Peregrine Falcons: a Look at Mercury Contamination in Proximity to Lakes Mead and Mohave

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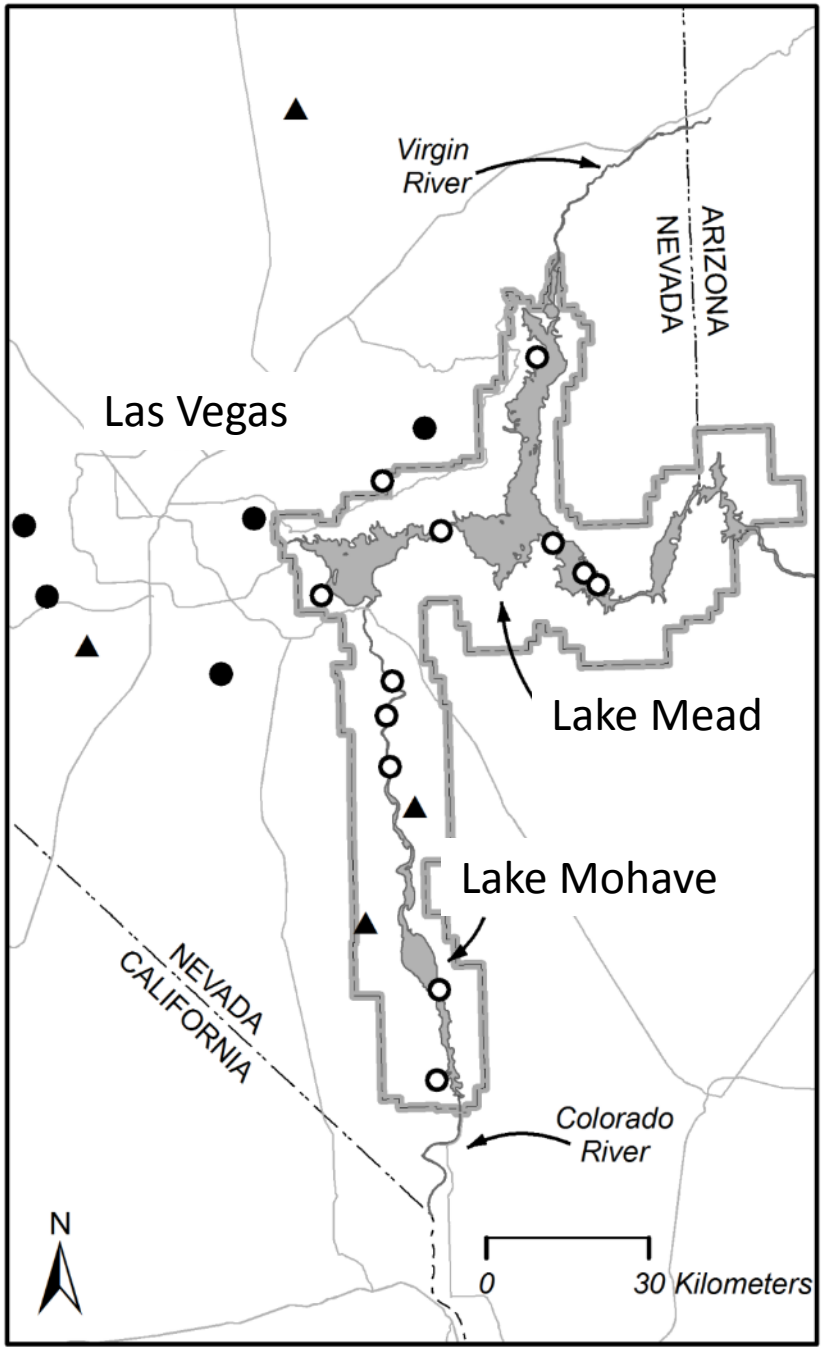
Study Area

- Lake Mead National Recreation Area (LMNRA):
  - 38 peregrine territories
  - Mean NND: 6.3 km
- Southern Nevada (SNV):
  - 23 peregrine territories
  - Mean NND: 12.8 km



Project Objectives

1. Assess Hg contamination in peregrines
   - Near water (LMNRA) vs. far from water (SNV)
2. Trace Hg pathway to peregrines through associated prey species
   - Dietary composition (aquatic vs. terrestrial birds)

Hg Characteristics

1. Bioaccumulates in aquatic systems in the form of methylmercury
2. Can cause neurological problems in humans
3. Negatively affects nervous, circulatory, and endocrine systems in birds
4. Adverse effects levels (feathers):
   - >13 ppm in Tree Swallows (Brasso & Cristol 2008)
   - ≥ 20 ppm in Ivory Gulls (Bond et al. 2015)
   - 5–40 ppm in Osprey (Burger & Gochfeld 1997)

Peregrines as an Ideal Biomonitor

- High trophic level predators with broad dietary breadth
- High site fidelity with long lifespan
- Widely distributed
- Local knowledge of reproductive parameters and diet

Benefits of Feather Analysis

- Relatively non-invasive
- Hg deposited in feathers during feather growth
- Correlation with dietary intake and total body burden
- Standardized comparisons between individuals and over time

Mercury Sampling Protocol

- Removed 1.5–2.0 cm from end of 4th primary feather
- Analyzed feathers from prey remains collected at eyries
- Determined total Hg using thermal decomposition (750° C)

Mercury Sampling Effort

- Sampled 12 peregrine territories within LMNRA and 6 from southern NV (2012–2013)
- Analyzed prey items from 337 individuals representing 87 species types (2008–2013)

Peregrines: Mercury (Hg) by Study Area

	LMNRA		
	n	Hg (ppm)	Range
Adult Mean*	12	17.2 ± 4.1	1.5–42.5
Brood Mean*	6	5.8 ± 2.1	0.8–13.1

Peregrines: Mercury (Hg) by Study Area

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	n	Hg (ppm)	Range	*n*	Hg (ppm)	Range
Adult Mean*	12	17.2 ± 4.1	1.5–42.5	5	2.7 ± 1.1	0.9–6.8
Brood Mean*	6	5.8 ± 2.1	0.8–13.1	3	0.7 ± 0.2	0.4–1.0

* Sig. diff. by study area (Mann-Whitney tests; $P < 0.05$)

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	LMNRA
Median Distance to Water (km)	0.1
Aquatic Bird Prey Composition (%)	71.8
Terrestrial Bird Prey Composition (%)	28.0

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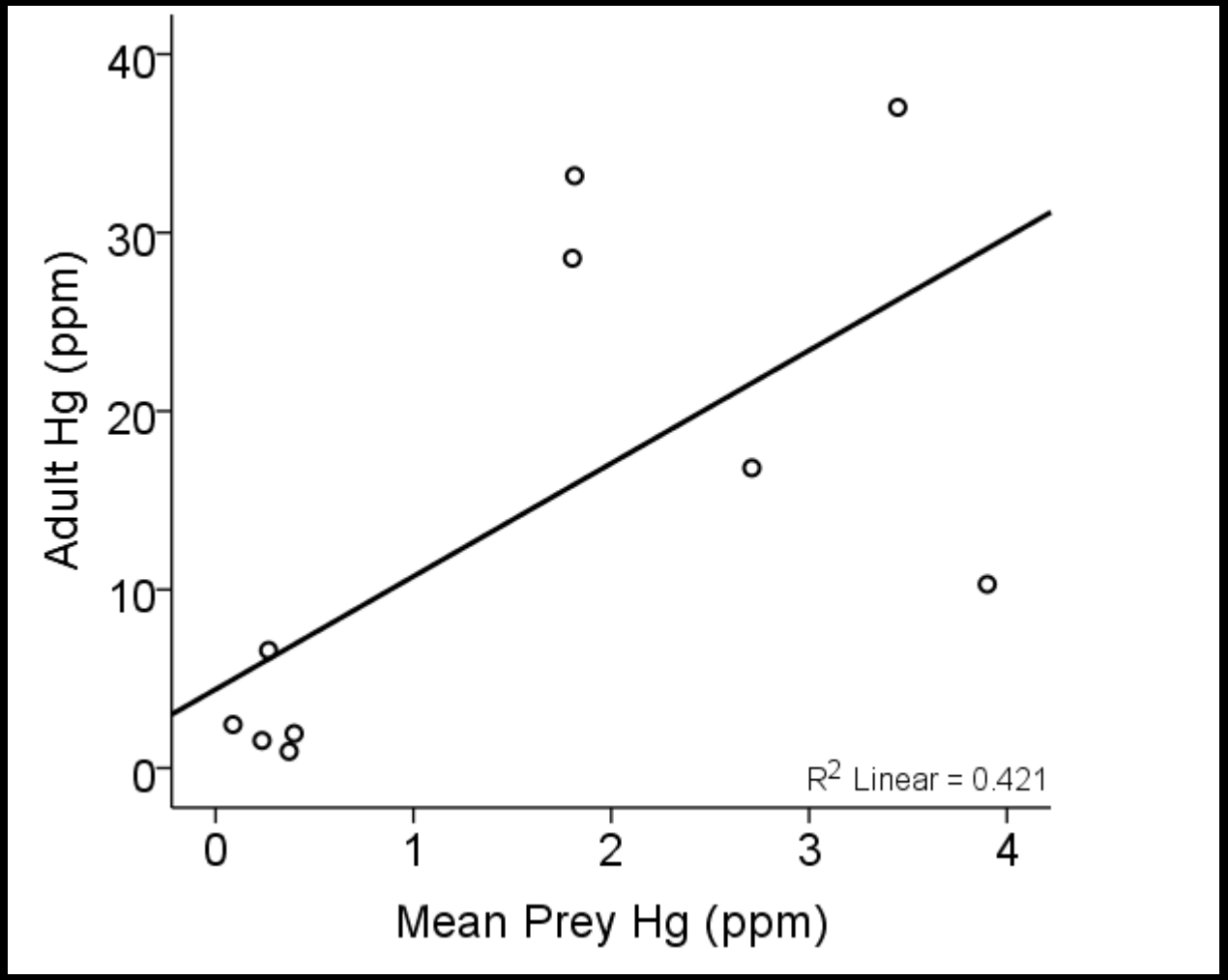
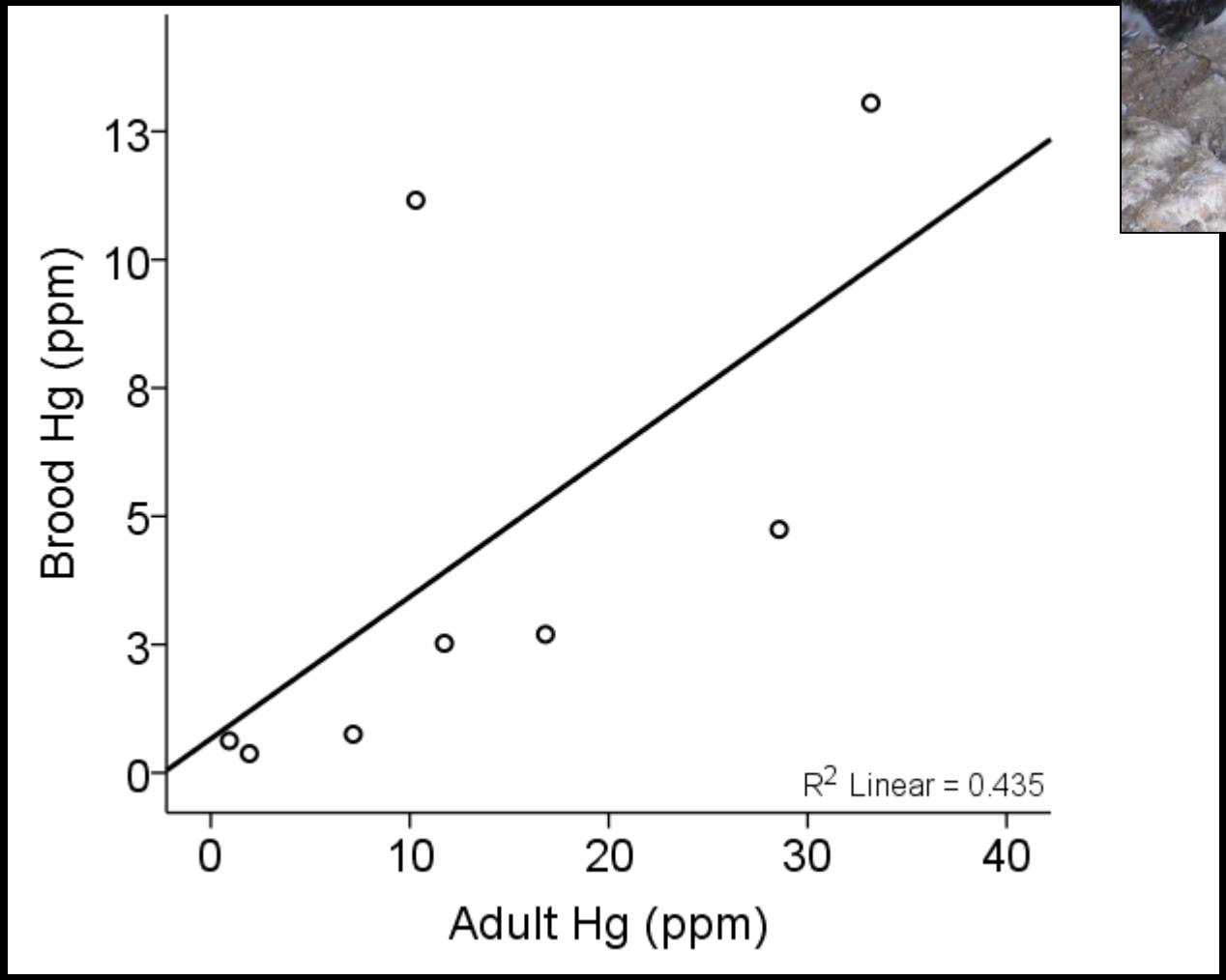
	LMNRA	SNV
Median Distance to Water (km)	0.1	34.9
Aquatic Bird Prey Composition (%)	71.8	17.9
Terrestrial Bird Prey Composition (%)	28.0	82.1

Relationships of Hg in Peregrines



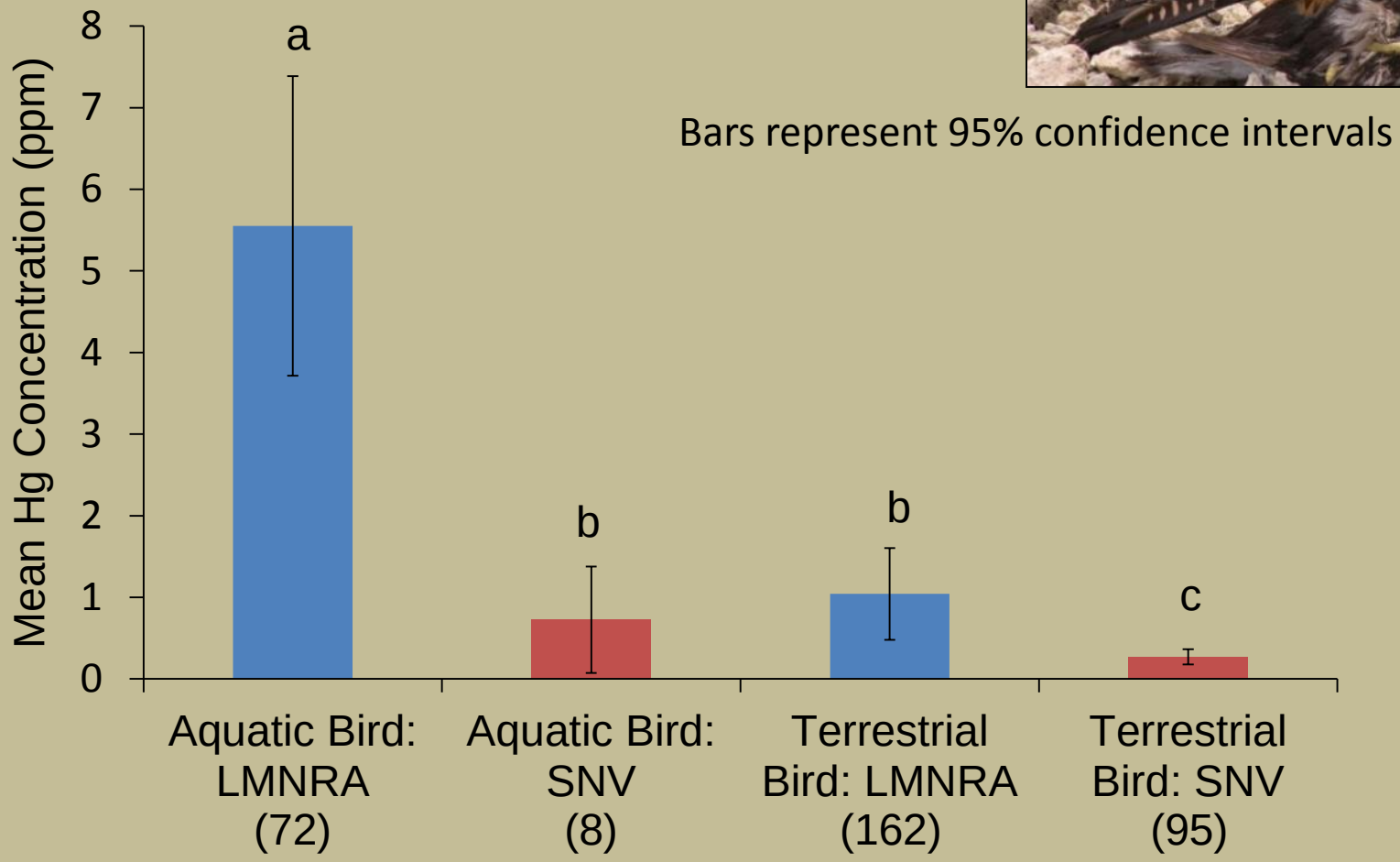
- $r^2 = 0.421$, $F_{1,8} = 5.815$, $n = 10$, $P = 0.042$

Relationships of Hg in Peregrines



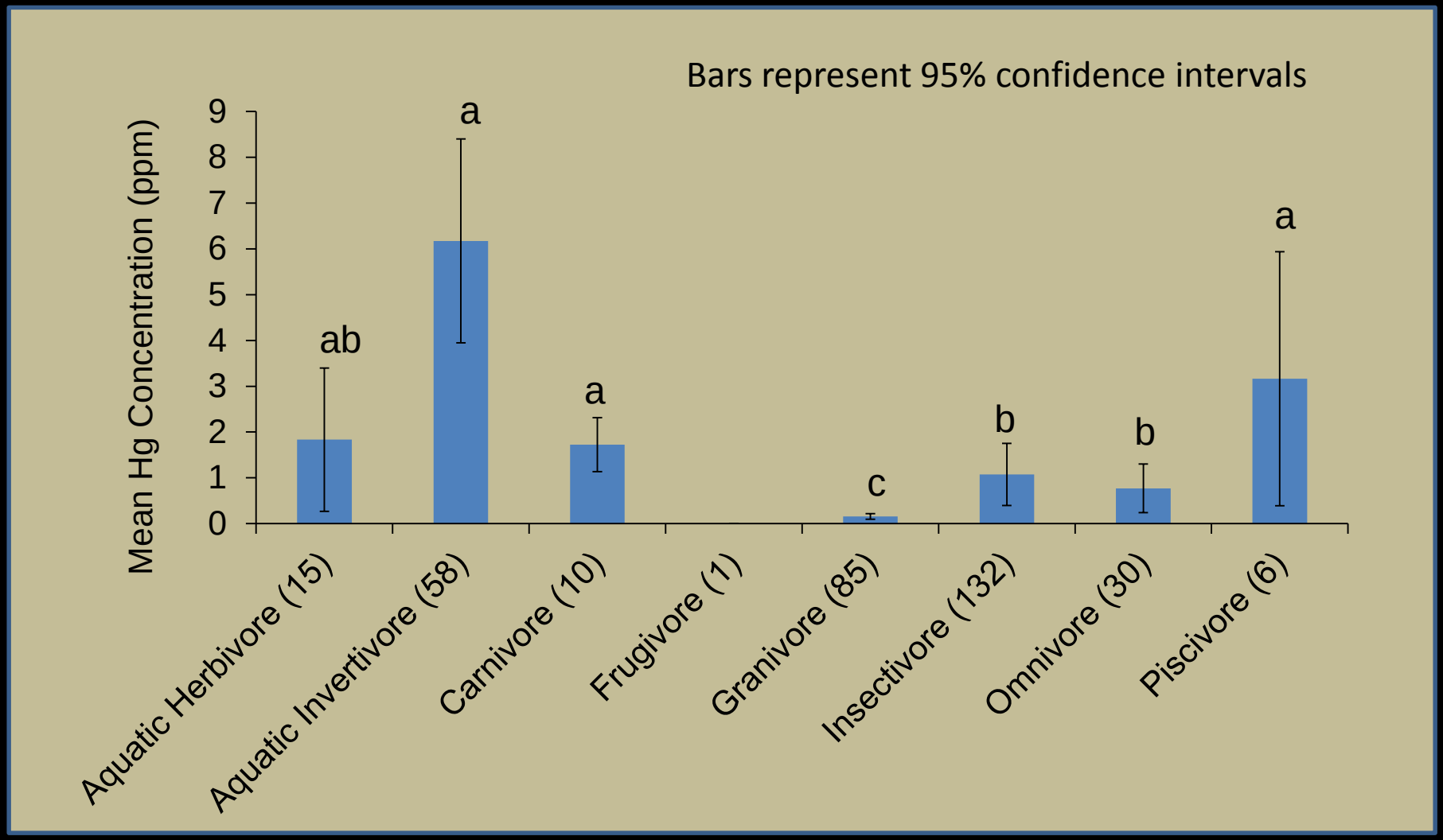
- $r^2 = 0.435$, $F_{1,6} = 4.617$, $n = 8$, $P = 0.075$

Prey Type by Study Area



- Sig. diff. in Hg levels between groups ($H_3 = 96.4$, $n = 337$, $P < 0.001$)
- Group differences determined with stepwise comparisons

Prey Foraging Guilds



- Sig. diff. in Hg levels between groups ($H_6 = 134.6$, $n = 337$, $P < 0.001$)
- Group differences determined with stepwise comparisons

Future Direction

1. Expand geographic scope
2. Establish time series at select territories
3. Assess productivity and turnover
4. Explore further the sources of Hg contamination

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