Community-based Wildlife Monitoring
In Selected Concessions of Chobe and the Okavango Delta, 2013 - 2015

A Partnership between Okavango Research Institute and Round River Conservation Studies

K. Heinemeyer¹, G.S. Masunga², K. Orrick¹, M. Sinvula³, J. Smith¹, S. Dain-Owens³

¹ Round River Conservation Studies, 104 East Main St #302, Bozeman, Montana, USA; corresponding author: kim@roundriver.org
² Okavango Research Institute, University of Botswana, Private Bag 285, Maun, Botswana
³ Round River Conservation Studies, 925 East 900 South; Suite 207, Salt Lake City, Utah, USA
Round River Conservation Studies is a research and education organization dedicated to supporting science-based conservation strategies for wild landscapes and the communities that depend upon them.

Our current project sites include working in the USA, Botswana, Canada, Chile, Costa Rica, and Namibia.
Community-based Wildlife Monitoring

- History of surveys in the Delta
- Aerial survey synopsis
- Meetings in Maun, SAREP monitoring project
- Resulting Round River’s partnerships with ORI, DWNP, SAREP, Community Trusts
Community-based Wildlife Monitoring

Today we will present:

- Density and Demography Surveys (DADS) of Wildlife
- Birds of Botswana Surveys
- Capacity building and Training with Escort Guides
Part I: Density and Demography Surveys (DADS)

- Wildlife Driving Transects
- Data on all large mammal species
- Counts, sex, age data
- Initiated in 2012
- 5 sampling seasons to date
- Concessions: NG18, 19, 33, 34, 41; CH 1, 2
DADS Survey Training

Training required before surveys undertaken
- Correct use of compass, GPS and laser range finder
- Estimating distances
- Classification of sex and age classes of each species
- Correct data recording
DADS Data Collection

• Drive transects between 6am and noon
• Most concessions have 4 transects
• Each transect varies in length (10-40km), on average 22 km long
• Each of 2 teams does 1 transect each morning
• Try to have 4 people on each team
• Angle, distance, GPS location, habitat type, vegetation cover
• Data collected allows us to map the animals location and measure their distance from the transect line
# DADS Sampling Effort

Survey protocol: Each survey is repeated 3 times, with a 2 day interval

<table>
<thead>
<tr>
<th>Concession</th>
<th>Dry 2013 Ave (Total) Km</th>
<th>Wet 2014 Ave (Total) Km</th>
<th>Wet 2015 Ave (Total) Km</th>
<th>Dry 2015 Ave (Total) Km</th>
<th>Wet 2016 Ave (Total) Km</th>
</tr>
</thead>
<tbody>
<tr>
<td>NG18</td>
<td>51.6 (120.2)</td>
<td>37.8 (113.2)</td>
<td>75.7 (174.2)</td>
<td>89.5 (268.6)</td>
<td>N/A</td>
</tr>
<tr>
<td>NG19</td>
<td>62.0 (186.0)</td>
<td>38.4 (115.3)</td>
<td>78.1 (234.4)</td>
<td>79.5 (238.5)</td>
<td>74.0 (221.9)</td>
</tr>
<tr>
<td>NG33/34</td>
<td>81.0 (243.1)</td>
<td>49.5 (148.4)</td>
<td>79.9 (239.8)</td>
<td>77.8 (233.4)</td>
<td>144.4 (433.2)</td>
</tr>
<tr>
<td>NG41</td>
<td>88.0 (248.7)</td>
<td>39.7 (119.1)</td>
<td>84.5 (253.5)</td>
<td>81.3 (243.8)</td>
<td>132.5 (397.4)</td>
</tr>
<tr>
<td>CH1</td>
<td>N/A</td>
<td>N/A</td>
<td>61.9 (185.7)</td>
<td>102.19 (306.6)</td>
<td>N/A</td>
</tr>
<tr>
<td>CH2</td>
<td>N/A</td>
<td>N/A</td>
<td>79.03 (157.1)</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>Species</td>
<td>CH1 (n=18)</td>
<td>CH2 (n=6)</td>
<td>NG18 (n=38)</td>
<td>NG19 (n=39)</td>
<td>NG33/34 (n=42)</td>
</tr>
<tr>
<td>---------------------</td>
<td>------------</td>
<td>-----------</td>
<td>-------------</td>
<td>-------------</td>
<td>----------------</td>
</tr>
<tr>
<td>African buffalo</td>
<td>148</td>
<td>36</td>
<td>52</td>
<td>186</td>
<td>2392</td>
</tr>
<tr>
<td>Eland</td>
<td>37</td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Elephant</td>
<td>123</td>
<td>5</td>
<td>245</td>
<td>254</td>
<td>469</td>
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<tr>
<td>Giraffe</td>
<td>71</td>
<td>189</td>
<td>91</td>
<td>281</td>
<td>169</td>
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<tr>
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<td>175</td>
<td>17</td>
<td>1772</td>
<td>3241</td>
<td>3334</td>
</tr>
<tr>
<td>Kudu</td>
<td>34</td>
<td>2</td>
<td>167</td>
<td>171</td>
<td>172</td>
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<td>Ostrich</td>
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<td>12</td>
<td>14</td>
<td>48</td>
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<tr>
<td>Red lechwe</td>
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<td></td>
<td></td>
<td></td>
<td>138</td>
</tr>
<tr>
<td>Redbuck</td>
<td></td>
<td></td>
<td>45</td>
<td>17</td>
<td>6</td>
</tr>
<tr>
<td>Roan</td>
<td>1</td>
<td>25</td>
<td>2</td>
<td>3</td>
<td>27</td>
</tr>
<tr>
<td>Steenbok</td>
<td>5</td>
<td>6</td>
<td>18</td>
<td>19</td>
<td>62</td>
</tr>
<tr>
<td>Tsessebe</td>
<td></td>
<td></td>
<td>30</td>
<td>25</td>
<td>48</td>
</tr>
<tr>
<td>Waterbuck</td>
<td></td>
<td></td>
<td>114</td>
<td>202</td>
<td>77</td>
</tr>
<tr>
<td>Wildebeest</td>
<td>18</td>
<td>3</td>
<td>54</td>
<td>15</td>
<td>530</td>
</tr>
<tr>
<td>Zebra</td>
<td>1049</td>
<td>4</td>
<td>126</td>
<td>407</td>
<td>188</td>
</tr>
</tbody>
</table>
What percent of the animals did we see?

- We know we don’t see all the animals while driving
- It is very important to understand what % we are probably seeing
- We assume that we can see 100% of animals within 25m
- We can also estimate how many we see at further distances

We estimate we only see about 25% of animals that are over 75-100m away!
DADS Density Estimates

We evaluated 2 ways to analyze for density estimates

- Line transect analyses (Distance sampling)
  - Gold standard, can include all animals seen
  - Key assumptions must be met
  - Must have many observations of each species

- Strip transect analyses (Strip-width sampling)
  - Include animals seen within 50m of transect
  - Assume we have seen 100% of animals within this strip (we know we will underestimate)
DADS Strip Transect Densities

- Strip transect estimates for 19 large mammals for each season and concession surveyed—African buffalo, baboon, common duiker, common reedbuck, eland, elephant, giraffe, hippo, impala, kudu, ostrich, red lechwe, roan, steenbok, tsessebe, warthog, waterbuck, wildebeest and zebra
- SE and %CV indicate data variation; would like CV >50%
- Can provide a baseline for on-going monitoring efforts

<table>
<thead>
<tr>
<th>Impala</th>
<th>Dry 2013</th>
<th>Wet 2014</th>
<th>Wet 2015</th>
<th>Dry 2015</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>D</td>
<td>SE</td>
<td>%CV</td>
<td>D</td>
</tr>
<tr>
<td>CH1</td>
<td>2.2</td>
<td>1.2</td>
<td>53</td>
<td>1.6</td>
</tr>
<tr>
<td>CH2</td>
<td>1.1</td>
<td>1.1</td>
<td>99</td>
<td></td>
</tr>
<tr>
<td>NG18</td>
<td>13.1</td>
<td>3.4</td>
<td>26</td>
<td>16.0</td>
</tr>
<tr>
<td>NG19</td>
<td>32.8</td>
<td>10.2</td>
<td>31</td>
<td>13.6</td>
</tr>
<tr>
<td>NG33/34</td>
<td>35.8</td>
<td>6.4</td>
<td>18</td>
<td>6.6</td>
</tr>
<tr>
<td>NG41</td>
<td>10.7</td>
<td>2.9</td>
<td>27</td>
<td>1.3</td>
</tr>
</tbody>
</table>
DADS Line Transect Densities

- Line transect estimates are a more robust approach if adequate data is collected with appropriate field protocols.
- For 7 species, we could pool data across concessions for key parts of analyses, while still calculating densities for each concession:
  - elephant, giraffe, impala, kudu, steenbok, warthog, zebra
- Goal: standardized field data across various survey efforts to leverage data
- This technique may provide a baseline for on-going monitoring efforts
## Strip and Line Transect Densities

<table>
<thead>
<tr>
<th>Impala</th>
<th>Dry 2013</th>
<th>Wet 2014</th>
<th>Wet 2015</th>
<th>Dry 2015</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>D</td>
<td>SE</td>
<td>CV</td>
<td>D</td>
</tr>
<tr>
<td>NG</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>18</td>
<td>Strip</td>
<td>13.1</td>
<td>3.4</td>
<td>26</td>
</tr>
<tr>
<td></td>
<td>Line</td>
<td>19.3</td>
<td>3.7</td>
<td>19</td>
</tr>
<tr>
<td>NG</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>19</td>
<td>Strip</td>
<td>32.8</td>
<td>10.2</td>
<td>31</td>
</tr>
<tr>
<td></td>
<td>Line</td>
<td>17.0</td>
<td>10.1</td>
<td>25</td>
</tr>
<tr>
<td>NG</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>33/34</td>
<td>Strip</td>
<td>35.8</td>
<td>6.4</td>
<td>18</td>
</tr>
<tr>
<td></td>
<td>Line</td>
<td>38.4</td>
<td>6.7</td>
<td>17</td>
</tr>
<tr>
<td>NG</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>41</td>
<td>Strip</td>
<td>10.7</td>
<td>2.9</td>
<td>27</td>
</tr>
<tr>
<td></td>
<td>Line</td>
<td>12.5</td>
<td>5.9</td>
<td>47</td>
</tr>
</tbody>
</table>

Density = per sq. km
DADS Density Estimates

Impala
DADS Demography Data

• Record the sex and age class for all animals seen
• Sex ratios (# Males: # Females) and age ratios (# Young: # Adult Females)
• Requires experience and training to do accurately
Demography Age Classes

A class = <12 months
B class = 12-24 months
C class = 24+ months
C* class = When there is only one male with a group of females. He is therefore a breeding male.

Impala

Once A class animals are around 5 months old (around April) it becomes difficult to reliably distinguish the classes of females. We therefore only count the males in a breeding herd and double the numbers to account for the females (assuming an even sex ratio).

Juvenile

Sub-adult

Adult
### DADS Demographic Data

#### Females per one adult male

<table>
<thead>
<tr>
<th>Impala</th>
<th>Dry 2013</th>
<th>Wet 2014</th>
<th>Wet 2015</th>
<th>Dry 2015</th>
</tr>
</thead>
<tbody>
<tr>
<td>NG18</td>
<td>2.75</td>
<td>1.24</td>
<td>0.69</td>
<td>2.07</td>
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<tr>
<td>NG19</td>
<td>2.47</td>
<td>3.33</td>
<td>1.82</td>
<td>2.72</td>
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<td>NG33/34</td>
<td>1.59</td>
<td>1.42</td>
<td>0.89</td>
<td>0.95</td>
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<tr>
<td>NG41</td>
<td>2.13</td>
<td>0.35</td>
<td>0.54</td>
<td>2.55</td>
</tr>
</tbody>
</table>

#### Juveniles per one adult female

<table>
<thead>
<tr>
<th>Impala</th>
<th>Dry 2013</th>
<th>Wet 2014</th>
<th>Wet 2015</th>
<th>Dry 2015</th>
</tr>
</thead>
<tbody>
<tr>
<td>NG18</td>
<td>0.11</td>
<td>0.25</td>
<td>0.05</td>
<td>0.08</td>
</tr>
<tr>
<td>NG19</td>
<td>0.10</td>
<td>0.24</td>
<td>0.14</td>
<td>0.06</td>
</tr>
<tr>
<td>NG33/34</td>
<td>0.15</td>
<td>0.27</td>
<td>0.35</td>
<td>0.13</td>
</tr>
<tr>
<td>NG41</td>
<td>0.05</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
</tr>
</tbody>
</table>
Conclusions

• First documented ground-based density estimates for a diversity of herbivore species in northern Botswana?

• Need enough data for rigorous analyses to provide confidence for long-term monitoring decisions

• With time, DADS can complement aerial surveys to assist with wildlife management

• Need to start looking at the larger picture and placing this information in the context of landscape and habitat conditions
Recommendations

We provide several recommendations in our report, but the most relevant:

• Increase the number of concession transects
• Standardize training and field methods across all survey efforts so we may combine data for analyses
• Establish a Monitoring Working Group
• Increase efforts to put population information into a larger context
Part II: Bird Surveys

SAREP monitoring recommended including bird surveys

- Little information on birds in area
- Potentially vulnerable to some impacts such as climate change, habitat loss, poisoning
- Indicator species
- Important economic resource (tourism)
Community Bird Surveys

3 types of surveys
- Birdlife Birds of Concern
- Birdlife Botswana Point Count Surveys
- SAREP Point Count Surveys
Birdlife Birds of Concern

- Opportunistic recording whenever a listed bird is seen during any of our field activities
- 943 birds of concern sightings (2,225 individuals) over 5 seasons
- 14 of 20 birds of concern species identified
- Data provided to Birdlife Botswana
SAREP Point Counts

- Point count surveys added in 2015
- Similar to Birdlife Point Counts
- 9-11 points in transect; exploring differences between 200 – 1000m
- 188 different species, 6,701 individuals seen throughout 2015!
- Found higher diversity near riverine habitats
Bird Survey Conclusions

• Bird surveys provide important information for monitoring
• Provide opportunity to develop bird identification skills in escort guides and students
• Recognition of birds as important components of Botswana’s biodiversity
• Survey protocols still being developed and refined
• Include bird survey topics in recommended Monitoring Working Group
Part III: Community Training and Involvement

All field efforts in collaboration with escort guides for each concession

Training includes

• Implementing standard field protocols for line transect surveys and bird surveys
• Use of GPS, digital laser rangefinder, compass
• Data recording protocols and quality control
• Bird identification by sight and call, recording protocols
• Computer use and data entry protocols
Outcomes

- 38 guides participated in wildlife monitoring activities since Feb 2013.

<table>
<thead>
<tr>
<th>Concession/Trust</th>
<th># Participating Community Escort Guides</th>
<th># Guides Participating in 2 field seasons</th>
<th># Guides Participating in 3 or more field seasons</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sankuyo</td>
<td>7</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>Mababe</td>
<td>17</td>
<td>7</td>
<td>3</td>
</tr>
<tr>
<td>Khwai</td>
<td>13</td>
<td>7</td>
<td>4</td>
</tr>
<tr>
<td>Chobe Enclave</td>
<td>2</td>
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</tbody>
</table>
Recommendations

- Critical to incorporate communities in long-term monitoring efforts
- Continue training of escort guides
- Work closely with head escort guides in order for them to pass on the skills and training
- Offer more advanced training with computer skills
Monitoring Discussion and Recommendations

- The monitoring surveys discussed are all relatively new to region
- With 3-4 years experience, perhaps now is the time to review and refine these protocols
- Monitoring Working Group
  - Review and refine survey protocols now
  - Develop collaborations to improve efficiency and effectiveness within each concession and across the region
  - Ensure standardized protocols and levels of training are consistently applied to every survey effort
  - Single entity (ORI, DWNP, or ?) to receive survey data and provide to designated analyst, allowing combined data to be leveraged for maximum utility
Acknowledgements

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