

2025 Desert Tortoise Drone Surveys in Zone 6 of the Red Cliffs Desert Reserve

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① Introduction

- Drone Surveys
- Computer Vision

② Red Cliffs Desert Reserve Surveys

- 2022-2023 Surveys
- 2025 Surveys
- 2025 Results

③ 2025 Analysis

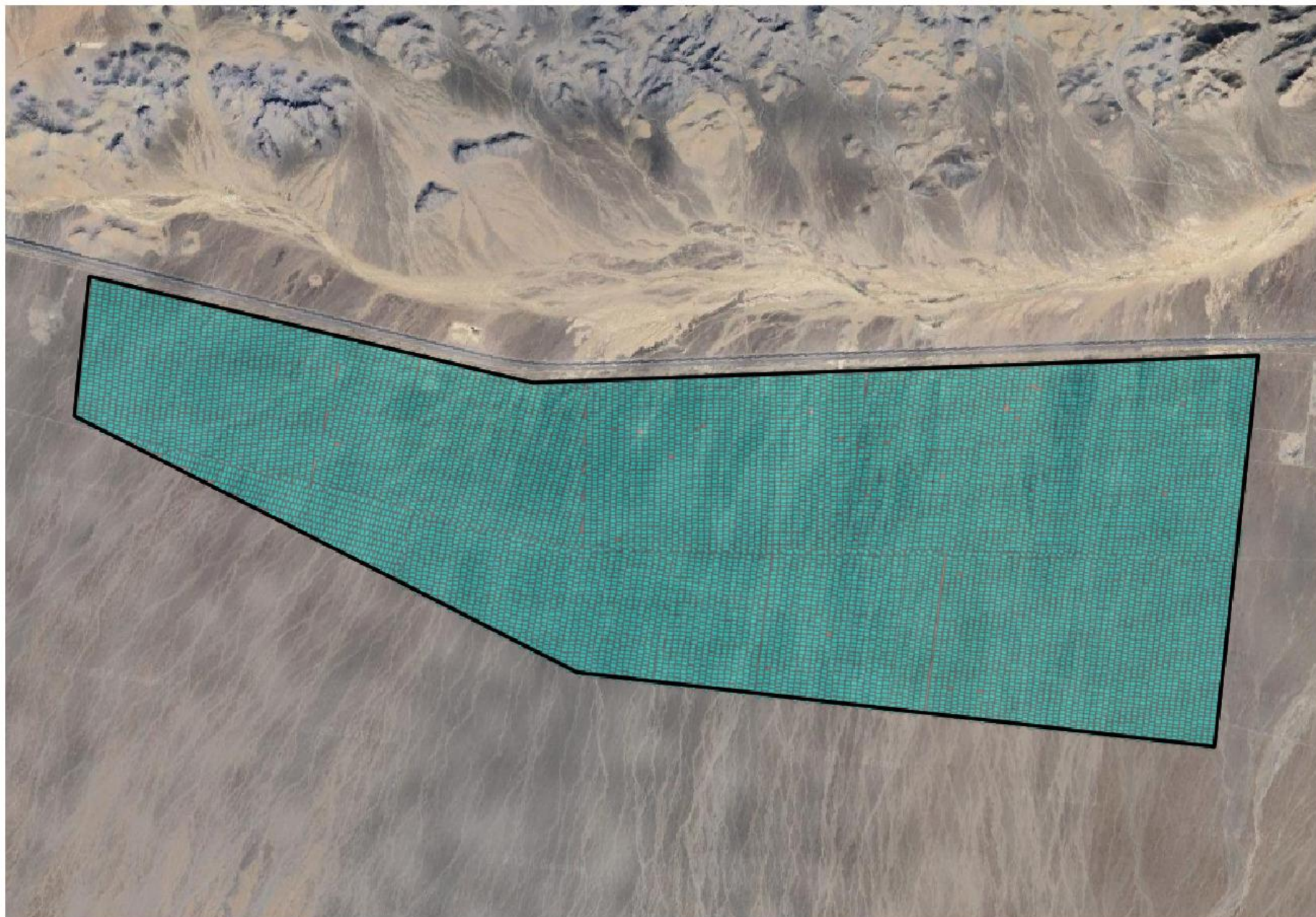
- g_0 Estimate
- Detection Curve
- Mean Overall Detection Rate ($\hat{g}$)
- Abundance - Surveyed Space
- Abundance - Zone 6

④ Conclusions



Drone Surveys







Tortoise Model:

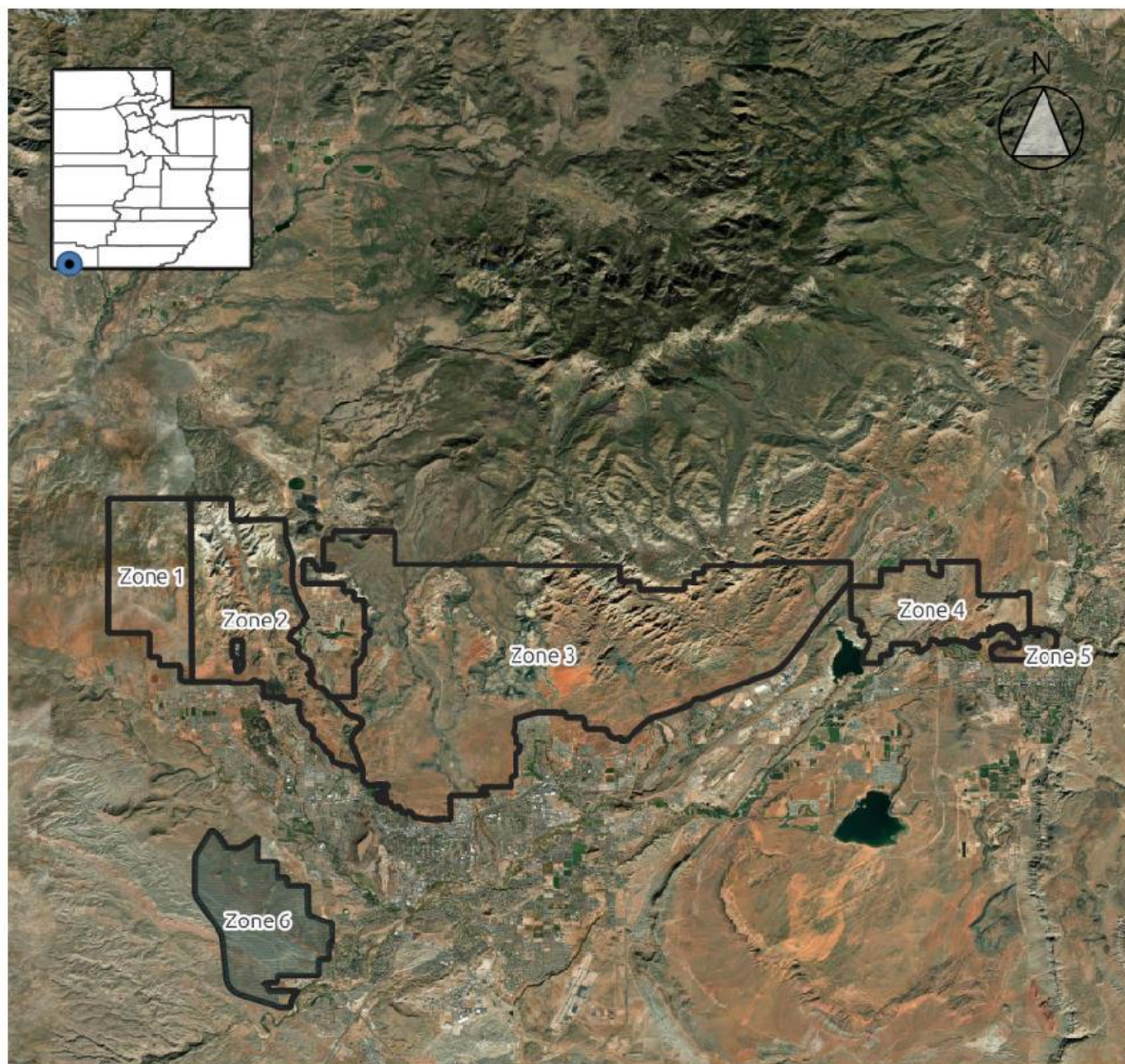
- $n=657$
- Trained on *agassizii* ($n=384$), *flavomarginatus* (243), and some styrotorts ($n=30$)
- Segregate training (80%) and validation (20%) sets
- Recall=89% (+5%)



- 2022 (Zone 6) and 2023 (Zones 2-5)
- g_0 surveys performed by Utah DNR
- Conducted in concert with pedestrian surveys
- High correspondence between drone and pedestrian abundance estimates

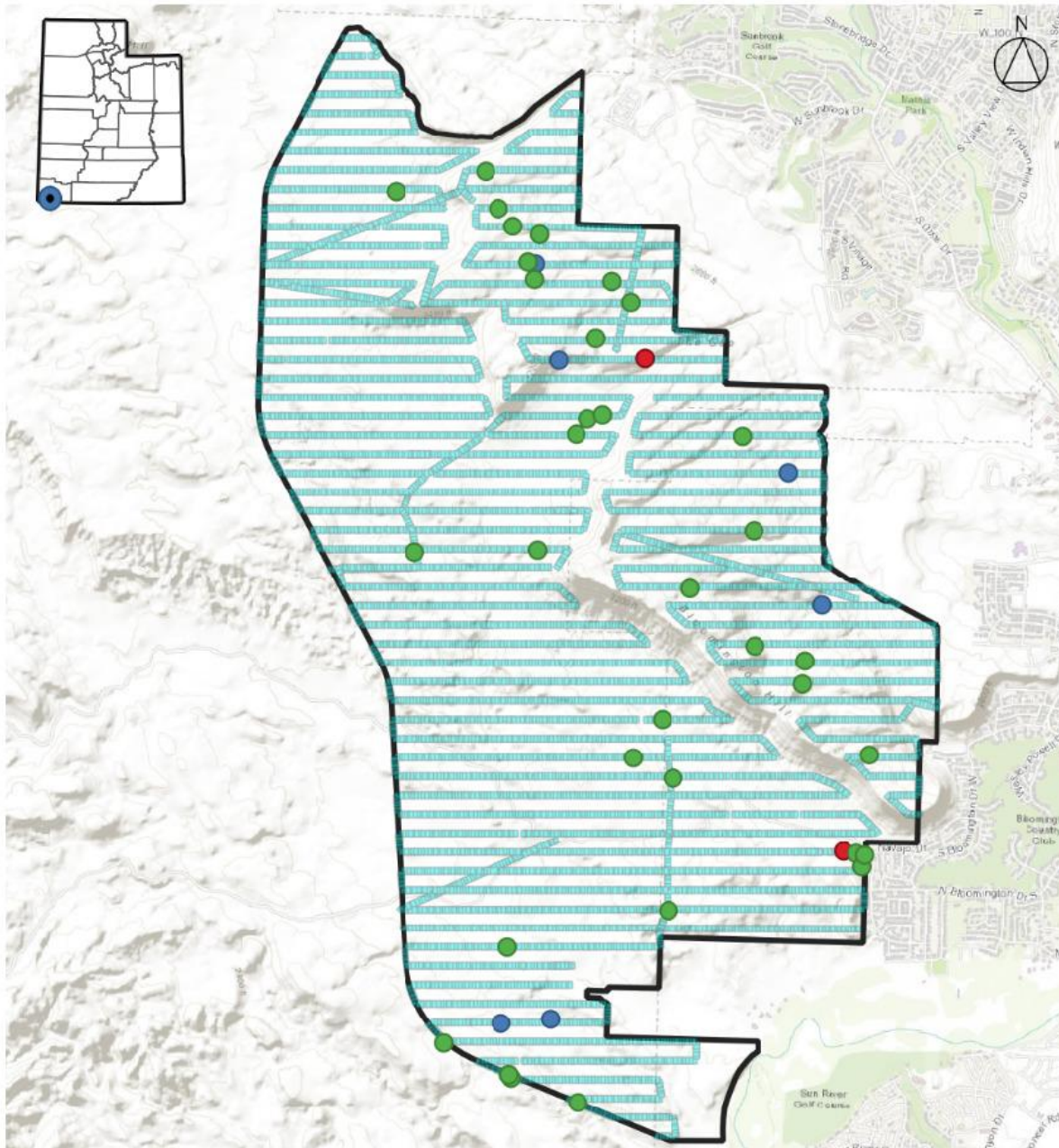


2025 Surveys



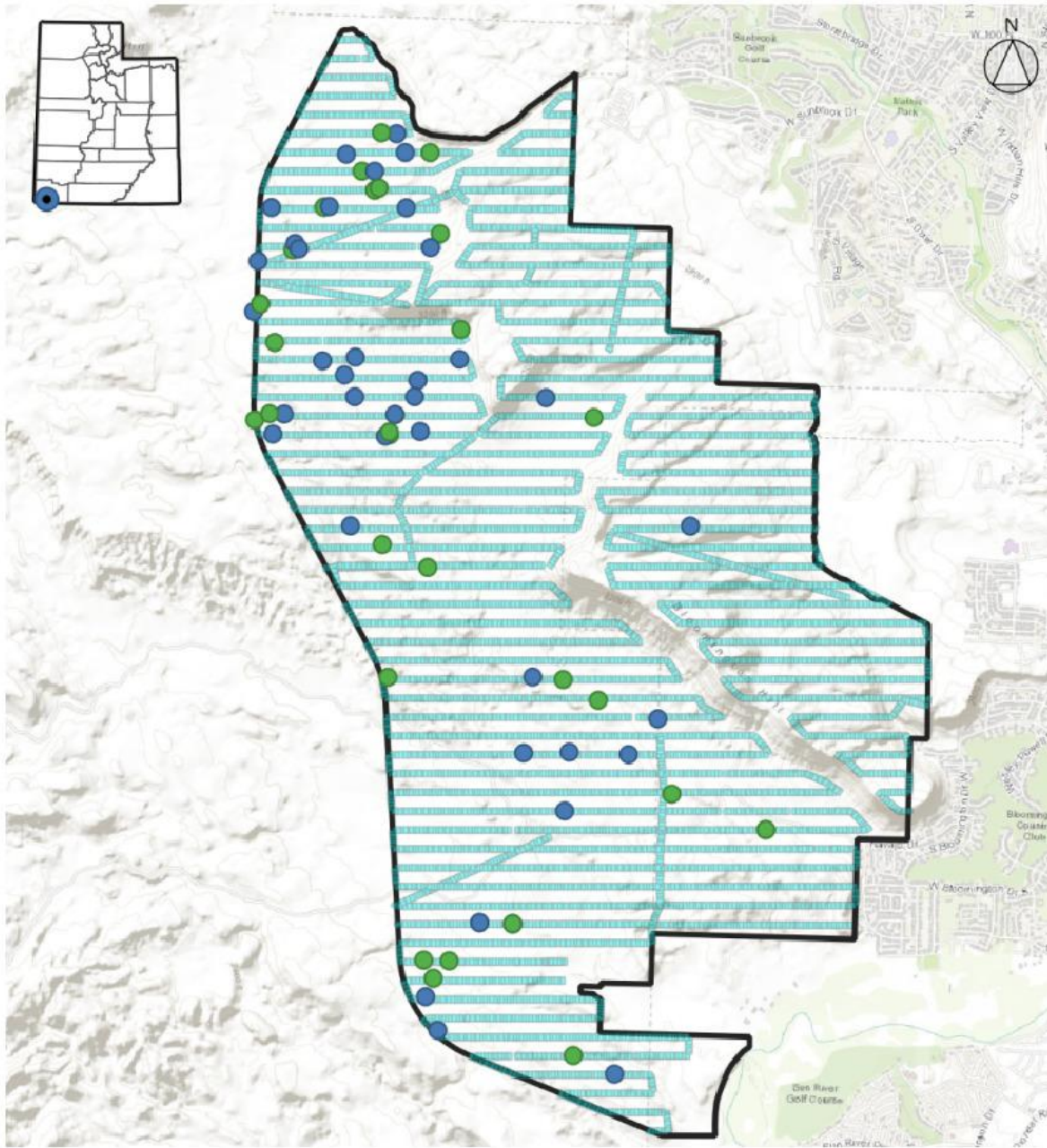
- April 28-May 1
- E-W oriented transects spaced 150 meters apart
- Freely Astro
- Sony Alpha 7R IV + 61 megapixel camera + 50 mm lens
- 73 m flight elevation (0.55 cm resolution)
- 2,448 total acres flown - 36% sample

2025 Results



- 40 unique tortoise detections
 - 34 adults
 - 6 juvenile
 - 2 carcasses
- 10 detections / pilot-day

2025 Results

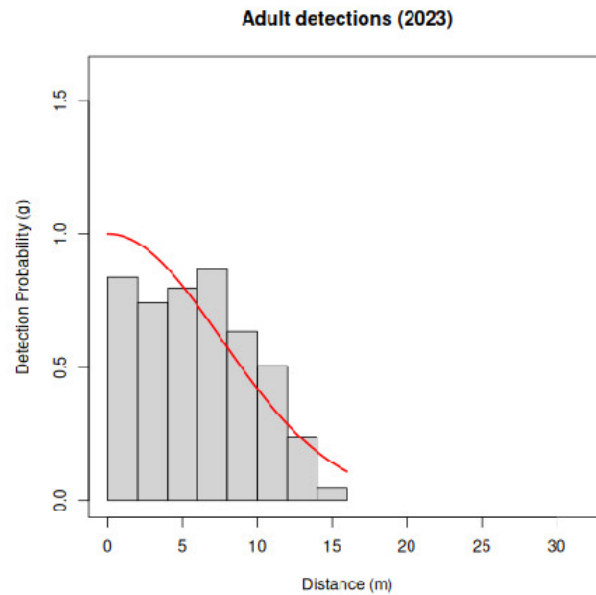


- Soil burrows
- 72 active and/or in good condition

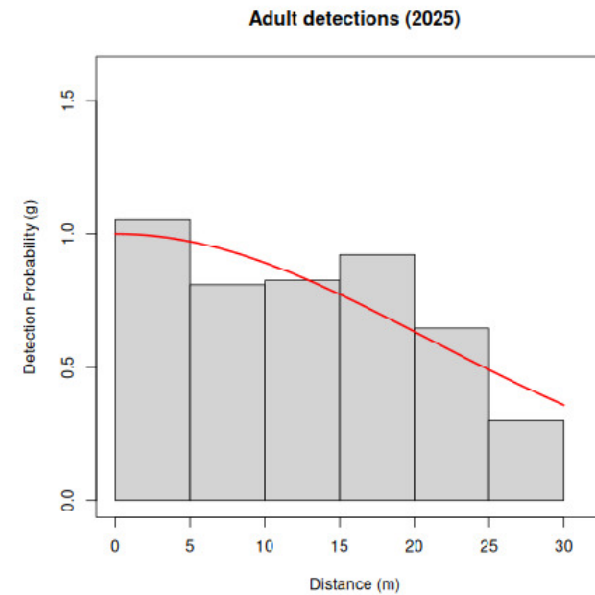
	Drone Detectability (g_0)	Pedestrian Detectability (g_0)
April 28	10%	40%
April 29	20%	40%
April 30	30%	40%
May 1	11%	21%
Combined	18%	34%

- Cold spring, dry winter - Mojave Max emerged on 5/8
- 2022 - 58%
- 2023 - 67%

Detection Curve



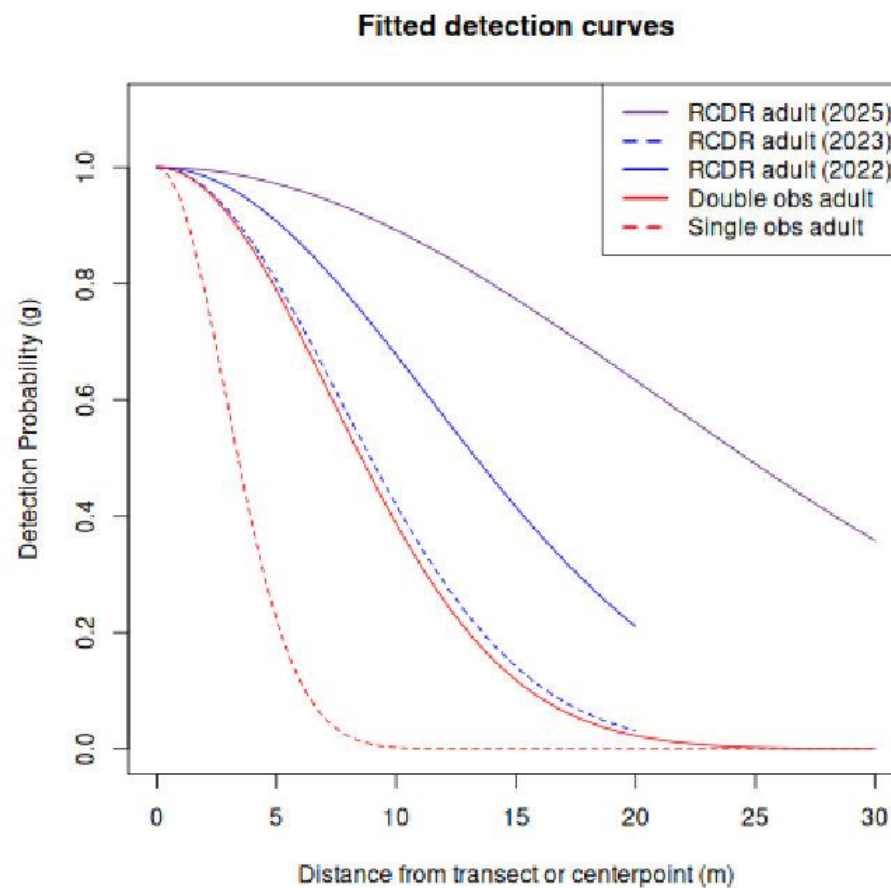
2023

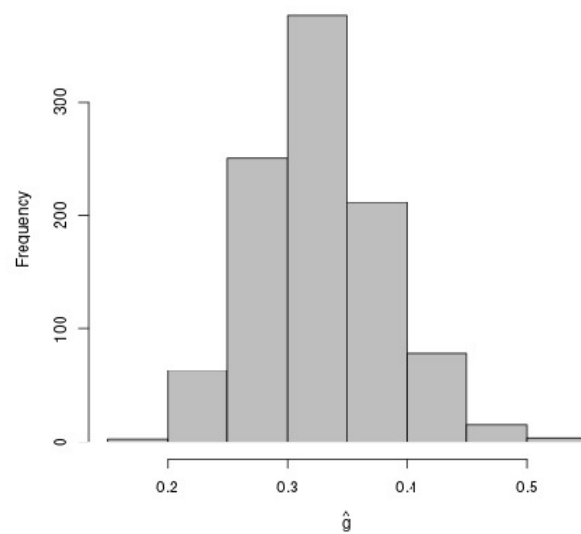


2025

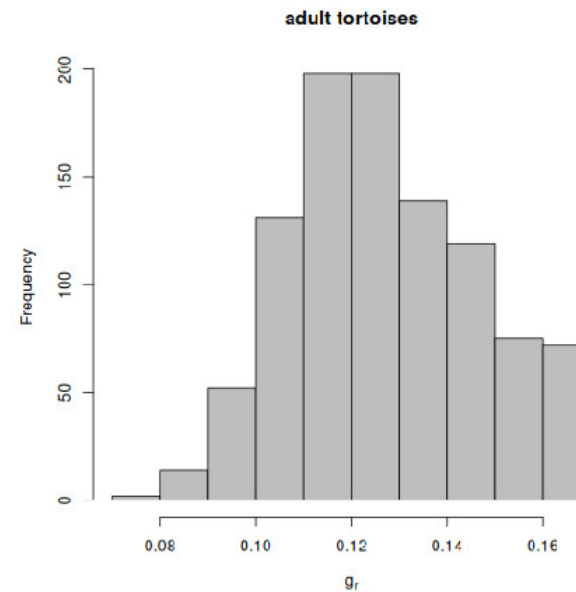
Detection function

Detection Curve



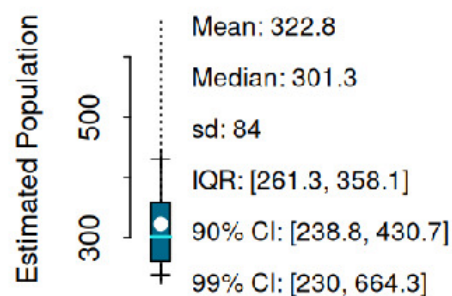
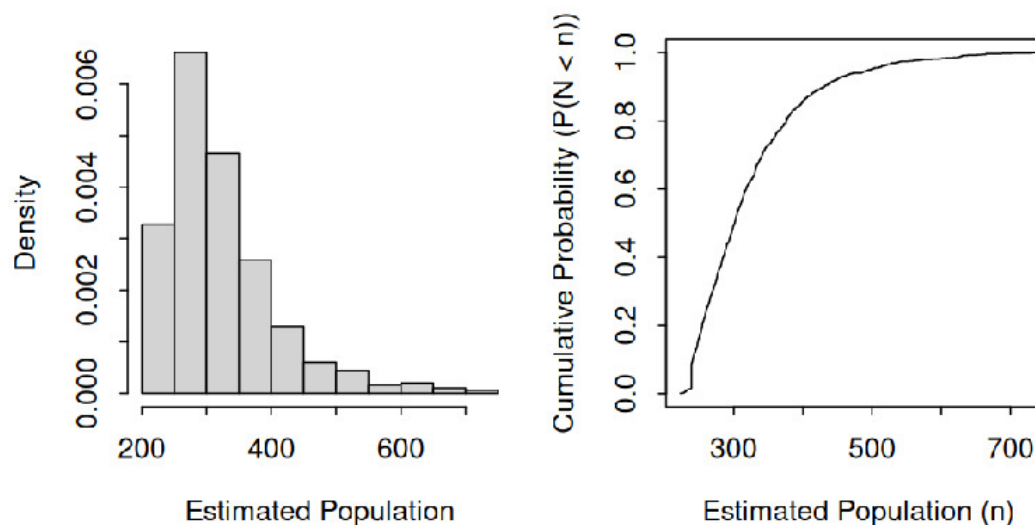
Mean Overall Detection Rate ($\hat{g}$)

2023 = 0.31



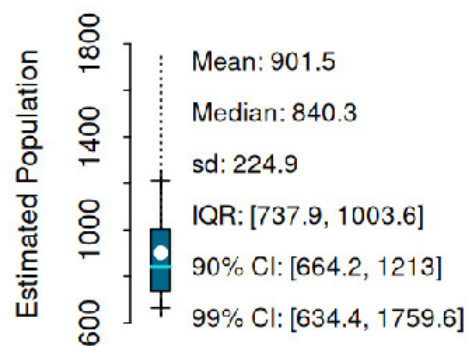
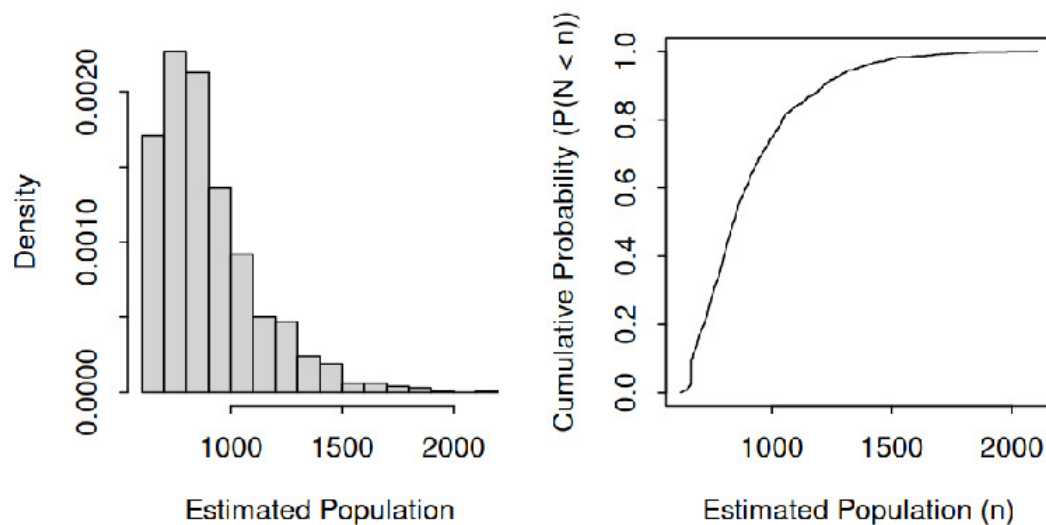
2025 = 0.13

Abundance - Surveyed Space



32.6 [24.1, 43.5] tortoises / sq km

Abundance - Zone 6



- Successful survey was possible despite drought conditions
- Tortoise density was significantly higher than estimated in 2022
 - 32.6 vs 28.0 tortoises / sq km
- Density was also higher than 2023 estimate for Zones 2-5
 - 32.6 vs 20.1 tortoises / sq km
- Among the highest reported densities of any Mojave desert tortoise population rangewide



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