



PHYLOGEOGRAPHY OF THE BOBWHITES

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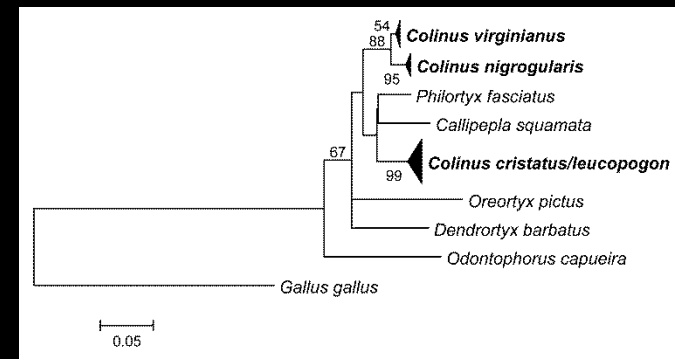
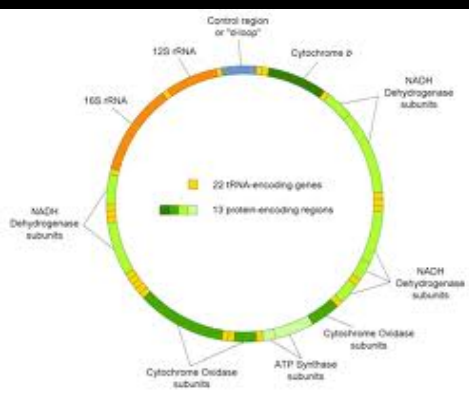
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The Bobwhites (*Colinus*): Savanna-specialists

Northern Bobwhite (*Colinus virginianus*)



Yucatán Bobwhite (*Colinus nigrogularis*)



Spot-bellied Bobwhite (*Colinus leucopogon*)

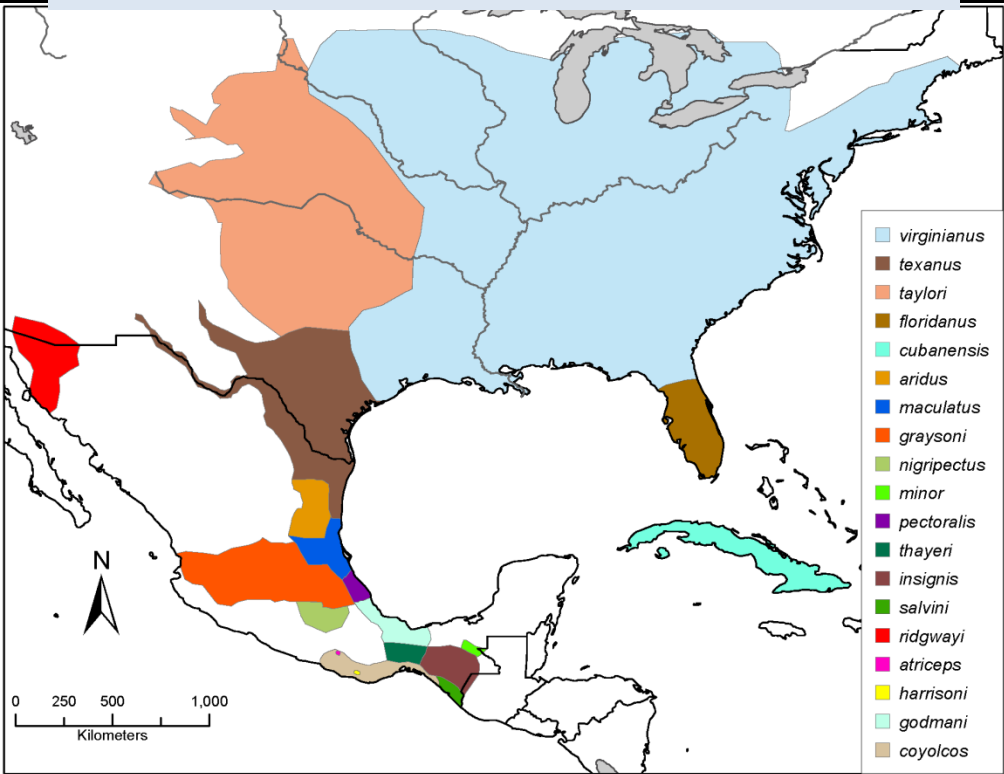


Crested Bobwhite (*Colinus cristatus*)

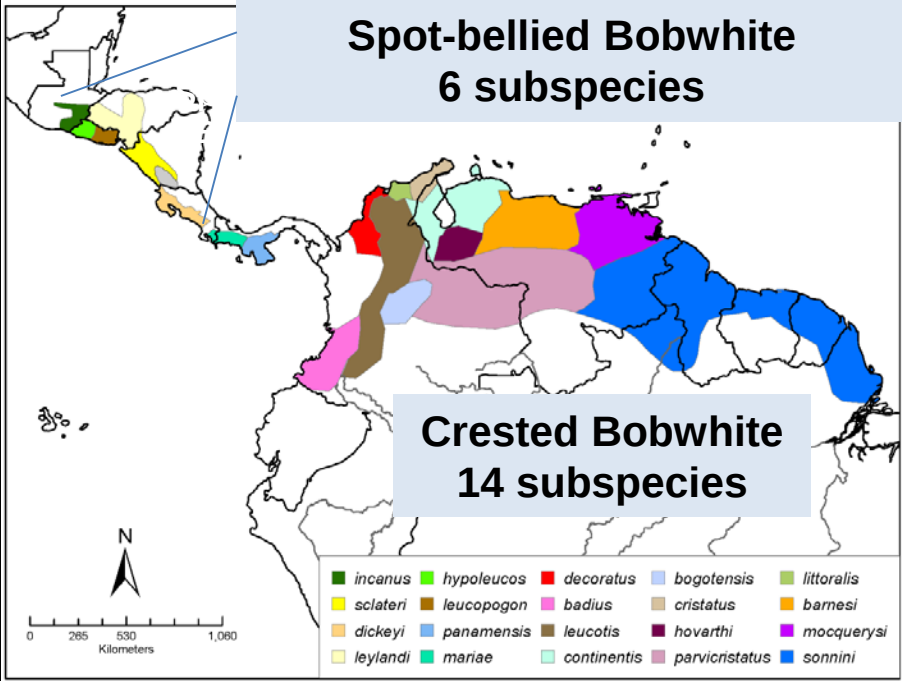


Subspecies Distributions

Northern Bobwhite
19 Subspecies

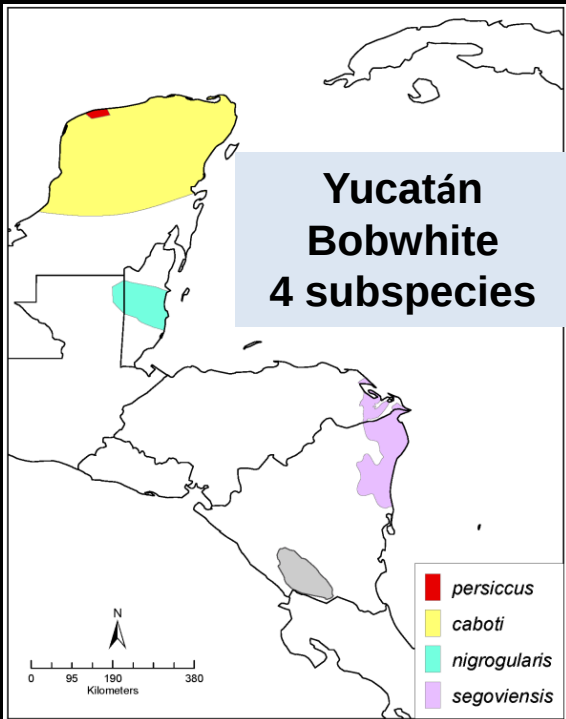


Spot-bellied Bobwhite
6 subspecies

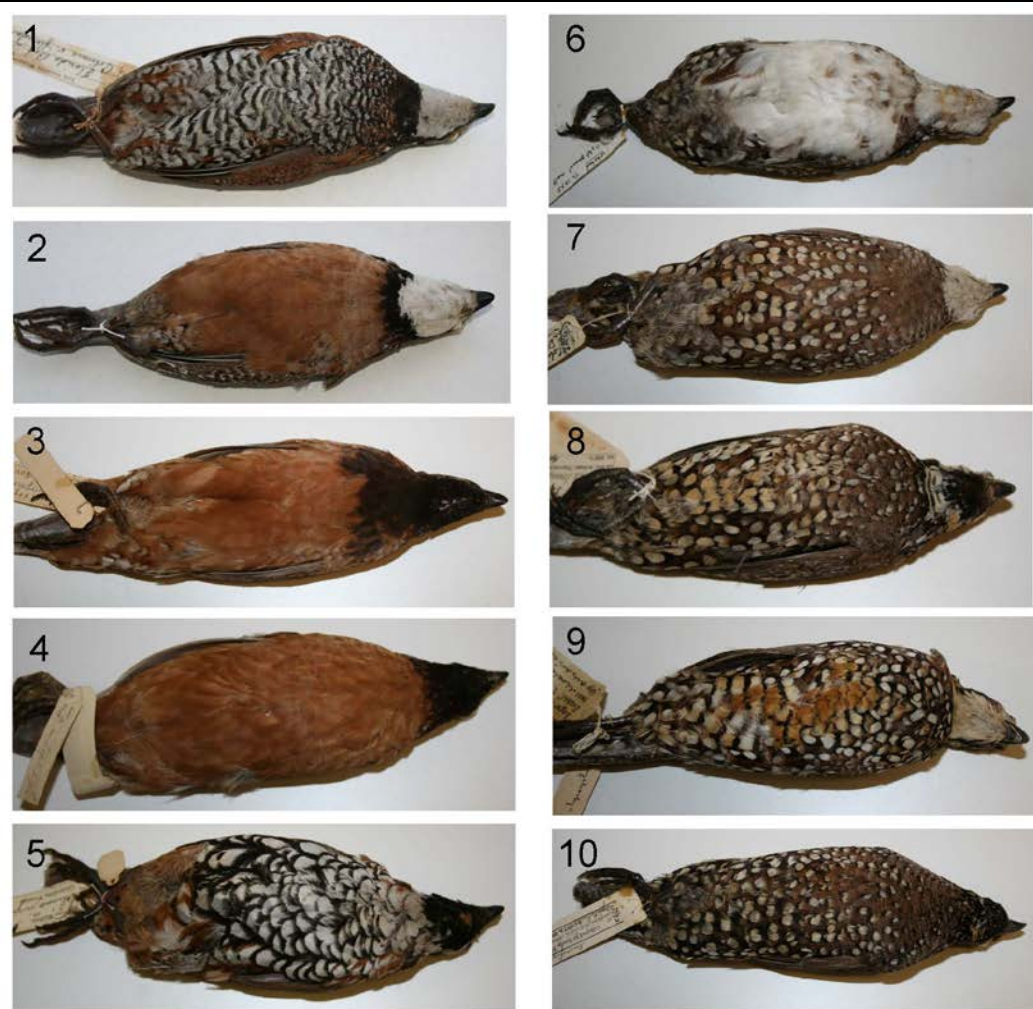


Crested Bobwhite
14 subspecies

Yucatán Bobwhite
4 subspecies



Geographic Variation in Bobwhites



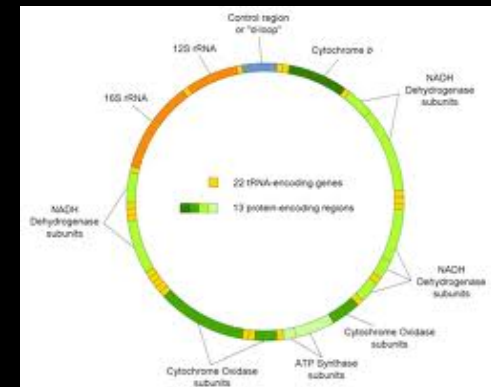
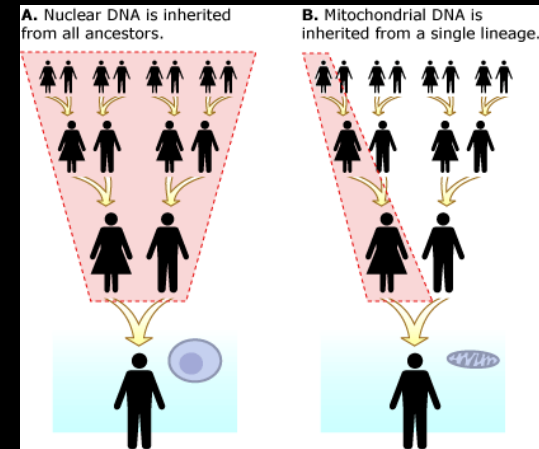
Geographic variation among bobwhite species. 1) *Colinus virginianus floridanus* [southern Florida], 2) *C. v. graysoni* [San Luis Potosí], 3) *C. v. coyolcos* [Chiapas], 4) *C. v. ridgwayi* [Arizona], 5) *C. nigrogularis* [Yucatán], 6) *C. leucopogon hypoleucos* [Guatemala], 7) *C. l. leucopogon* [El Salvador], 8) *C. l. sclateri* or *leylandi* [Costa Rica], 9) *C. cristatus* [Venezuela], and 10) *C. cristatus* [Colombia].

Unanswered Questions

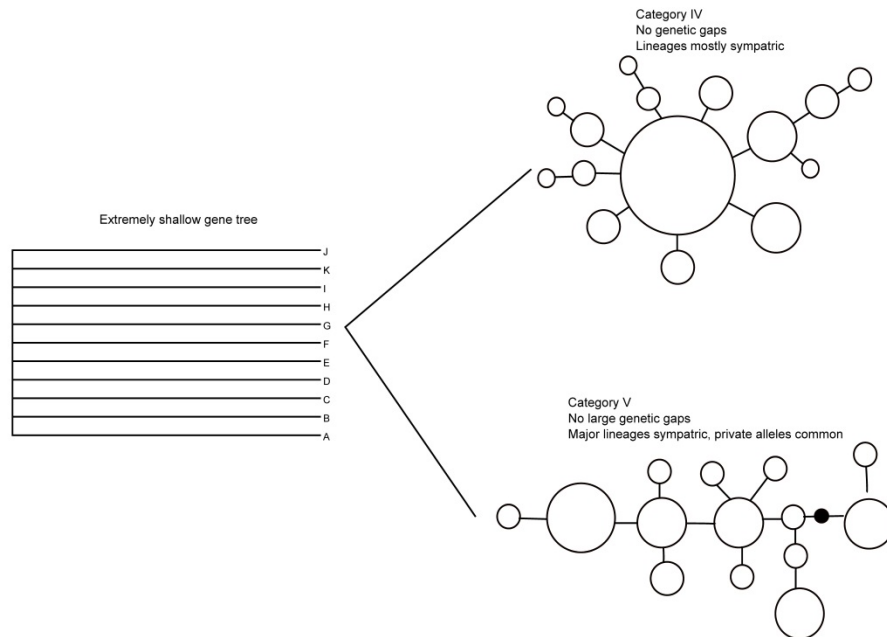
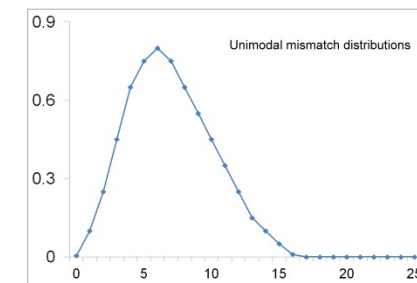
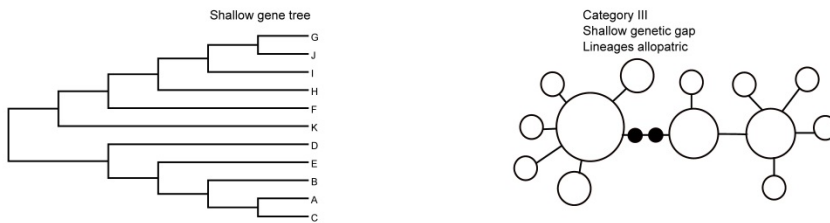
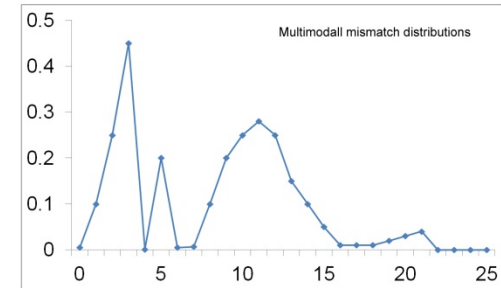
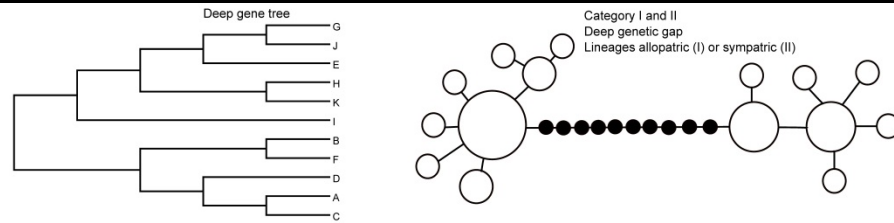
- How many bobwhite species are there?
- How are those species related to one another?
- How distinct are the subspecies within each bobwhite species?
- Biogeographic and evolutionary history?

Phylogenetics and Phylogeography

- Phylogenetics: evolutionary relationships among groups.
- Phylogeography
 - Geographic distribution of genetic genealogies.
 - Infer causes of observed patterns.
- Mitochondrial DNA (mtDNA)
 - Great initial genetic marker.
 - Maternal inheritance
 - No recombination



Phylogeographic Patterns



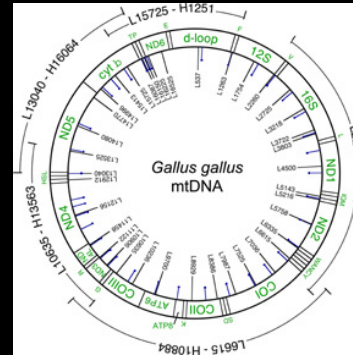
Objectives

- Examine the interspecific relationships among the bobwhite species using mtDNA.
- Examine phylogeography of each species.
- Determine how much genetic variation is accounted for by subspecies taxonomy.
- Use findings to infer historical causes of phylogenetic and phylogeographic patterns.

Methods: Laboratory



Tissue sample



DNA Extraction



PCR

We amplified a 350-bp segment of ND2 and 220-bp D-loop of the mitochondrial genome.



Editing

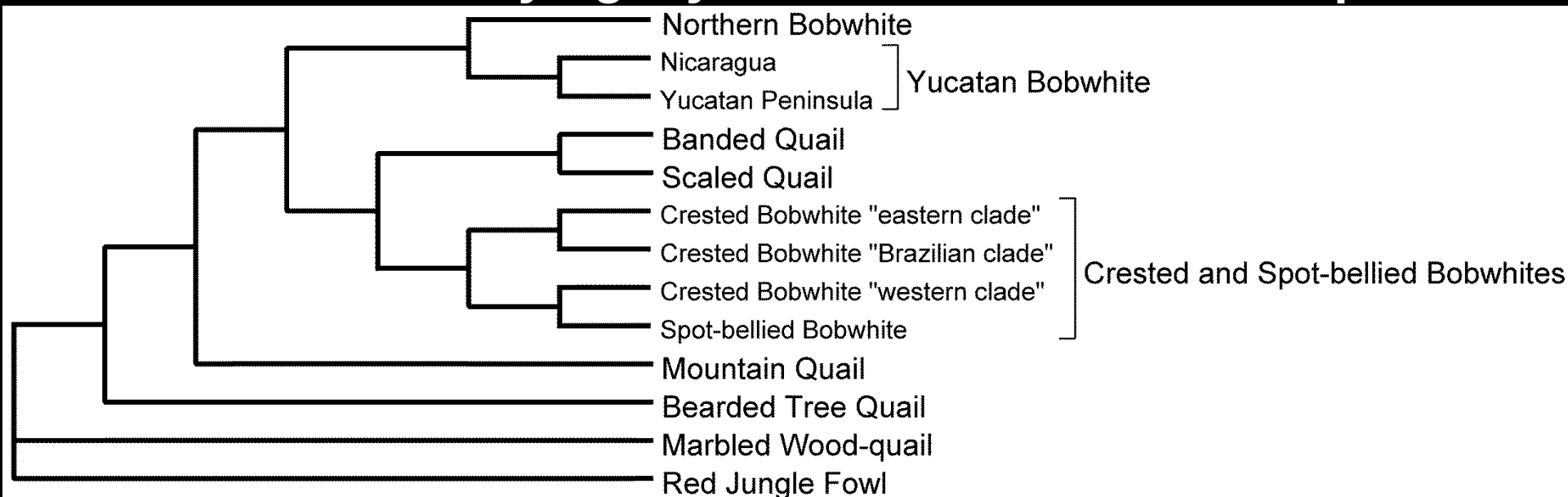


Sequencing

Methods: Analysis

- Interspecific relationships (ND2 and D-loop)
 - Maximum likelihood phylogenetic tree.
 - Sequence divergences among bobwhite species.
- Intraspecific phylogeography (D-loop only)
 - Minimum spanning networks of haplotypes
 - Distribution of pairwise nucleotide differences
 - Unimodal = demographic expansion.
 - Multimodal = population differentiation.
 - Analysis of molecular variance (AMOVA)
 - Quantifies the amount of genetic variation due different hierarchical levels.
 - How much genetic variation accounted for by subspecies.

Bobwhite Phylogeny based on ND2 and D-loop

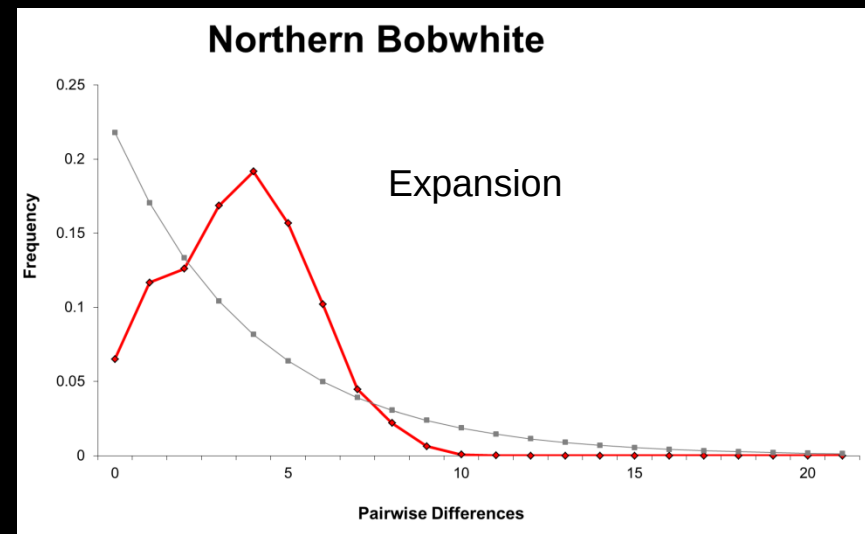
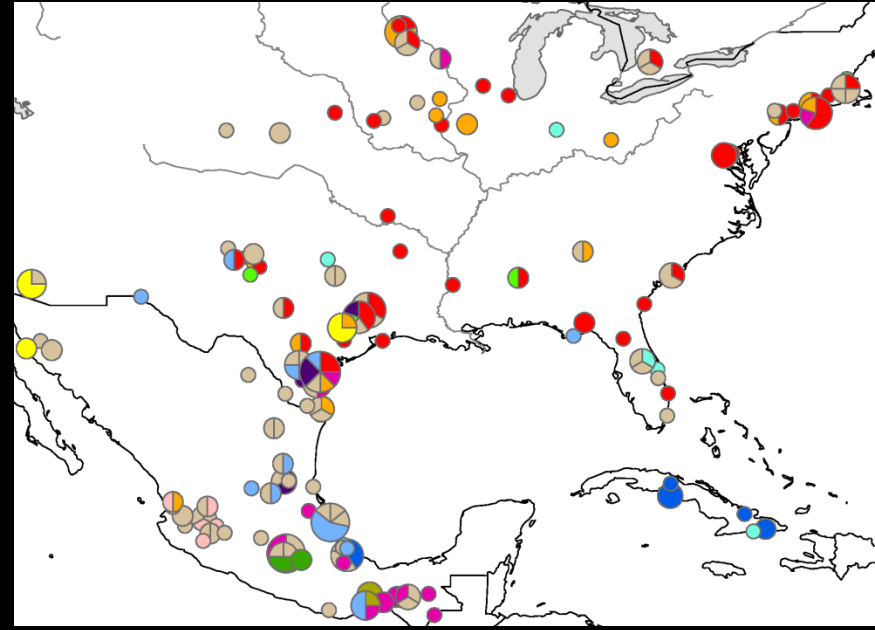
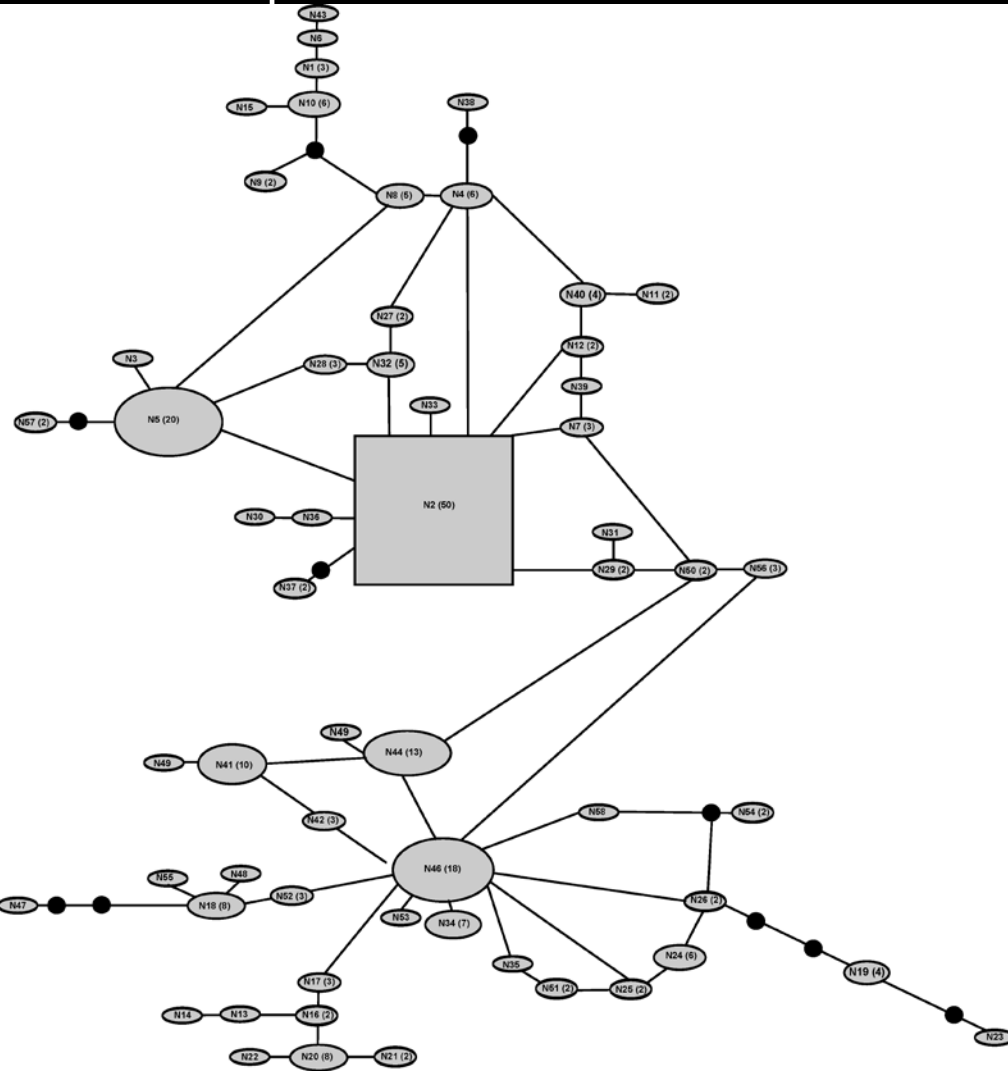


Sequence Divergences (p distance)

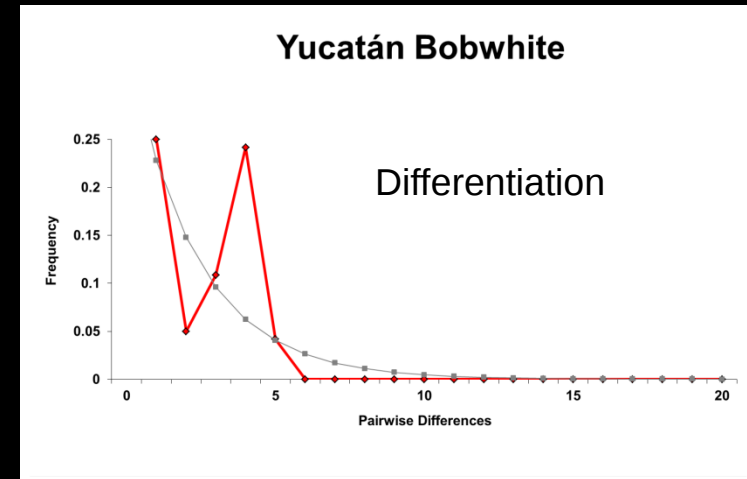
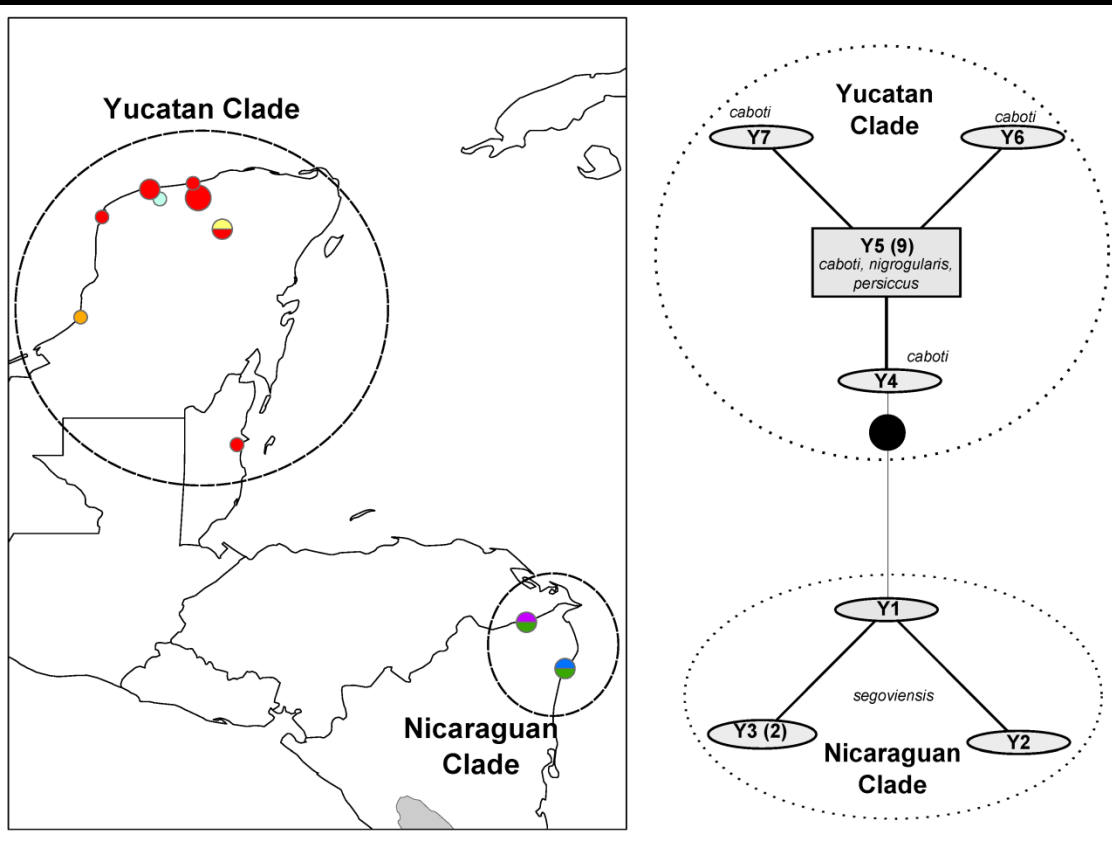
	Crested	Spot-bellied	Yucatán
Crested			
Spot-bellied	0.022		
Yucatán	0.098	0.094	
Northern	0.091	0.083	0.027

Northern Bobwhite

- 58 haplotypes.
- 50% of haplotypes shared by ≥ 2 subspecies.

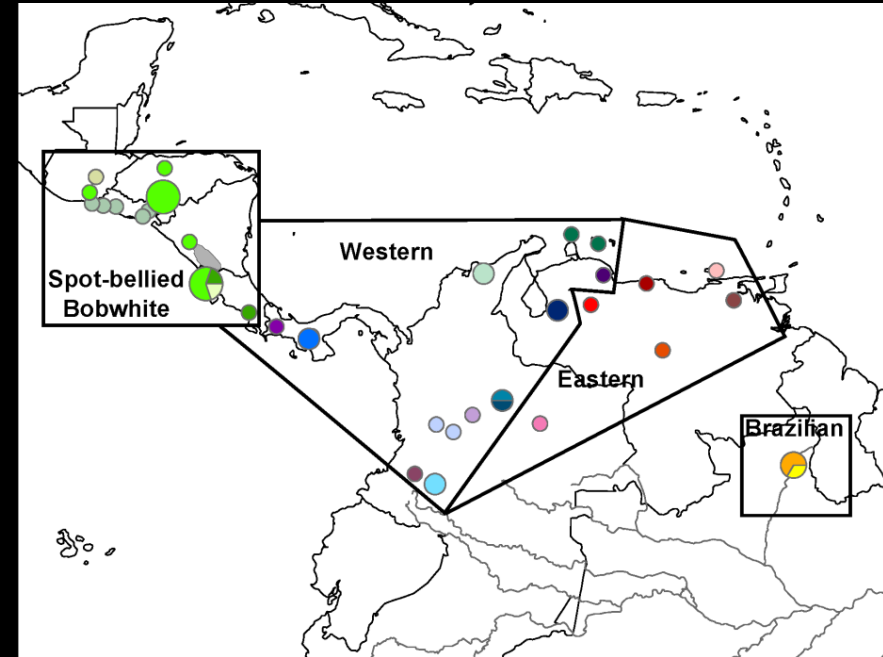
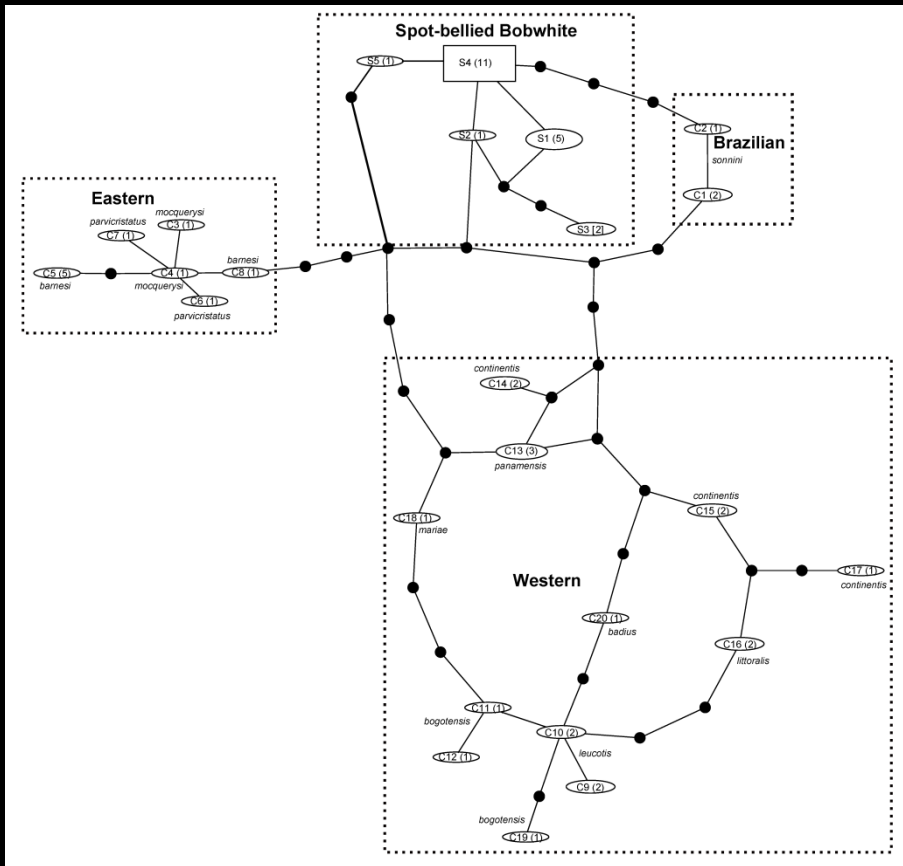


Yucatán Bobwhite

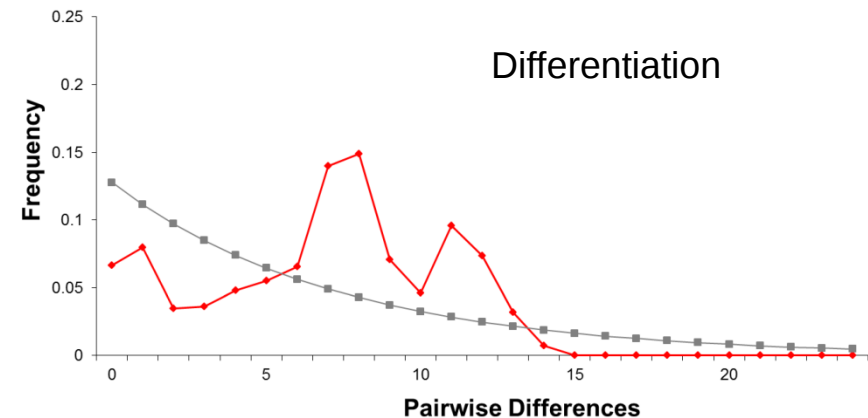


- 7 haplotypes.
- 2 geographically and genetically distinct groups.

Crested and Spot-bellied Bobwhites

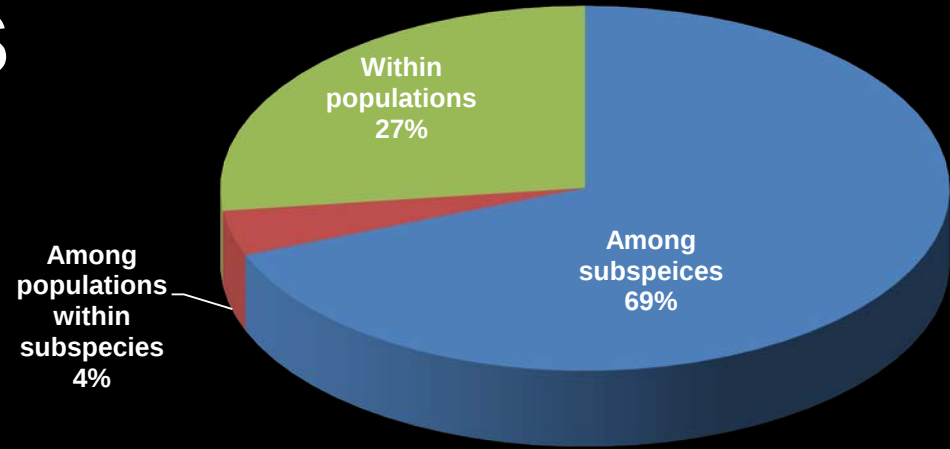


Crested/Spot-bellied Bobwhite Complex

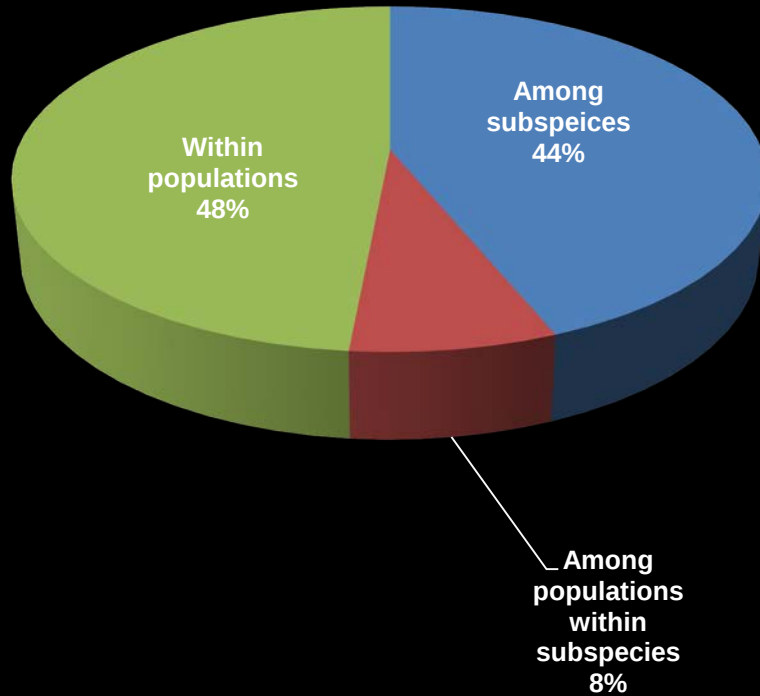


- 5 spot-bellied bobwhite haplotypes shared among subspecies.
- 20 crested Bobwhite subspecies not shared among subspecies.

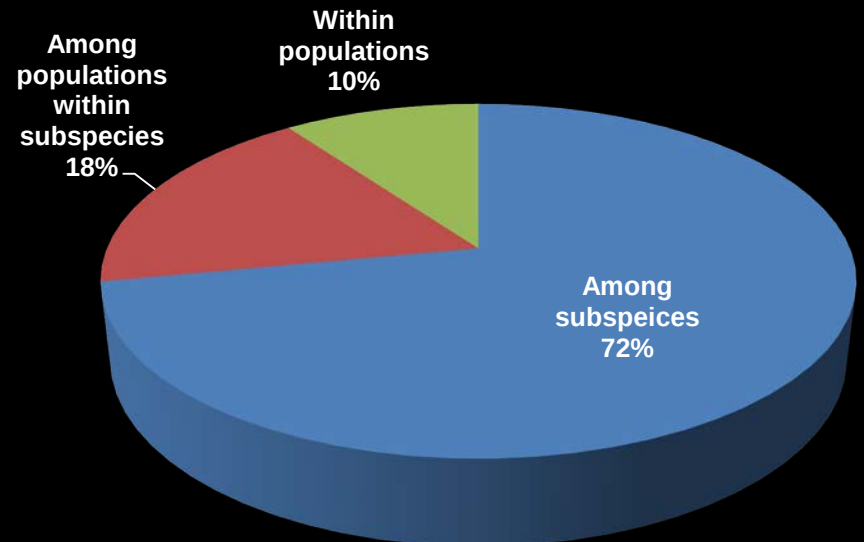
AMOVA Results



Yucatán Bobwhite



Northern Bobwhite



Crested and Spot-bellied Bobwhites

Conclusions

- Species relationships
 - *Colinus* may not be a natural group.
 - Yucatán and northern bobwhites are distinct species.
 - Species status of crested and spot-bellied bobwhites unclear.
 - 1 polytypic species?
 - 4 closely related species?
- Phylogeography
 - Northern bobwhite
 - Repeated patterns of isolation and expansion.
 - Climate driven changes in availability of suitable habitat.
 - Yucatán and crested/spot-bellied bobwhites
 - Allopatric fragmentation
 - Climate-driven expansion and fragmentation of savanna and geological events.

Future Research

- Future work
 - Additional samples from all species
 - Additional genes
 - Morphometric and colorimetric analysis

Acknowledgments

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 - Welder Wildlife Foundation
 - Yale Peabody Museum
 - Field Museum of Natural History
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