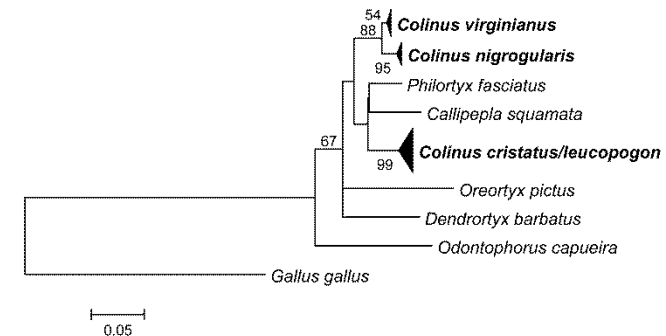


MOLECULAR ECOLOGY OF NEW WORLD QUAILS: MESSAGES FOR MANAGERS

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New World Quails—Odontophoridae

Crested quails
(*Callipepla*)



Banded quail
(*Philortyx*)



Tree-quails
(*Dendrortyx*)



Mountain quail
(*Oreortyx*)



Wood quails
(*Odontophorus*)

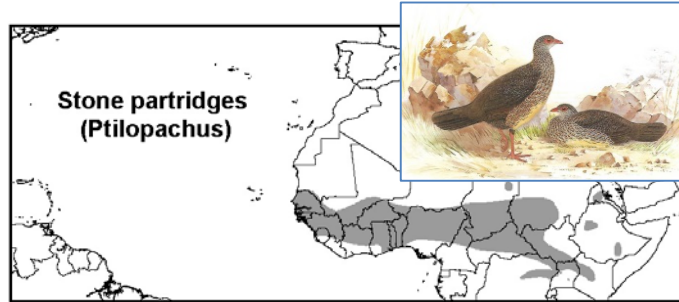


- 10 genera, 33 species
- Most species poorly studied
- Limited genetic research

Bobwhites (*Colinus*)



Stone partridges
(*Ptilopachus*)



Singing quail
(*Dactylortyx*)



Tawny-faced quail
(*Rhynchortyx*)

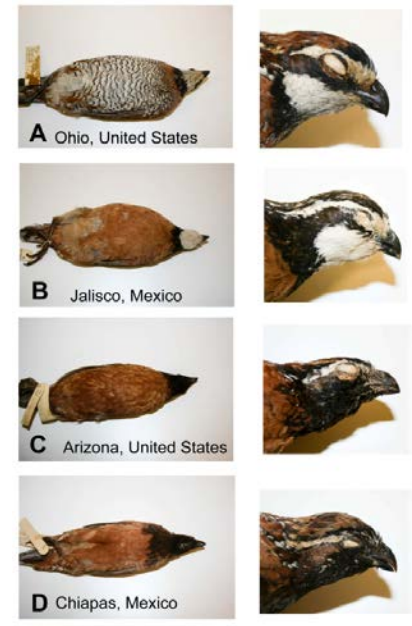
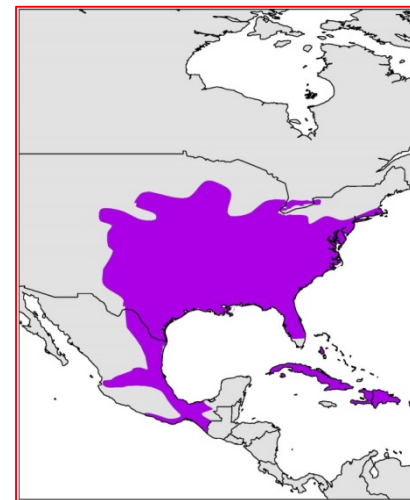


Harlequin quails
(*Cyrtonyx*)



Northern Bobwhite (*Colinus virginianus*)

- Most thoroughly studied
- Wide geographic distribution
- Popular upland gamebird
- Traits
 - Terrestrial
 - Short-lived
 - Poor disperser
 - Boom-bust species
 - Geographic variation



Population Dynamics and Structure

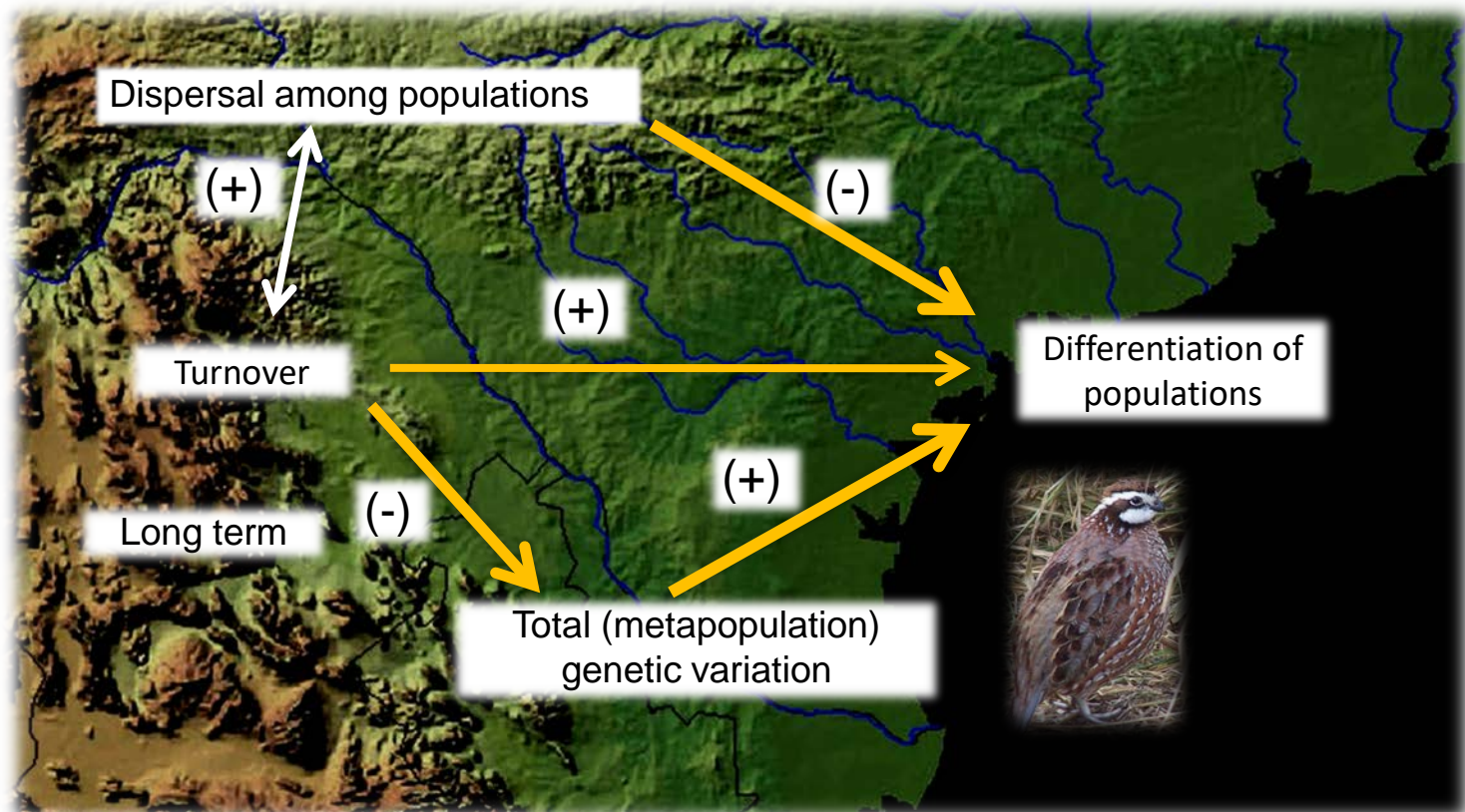
Limited dispersal

+

=

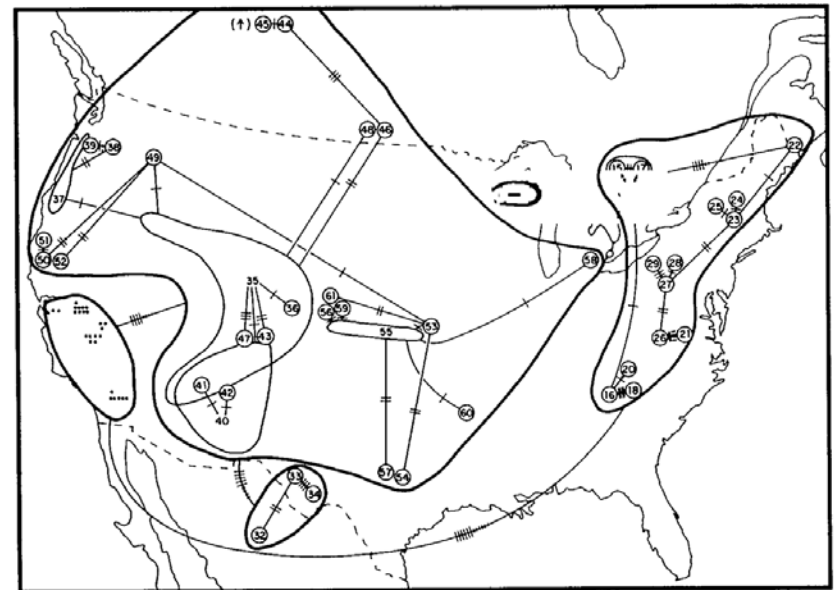
Strong
population
structure

Rapid population turnover



Example

- Rodents
- Limited dispersal
- Short-lived
- Population fluctuations



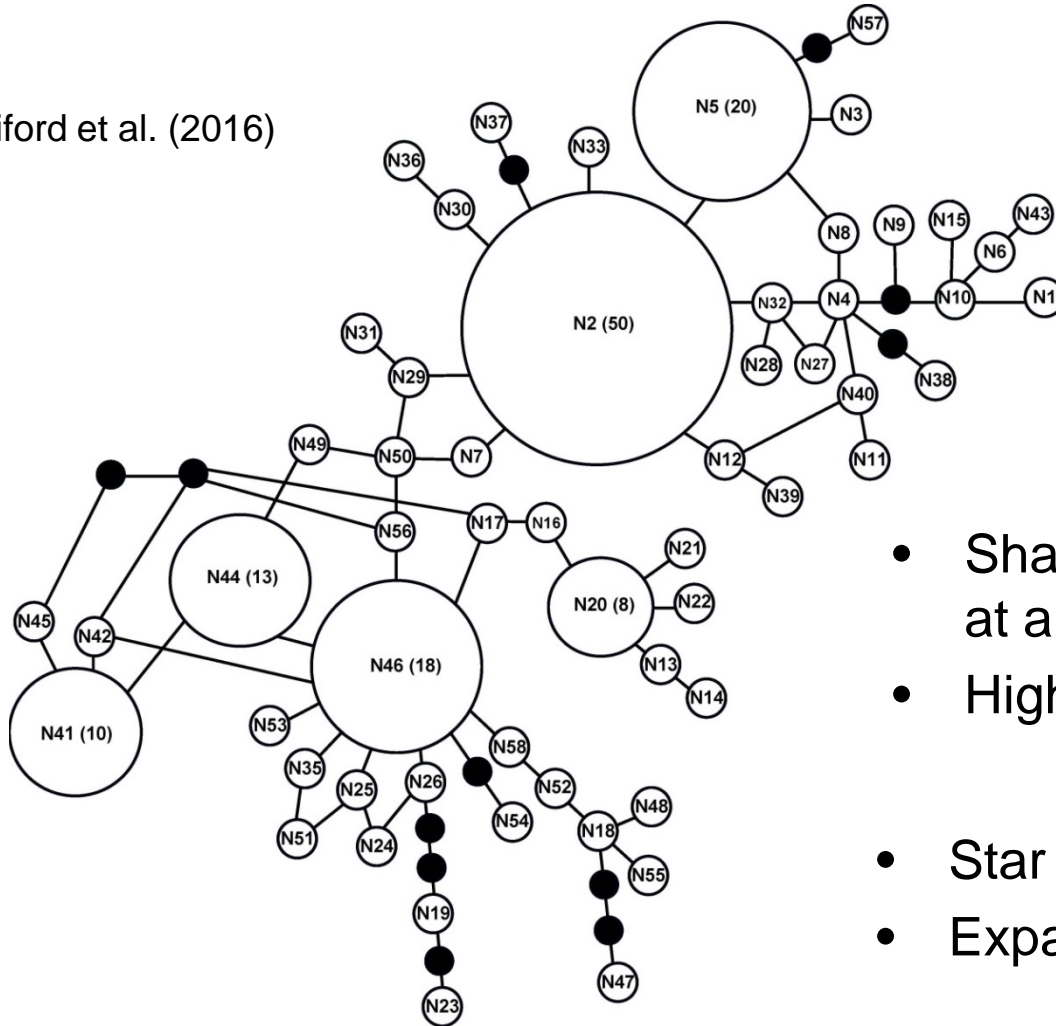
Deer Mouse (*Peromyscus maniculatus*, Lansam et al. 1983)

Bobwhite Molecular Ecology

- Mitochondrial DNA (mtDNA)
 - Uniparental (maternal) inheritance
 - Control region
 - Local, regional, range-wide studies
- Nuclear microsatellites
 - Biparental inheritance
 - Local and regional studies

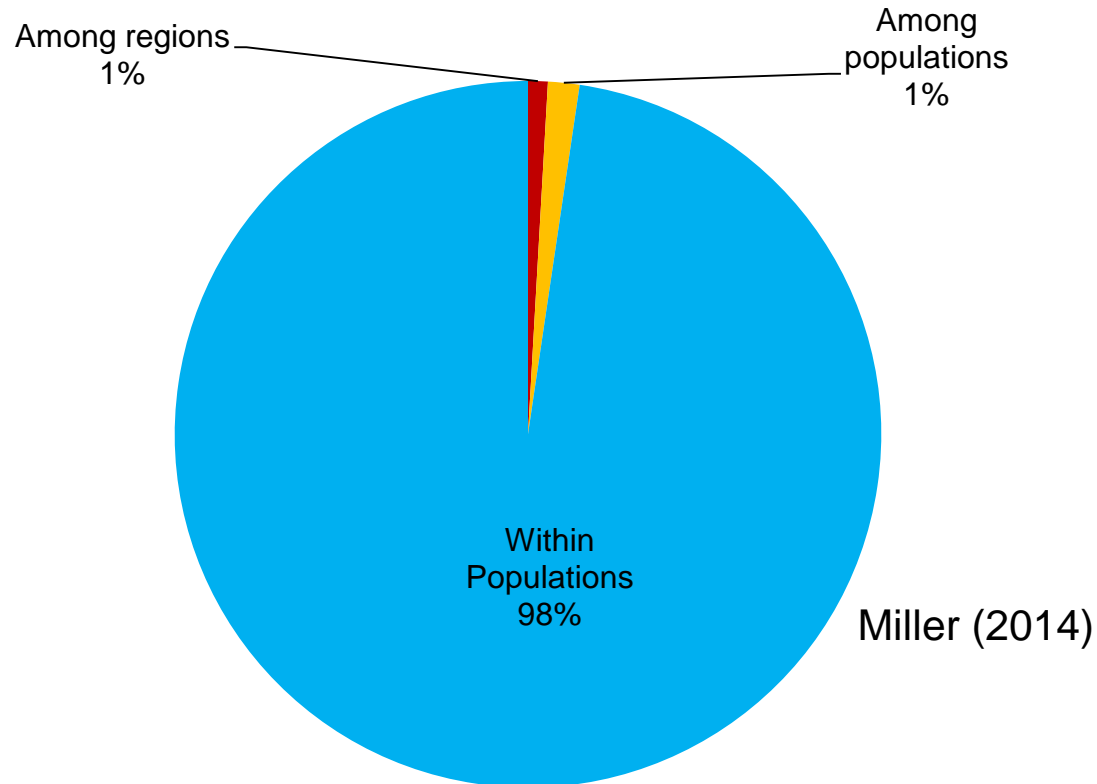
Population Structure: Mitochondrial Control Region

Williford et al. (2016)



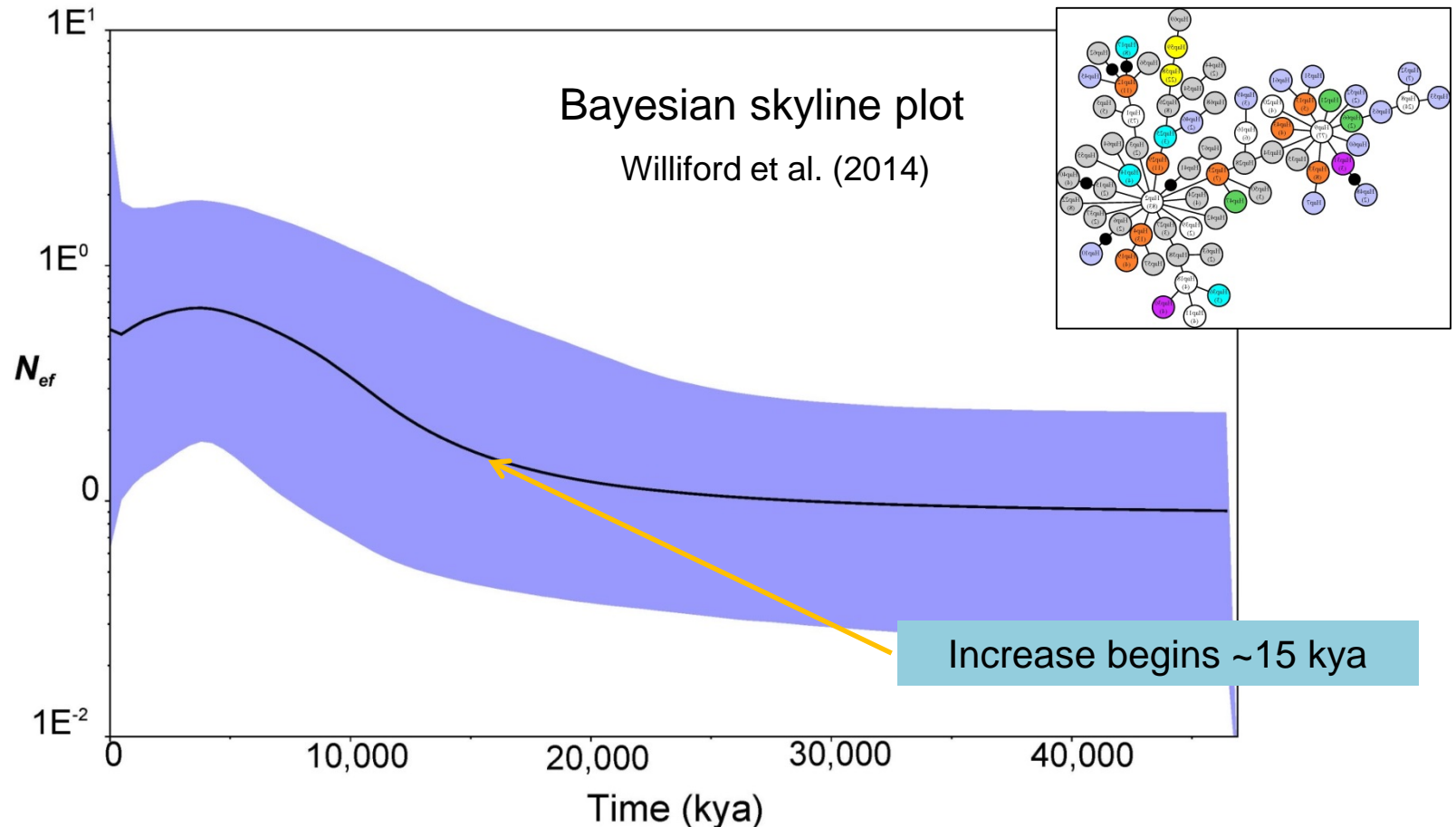
- Shallow population structure at all levels
- High genetic diversity
- Star phylogeny
- Expansion from refugia
- No congruence with subspecies taxonomy

Population Structure: Microsatellites



- Most genetic variation within populations.
- Little differentiation between Great Plains and South Texas.
- High genetic diversity

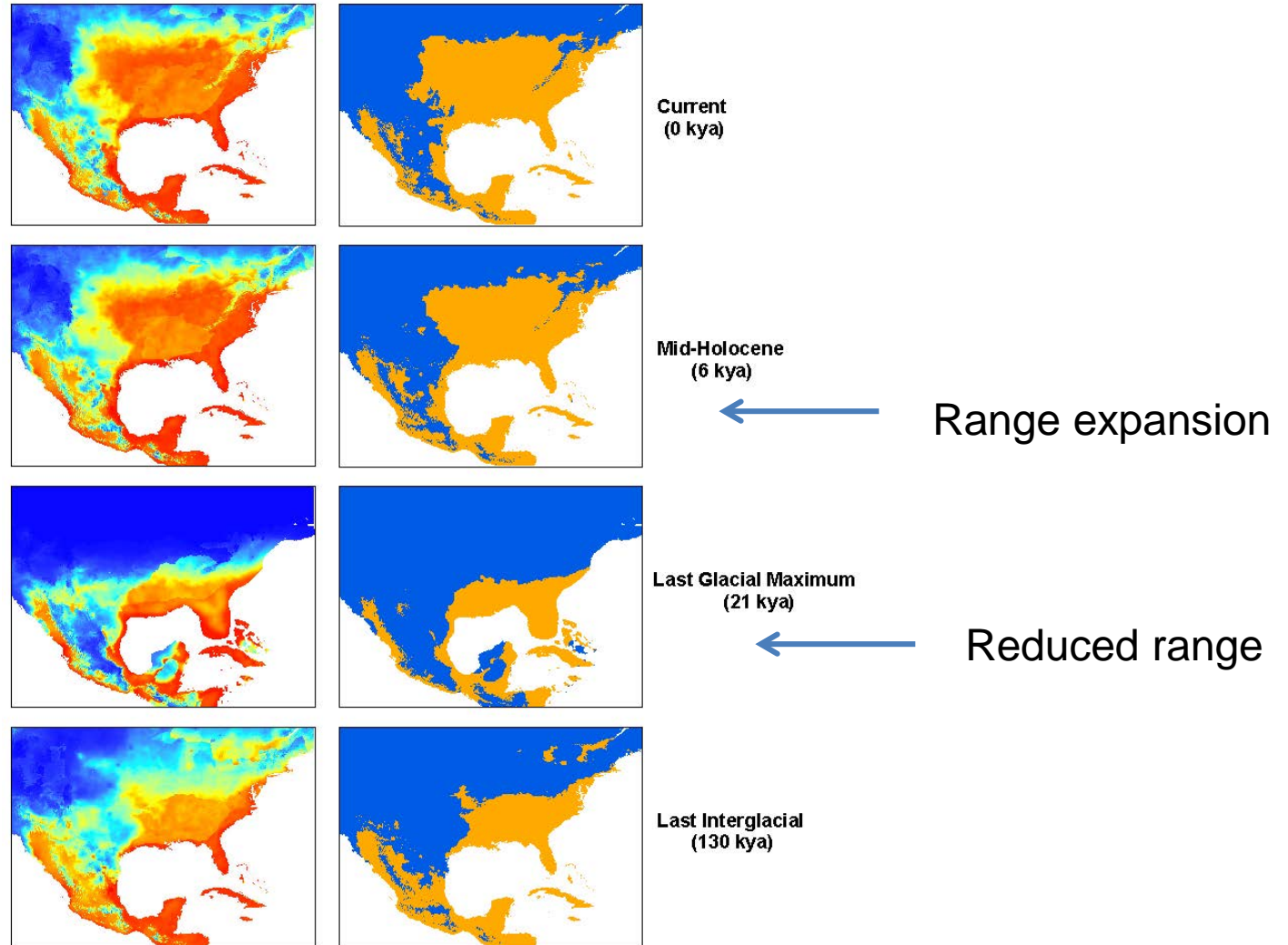
Demographic Inference



- Past population expansion (mtDNA)
- Increase in effective population size

Ecological Niche Modeling

Supports inferences of post glacial expansion by bobwhites



Why Don't We Observe Genetic Structure in Bobwhites?

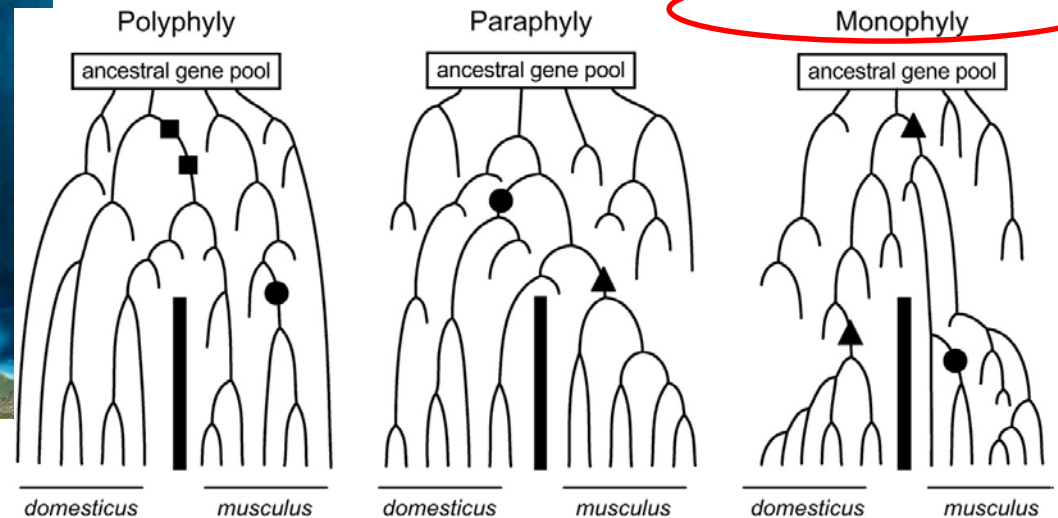
- Signal of past expansion is strong.
- Dispersal is more important than previously thought.

Post Glacial Expansion

- Strong signal of expansion in mitochondrial DNA
- 1 million years needed for reciprocal monophyly



18,000 years ago



Avise et al. (1983), Avise (2004),
Salcedo et al. (2007)

Pre-Columbian North America

Pre-Columbian Fire Regimes

- Extensive grasslands
- Savannas and prairies in abundant eastern USA

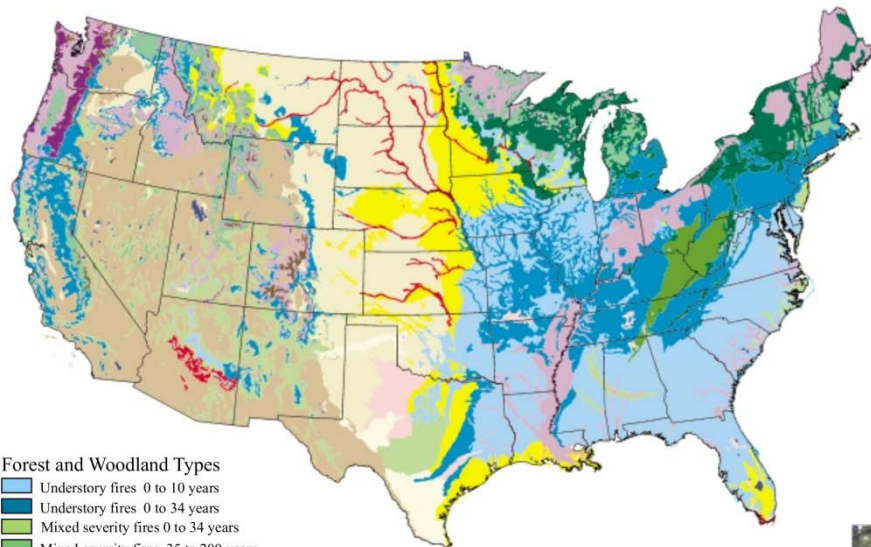


FIG. 1.3. **Hempstead Plains** of Long Island in 1909 (from Harper, 1911). From the American Geographical Society Collection, University of Wisconsin-Milwaukee Library.



Forest and Woodland Types

- Understory fires 0 to 10 years
- Understory fires 0 to 34 years
- Mixed severity fires 0 to 34 years
- Mixed severity fires 35 to 200 years
- Mixed severity fires 201 to 500 years
- Mixed severity fires 500+ years
- Stand replacement fires 0 to 34 years
- Stand replacement fires 35 to 200 years
- Stand replacement fires 201 to 500 years
- Stand replacement fires 500+ years

Grass and Shrub Types

- Mixed severity fires 0 to 34 years
- Stand replacement fires 0 to 10 years
- Stand replacement fires 0 to 34 years
- Stand replacement fires 35 to 100 years
- Stand replacement fires 101 to 500 years

- Other
- Water

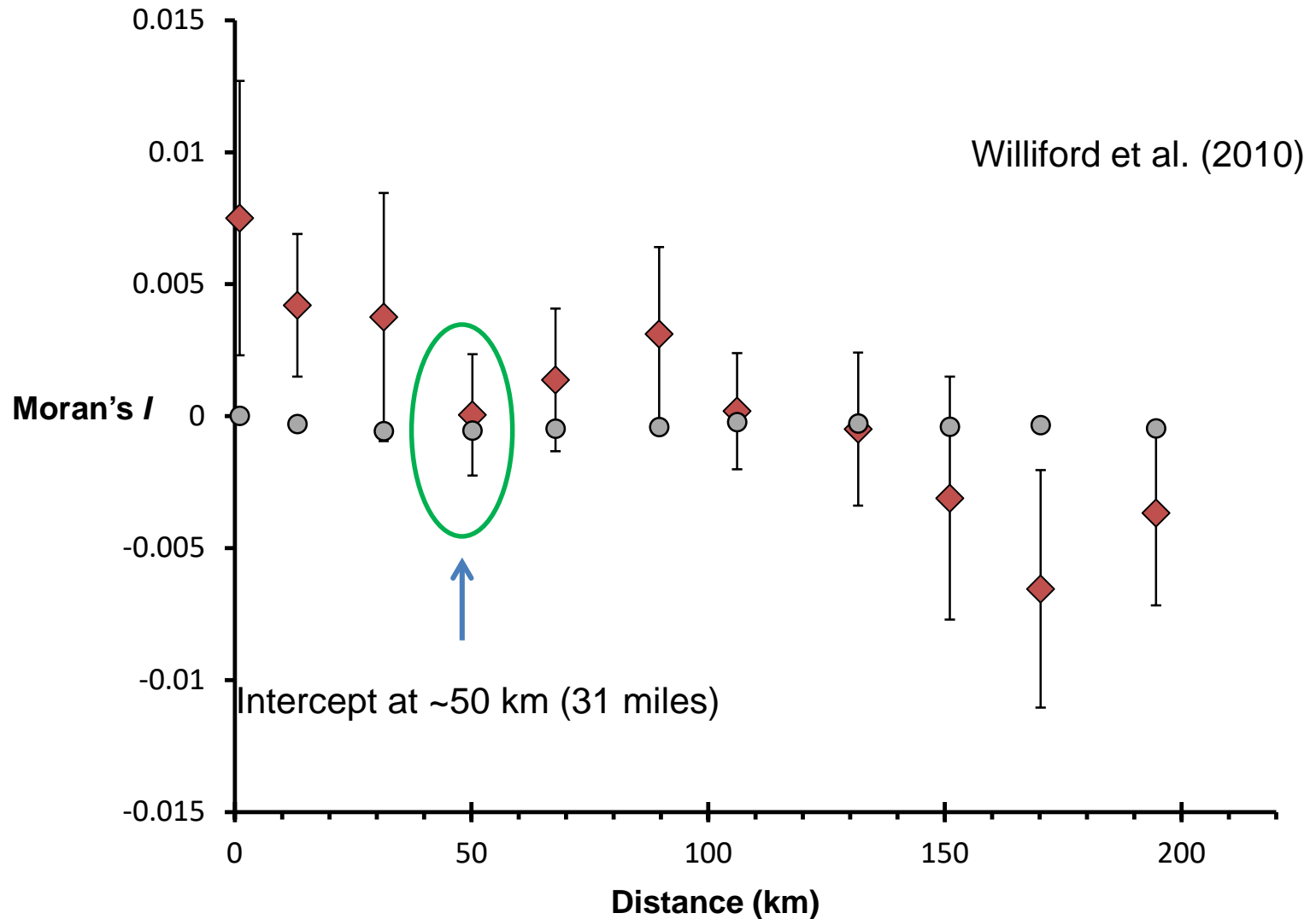
Brown et al. (2000)

Dispersal

- Believed to move ≤ 1 km (0.6 mile) from natal site.
- Exceptions
 - Virginia: ≥ 2 km (1.2 miles, Fies et al. 2002)
 - South Texas: 104 km (65 miles, Lehmann 1984)
 - Oklahoma: 10 km (6 miles, Townsend et al. 2003)



Geographic distance vs. genetic distance



**Assume diameter of a local population is 31 miles...
Corresponds to an area of 502,655 acres!**

What Does All This Mean?

- Bobwhites can disperse over large distances, **IF...**
- Large, contiguous patches of suitable landscape exist
- Few barriers exist

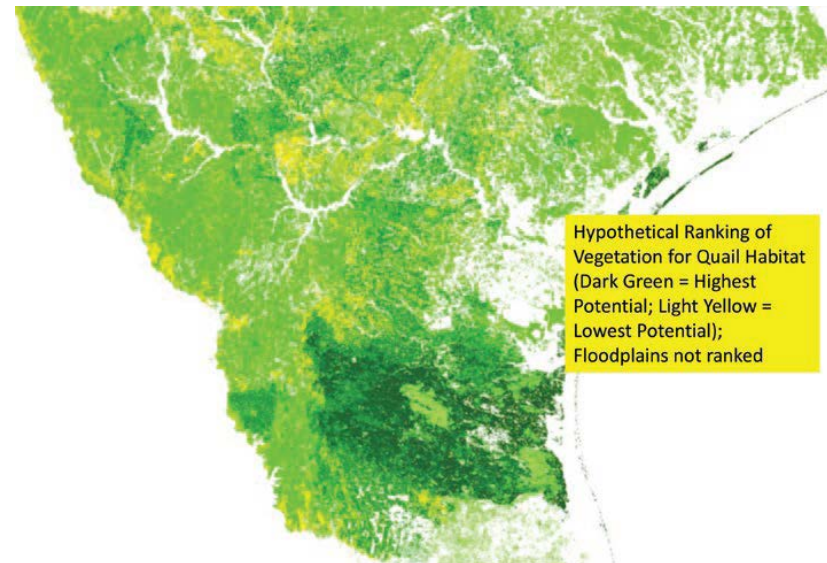


Bobwhite Management Is Upside Down

- Hunting is managed at state level
- Habitat is managed at pasture level

South Texas – Happy Accident?

- Legacy Landscape for Northern Bobwhite Conservation
- 10 million acres of bobwhite habitat
- Large ranches, petroleum, limited farming
- Urban-suburban sprawl limited by private land holdings



Brennan (2014)

Management Implications

- Subspecies may not be useful as management units.
- Manage bobwhites from a regional perspective.
- Long-distance dispersal is important.
- Preserve and enlarge bobwhite habitat to ensure dispersal and recolonization.

Future Research Needs

- Northern bobwhite
 - Linking genes with traits
 - Gene expression
 - Annotation of bobwhite genome
 - Long-term studies linking changes in genetic diversity with population dynamics
 - Test conclusions from previous range-wide genetic study using mitochondrial genomes and nuclear markers
- Other species of New World quails
 - Ecological and behavioral studies of Neotropical species
 - Test conclusions from previous range-wide genetic studies of scaled, Gambel's, and California quails
 - Initial range-wide genetic studies other species
 - Studies of population genetics for all species

Acknowledgments

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 - South Texas Charity Weekend

Questions?