) and pup (5 femurs) long bones were obtained from UAM<sup>4</sup> and NOAA-MML<sup>5</sup>.
- Bone was cut **longitudinally along frontal plane** and sub-sampled at **7 different locations** (Fig. 1 and 2).
- Sub-samples were washed, freeze-dried, and homogenized.
- [THg] quantified in triplicate: Nippon MA-3000 direct mercury analyzer (Tokyo, Japan).
- Repeated measures ANOVA and LSD was used to identify statistical difference (**p<0.05**) in [THg] across bone type and location (Fig 1 and 2). Values shown as [THg] mean [THg] ± SE.

## Acknowledgements

We are grateful to our collaborators at the University of Alaska Museum of the North<sup>4</sup> (UAMN, NMFS permit 25500) and National Oceanic and Atmospheric Administration Marine Mammal Lab<sup>5</sup> (NOAA MML, MMPA permit 18528), who provided bone specimens for this research.