

# Challenges in Quantifying the Effectiveness of Avoidance and Minimization Measures



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# Avoidance and Minimization Measures

- Different reasons to implement
  - Voluntary (environmental due diligence)
    - migratory birds
    - bats



- Required (reduce take to the maximum extent practicable)

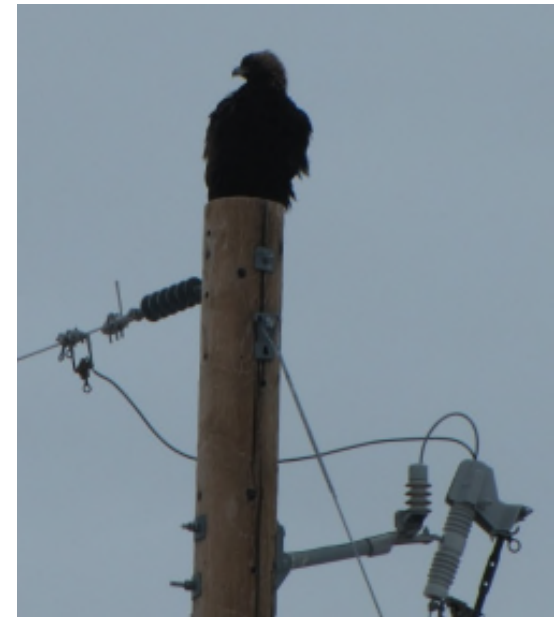
Rare events {  
– threatened and endangered species  
– eagles



- Need to quantify the reduction of impacts (i.e., success of implementation)

# Effectiveness Monitoring

- Definition: A program designed to evaluate whether or not there is a reduction in impacts as a result of implementation of a given avoidance and minimization measure.
- Variation in program objectives
  - Quantify
    - When already demonstrated to be effective
    - E.g., power-pole retrofits
  - Demonstrate and quantify
    - Predicted reduction, but untested
    - E.g., experimental measures



# Challenges

- Poor understanding of factors related to risk/impacts
- Difficult to control for confounding variables
- Sample size may be limited at a single site
- Inherent uncertainty in fatality estimation



# Metrics of Effectiveness

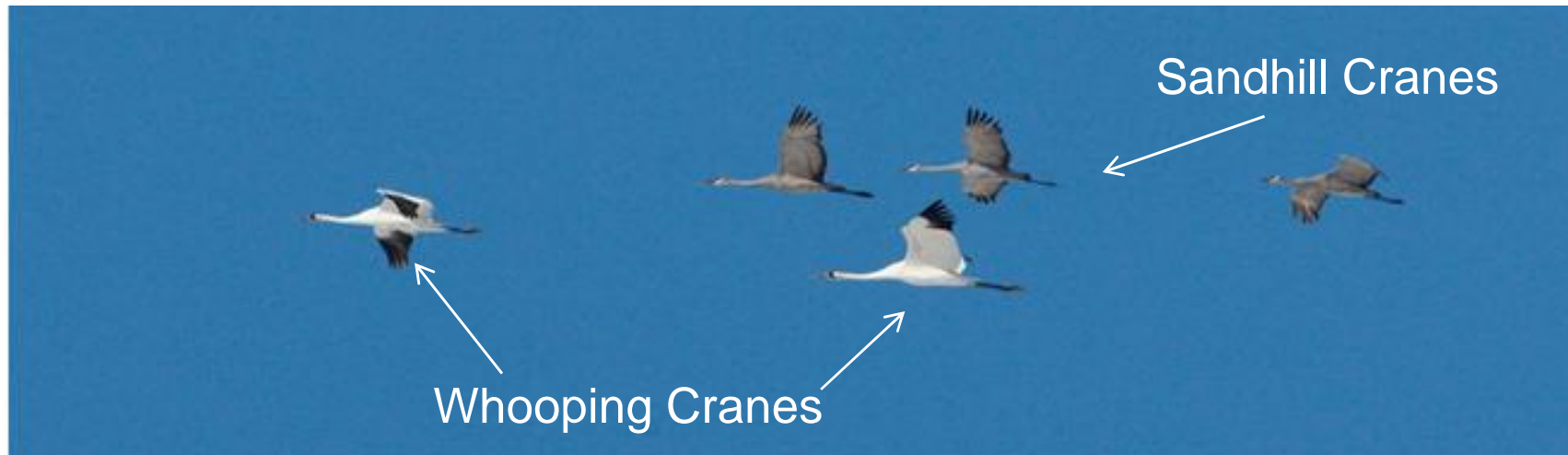


- Estimated or observed fatality rate
  - Most common
  - Lack of precision
  - May not accurately capture risk
- Alternative metrics
  - Best metrics use attributes that
    - Can be measured with relative accuracy
    - Have good sample sizes
    - Have baseline data available
    - Are well-correlated with risk



# Alternative Metrics

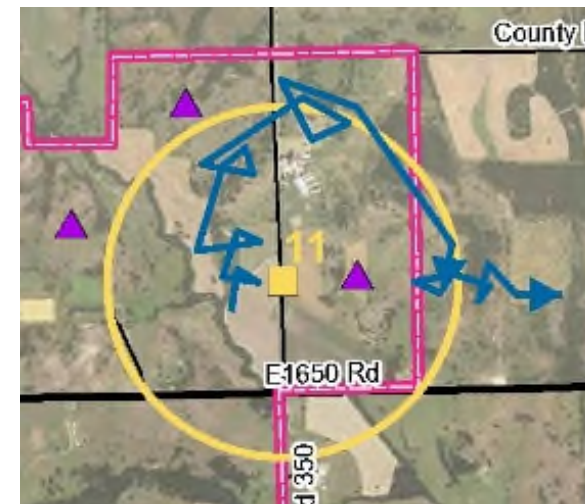
- Measurements of use
- Behavioral responses
- Fatality rates of a surrogate species



# Alternative Metric – Example 1

## Audible Deterrent for Raptors

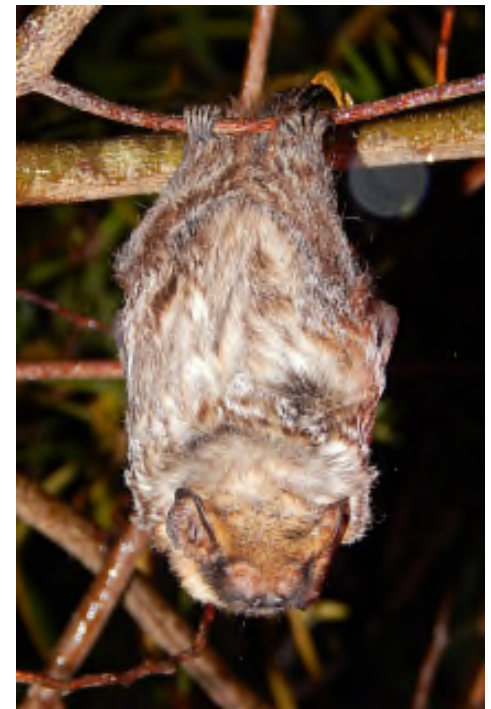
- Flight paths or use in the zone of risk can be quantified and are often collected pre-construction (i.e., baseline)
- Correlation with collision is assumed, and collision probabilities are available in the literature
- Response to initiation of the deterrent can be measured
- Averted flight paths can be equated to avoided collision risk



## Alternative Metric – Example 2

### Hawaiian hoary bat (Endangered)

- Bat use potentially correlated with risk
- Dim UV light deterrent installed at macadamia nut orchard
- Thermal and acoustic detectors to quantify bat use
- Bat use was greatly reduced with UV light treatment



Gorresen, M.P., P.M. Cryan, D.C. Dalton, S. Wolf, J.A. Johnson, C.M. Todd, F.J. Bonaccorso. 2015. Dim ultraviolet light as a means of deterring activity by the Hawaiian hoary bat *Lasiurus cinereus semotus*. *Endangered Species Research* 28:249-257.



# Rare Events

- Unique challenges
  - Often tied to regulatory risk and permit compliance
  - Hard to detect a rare event
  - Greater level of effort to create precise estimates of fatalities
  - Smaller sample size to detect an effect of a measure



# Management Implications

- Study design is crucial
- Include effectiveness monitoring at earliest planning stages
- Results of effectiveness monitoring influence
  - Acceptance of experimental avoidance and minimization measures
  - Adaptive management decisions
  - Compensatory mitigation requirements
- If you didn't measure it, it didn't happen



## For more information or questions:



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