XEROSPERMOPHILUS GROUND SQUIRRELS IN SOUTHERN CALIFORNIA

Genetic Structure Across a Contact Zone

Those Responsible

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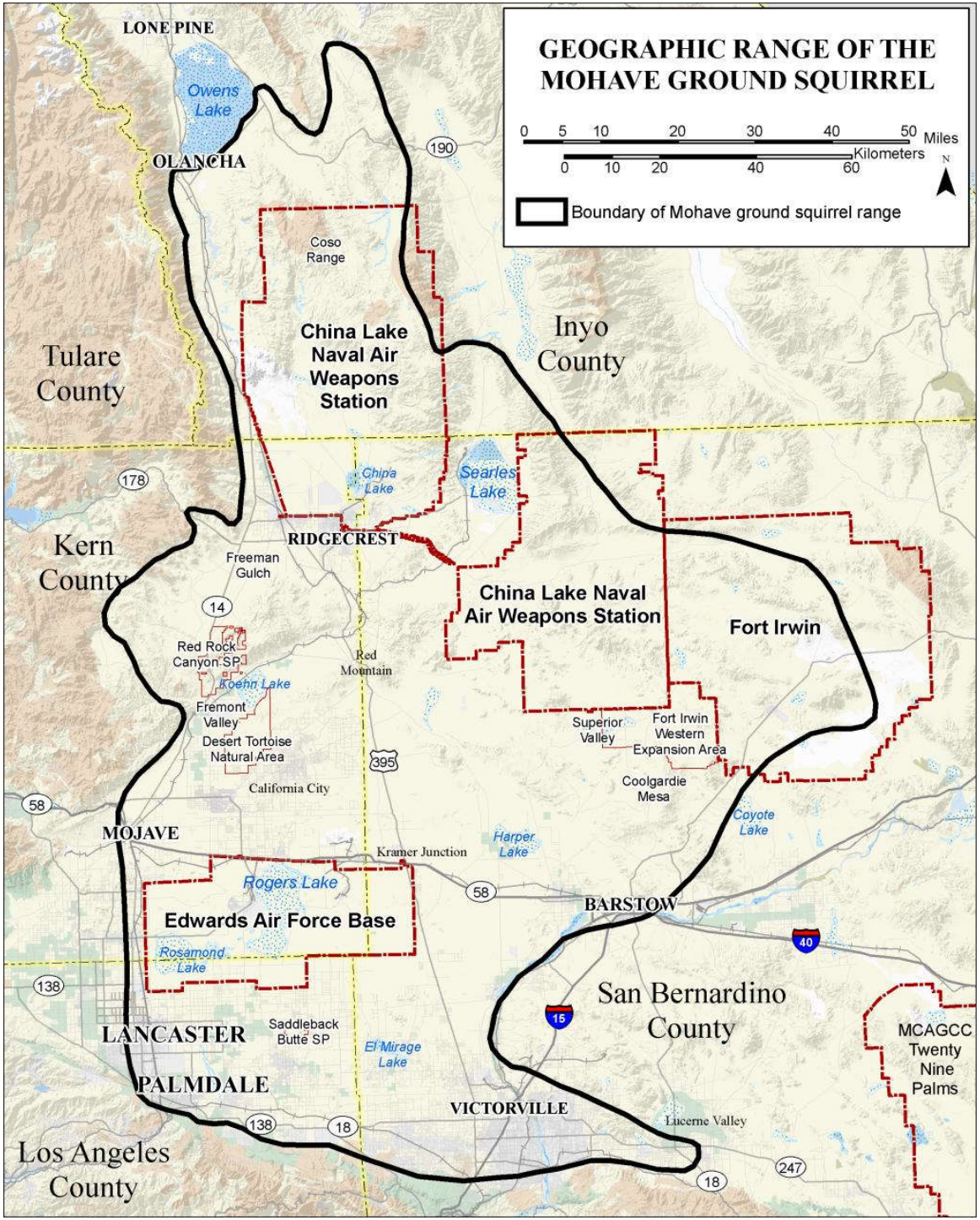
Xerospermophilus Ground Squirrels in the Mojave Desert

- 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


Oregon
Idaho
Wyoming
Nevada
Utah
Colorado
United States
California
New Mexico
Arizona
Baja California
Mexico
Sonora
Chihuahua
Sinaloa
GEOGRAPHIC RANGE OF
MOHAVE GROUND SQUIRREL AND
ROUND-TAILED GROUND SQUIRREL
0 50 100 200 300 400 500 Miles
0 100 200 400 600 Kilometers
N
Mohave ground squirrel range
round-tailed ground squirrel range


GEOGRAPHIC RANGE OF THE MOHAVE GROUND SQUIRREL
0 5 10 20 30 40 50 Miles
0 10 20 40 60 Kilometers
N
Boundary of Mohave ground squirrel range
LONE PINE
Owens Lake
OLANCHA
190
Coso Range
China Lake Naval Air Weapons Station
Inyo County
Tulare County
178
Chipa Lake
Searles Lake
RIDGECREST
Freeman Gulch
Kern County
14
China Lake Naval Air Weapons Station
Fort Irwin
Red Rock Canyon SP
Koehn Lake
Red Mountain
Fremont Valley
Desert Tortoise Natural Area
Superior Valley
Fort Irwin Western Expansion Area
395
California City
Coolgardie Mesa
58
MOJAVE
Kramer Junction
Harper Lake
Coyote Lake
Rogers Lake
58
BARSTOW
Edwards Air Force Base
Rosamond Lake
40
138
San Bernardino County
15
LANCASTER
Saddleback Butte SP
El Mirage Lake
MCAGCC Twenty Nine Palms
PALMDALE
VICTORVILLE
Lucerne Valley
138
18
247
18
Los Angeles County

Mohave Ground Squirrel with White-tailed Antelope Squirrel

Round-tailed Ground Squirrel

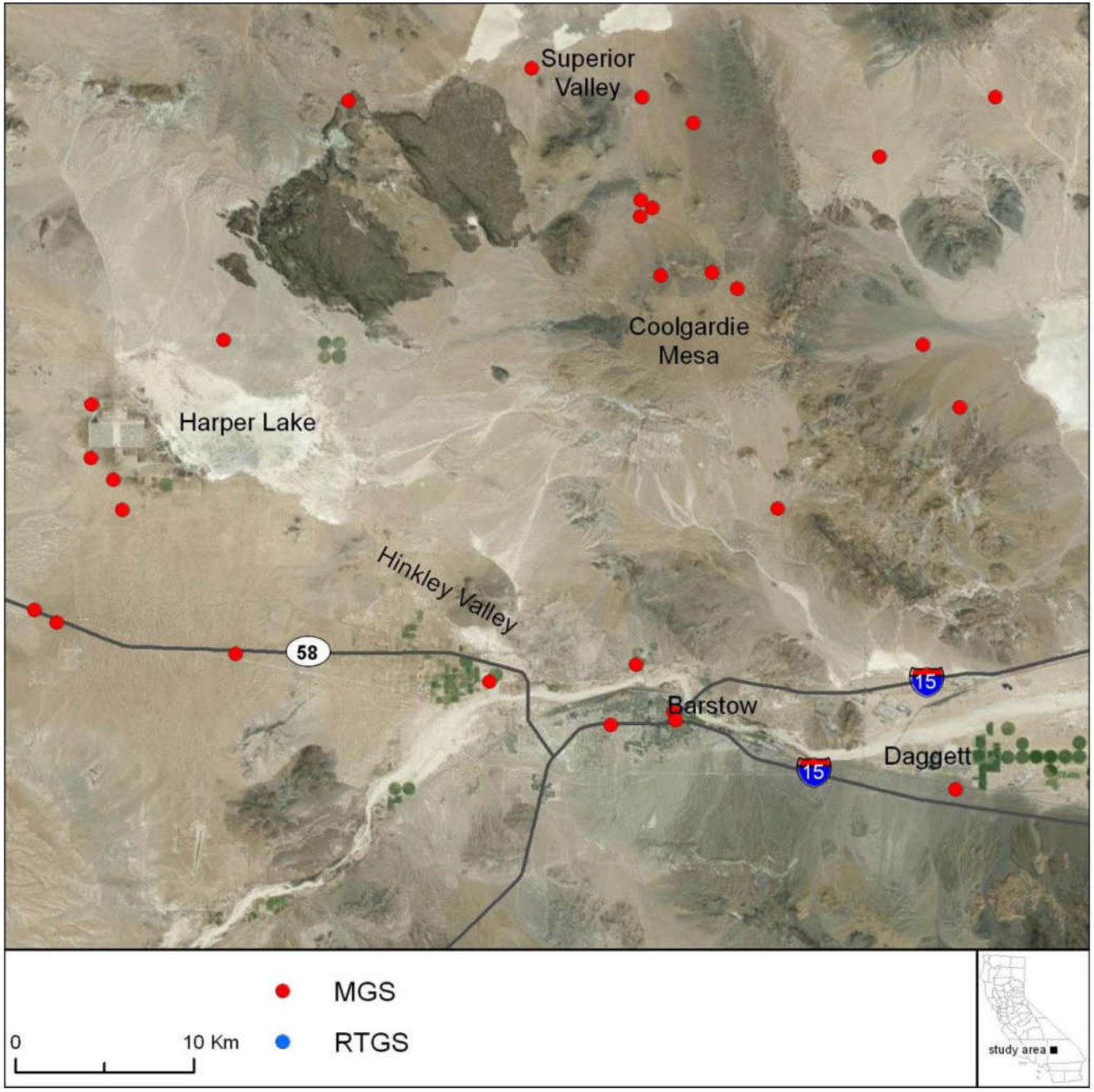


Figure 2. Geographic distribution of CNDDB Mohave ground squirrel records in the Barstow area from the period 1975-1993.

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

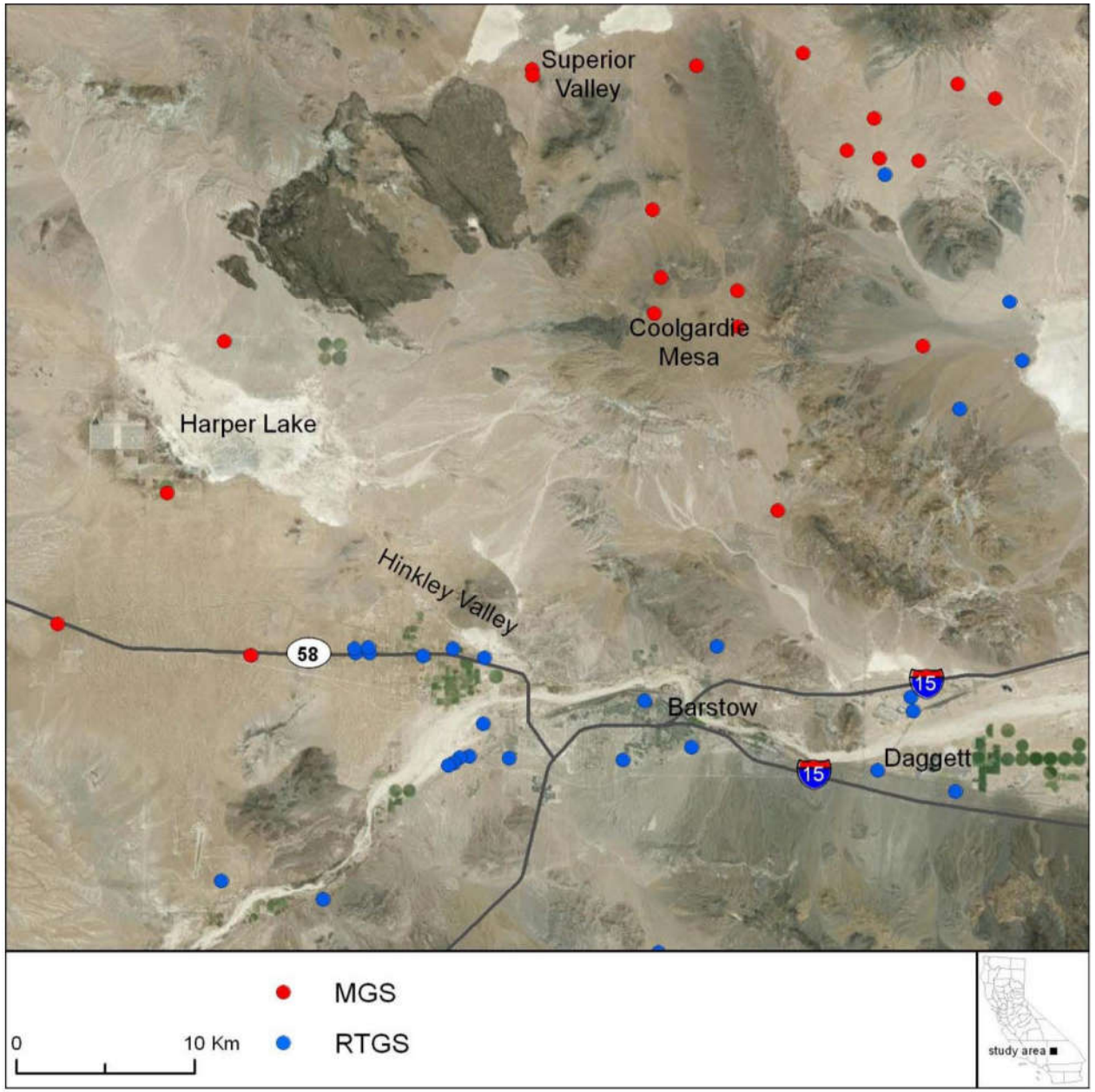


Figure 4. Geographic distribution of Mohave ground squirrel and round-tailed ground squirrel trapping records from the Barstow area from the period 1914-2009.

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*

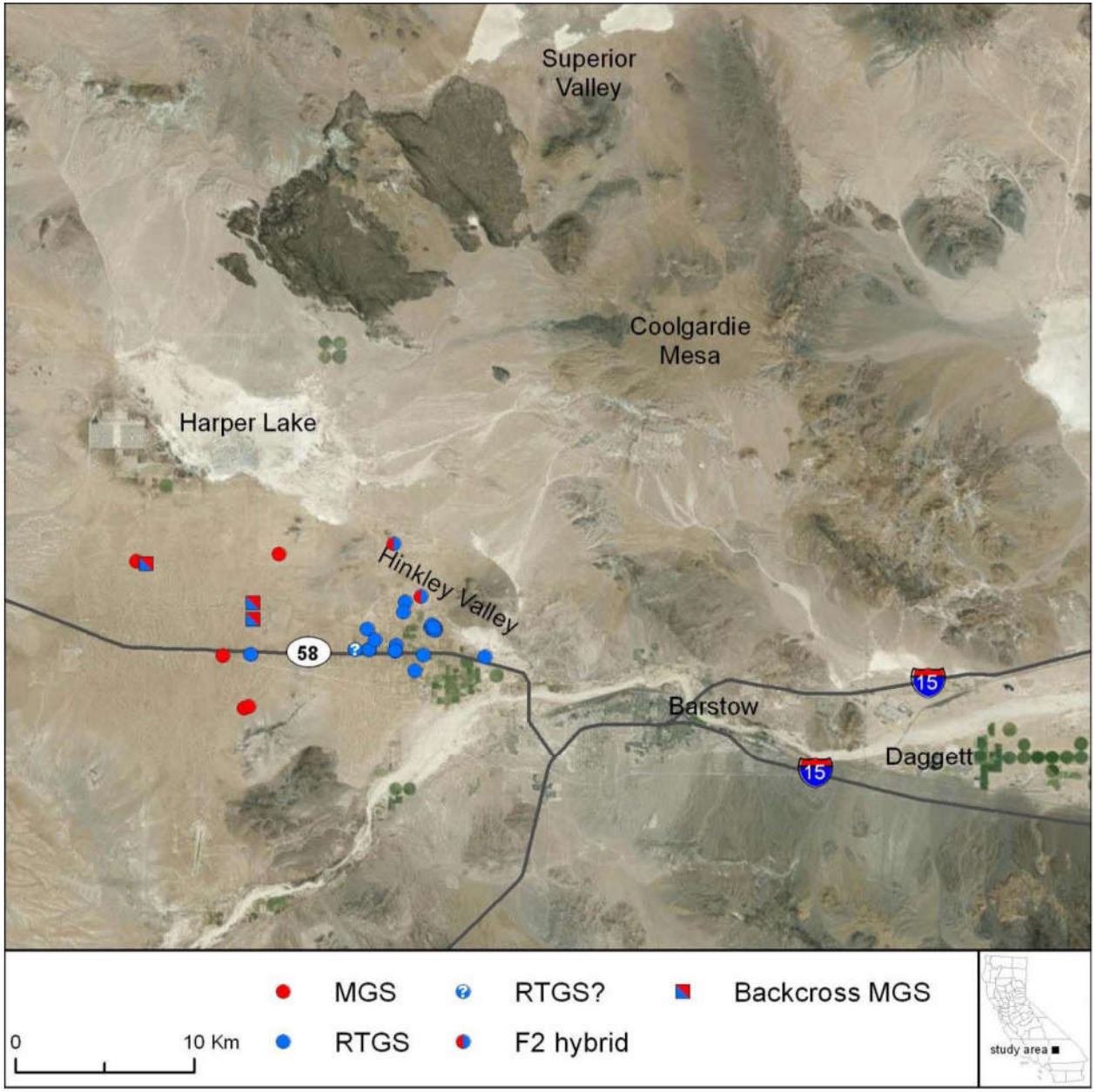


Figure 5. Geographic Distribution of Mohave ground squirrels, round-tailed ground squirrels, and hybrids in the Hinkley area based upon genetic analysis.


2012-04-25 10:36:58 AM M 5/5
95°F
PC800 HYPERFIRE PRO
RECONYX


2012-04-25 11:22:00 AM M 1/5
86°F
PC800 HYPERFIRE PRO
RECONYX

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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