

Peregrine Falcons as Biomonitors: Assessing Mercury in Southern Nevada

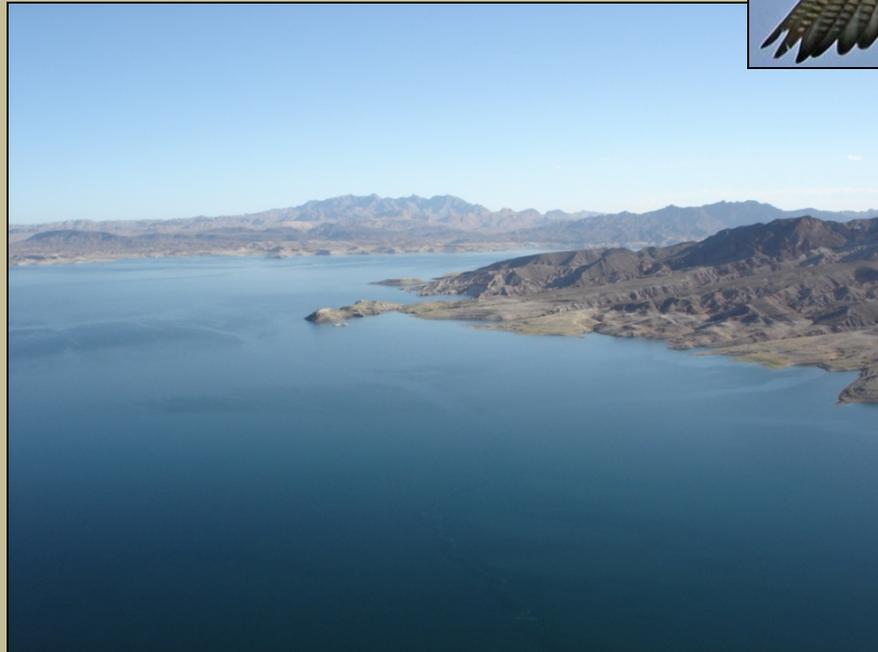


Joseph G. Barnes

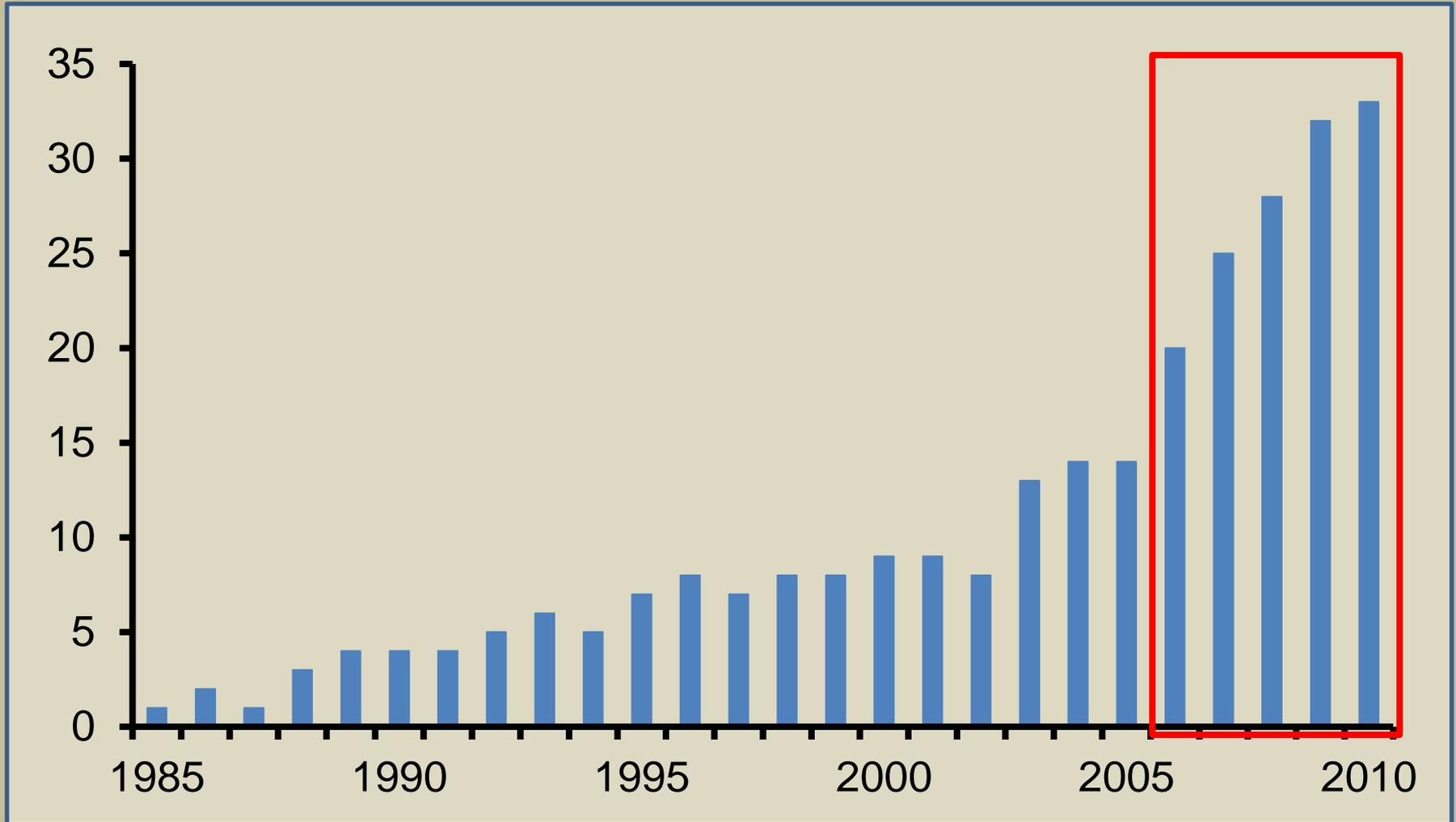
Public Lands Institute, UNLV

LMNRA Background

- First breeding pair in Nevada since 1950s located at Lake Mead in 1985
- Annual monitoring of known territories
- Rigorous, park-wide searching/mapping of potential habitat begun in 2006
- Prey-base assessment begun in 2006

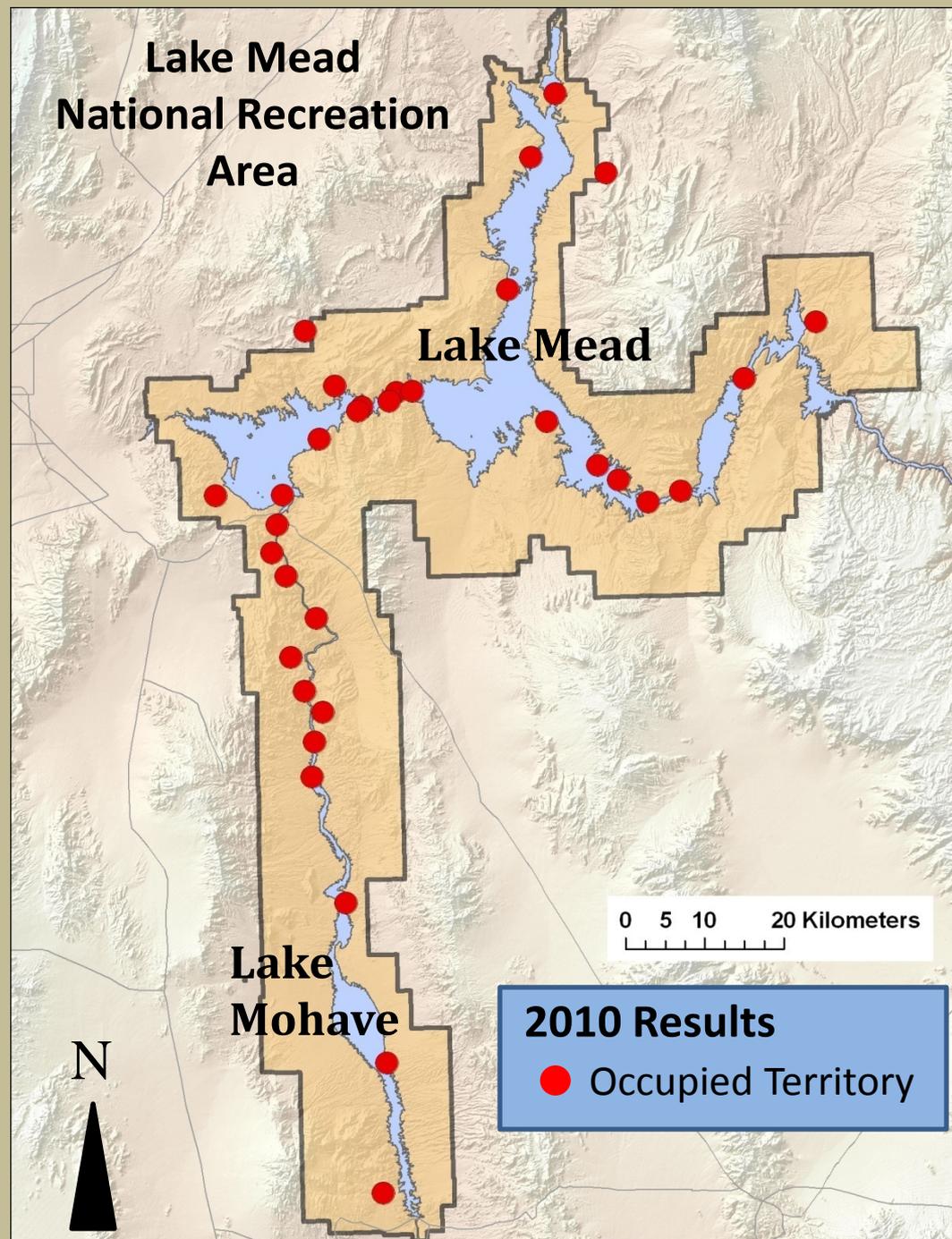


Number of Occupied Territories in Lake Mead NRA



Peregrines in LMNRA

- 38 known territories as of 2012
- Mean reproductive success: 70.6% (2006-2010; $N = 102$)
- Mean young/successful breeding attempt: 2.46 (2006-2010; $N = 72$)



Overview of Mercury Assessment Project

1. Assess Hg contamination in peregrines
 - Within LMNRA vs. SNV
2. Assess Hg contamination in prairie falcons
3. Trace Hg pathway through associated prey species
 - Prey composition (aquatic vs. terrestrial birds)
 - Distance to water
4. Band peregrines to assess mortality and site turnover



Mercury Environmental Contamination

1. Hg readily bioaccumulates in aquatic systems in the form of methylmercury
2. Hg exposure can cause neurological problems in humans
3. Hg negatively affects nervous, circulatory, and endocrine systems in birds
4. Hg concentration in feathers correlated with reduced reproductive success above 13 ppm in songbirds (Brasso & Cristol 2008), 40 ppm in common loons (Evers et al. 2008), and from 5-40 ppm in osprey (Burger & Gochfeld 1997)

Peregrines as an Ideal Biomonitor for Mercury

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



Peregrines as an Ideal Biomonitor for Mercury

Benefits of Feather Analysis:

- Relatively non-invasive
- Hg deposited in feathers during feather growth
- High correlation between dietary intake, total body burden, and Hg concentrations in feathers



Mercury Sampling Effort

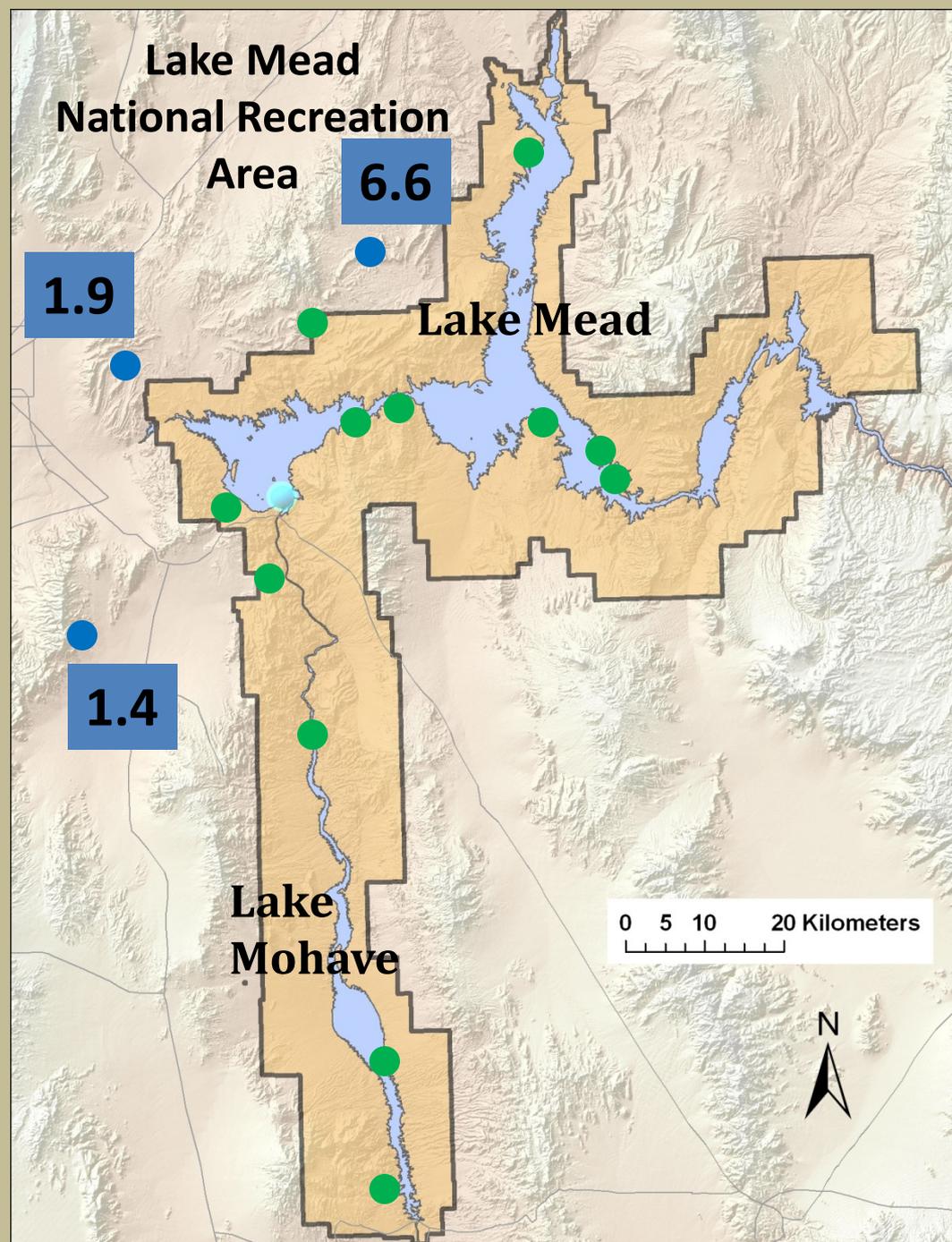
- Sampled from 12 peregrine territories within LMNRA and 6 from southern NV
- Tested 101 feathers from 40 peregrines
- Analyzed prey items from 308 individuals representing 89 species types



Mercury Contamination: SNV Peregrines

	<i>N</i>	Mean Hg ppm
Adult	5	2.6 (0.7–6.6)
Nestling	7	0.6 (0.1–1.0)

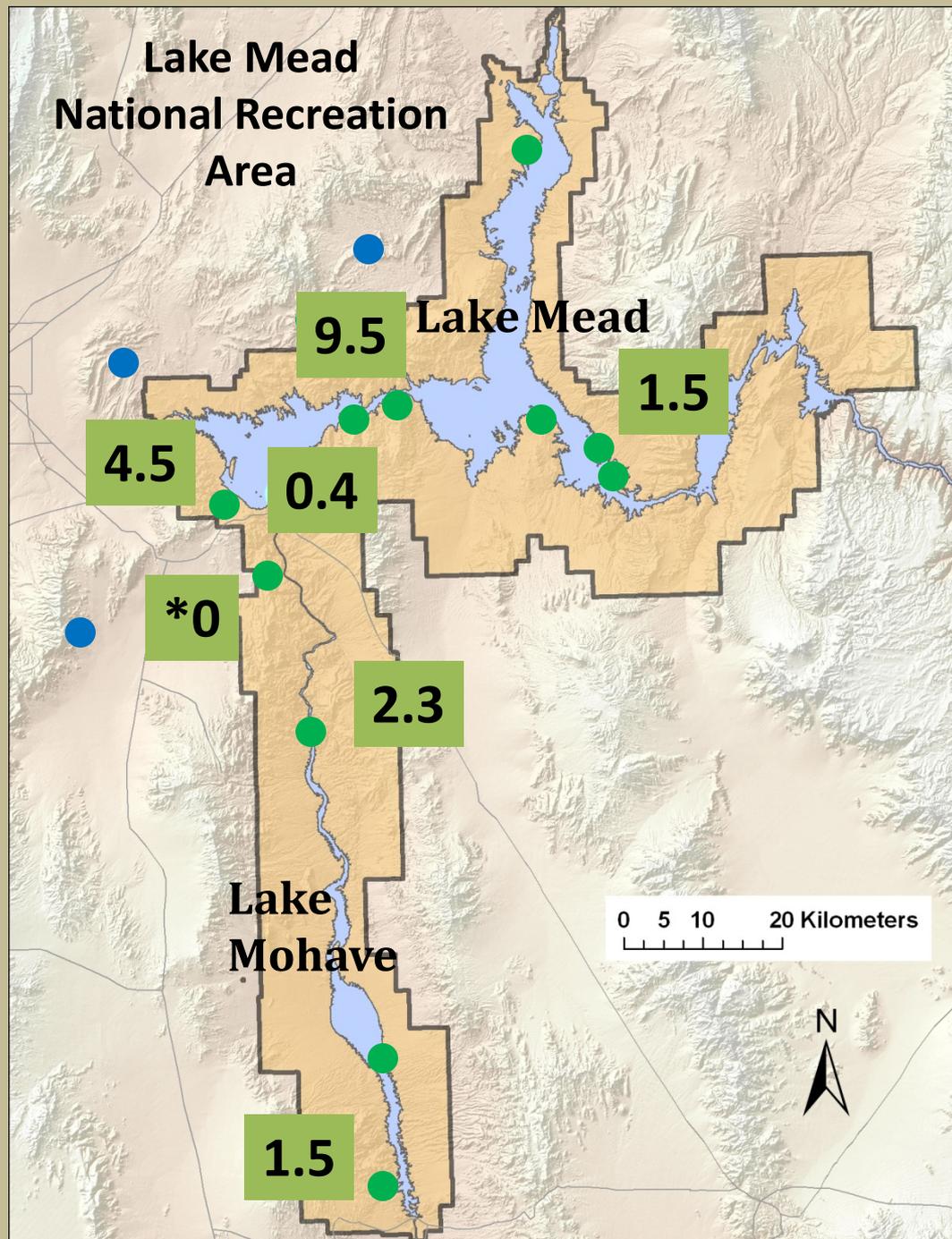
- Hg detected in all peregrines tested



Mercury Contamination: LMNRA Peregrines

	<i>N</i>	Mean Hg ppm
Adult	10	12.9 (0.4–34.7)
Nestling	12	4.5 (0.8–11.5)

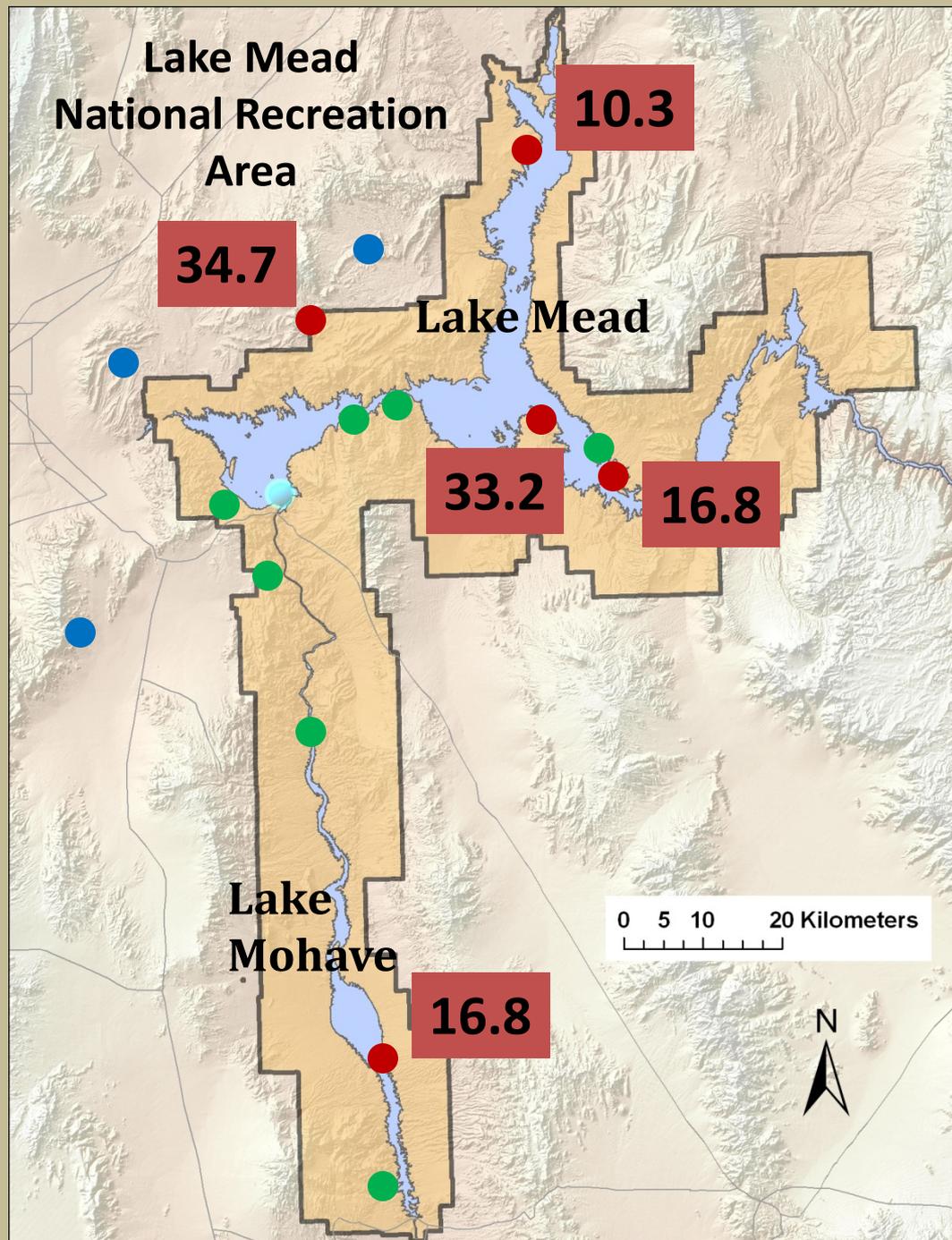
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Mercury Contamination: LMNRA Peregrines

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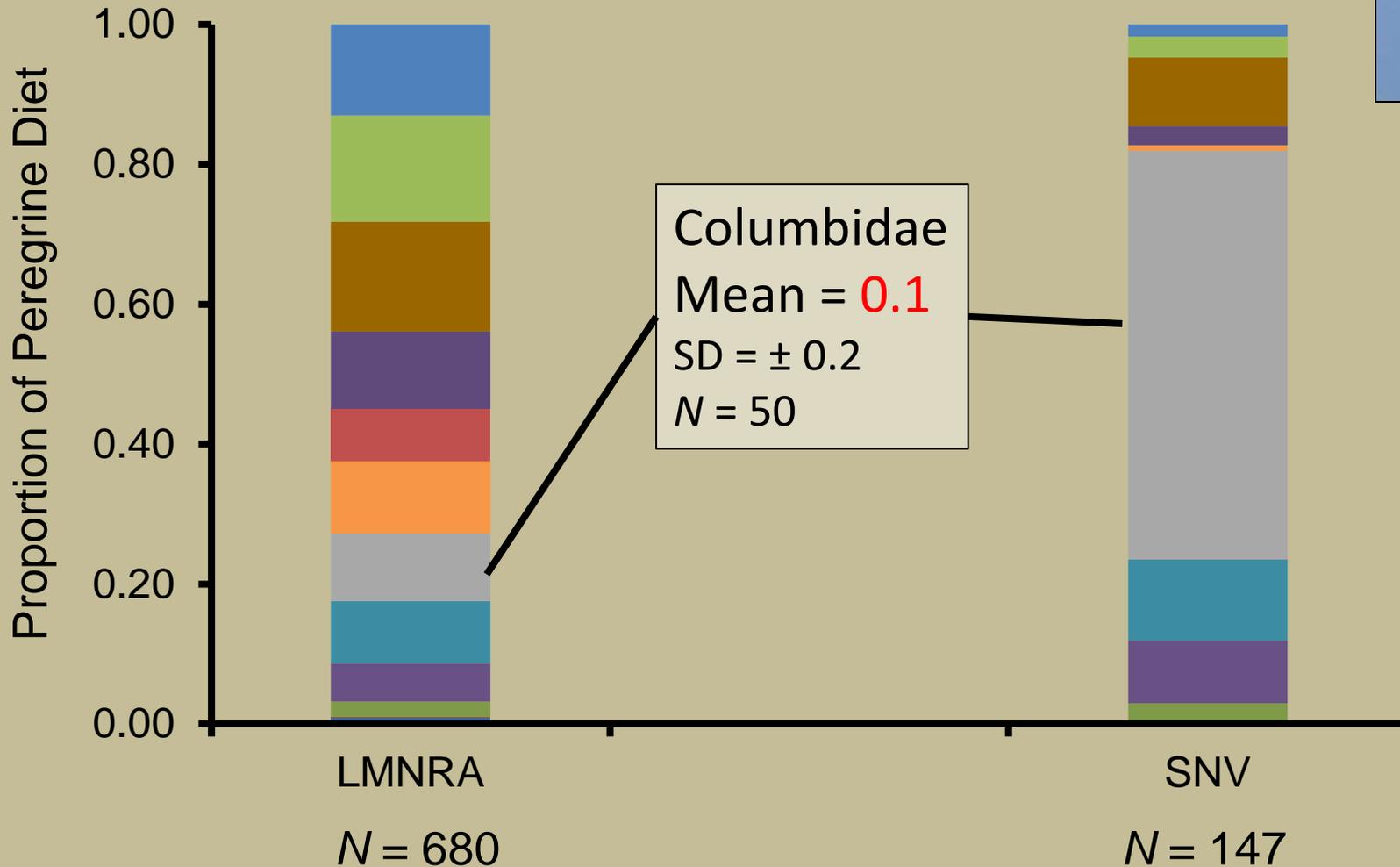
Mercury Contamination: Prey Species



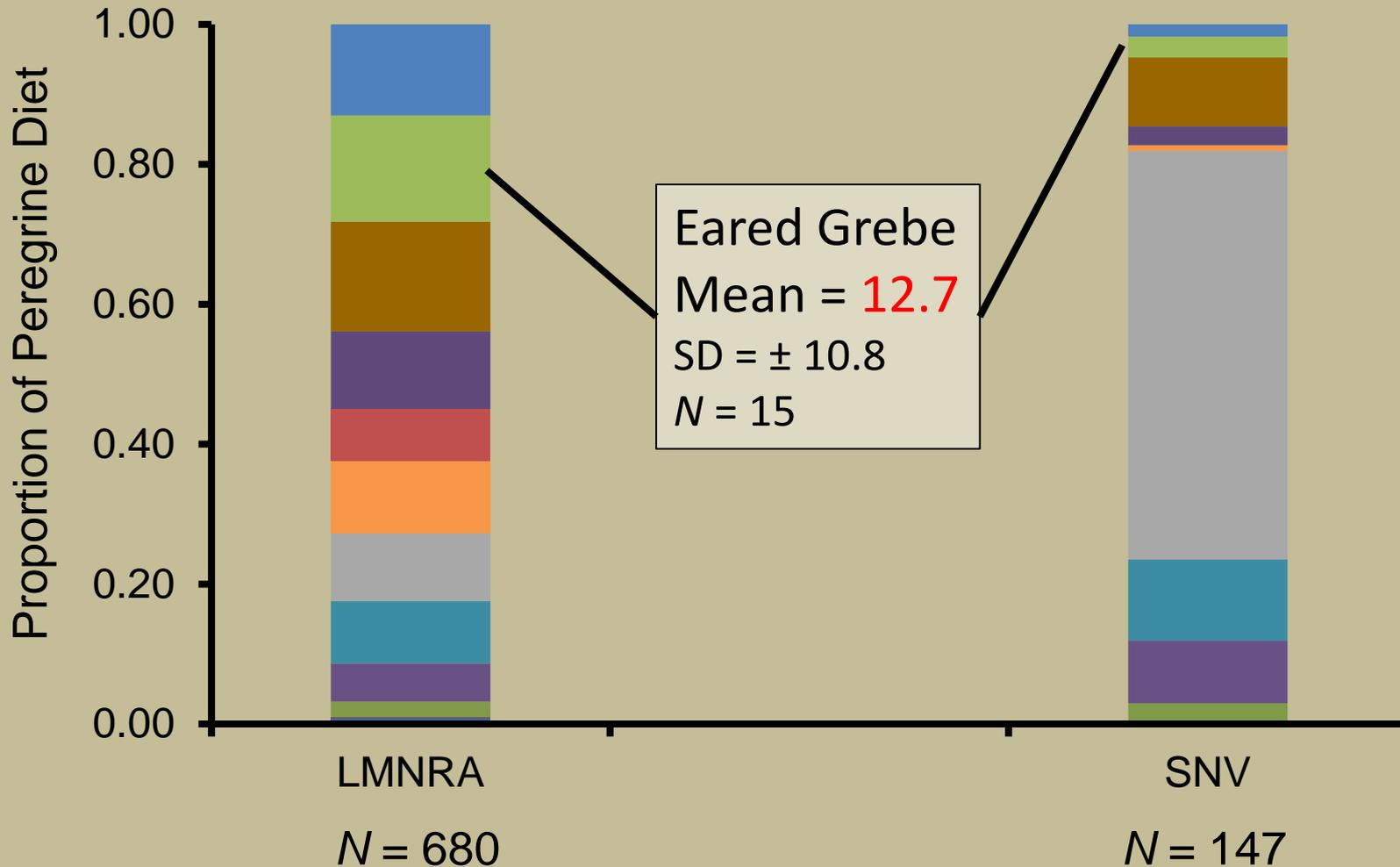
Prey Type	N	Mean Hg (ppm)		% Dietary Biomass	
				LMNRA	SNV
Aquatic Bird	69	4.61	7.2	71.4	18.1
Terrestrial Bird	239	0.71	2.6	22.7	81.9

- 89 prey species types tested
- 95 avian prey species identified in southern NV

Peregrine Diet by Mercury Contamination (ppm): Biomass



Peregrine Diet by Mercury Contamination (ppm): Biomass





Impending Problems...?

High levels of Hg among local peregrines may impact reproduction and survival

- Breeding adults at 4 of 11 territories > 15 ppm Hg
- Compares with levels of 16.7, 16.3, and 21 ppm in contaminated populations of common loons, osprey, and bald eagles
- Overall, eared grebes highly contaminated (mean > 12 ppm) with elevated levels also detected in several individuals of terns, shorebirds, and waterfowl

Future Research Needs

1. Additional Hg analysis
2. Further assessment of productivity
3. Color banding to assess mortality and turnover
4. Verify extent of peregrine year-round movements
5. Where is prey accumulating Hg?



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