

Genetic Structure and Diversity in South Texas Bobwhites: Implications for Conservation



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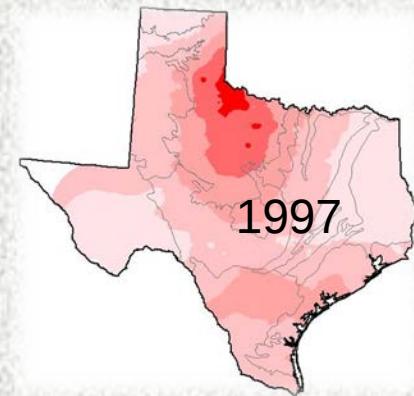
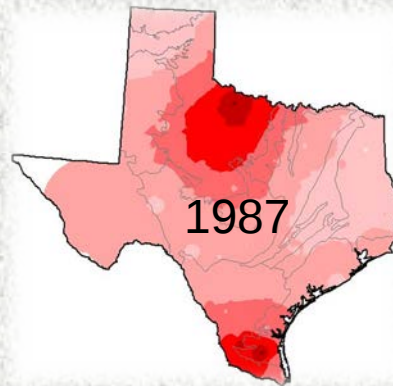
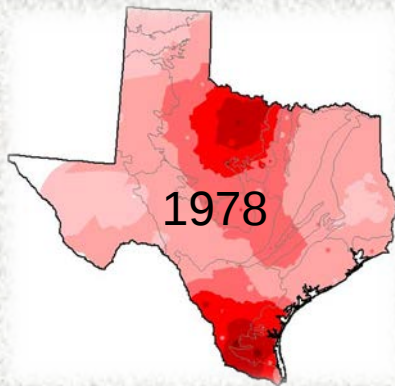
Meet the Northern Bobwhite...

- Twenty-two subspecies
- Ground-dwelling upland bird
 - About 200 g
 - Short-lived (1 yr)
 - High reproductive rate
 - Relatively sedentary



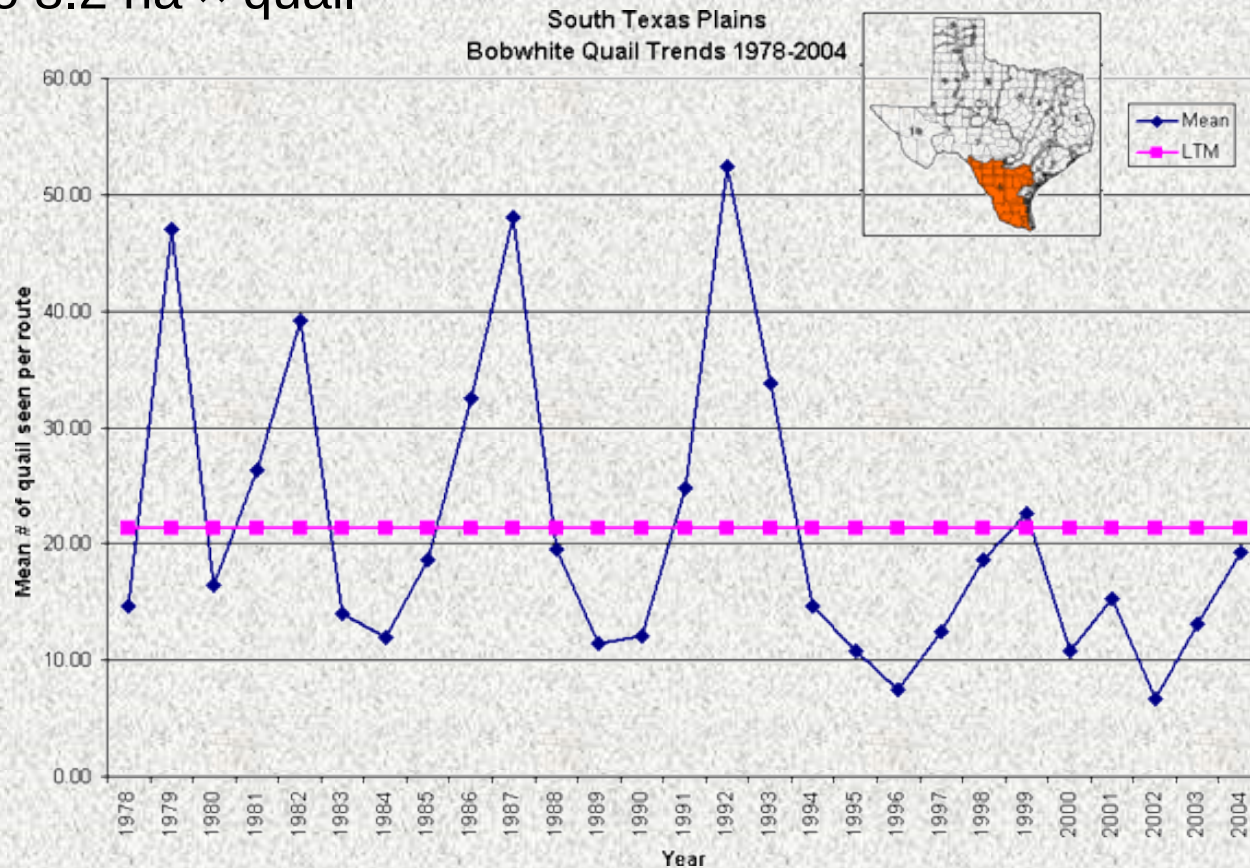
Bobwhite population trends

- Range-wide decline
 - Changes in land-use
 - Huntatable populations in Texas, Georgia-Florida



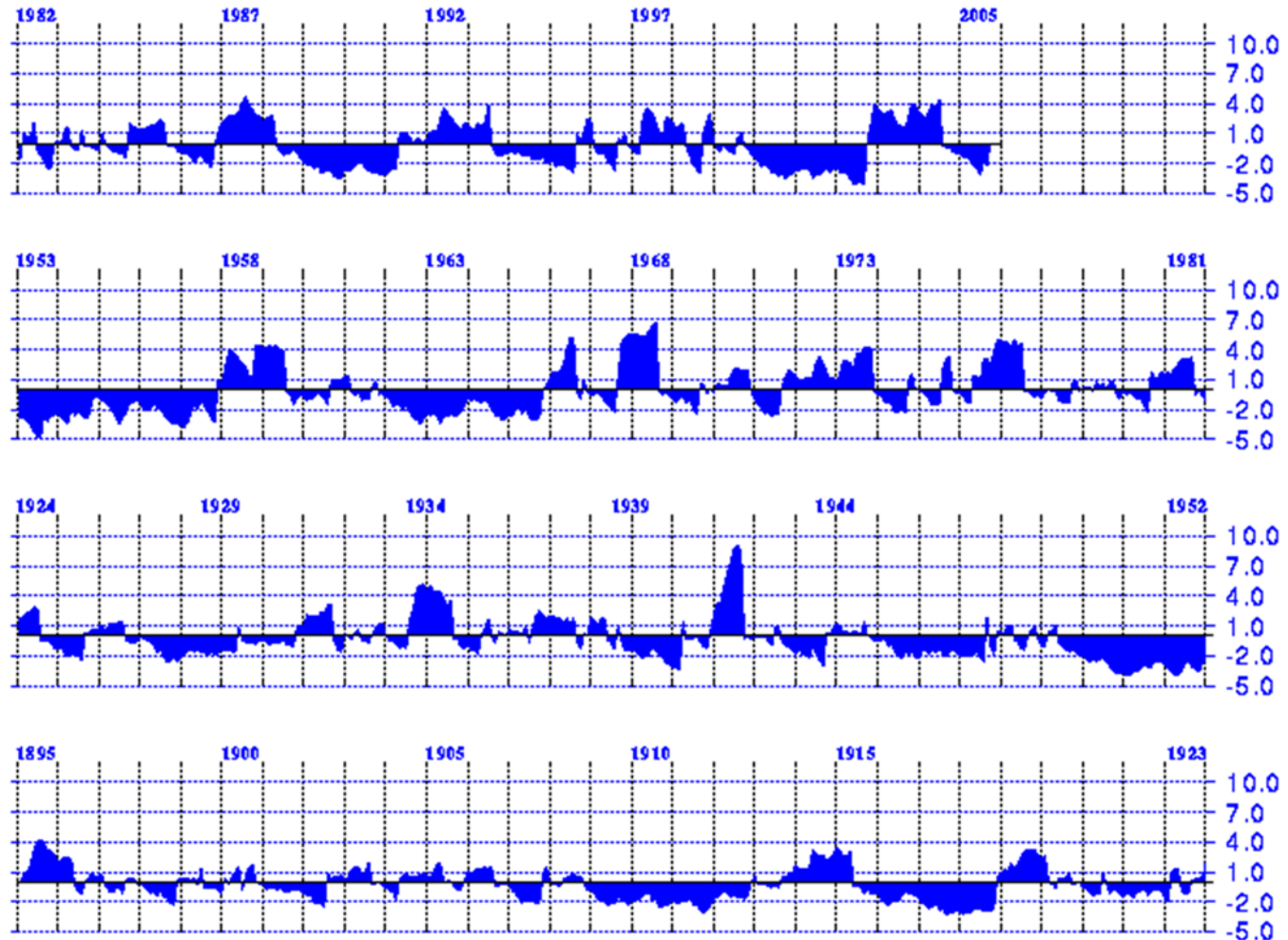
Bobwhite population trends

- “Boom and bust” population dynamics
 - Winter densities varied 6-fold during 10-yr period (Lehmann 1984)
 - 1.4 to 8.2 ha × quail⁻¹



Precipitation drives populations

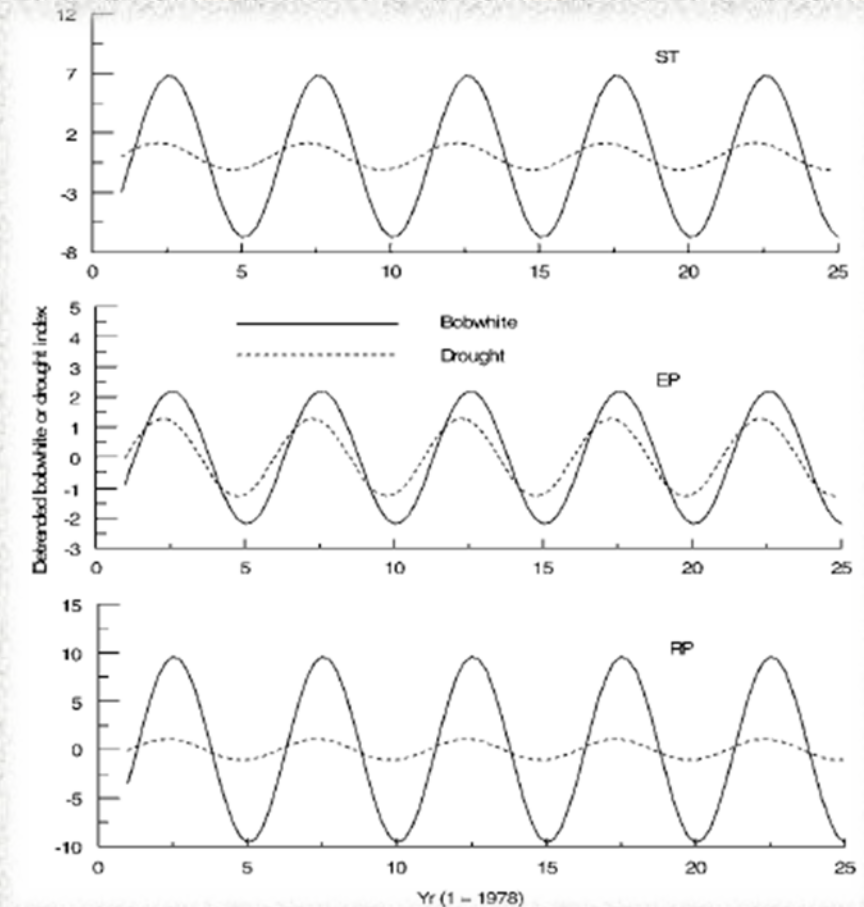
Palmer Drought Severity Index



Texas - Division 10: 1895-2005 (Monthly Averages)

Bobwhite population trends

- Cyclic behavior
- Region-wide
 - South Texas
 - Edwards Plateau
 - Rolling Plains
- Five-year periods



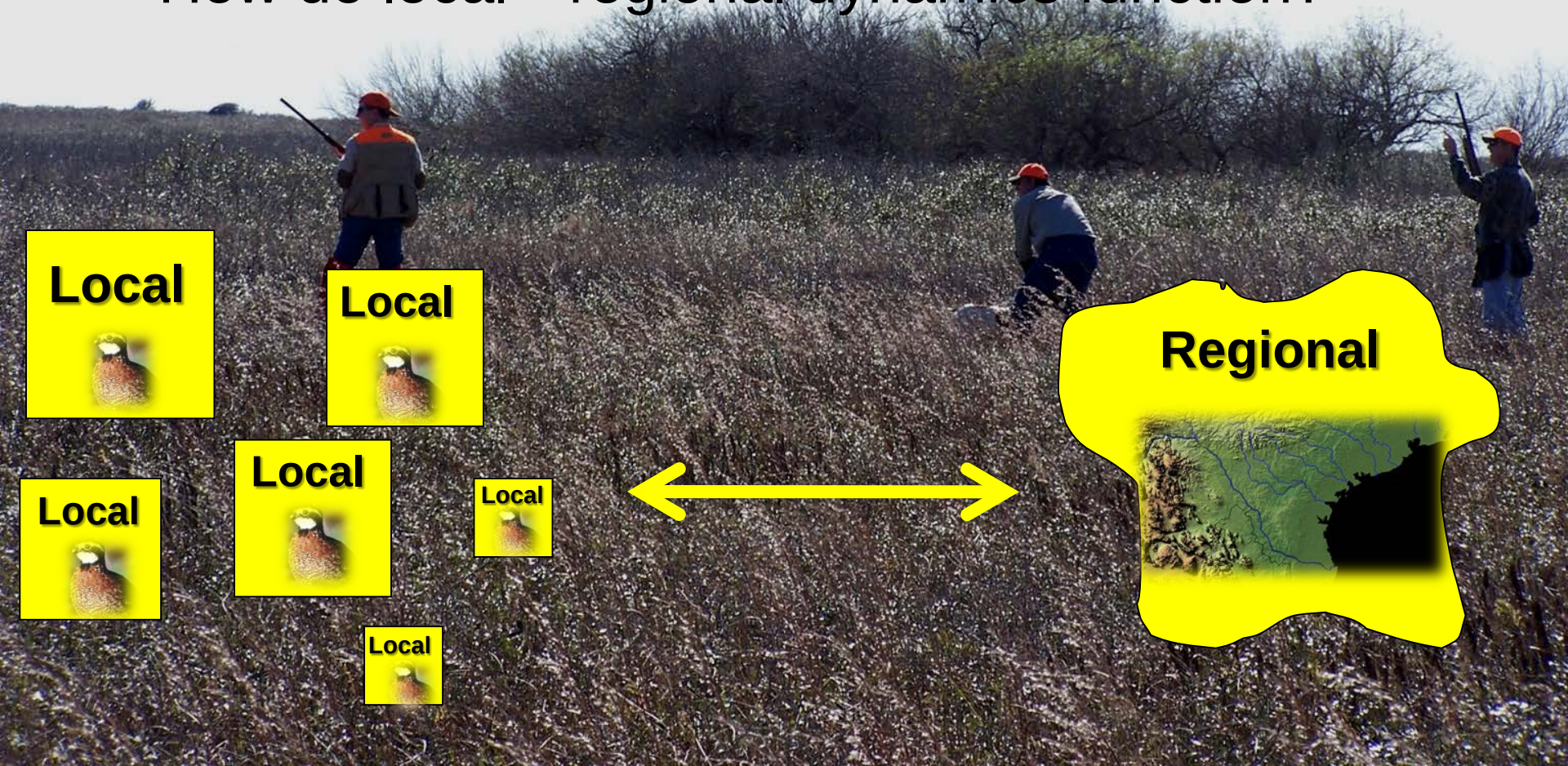
Bobwhite population dynamics

- Sustaining populations found only in extensive areas of contiguous habitat
- When habitat patches are altered or fragmented to some (presently unknown) threshold level, populations collapse



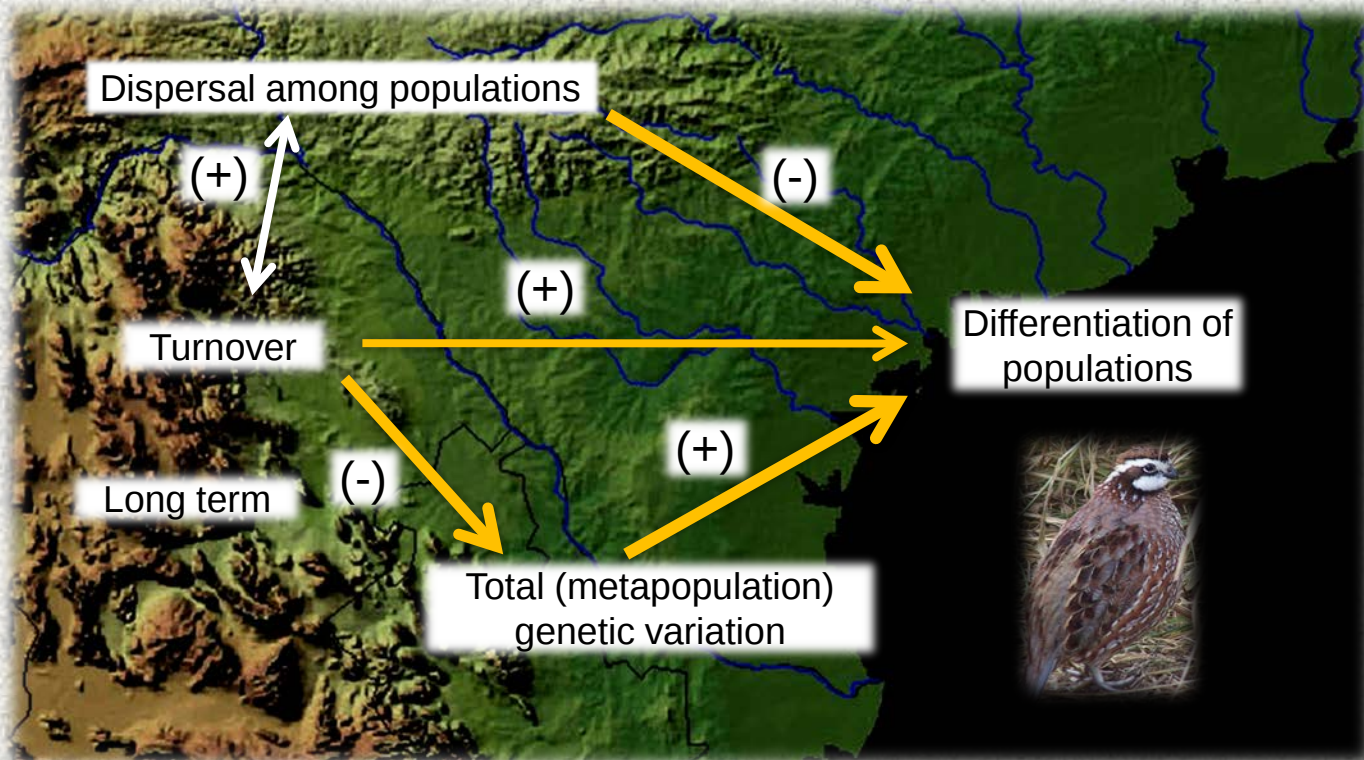
South Texas quail populations...

- Effects of land-use, dynamics at regional scale
- Management at local scale
- How do local—regional dynamics function?



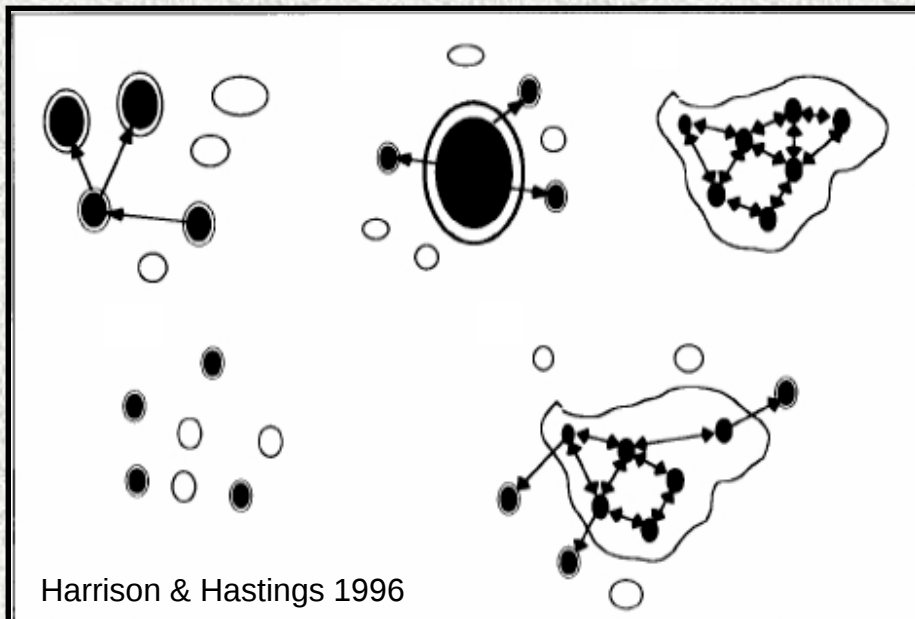
Population dynamics and structure

- Low dispersal, high turnover
 - Genetic structure high
 - Genetic diversity low or variable

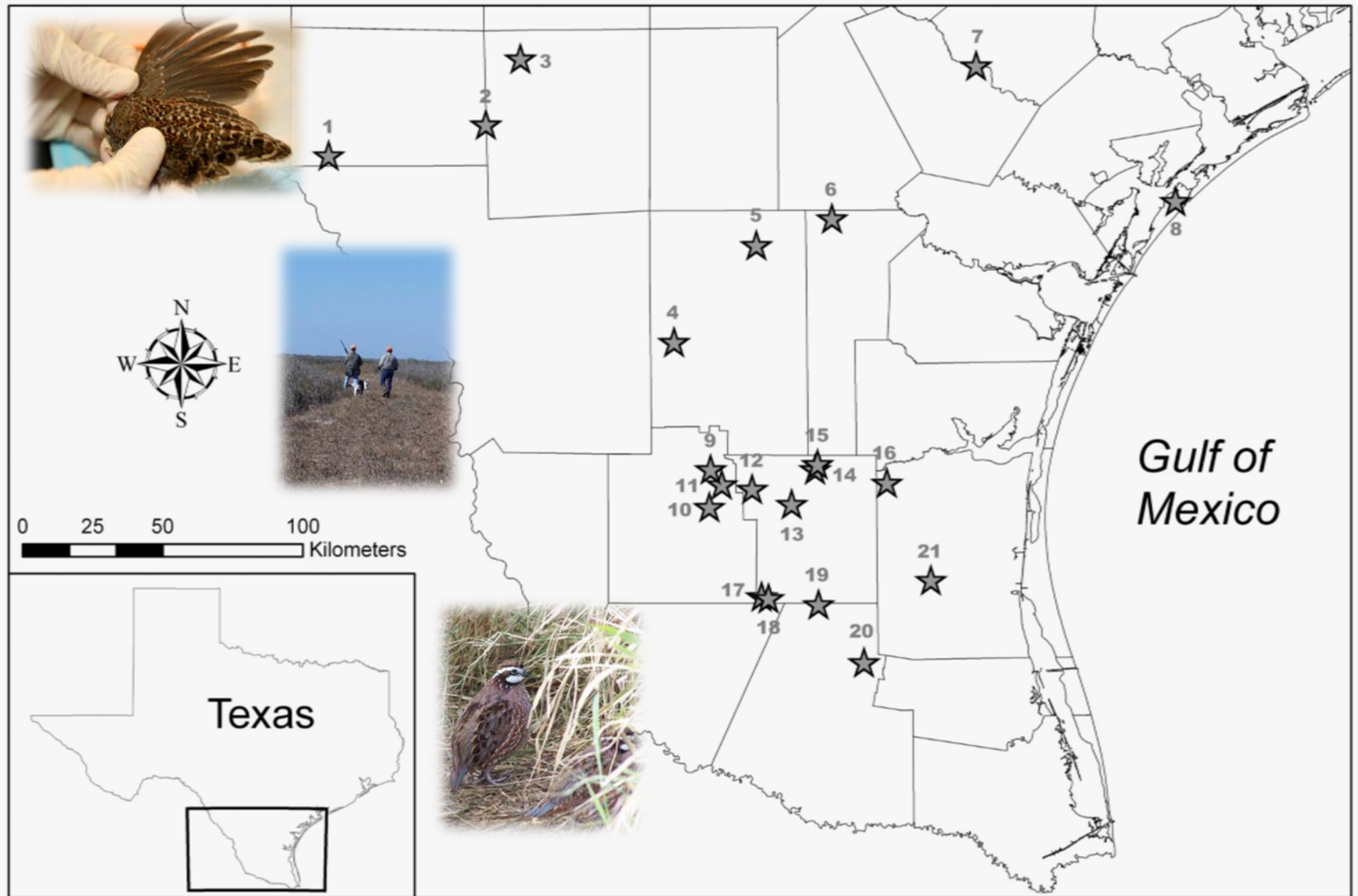


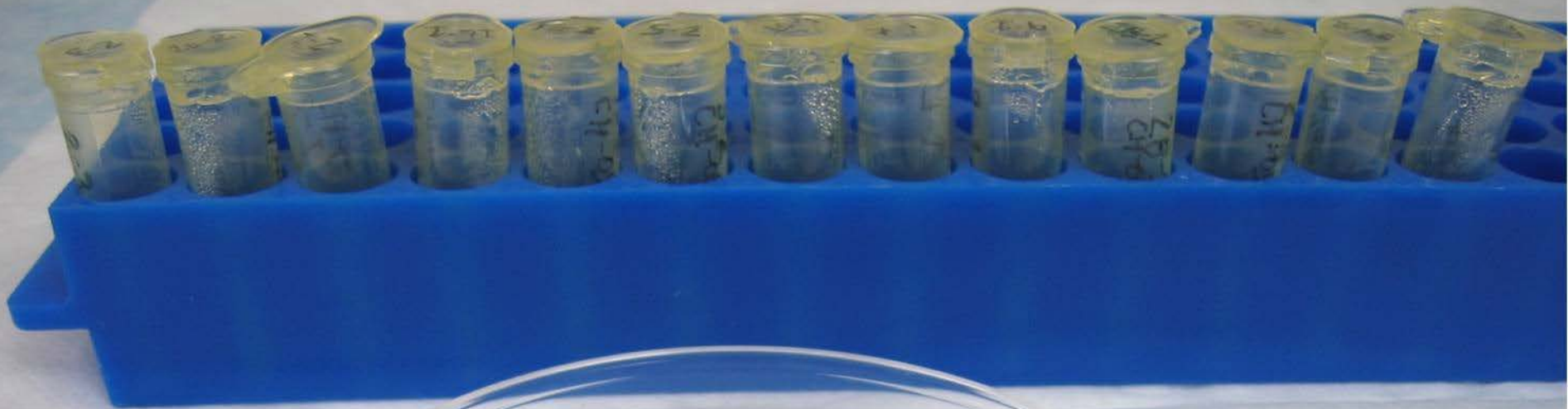
Population dynamics and structure

- Estimate diversity and population structure
 - Large-scale investigation
 - Infer effects of population dynamics, connectivity



Populations used in genetic analyses





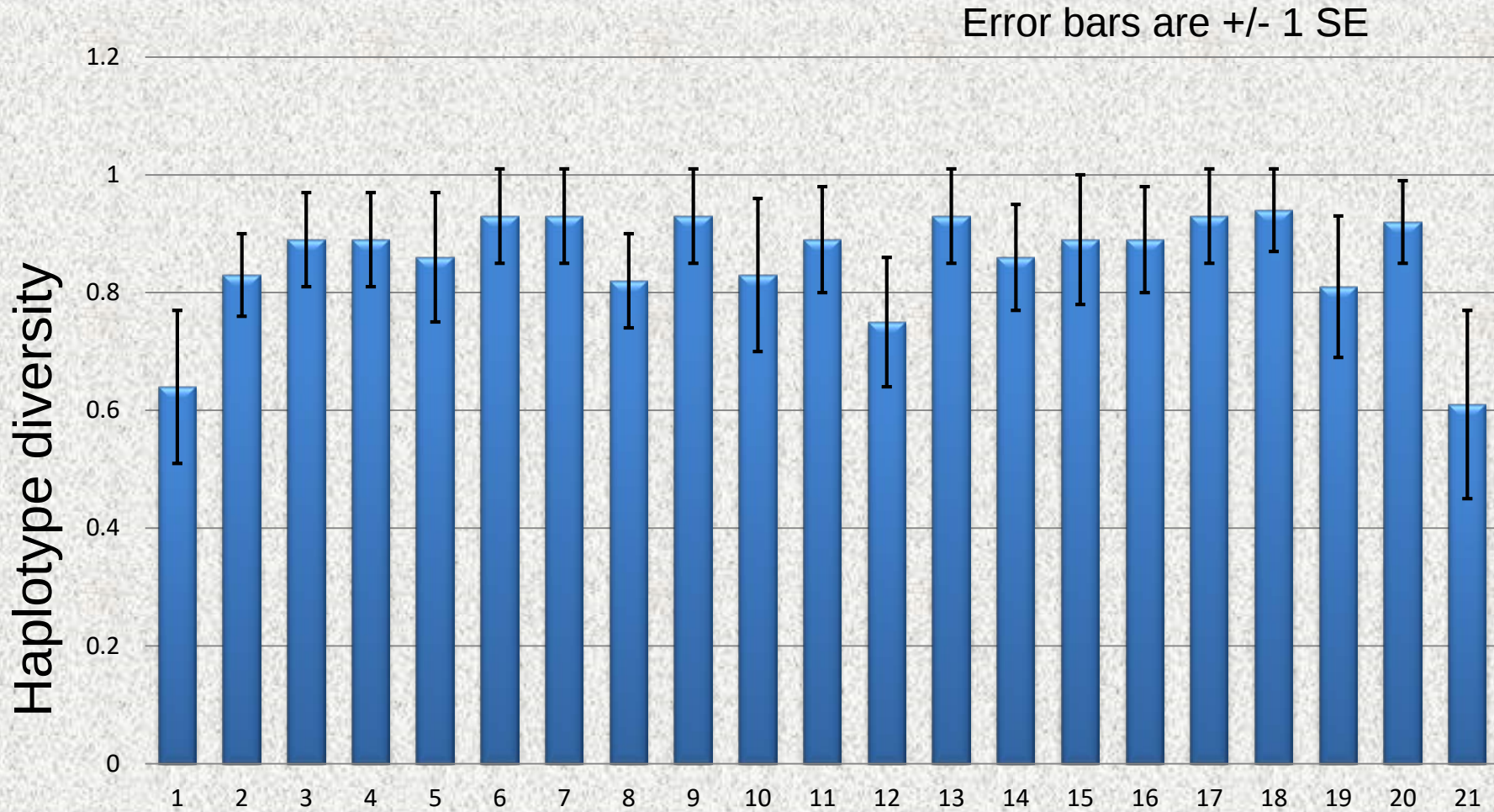
- **DNA extraction and amplification**
 - Extracted DNA using a commercial kit
 - Sequenced 380bp portion of mtDNA control region
 - Amplified 7 microsatellite DNA loci using PCR

Data analysis

- mtDNA data (380 bp)
 - Haplotype diversity
 - AMOVA
 - Minimum spanning network
- Microsatellite data (7 loci)
 - Gene and allelic diversity
 - Pairwise F_{ST} , exact test of differentiation
 - AMOVA
 - Spatial autocorrelation



Haplotype diversity

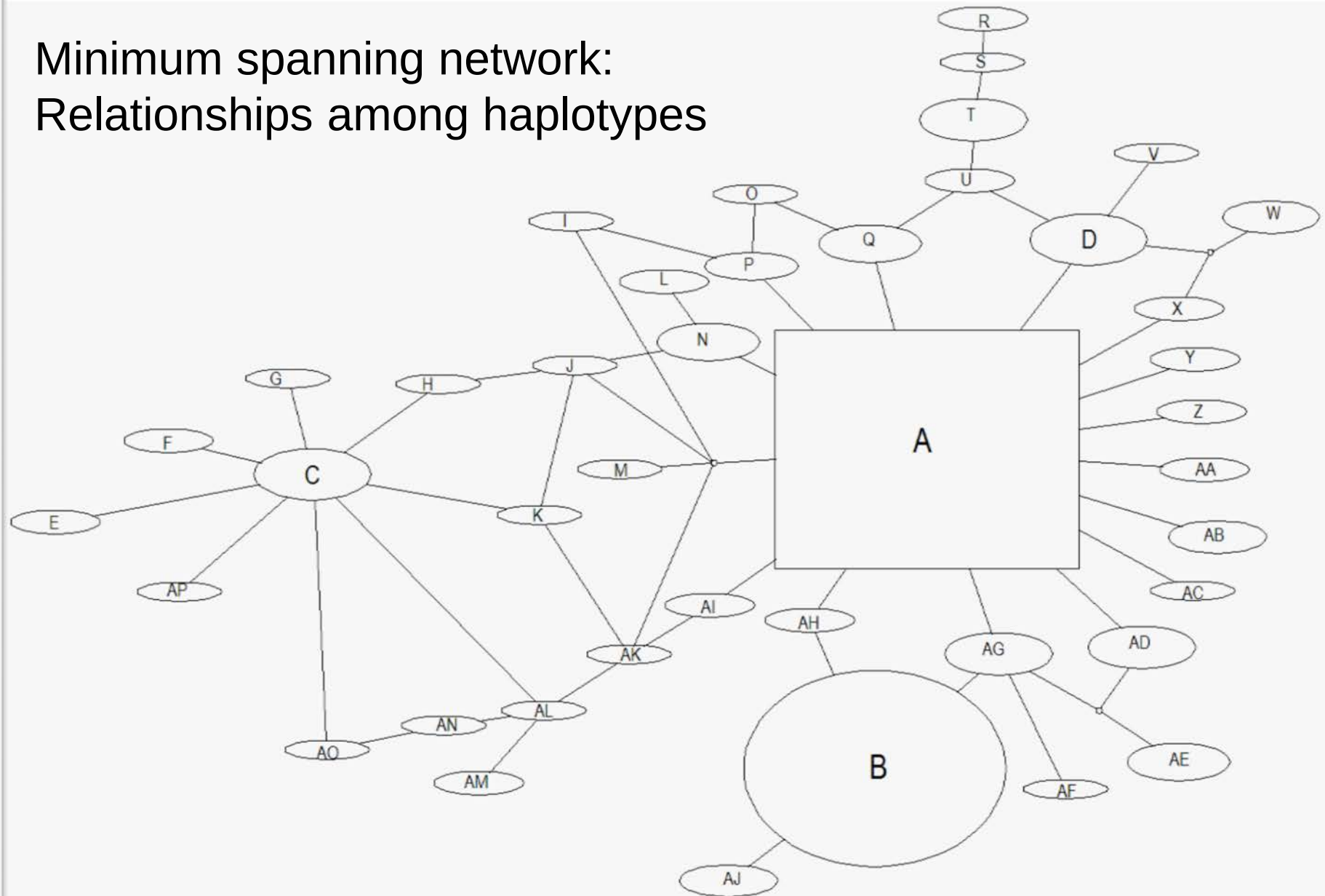


21 sites

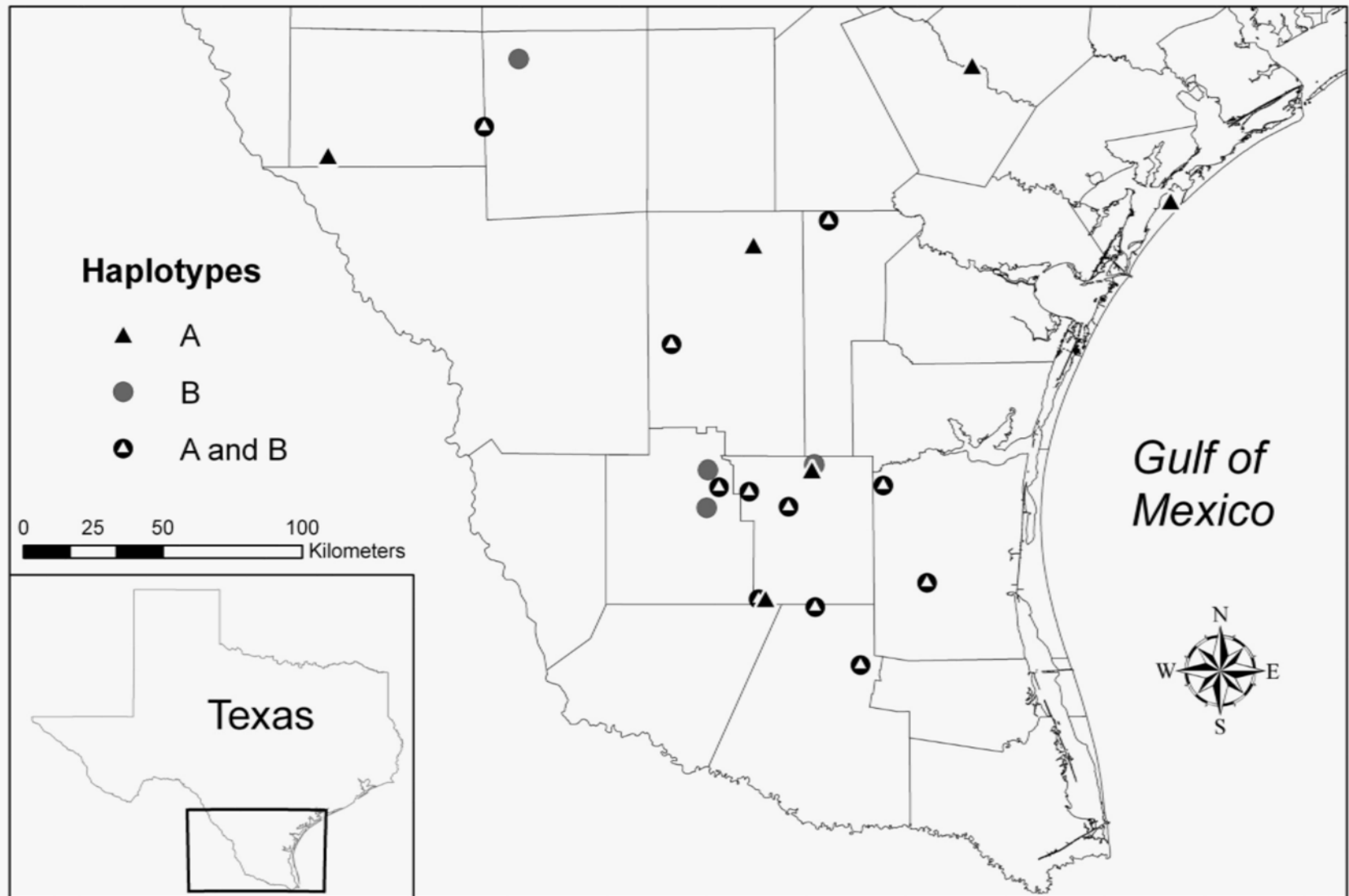
N = 8 to 12 per site

Site

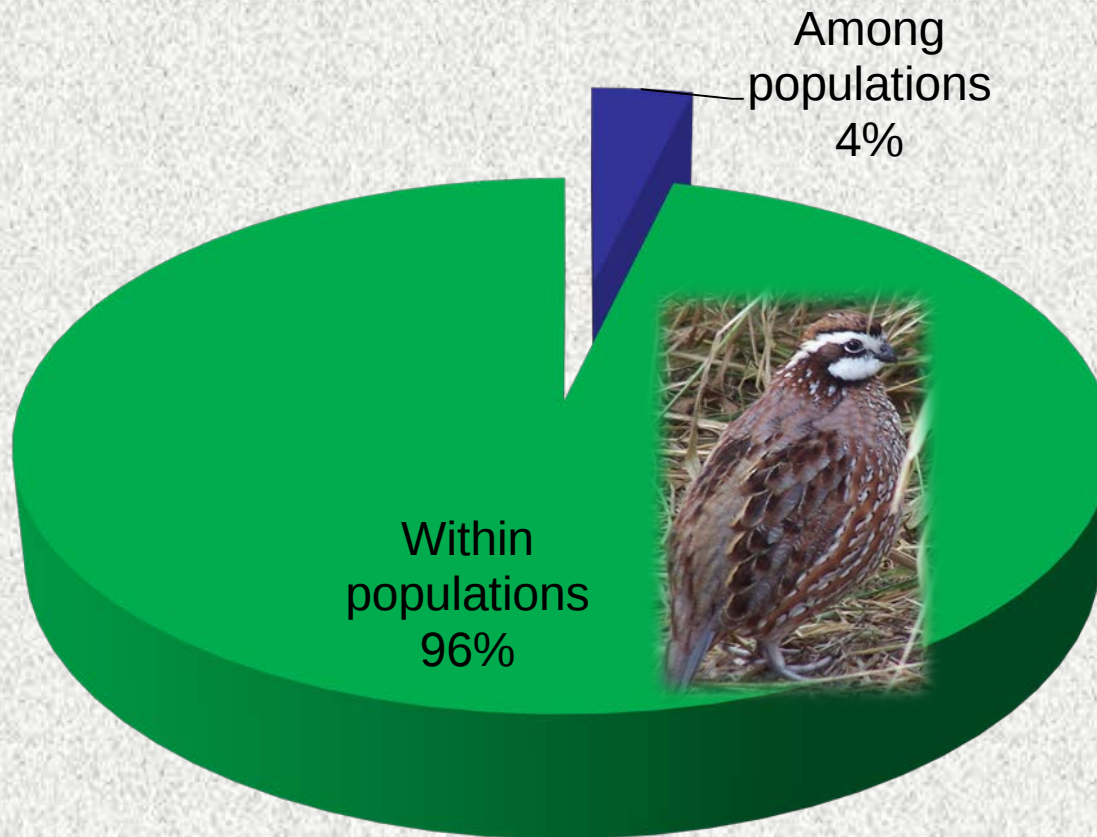
Minimum spanning network: Relationships among haplotypes



The 2 most common haplotypes were widely distributed...



AMOVA for mtDNA data



21 sites
N = 190

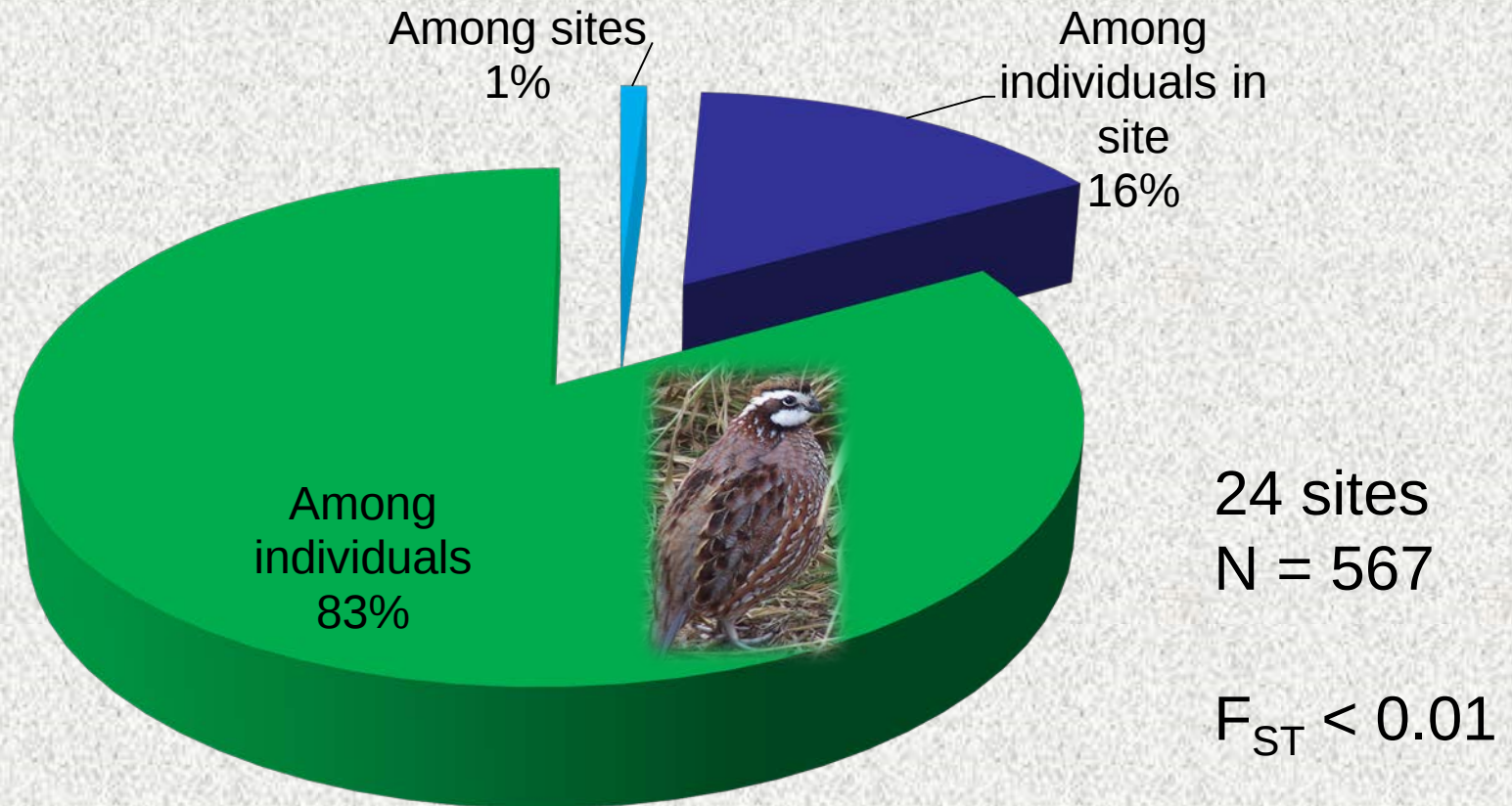
$F_{ST} = 0.037$

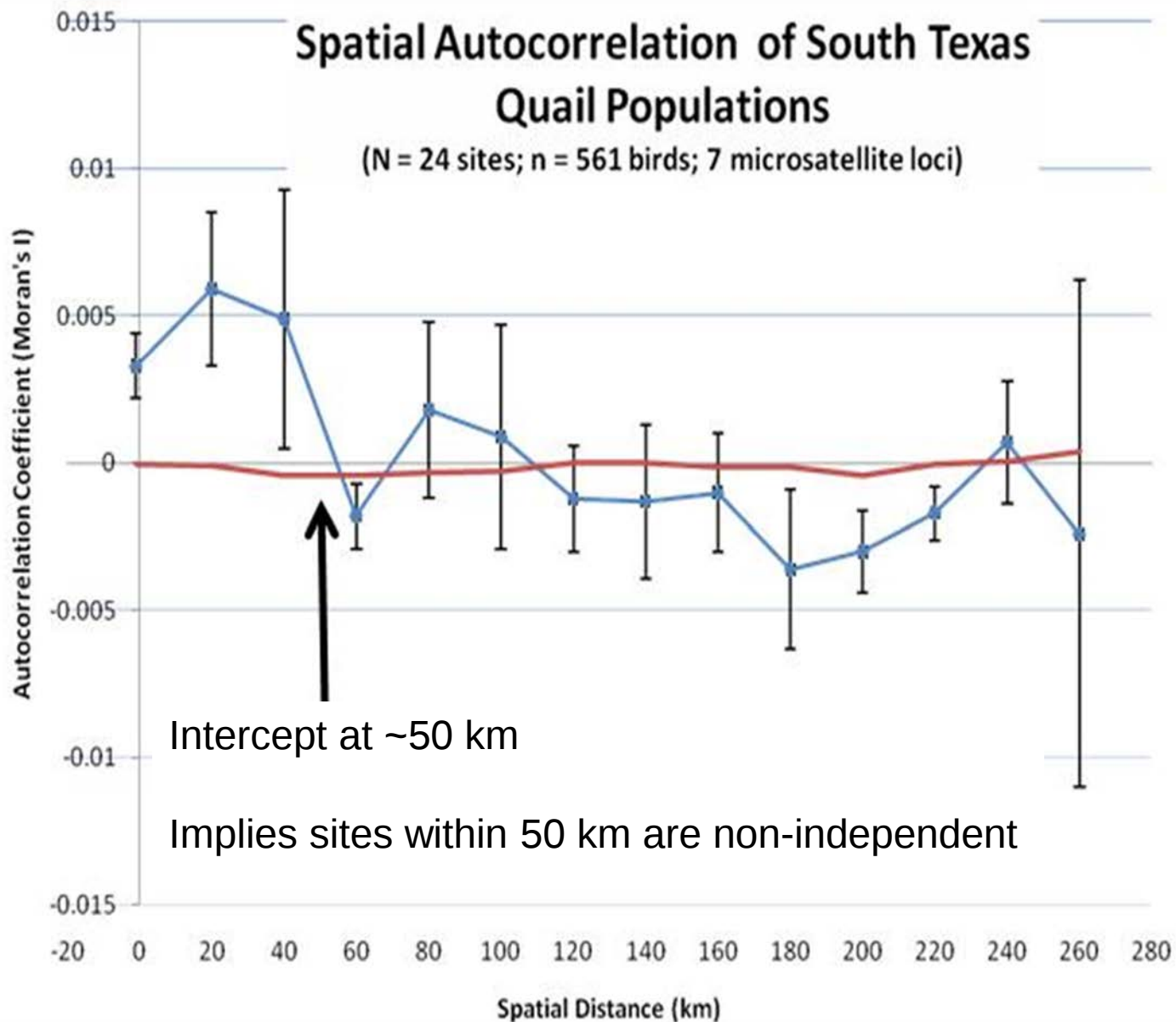
Microsatellite diversity and population structure

- Sampled 24 sites, 567 individuals
- Observed heterozygosity = 0.58
 - Range: 0.39 to 0.86
- 13 alleles/ locus
 - Range: 7 to 19 alleles
- Low structure
 - $F_{st} < 0.01$
 - Exact tests non-significant
 - Pairwise F_{st} non-significant



AMOVA for microsatellite data

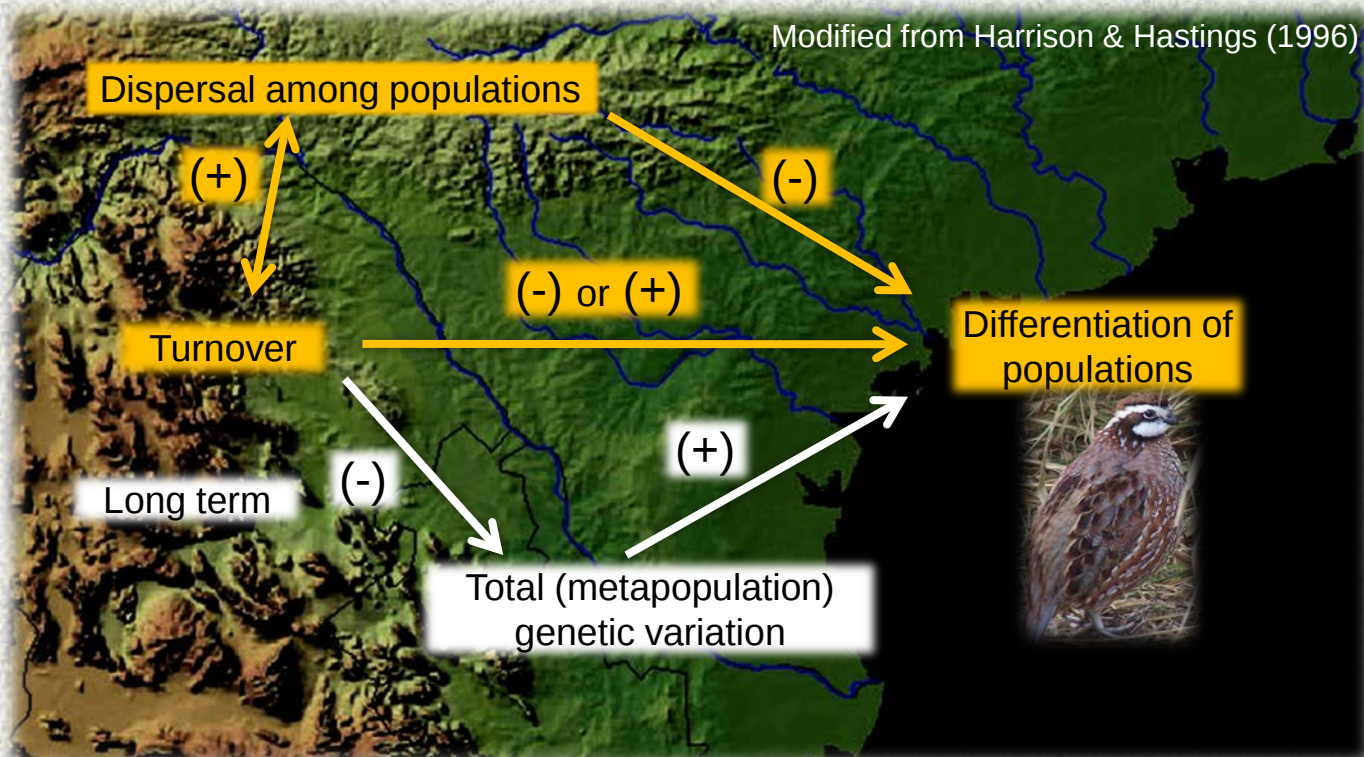




Assume diameter of a local population is 50 km....
Corresponds to an area of 1,964 km² or 502,655 ac

Population dynamics, diversity and structure

- Low differentiation, high diversity
 - Importance of dispersal? Role of population turnover?
 - Life history, dispersal, and genetic variation....



Implications for bobwhites

- Theoretical predictions for high-turnover populations: should be good dispersers
 - Otherwise, bottlenecks, stochastic events
 - Dispersal more important than previously realized?
 - Maintain genetic variability, minimize structure
 - Do bobwhites fit a metapopulation model?
 - Re-colonization and extinction dynamics
 - Counterbalance local extinctions during boom-bust

Implications for bobwhites

- One of the most studied, managed species
 - Populations continue to decline
- Extant populations occupy intact habitats
 - Large continuous sections of suitable habitat
 - Uninterrupted patterns of dispersal
 - Habitat fragmentation = no re-colonization?
 - Local populations eventually extirpated through stochastic events

Implications for bobwhites

- Most current management is site-specific
- If dispersal is critical to bobwhite populations, small-scale management may be insufficient
- To halt or reverse the Northern Bobwhite decline, a shift to large-scale management of habitat resources that provide usable space may be required (Williams et al. 2004).

Acknowledgements

- Texas Parks and Wildlife Department
- Richard M. Kleberg, Jr. Center for Quail Research
- South Texas Quail Associates Program
- C. Berdon Lawrence, Lawrence Family Foundation
- C. C. Winn Endowed Chair for Quail Research
- Alfred C. Glassell, Jr. Endowed Professorship for Quail Research



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