Use of Aerial Survey Methods to Estimate Ungulate Populations in the Oil Sands Region

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Background: Aerial Surveys

- Used for assessments of:
  - Population size
  - Distribution and trends
  - Impacts of harvesting, predation or other disturbance

- Environment and Sustainable Resource Development (ESRD) use for population management:
  - Important resource for aboriginal groups, hunters and outfitters
  - Set hunting allocations and track population trends
  - Wildlife Management Units (WMU)
Background: JOSM

• JOSM: Core Terrestrial Biodiversity Monitoring
• AEMERA-ESRD program provides enhanced moose and deer monitoring:
  • Survey WMUs having > 50% area within the oil sands region
  • Increase the quantity and frequency of surveys within the JOSM area
  • Use robust methods to provide improved population and density estimates
  • Support AEMERA State of the Environment Reporting
Introduction

• Traditionally aerial surveys have been flown following a modified-Gasaway survey method
• Recently wildlife biologists with ESRD have trialed Distance Sampling methods with encouraging results
  • Buckland et al. 2001, Peters et al. 2014
• JOSM surveys:
  • 2013: Modified-Gasaway
  • 2014: Distance Sampling
Methods: Modified-Gasaway

Strata

Low  \( D_L \theta_L^2 \)
Med  \( D_M \theta_M^2 \)
High \( D_H \theta_H^2 \)

Scale w/ Sampling Fraction

\[ \hat{D} = \frac{n}{a} \]

n = number of animals
a = area sampled
Methods: Distance Sampling

\[ \hat{D} = \frac{n}{2wL\hat{P}_a} \]

- \( n \) = number of animal groups
- \( 2wL \) = area
- \( \hat{P}_a \) = detection function

Diagram showing perpendicular distance to transect line.
Methods: Distance Sampling

• Analysis:
  • Data analyzed using Distance 6.0 (Thomas et al. 2010)
  • Candidate models were fit to the data and assessed using goodness of fit tests
  • Final model selection based on Akaike’s Information Criterion (AIC; Buckland et al. 2001)
Methods: Comparison

• Advantages to Distance Sampling:
  • Provides equal or greater precision on density estimates (Peters et al. 2014)
  • Less flying required (no pre-stratification required)
    » Less expensive
  • Survey multiple species
  • Randomize transects to adequately cover the WMU
  • Can include other covariates and post-stratification
Gasaway Results: 2013

<table>
<thead>
<tr>
<th>WMU</th>
<th>Population Estimate</th>
<th>Confidence Limit</th>
<th>Moose Density</th>
</tr>
</thead>
<tbody>
<tr>
<td>512</td>
<td>2,378</td>
<td>± 16.3%</td>
<td>0.30/km²</td>
</tr>
<tr>
<td>517</td>
<td>305</td>
<td>± 44.5%</td>
<td>0.06/km²</td>
</tr>
<tr>
<td>518</td>
<td>856</td>
<td>± 29.6%</td>
<td>0.07/km²</td>
</tr>
<tr>
<td>528</td>
<td>2,241</td>
<td>± 13.6%</td>
<td>0.19/km²</td>
</tr>
<tr>
<td>541</td>
<td>531</td>
<td>± 33.7%</td>
<td>0.07/km²</td>
</tr>
</tbody>
</table>
## Distance Results: 2014

<table>
<thead>
<tr>
<th>WMU</th>
<th>Population Estimate</th>
<th>Coefficient of Variation</th>
<th>Moose Density</th>
</tr>
</thead>
<tbody>
<tr>
<td>511</td>
<td>721</td>
<td>0.24</td>
<td>0.12/km²</td>
</tr>
<tr>
<td>515/651/841</td>
<td>392</td>
<td>0.18</td>
<td>0.13/km²</td>
</tr>
<tr>
<td>515/651/841 Moose</td>
<td>2,750</td>
<td>0.14</td>
<td>1.02/km²</td>
</tr>
<tr>
<td>726</td>
<td>277</td>
<td>0.24</td>
<td>0.05/km²</td>
</tr>
</tbody>
</table>
Discussion

• Survey design: Distance sampling methods provide improved density estimates and require less effort to obtain
• Moose density estimates are quite variable across the oil sands region (0.05-0.30/km²)
• Quality, quantity and frequency of completing AUS surveys is heavily weather dependent
• Immediate trend assessments difficult since surveys were last completed 7-13 years ago
Future Work

• Surveys completed in 2015: WMUs 519, 527, 503
• Develop improved methods for obtaining estimates in low density WMUs
  – Evaluate distance sampling in low density WMUs
  – Test the efficacy of infrared technology (e.g. FLIR)
• Increased frequency of ungulate surveys will support population trend reporting within oil sands region
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Questions?