REMOTE EGG OILING (REO)

THE USE OF EMERGING TECHNOLOGY FOR MANAGEMENT OF THE COMMON RAVEN FOR CONSERVATION OF THE MOJAVE DESERT TORTOISE

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SPECIAL THANKS TO

ANDREA CURRYLOW
JENNIFER BROWN
LARRY LaPRE

BRENDA HANLEY
STEPHEN FETTIG
PHIL DeREIMER

TARA CALLAWAY
CRAIG SHERWOOD
ASHLEY SPENCELEY
INTRODUCTION

• Egg Oiling - for 70 years oiling the eggs of ground nesting birds (Canada geese, cormorants) has been used to control their reproduction

• Remote Egg Oiling (REO) – Since 2016 Hardshell, Sundance and their partners have developed methods of remotely oiling raven eggs on natural substrates (cliff faces, Joshua trees, tamarisks, etc)

• We anticipate oiling raven nests on utility towers in 2019 as well as expanded natural substrate nest treatment in CA
THE PROBLEM: TOO MANY RAVENS!
WHY SO MANY RAVENS?
NATURAL SUBSTRATE NESTS
NESTING SUBSTRATES HUMANS PROVIDE
LOCATION, LOCATION, LOCATION
RAVENREALTY.COM

• A raven’s view of transmission towers
  – Complete protection from terrestrial predators
  – Nearly complete protection from aerial predators
  – Solid structure
  – Great view of surrounding landscape
    • Approach of rivals and enemies obvious
    • Movement of prey obvious
A BROAD ECOLOGICAL CRISIS
TORTOISES IN PERIL
Kramer Hills Permanent Study Plot, 1988
WHAT HAS BEEN DONE?

• Public education: limited but valuable efforts
• Subsidy reduction: inherently limited
  – Capping of landfills
  – Use of raven-proof dumpsters
  – Enforcement of municipal codes
  – Anti-perching devices
• Nest removal: labor intensive and ultimately futile
• Shooting: difficult, expensive, unpopular with public in portions of the tortoise range; for tortoise conservation limited to “offending ravens” in CA
• Poisoning: controversial in portions of the tortoise range; not allowed in CA; difficult to document effectiveness
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NET RESULT: MINIMAL EFFECT ON RISING RAVEN NUMBERS
The "Offending Ravens" Question

• History of the current approach in CA.
• Are there ravens specializing on killing juvenile tortoises?
• Is that predation limited to the nesting season?
• Finding raven predated juveniles in open desert calls the assertion into question.
• How can we answer the question?
• What can we do about the problem?
RAVENS BENEFIT FROM TOWERS

• Wider distribution of ravens in habitats they otherwise would not be able to occupy
• Ideal nest structures may increase nesting success: reduced loss to nest predators; improved food gathering
• Superior-Cronese Critical Habitat Unit: a case in point
NATURAL SUBSTRATE NESTS AND SUBSIDY SITES
NATURAL SUBSTRATE NESTS, SUBSIDY SITES, AND TOWER NESTS
NATURAL SUBSTRATE NESTS, SUBSIDY SITES, AND TOWER NESTS WITH TOPOGRAPHY
TOWER NESTS WHERE NATURAL SUBSTRATE IS LIMITED OR UNAVAILABLE
LAND STATUS
TORTOISE CRITICAL HABITAT and UTILITY LINES

Critical Habitat for the Mojave Population of the Desert Tortoise (Gopherus Agassizii) in California
REO: A NEW APPROACH

• 2016
  – Obtained permits
  – Experimentation with three methods at Hyundai-Kia California Proving Grounds
• 2017
  – Focus on egg oiling on natural substrates at Hyundai and Superior-Cronese CHU
  – Initial Remote Fluid Application System (RFAS) development
• 2018
  – Engineered tools (patent pending, RFAS) and methods for treating natural substrate nests at Hyundai, Superior-Cronese and Chemehuevi CHUs
  – Engineered drone based oiling RFAS for transmission tower application
REO: A NEW APPROACH

• 2018 (continued)
  – Initial publication on egg oiling results in review
  – Intellectual property protection in place
  – Numerous demonstrations, workshops and presentations over last year
  – Best Management Practices document now complete
  – Pending agreements with SCE and LADWP for tower nest oiling
  – Expanded use of REO on natural substrate nests
The BMP - a living document
COLLABORATION WITH UTILITIES

- SAFETY MANAGEMENT SYSTEM
- OPERATIONS MANUAL
- TRAINING MANUAL
SCE Demonstration Flight at Workshop, Daggett, CA, 30 May 2018
How We Get Oil on Raven Eggs
Ground-based RFAS- current version can reach 45’
Can treat approx 85% of natural substrate nests
Ground-based Egg Oiling
RESULTS TO DATE: 2016-2018

• All oiled nests, all delivery methods-
  – 67 nests and 71 clutches treated
  – 305/309 treated eggs failed to hatch
• Don’t waste money
  – Carefully consider, e.g., the advisability of egg oiling in drought years in low raven density areas
  – Search efficiently for nests. The highest cost of egg oiling is finding nests and determining timing of oiling. Explore other options for remote nest detection and monitoring
  – Collaborate with all parties: experienced field staff, agencies, utilities, other interest groups
Applied Research and Modeling

- Utilizing Raven Monitoring Data 2013-2017, Collaboration with University of Nevada, Reno (Dr. Ken Nussear)

- Modelling the Effects of Egg Oiling, Collaboration with Cornell University (Dr. Brenda Hanley)
1) IN ALL CASES, decreasing fecundity (egg oiling) WILL decrease the growth rate.

2) We know this from THE SHAPE OF THE MATHEMATICAL SURFACE ACROSS THE ENTIRE SUPERPARAMETER SPACE, even if we do not have precise vital rate estimates.

3) What remains unknown is the EXACT effect that X intensity of egg oiling will have on Y system. (....BUT! We can derive an equation for that!)
Preferred Citation for this Software

This software was created as an auxiliary tool for a research entitled:


These demographic results are calculated using long established equations internal to population matrix models (Caswell, 2001). All code for this app was run on previously published equations in arbitrarily open for X.

Math and Software References

Mathematical references


Harvey, D.J., Dierma, B.C., 2019: Analytical expressions for the dependence of demographic quantities and extinction criteria on a three-stage vector population matrix. Natural Resources Modeling.


Next Steps:
1) Count ravens- consistent methods of counting over large areas essential for population estimates and guiding management
2) Continue and expand subsidy reduction
   • via hazing
     • At food subsidy sites
     • At water sources
     • At roosts
   • Via management of subsidy (e.g. landfill practices)
3) Alter human behavior via increased public education

However, many tools, including new methods, are necessary to buy time for tortoises. Anthropogenic alterations, such as power towers, will subsidize ravens indefinitely and require long-term application of direct raven control.
Next Steps (2):
Thus:
1. Continue to invest in device development
2. Implement REO widely to reduce or reverse raven population growth
3. Refine field techniques and management model
4. Continue collaboration with entities, such as utilities, that have a stake in raven control
5. Assess effect of control methods through use of artificial tortoise models (Techno-tortoises™) or monitoring of surrogate species
   • Ideal surrogate would be a known raven prey species with a highly detectable fecundity rate
6. Commit to continue the effort
We’re hoping to avoid using the trained bears...