XEROSPERMOPHILUS GROUND SQUIRRELS IN SOUTHERN CALIFORNIA

Genetic Structure Across a Contact Zone
Those Responsible

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Two closely-related species are found in the Mojave Desert of California:

- Mohave ground squirrel (*X. mohavensis*)
- Round-tailed ground squirrel (*X. tereticaudus*)

Their distribution has been considered allopatric:

- MGS in winter rainfall western Mojave Desert
- RTGS in summer rainfall eastern Mojave and further east and south
Conservation Status

- The Mohave ground squirrel is endemic to a small area in the western Mojave Desert.
- It has been listed as Threatened under the California Endangered Species Act since 1984.
- The round-tailed ground squirrel is widely distributed in the eastern Mojave and ranges into southern Nevada, much of Arizona, and south into Mexico.
Mohave Ground Squirrel with White-tailed Antelope Squirrel
Round-tailed Ground Squirrel
Figure 2. Geographic distribution of CNDDB Mohave ground squirrel records in the Barstow area from the period 1975-1993.
Changes in Distribution

- **RTGS** now found west of Mojave River in disturbed farming country around Hinkley
- This species appears much more of a generalist – although no studies in CA of diet or habitat requirements
- Tolerant of disturbance and often found in and around towns and farms
Figure 4. Geographic distribution of Mohave ground squirrel and round-tailed ground squirrel trapping records from the Barstow area from the period 1914-2009.
Interactions Between the Two Species

- By 2007 it was clear that *X. tereticaudus* occurred quite a bit W of the Mojave river.
- There was a plan to collect tissue samples from *Xerospermophilus* captured in that area.
- A number of biologists contributed to this effort, resulting in a series of samples that were studied in Prof. Matocq’s lab at University of Nevada, Reno.
Genetic Methods

- A total of 127 samples were analyzed, 55 from the focal area west of Barstow
- 13 microsatellite loci were amplified
- Genetic clusters were identified by Bayesian assignment using *structure* ver. 2.2
- Each individual was assigned to a genetic cluster, but there could be partial assignment to >1 cluster, possibly indicating hybrid ancestry
Identifying Hybrids

- Software NEWHYBRIDS 1.1 Beta used to assign individuals to 1 of 6 genotypic classes:
  - Pure *X. tereticaudus*
  - Backcross to *X. tereticaudus*
  - F1 hybrid
  - F2 hybrid
  - Backcross to *X. mohavensis*
  - Pure *X. mohavensis*
Figure 5. Geographic Distribution of Mohave ground squirrels, round-tailed ground squirrels, and hybrids in the Hinkley area based upon genetic analysis.
Genetic Conclusions

- Pure parental types of both species occur in spatial proximity
- Hybridization occurs occasionally
- Some hybrids are fertile
- Backcrossing occurs in both parental directions
- More detailed SNP analysis will provide deeper insight into the extent of introgression
Ecological and Evolutionary Implications

- There is strong evidence that *X. tereticaudus* are moving westward into undisturbed desert habitat historically occupied by *X. mohavensis*
- Is this related to long-term shifts in rainfall and vegetation due to climate change?
- Are we seeing a potential breakdown of genetic barriers between the two species?
- Is this a real threat to the genetic integrity of the threatened Mohave ground squirrel?
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