Estimating Inter-annual Variability in Project Take for Rare Events

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Auwahi Wind
Overview

• Estimating Take for Incidental Take Permits

• Variation in Take
  ▪ Sources of variation
  ▪ Effects of variation

• Rare events

• Hawaiian Hoary Bats – A Case Study
Estimating Take for Incidental Take Permits

• Anticipated Impact
  ▪ Predicting future take
  ▪ Take limits

• Mitigation triggers

• Compliance
  ▪ Monitoring
  ▪ Reporting
Variation in Take

- Natural sources
  - Random
  - Environmental fluctuations
  - Cyclic
  - Population change

- Operational sources
  - Operational changes
  - Future technologies

- Directional changes in take
Variation in Take

• Assessing inter-annual variation
  ▪ Sample sizes and monitoring effort
  ▪ Effects of variation on fatality estimates
  ▪ Effectiveness of operational changes and deterrents
    – When does change occur?
    – What is the scale of change?
    – Confounding variation
Rare events

- Why rare?
  - Endangered species
  - Low detectability
- Rare vs. common events
  - Limitations of fatality estimators
  - Impacts of variability
- Approaches to estimation
  - Common surrogates
  - Evidence of Absence
Auwahi Wind

- Auwahi Wind Farm
  - East Maui, Hawaii
  - Eight Siemens 3.0 MW wind turbines
  - Commercial operation December 2012
  - Anticipated operational life – 20 years

- Incidental Take Permit
  - ITP issued February 24, 2012
  - Hawaiian petrel, Hawaiian goose, Blackburn’s sphinx moth, Hawaiian hoary bat

- HCP Amendment (in progress)
Auwahi Wind - Hawaiian Hoary Bat

• Status
  ▪ Federally endangered – listed 1970
  ▪ Limited information on population size and distribution
  ▪ Taxonomy

• Requested Take – Auwahi HCP (2012)
  ▪ Direct – 19 adults
  ▪ Indirect – 8 young
  ▪ Rationale
    – Low numbers acoustic detections
    – Lack of roosting habitat
    – Low mortality rate at other wind farms

• Tiered Approach
Auwahi - Hawaiian Hoary Bat

- Monitoring program
  - Pulsed monitoring
    - Intensive monitoring (2013-2014)
    - Systematic monitoring
    - Interim inspections
  - Bias trials
  - Fatality estimation
  - Mitigation triggers
Auwahi Wind - Hawaiian Hoary Bat

• Sources of variation
  ▪ Natural
    – Random
    – Seasonal
    – Population changes
    – Environmental fluctuations

▪ Operational changes
  – Low wind speed curtailment (February 2015)
  – Deterrents
  – Other
Auwahi - Hawaiian Hoary Bat

- Years 1-4 results

<table>
<thead>
<tr>
<th>Year</th>
<th>Observed Fatalities</th>
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<td>2013</td>
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<tr>
<td>2014</td>
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<tr>
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Estimated Fatality Rates (95% CI)

- Auwahi Pre-LWSC
- Auwahi Post-LWSC
Auwahi - Hawaiian Hoary Bat

- HCP amendment (in progress)
  - Take higher than anticipated
  - Considerations
    - Curtailment effect
    - Deterrent available?
    - 2016 anomalous?
Effects on predicted take
Summary

• Variation in fatality rates affects predictions of take and approaches for assessing compliance with permitted levels of take.

• When take occurs rarely, measuring effects of variation poses additional challenges for monitoring and assessment.

• Planning for alternative outcomes should be considered, as effects of variation and changes in take may not be immediately discernible.
Additional information or questions?

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