

Comparison of total mercury concentrations in hair of three pinniped species from the Aleutian Islands and Bering Sea, Alaska.

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Background

Extensive analyses of total mercury concentrations [THg] in hair of Steller sea lions (SSL; *Eumetopias jubatus*) between 2011 and 2015 show median [THg] was significantly higher in young pups from the western Aleutian Islands, Alaska (WAI; 11.31 µg/g, n=209) than in central Aleutian Islands pups (CAI; 9.77 µg/g, n=215), while [THg] medians for eastern Aleutian Island (EAI; 6.33 µg/g, n=50) and Bering Sea pups (BER; 7.35 µg/g, n=67) were significantly lower than WAI or CAI (K-W H=33.604, p<0.001; Figure 1). While the Hg exposure pathway is expected to be maternal dietary intake during gestation, concurrent analysis of samples of commercially available fish and cephalopods (presumed or likely SSL prey) from these regions have not obviously accounted for regional [THg] differences in SSL, or for high individual variability in [THg] among pups at one rookery in the WAI (range 2.55 – 73.74 µg/g). As a result, we have expanded this study to investigate [THg] in hair of Pacific harbor seals (HS; *Phoca vitulina*, n=49) and northern fur seals (NFS; *Callorhinus ursinus*, n=129) from these regions to ascertain whether pinniped species with different foraging preferences (i.e., nearshore vs pelagic, respectively) deposit different levels of mercury while growing hair.

Objective

The objective of this study was to quantify hair [THg] in harbor seals and northern fur seals across regions of the Aleutian Islands and southern Bering Sea to determine if these species that forage in the same ecosystems as Steller sea lions also accumulate mercury in their fur and if differences in foraging ecology (fur seals typical forage pelagically, whereas harbor seals forage more near shore) might help us determine where pinnipeds are most likely to encounter mercury contaminants in their prey.

Methods

Hair samples were collected from the pelvic region (approximately 5 cm x 5 cm area) of free-ranging harbor seals and northern fur seals while restrained during collaborators' telemetry studies. The [THg] in hair was quantified in duplicate after washing and freeze-drying, using a Milestone direct mercury analyzer (DMA-80). Detailed methods, including standard reference materials and QA/QC approaches can be found in Rea et al. (2013).

Conclusions

- There were regional differences in exposure to mercury in Steller sea lions.
- There were also regional differences in total mercury concentrations in the hair of northern fur seals, with seals foraging to the west of St. Paul Island having the lowest median [THg] in hair, but a very wide range of [THg] was found in fur seals foraging on the continental shelf to the east of St. Paul Island.
- There was no significant difference in median [THg] among regions for harbor seals, but median [THg] was higher for harbor seals than Steller sea lions in the central Aleutian Islands.
- Telemetry data will be available for a subset of fur seals (SNP Vostochni rookery adult females), harbor seals and adult female sea lions, to investigate more closely the relationship between [THg] and foraging patterns within each region.
- In general, the current pattern suggests that pinnipeds which forage nearshore or on-shelf tend to accumulate higher concentrations of total mercury in hair.

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Literature Cited

Rea, L.D., J.M. Castellini, L. Correa, B.S. Fadely, and T.M. O'Hara. 2013. Maternal Steller sea lion diets elevate fetal mercury concentrations in area of population decline. *Science of the Total Environment* 454-455: 277-282.

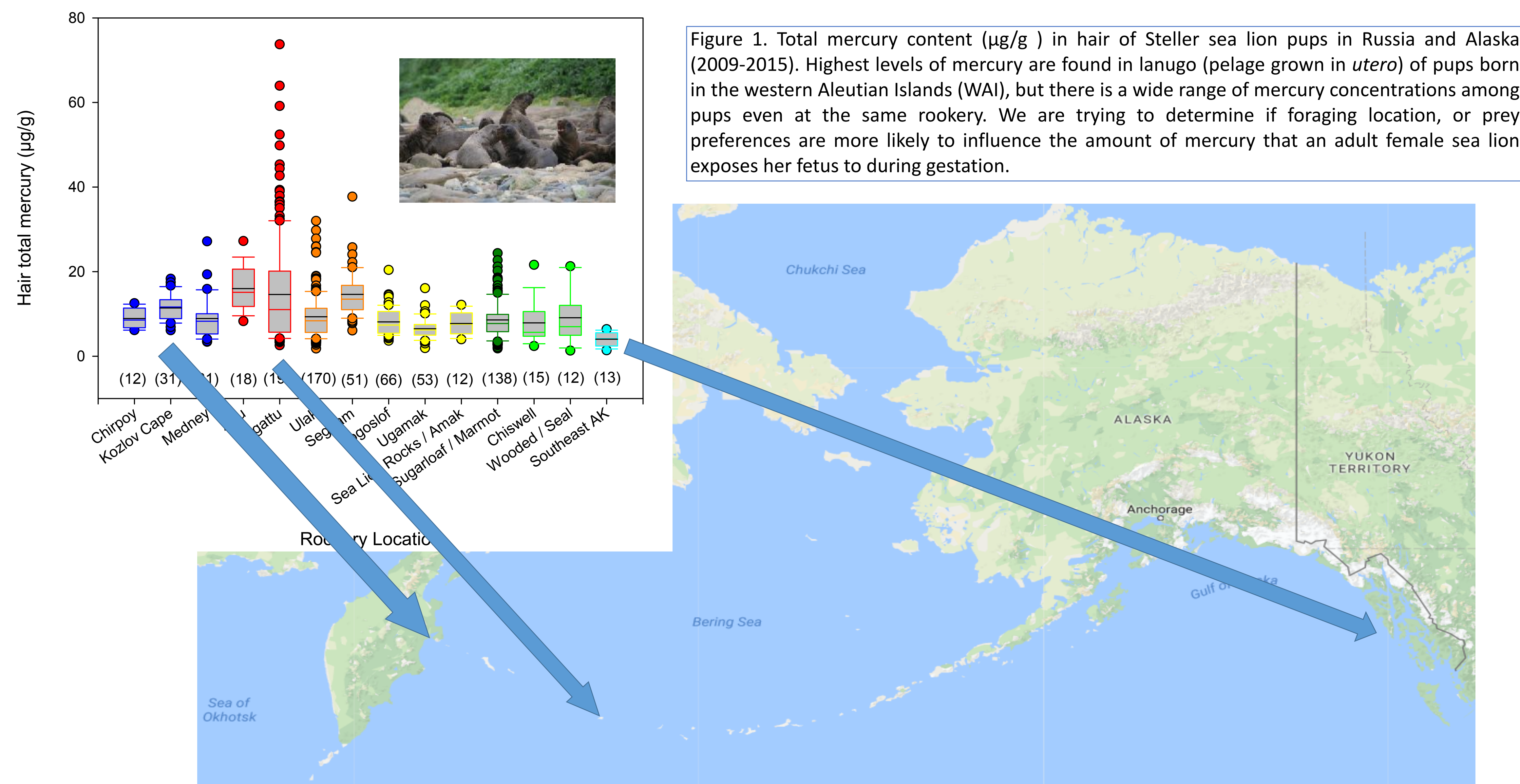


Figure 1. Total mercury content (µg/g) in hair of Steller sea lion pups in Russia and Alaska (2009-2015). Highest levels of mercury are found in lanugo (pelage grown in utero) of pups born in the western Aleutian Islands (WAI), but there is a wide range of mercury concentrations among pups even at the same rookery. We are trying to determine if foraging location, or prey preferences are more likely to influence the amount of mercury that an adult female sea lion exposes her fetus to during gestation.

Results

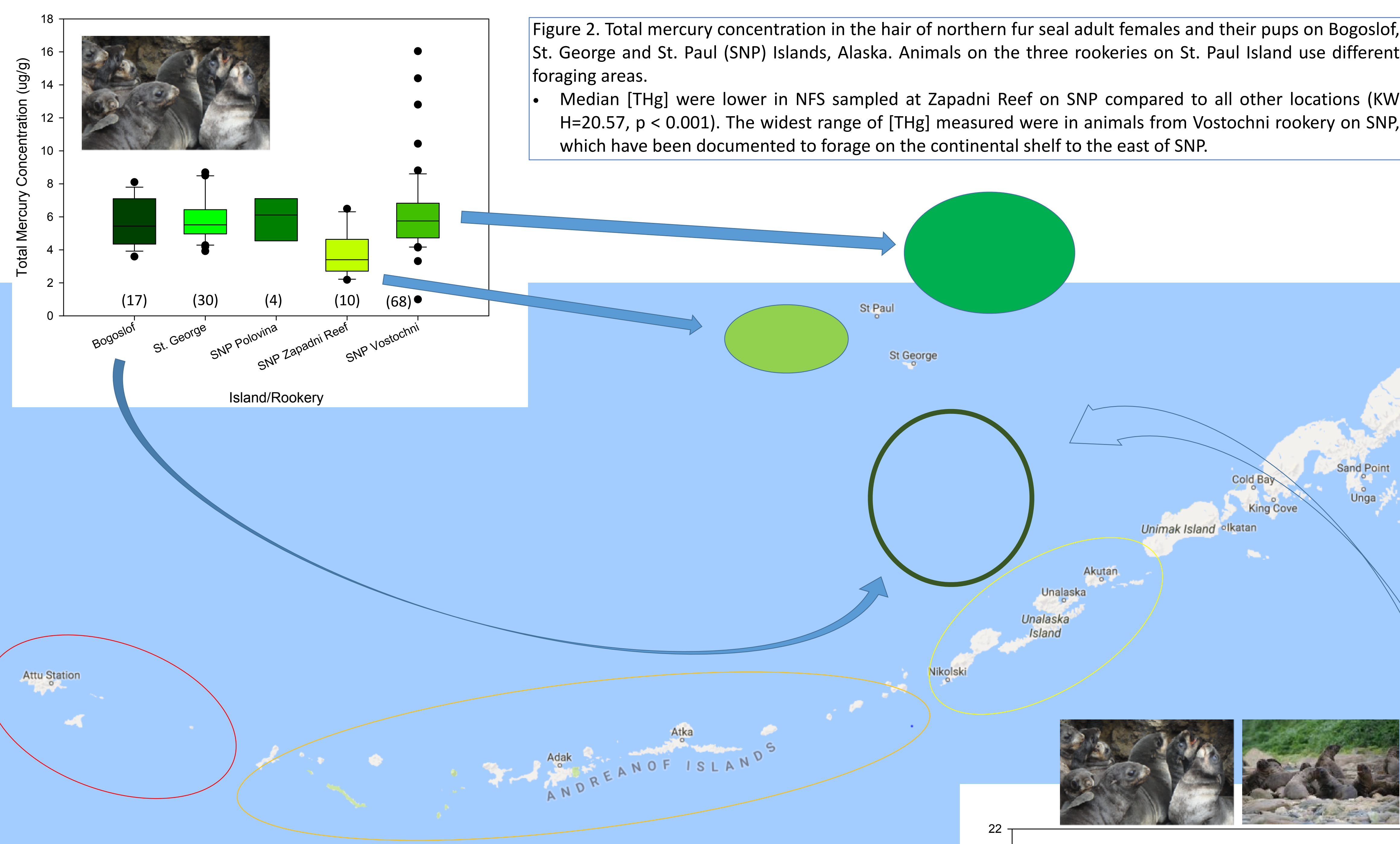


Figure 2. Total mercury concentration in the hair of northern fur seal adult females and their pups on Bogoslof, St. George and St. Paul (SNP) Islands, Alaska. Animals on the three rookeries on St. Paul Island use different foraging areas.

- Median [THg] were lower in NFS sampled at Zapadni Reef on SNP compared to all other locations (KW H=20.57, p < 0.001). The widest range of [THg] measured were in animals from Vostochni rookery on SNP, which have been documented to forage on the continental shelf to the east of SNP.

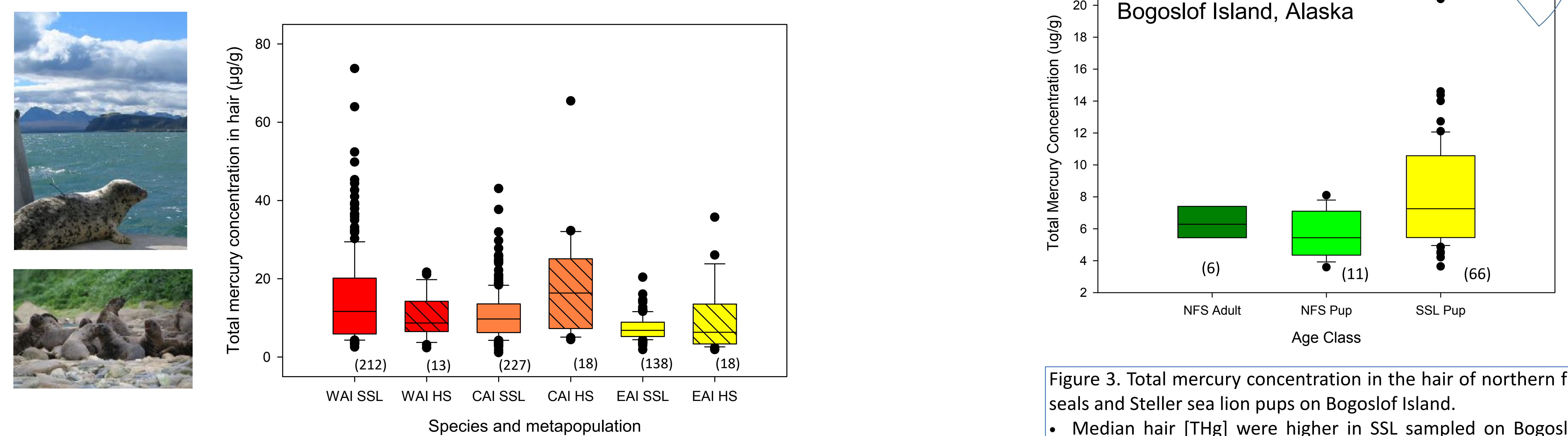


Figure 3. Total mercury concentration in the hair of northern fur seals and Steller sea lion pups on Bogoslof Island, Alaska.

- Median hair [THg] were higher in SSL sampled on Bogoslof Island (7.35 µg/g, n=66) than in NFS sampled on this island (5.49 µg/g, n=17; H=8.799, p<0.005).

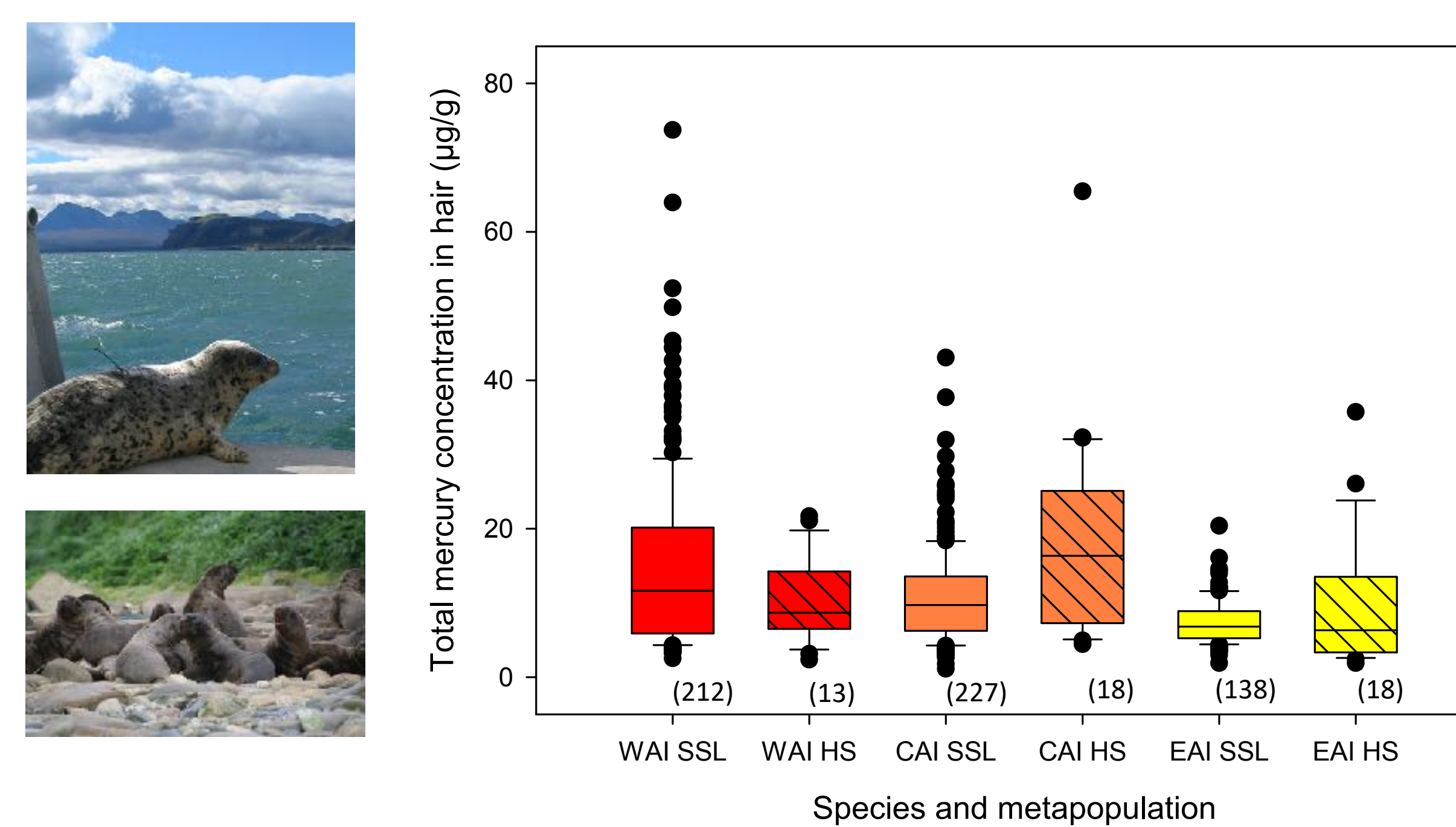


Figure 4. Total mercury concentration in the hair of Steller sea lions (SSL; solid) and harbor seals (HS; hashed) in the western (WAI; red), central (CAI; orange) and eastern (EAI; yellow) Aleutian Islands.

- There was no significant difference between median [THg] in HS and SSL hair in HS, nor in the EAI (p>0.200). In the CAI, median hair [THg] was higher in HS (16.3 µg/g, n=18) than in WAI sampled in this region (9.7 µg/g, n=227).