## Variability in muscle total mercury concentrations among three species of auklet



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Summary

Matthew in 2018 had higher

Crested Auklets at St.

THg,  $\delta^{15}$ N and  $\delta^{13}$ C

compared to the Crested

Auklets at the Rat Islands.

Least Auklets at St. Matthew in

higher  $\delta^{15}N$  compared to those

at the Rat Islands, but lower

 $\delta^{15}$ N compared to the 2018

birds from St. Matthew.

Parakeet Auklets at St.

Matthew in 2019 had lower

THg, higher  $\delta^{15}$ N and  $\delta^{13}$ C

compared to the Parakeet

Auklets at Kiska Island in

2019 had lower THg and

### Background

\* neurotoxin both natural and anthropogenic sources

Higher levels are associated with poor reproductive output through:

- \* reduced survival of hatchlings and fledglings
- \* potential disruption of migration timing related hormones

Elevated levels also affect:

- \* motor skill function \* spatial orientation
  - \* potential reduced foraging efficiency

Seabird Mass Mortality Events

Mercury

- \* began Summer 2015 & continued each summer since
- \* occurred around the Aleutian Islands and Bering Sea
- \* Crested Auklets were highly impacted
- \* many seabird species have had poor reproductive success since

Kaler et al., 2022 Schoen et al., 2022

Dietz et al., 2019

Schultner et al., 2014 Smith et al., 2022

Wolfe et al., 1998

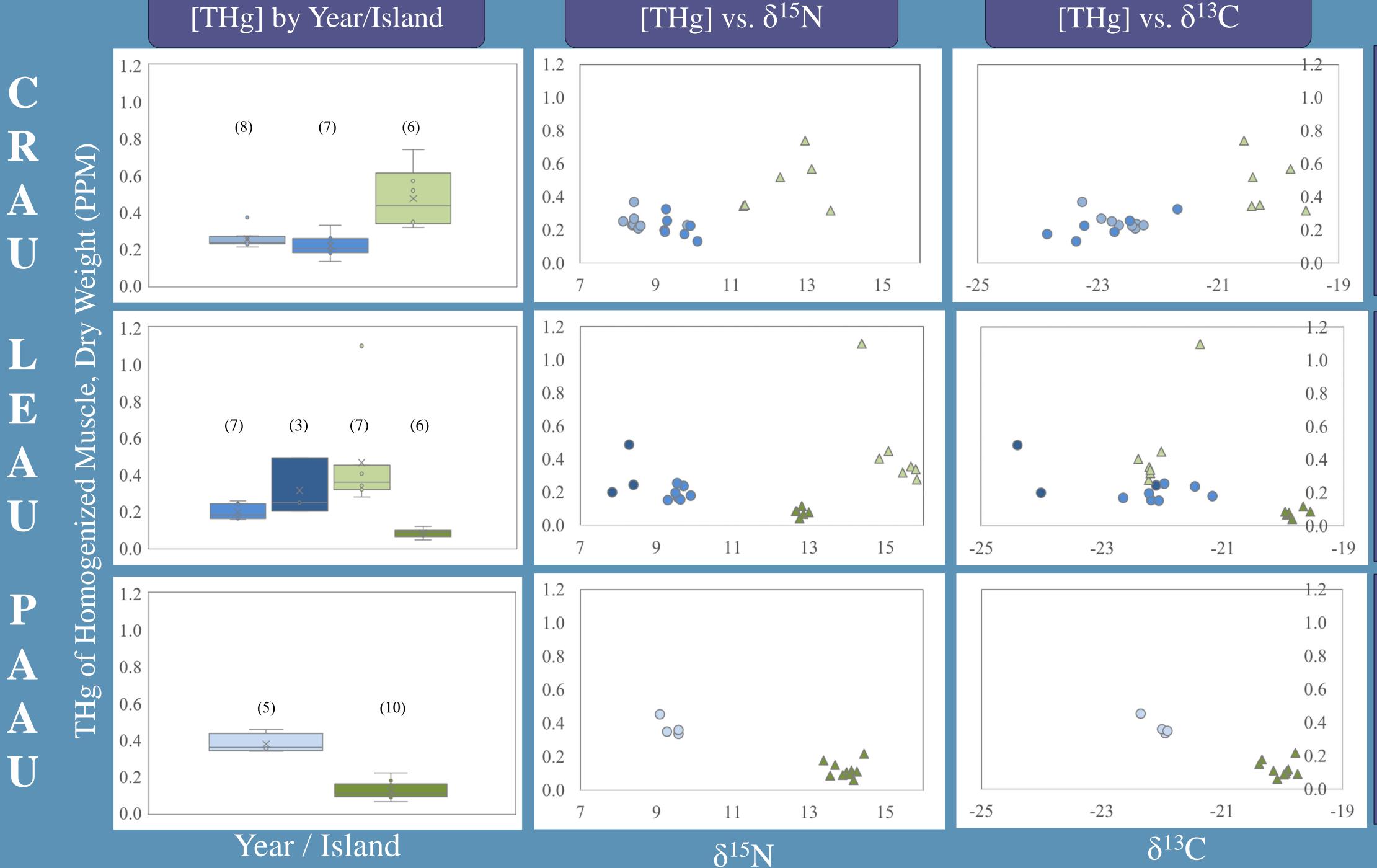
Dietz et al., 2019

#### Project Description

I compared muscle total mercury concentrations in three species of planktivorous auklets that have slightly different dietary preferences, collected in the Rat Islands and at St. Matthew (see map) during the breeding season (see table below for species comparisons).

SPECIES	LIFESPAN	FORAGING AREAS	PRIMARY PREY	MASS	CITATIONS
Crested Auklet (CRAU) Aethia cristatella	8 yrs	Estimated maximal dive depth of 30m (little known about underwater activities). Often forages in open ocean over vertically stratified waters, far from shore and breeding colony. May feed nearshore where tidal flux results in turbulence that aggregates prey.	euphausids; also other planktonic crustacea	Males heavier than females. At Buldir Island, when arriving at breeding sites, mean adult masses were: males 267.7g ± 17.1, females 251.4 ± 17.6. Adult mean masses from St. Lawrence Island were 260g ± 14.0 (both sexes).	Jones (2020)
Least Auklet (LEAU)  Aethia pusilla	5 yrs	Estimated maximal dive depths of 15-25m. Typically forages far from shore in areas of strong vertical turbulence resulting in concentrations of copepods at surface. Not known to enter bays, coves, or other protected waters.	also larval shrimp and other small zooplankton	No difference between sexes. At Buldir and Kiska Islands, when arriving at breeding sites, mean adult masses were: 82 ± 5. Adult mean masses from St. Lawrence Island were 86.6 ± 6.4.	Bond et al. (2020)
Parakeet Auklet (PAAU) Aethia psittacula	8 yrs	No data on dive depth; generally expected to be similar to other auklets. Unlike other auklet species, PAAU are more dispersed over deep offshore waters and avoid upwelling or turbulent areas.	jellyfish; also copepods, euphausids, amphipods and fish larvae	Males slightly larger than females. At Buldir Island, when arriving at breeding sites, mean adult masses were: males 272.7 ±19.9, females 266.9 ± 16.8.	Jones et al. (2020)

# Results



Aleutian Islands, Rat Island Group

2010 Buldir

2010 Kiska

2011 Segula

2016 Kiska 2018 St. Matthew

Northcentral Bering Sea

2019 St. Matthew

#### Acknowledgments

Thank you Dr. Douglas Causey for access to samples and to the METALab for use of their mercury analyzer.

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### Discussion

### General Notes

All three auklet species demonstrate spatiotemporal variability in total mercury and stable isotopes.

The base of the food web could vary from each study area, which could explain trophic level differences.

At St. Mathew Island, the parakeet auklets in 2019 were eating in relatively shallower waters or closer to shore than the parakeet auklets in 2018.

### Future Directions

2010.

#### Current Research

Measure mercury on 28 additional auklet muscle samples (incoming).

Learn and conduct statistical tests for differences on full dataset

### Future Research

Will hopefully conduct PCRs to determine sex of these birds this summer, allowing me to look at differences in THg with respect to age and sex.

### Methods

#### Sample Acquisition

Homogenized breast muscle samples were loaned to S. Crawford at UAF from Douglas Causey's archival collection held at UAA. Seabirds were lethally collected under federal (USFWS MB795841) and state (ADFG 09-141, 10-133, 11-063, 12-085, 13-130, 14-084, 15-087, 16-096, 18-100, 19-152, 22-101, 23-129) scientific permits, and UAA IACUC protocols (350005, 751485, 752711, 1216862, 1216863, 1721620, 1721621). Dr. Causey also provided associated data for each bird, including species, collection year, location, and bulk stable isotope measurements of carbon and nitrogen ( $\delta^{13}$ C and  $\delta^{15}$ N, respectively).

#### Laboratory Analyses

I measured the total mercury concentration ([THg]) of the homogenized auklet muscle samples using a direct mercury analyzer (Nippon MA-3000) and following the established protocol of the U.S. EPA Method 7473 (United States Environmental Protection Agency, 2007). The mean of two technical replicates are presented as the [THg] of each sample. Each technical replicate required  $\approx 0.02$  g of dried, homogenized tissue. Data Summarization

I used Microsoft Power BI and Excel programs to examine the [THg] data for each species with respect to year, location, and stable isotope measurements, creating plots to better visualize the data and trends.

#### Study Area

Sample were collected from birds in the Rat Island group of the Aleutian Islands (Buldir, Kiska, and Segula Islands) and St. Matthew Island in the northcentral Bering Sea.



#### References

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