Diet of barred owls in California elucidated with high-throughput-sequencing

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Research Questions

- What species are predated by Barred Owls in a novel environment?
- How do Hybrid diets compare to their parent species?
- Can genetic methods help elucidate diet in barred and hybrid owls?

Pellet Analysis

- Significant differences in prey composition in pellets vs direct observations | (Livezey, 2007)
- Up to 50% loss of bone material, 20% loss of individual prey items | (Raczynski and Ruprecht, 1974)

Mostly fur

Not much fur

Morphological Stomach Content

- Possible given access to stomachs as a result of lethal removal studies
- Identification of prey items based on content material
  - Bones
  - Fur/Skin/Feathers
  - Whole specimens

Danny Hofstadter

DNA Metabarcoding

- Allows for identification of rare, highly degraded, or even visually absent items | (Pinol et al, 2014)
- High taxonomic resolution
- Allows for bulk detection of prey items
- Has been shown to increase proportion of identifiable prey items | (Pompanon et al, 2012; Newmaster et al, 2013; Aguilar et al, 2016)

Early Results

- Separately processed stomachs and intestines from all 2019 removals (~150 individuals)

  - *Coronavirus Lockdowns*-

- Extracted, amplified, and sequenced 125 samples
  - Includes both Barred Owls and Hybrids
  - Completed results for Mammalia, Amphibia, Reptilia
  - Partial results for Aves

Early Results

- Frequency of Occurrence (FO)
  - Percent of owls where prey item is detected
- Percent of Occurrence (PO)
  - Proportion of total prey each prey type represents
- Absence/Presence Data
  - Does not account for multiple predations of same prey item, biomass, etc.

Early Taxonomic Results

Class

↓

Order

↓

Family

↓

Genus

↓

Species

Early Taxonomic Results

Class

↓

Order

↓

Family

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Genus

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Species

Early Taxonomic Results

Class

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Order

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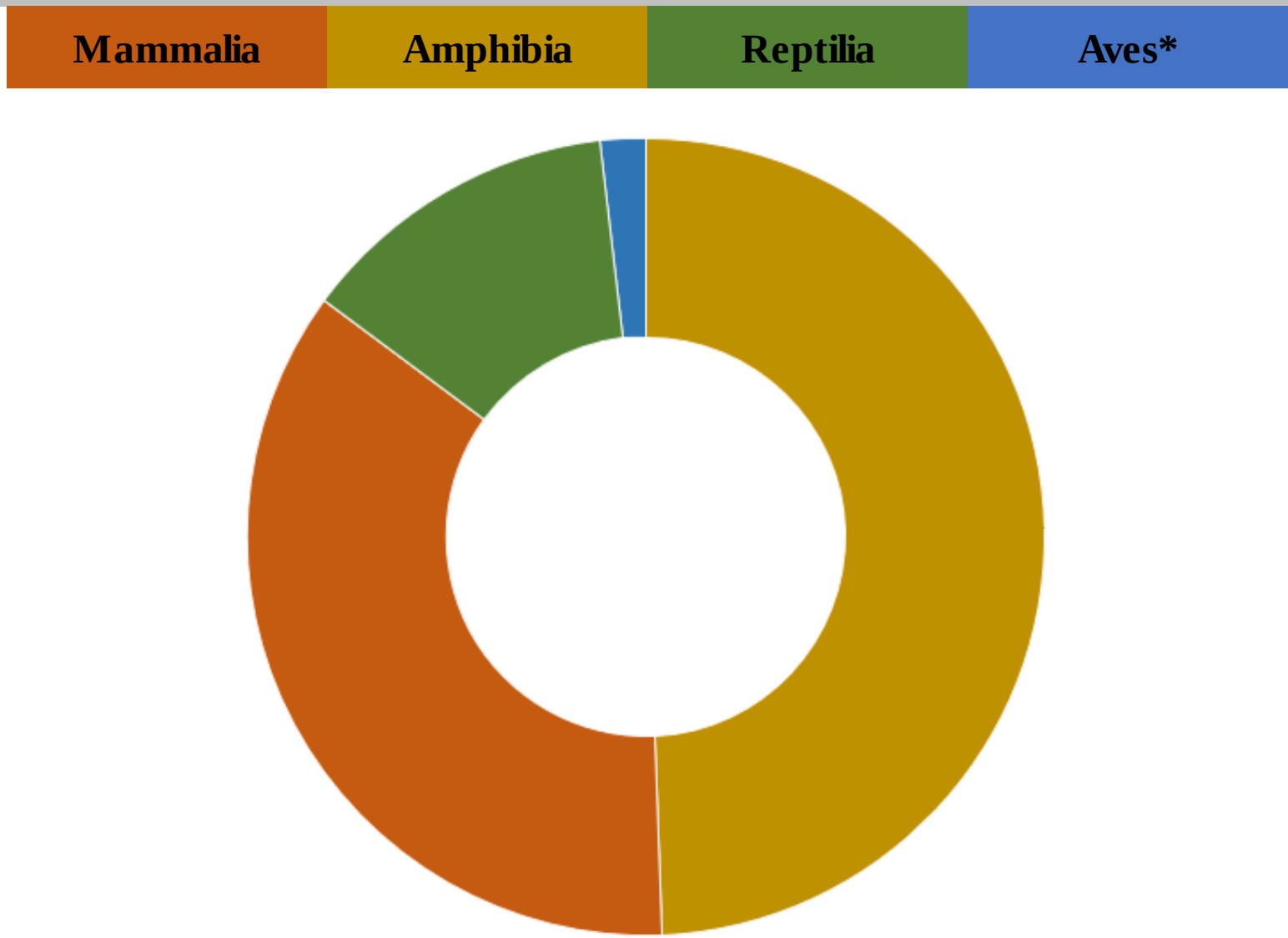
Species



Early Taxonomic Results

Class

↓

Order

↓

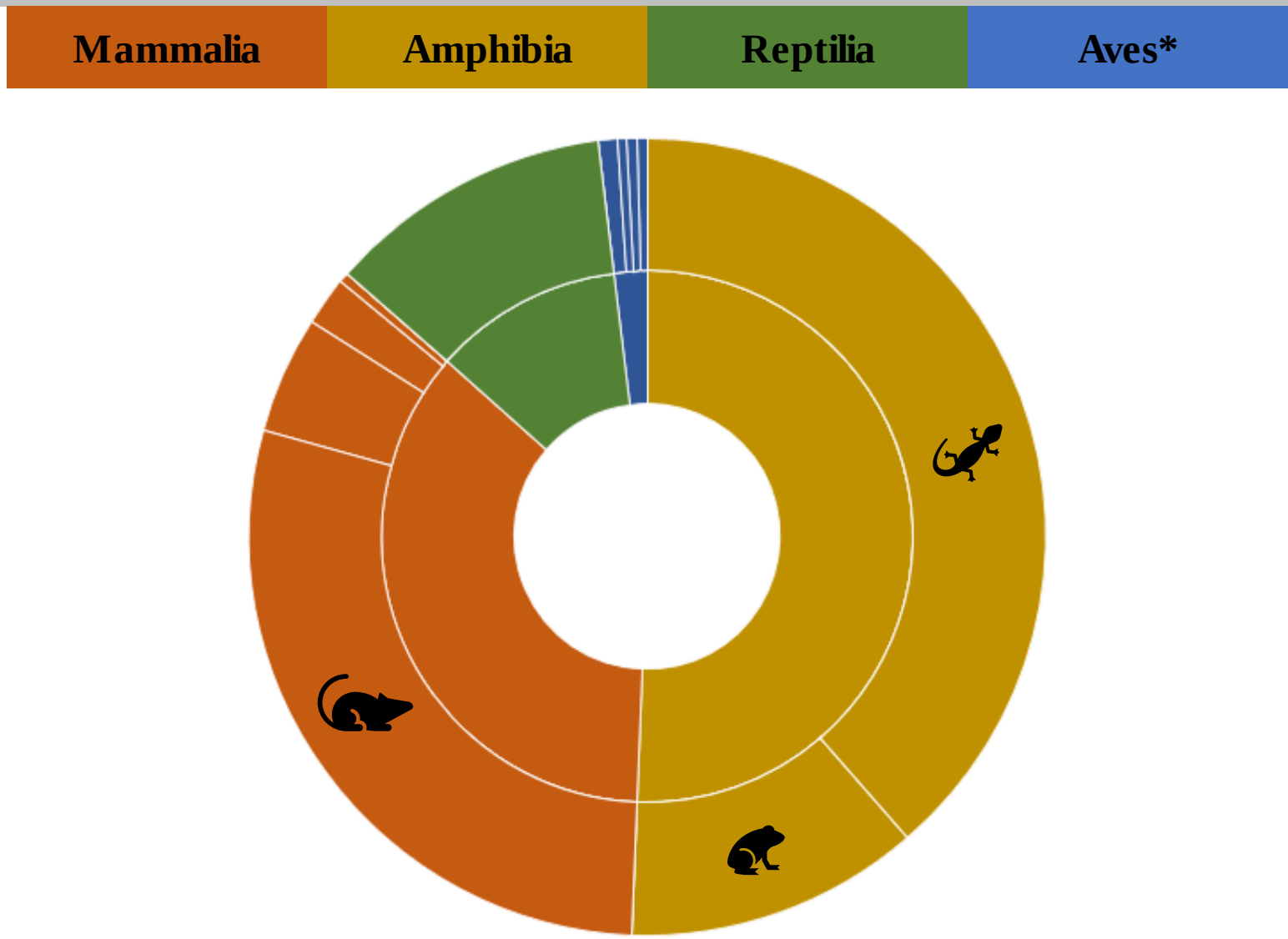
Family

↓

Genus

↓

Species



Early Taxonomic Results

Class

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Order

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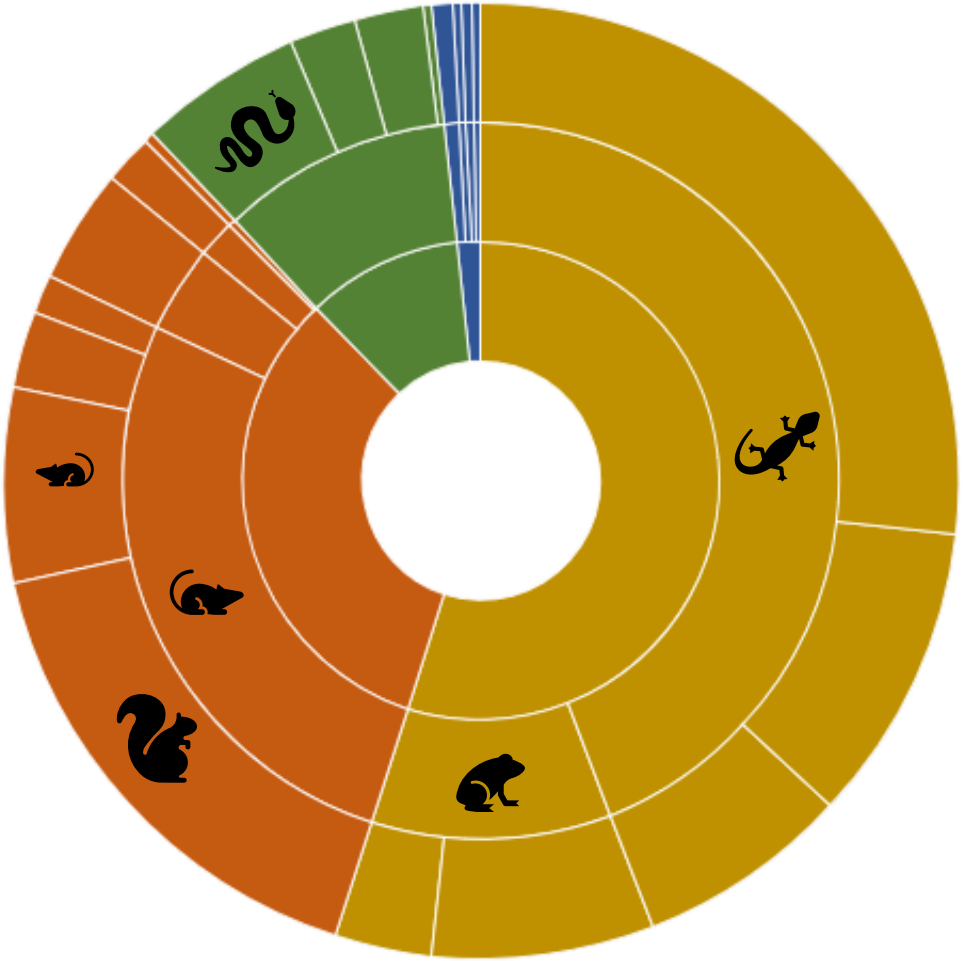
Species



Early Taxonomic Results

Class

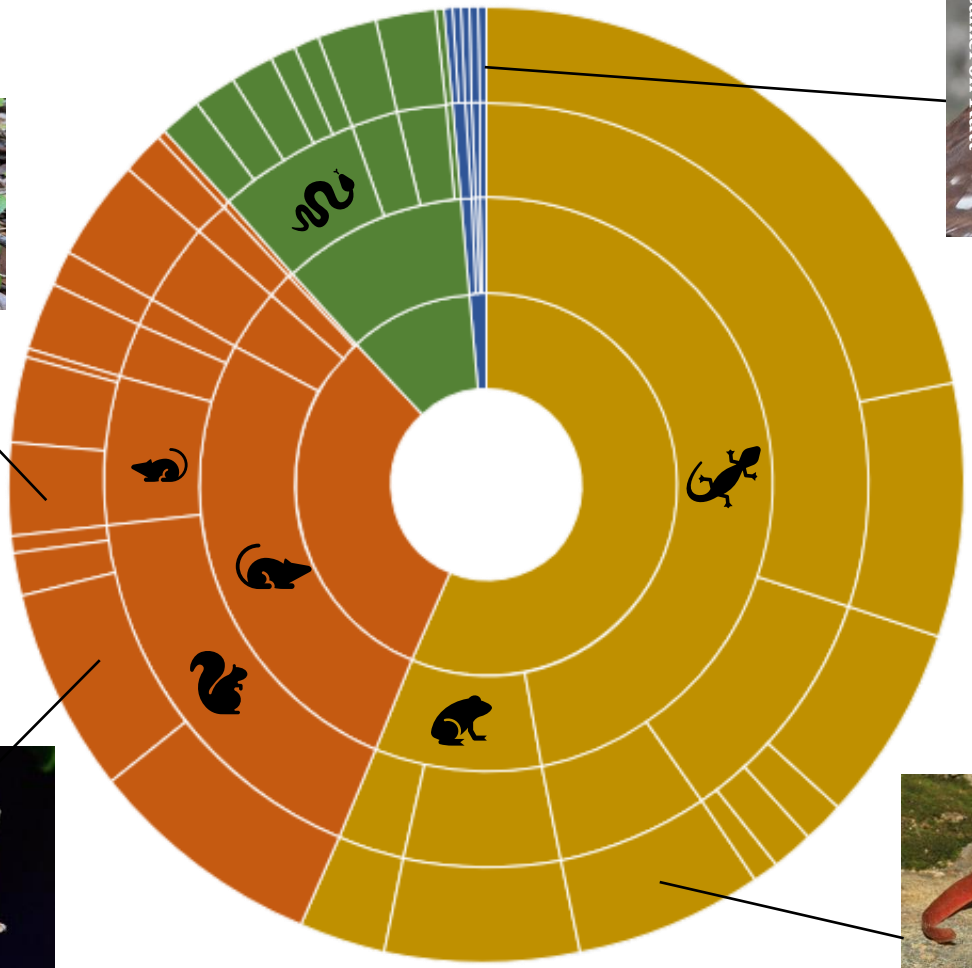
Order

Family

Genus

Species

Mammalia	Amphibia	Reptilia	Aves*



Early Taxonomic Results

Mammalia | Amphibia | Reptilia | Aves*

Class

↓

Order

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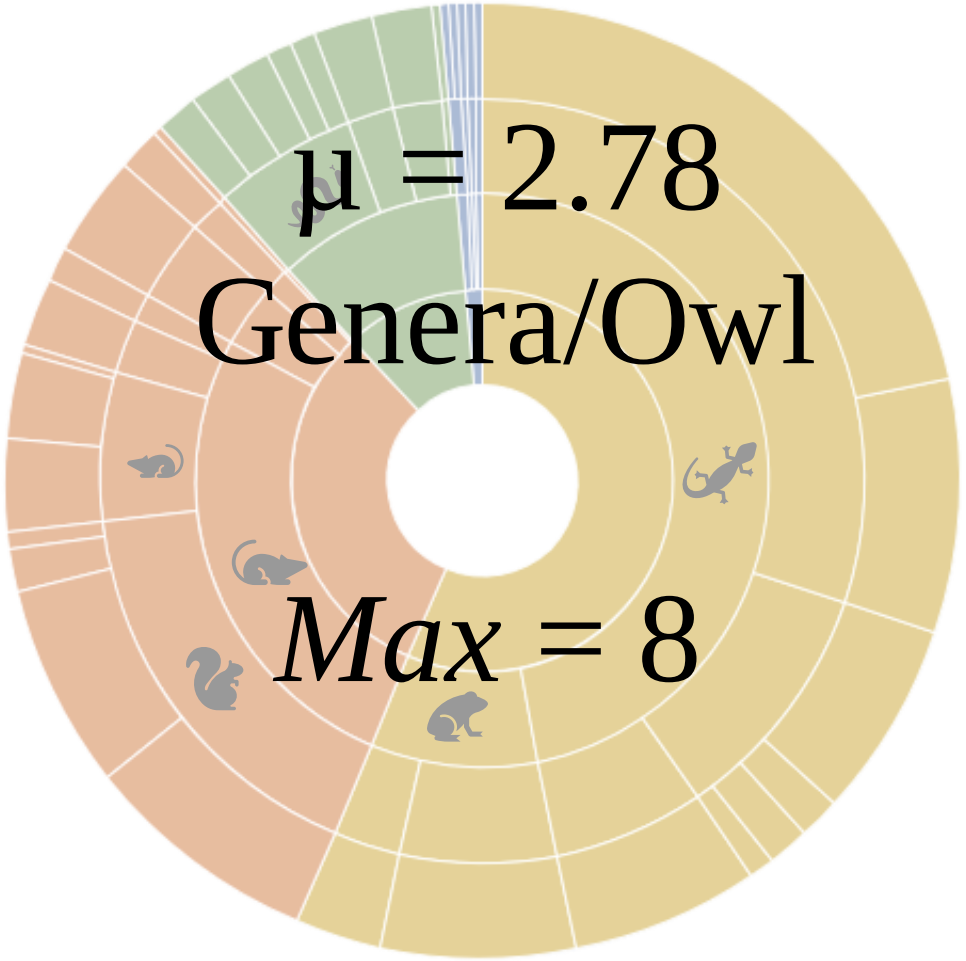
Family

↓

Genus

↓

Species



Early Taxonomic Results

Class

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Order

↓

Family

↓

Genus

↓

Species

Genus: *Tamiasciurus*

28 Detections ↓ Confirmed Species ID!

T. douglasii.
Douglas Squirrel

Early Taxonomic Results

Class

↓

Order

↓

Family

↓

Genus

↓

Species

Genus: *Anaxyrus*

10 Detections

?

A. boreas
Western Toad

A. canorus
Yosemite Toad

Early Taxonomic Results

Class

↓

Order

↓

Family

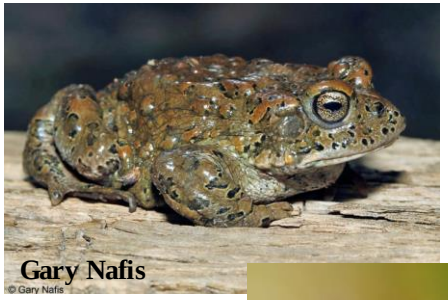
↓

Genus

↓

Species

- Molecular sequencing methods work across taxonomic levels
- Specific resolution requires an expansion of the current California genetic data bank



Barred Owl vs. Hybrids

Maybe!

Only Sierra Nevada Removals:

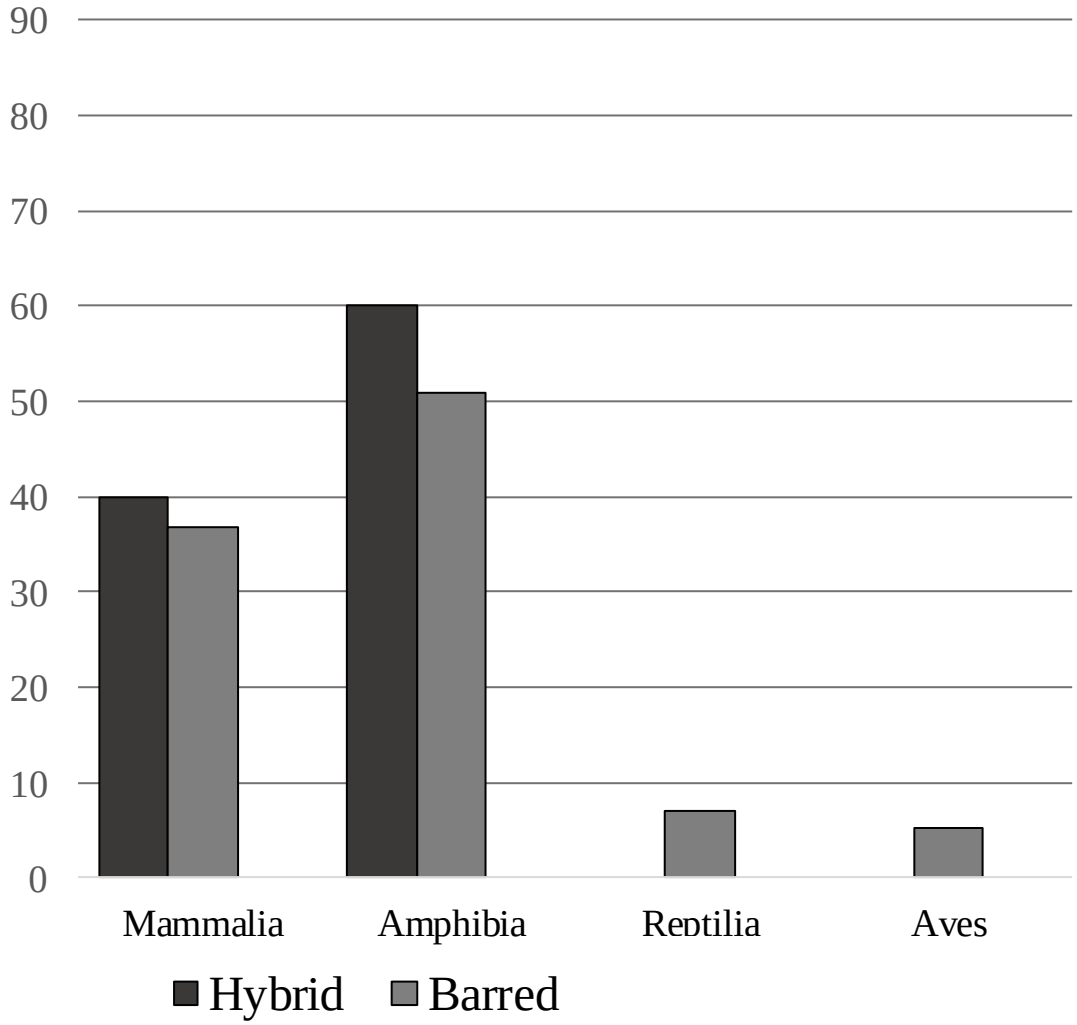
- 31 Barred Owls
- 7 Hybrid Owls

At Genus level, Hybrid prey demonstrates:

Lower Shannon's Diversity ($p < 0.1$)
Lower Rarefied Species Richness ($p < 0.1$)

Barred Owl vs. Hybrids

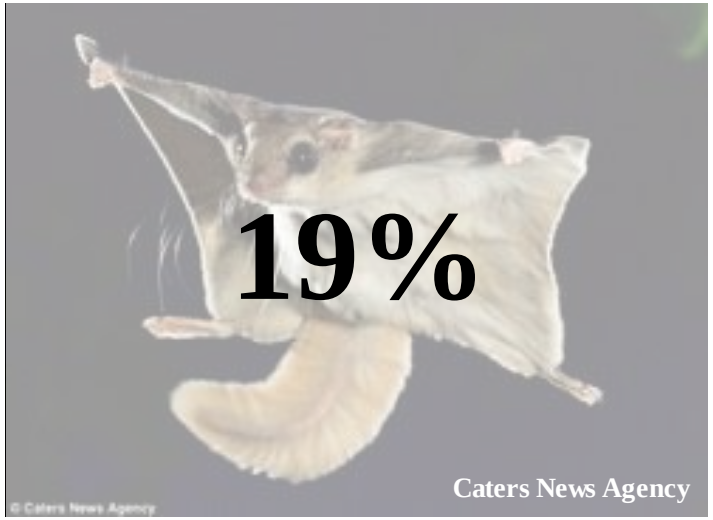
Class-level Comparison:



Conclusions

- Hybrids appear similar to Barreds at Class level, but less diverse at lower levels
- Established genetic metabarcoding methods that work with Barred Owls
- Large number of prey detections
  - Barred owls are consuming key spotted owl prey
  - Barred owls are consuming key prey items for other species of concern
  - Barred owls are consuming a large number of amphibians

Conclusions



Upcoming Work

- Finish processing data
  - Additional Aves
  - Invertebrates
  - Fish
- Expand genetic reference data
- Refine and expand analyses with completed data
  - Barreds v. Hybrids
  - Klamath Range v. Sierra Nevada
  - Landscape Features
  - Seasonal Trends

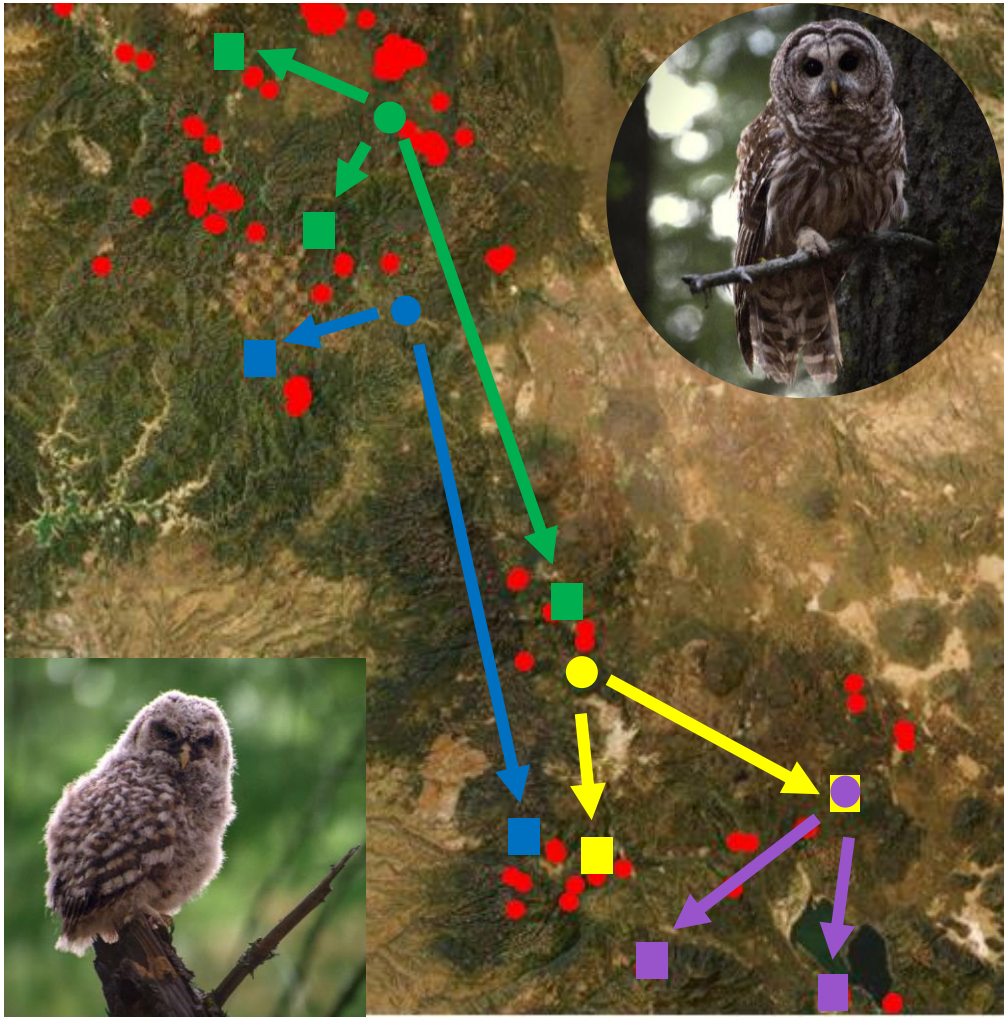
Upcoming Work

Genetic Kinship

- Identification of Parent – Offspring Dyads

- Immigration Rates into Sierra Nevada Population
- General Dispersal from Parent Territories

Genetic Kinship



Thank You!

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