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Overview

• Population estimates and trend
• Occupancy by females with offspring
• Mortalities and mortality rates

Some results are preliminary
Greater Yellowstone Ecosystem

- National Parks = 10,344 km²
- Primary Conservation Area/Recovery Zone = 23,828 km²
- Demographic Monitoring Area (DMA) = 49,931 km²
Greater Yellowstone Ecosystem

- National Parks = 10,344 km$^2$
- Primary Conservation Area/Recovery Zone = 23,828 km$^2$
- Demographic Monitoring Area (DMA) = 49,931 km$^2$
- Occupied range (2002-2016) = 64,849 km$^2$
Population and Trend Estimation
Number of females with cubs: Chao2 estimator

- Annual counts based on Knight et al. (1995) “rule set”: sightings of unique females with cubs
- Cherry et al. (2007) applied estimator to correct for sighting heterogeneity (Chao2)
- Trend over time
Observation flights 2017

- 54 aerial observation areas
  - Round 1: 54 units
  - Round 2: 40 units
- 184 survey hours
- 369 groups
  - 510 grizzly bears
Females with cubs 2017

- 180 observations
  115 aerial (64%)
  65 ground (36%)
Females with cubs 2017

- 180 observations
  115 aerial (64%)
  65 ground (36%)

- 58 unique females with cubs
  Mean litter size = 1.98
  15 single (25.9%)
  30 twins (51.7%)
  12 triplets (20.7%)
  1 quadruplet (1.7%)
Females with cubs 2017

- 180 observations
  115 aerial (64%)
  65 ground (36%)

- 58 unique females with cubs
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  15 single (25.9%)
  30 twins (51.7%)
  12 triplets (20.7%)
  1 quadruplet (1.7%)

- 57 in DMA
Initial sightings of females with cubs inside and outside DMA 1973-2017
Number of females with cubs 2017 (DMA only)

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Estimate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unique females with cubs</td>
<td>57</td>
</tr>
<tr>
<td>Chao2</td>
<td>64</td>
</tr>
<tr>
<td>Model-averaged Chao2</td>
<td>57</td>
</tr>
</tbody>
</table>
Bias in Chao2 estimator

Schwartz et al. (2008)

<table>
<thead>
<tr>
<th>True no. females with cubs</th>
<th>Chao2 estimate</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>20</td>
<td>16</td>
</tr>
<tr>
<td>40</td>
<td>27</td>
</tr>
<tr>
<td>60</td>
<td>36</td>
</tr>
<tr>
<td>80</td>
<td>44</td>
</tr>
<tr>
<td>100</td>
<td>52</td>
</tr>
</tbody>
</table>

Scatterplot showing the true number of females with cubs vs. the Chao2 estimate.
Annual estimates of females with cubs 1983-2017 (DMA only)
Trend in annual estimates of females with cubs 1983-2017 (DMA only)
Total population estimate (DMA only)

Derived from:

- Model-averaged Chao2 estimate of number of females with cubs
- 2002-2011 vital rates and derived age structure to estimate population segments
## Total population estimate 2017 (Chao2 estimator; DMA only)

<table>
<thead>
<tr>
<th>Population segment</th>
<th>Estimate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Independent females (≥2 yrs old)</td>
<td>250</td>
</tr>
<tr>
<td>Independent males (≥2 yrs old)</td>
<td>250</td>
</tr>
<tr>
<td>Dependent young (cubs and yearlings)</td>
<td>217</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>718</strong></td>
</tr>
</tbody>
</table>
Occupancy by Females with Young
Occupancy by females with young (cubs, yearlings, or 2-year-olds) 2017

- 17 of 18 Bear Management Units (BMUs) occupied during 2017

- 18 of 18 BMUs occupied at least 3 of last 6 years (2012-2017)
Mortalities and Mortality Rates

Photo: J. Smith, D. Scott, MTFWP
Known and probable mortalities 2017

- 46 in DMA
  - 39 human-caused
  - 3 natural
  - 4 undetermined cause
Known and probable mortalities 2017

• 46 in DMA
  39 human-caused
  3 natural
  4 undetermined cause

• 4 outside DMA
  3 human-caused
  1 natural
Known and probable mortalities 2017

- 46 in DMA
  - 39 human-caused
  - 3 natural
  - 4 undetermined cause

- 4 outside DMA
  - 3 human-caused
  - 1 natural

- 1 additional mortality
  (skull found) likely died prior to 2015, sex unknown
Cumulative counts of known and probable mortalities by week 2009-2017
<table>
<thead>
<tr>
<th>Area</th>
<th>Sex</th>
<th>Dependent (&lt;2 years old)</th>
<th>Independent (≥2 years old)</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inside DMA</td>
<td>Female</td>
<td>0</td>
<td>11</td>
<td>11</td>
</tr>
<tr>
<td></td>
<td>Male</td>
<td>3</td>
<td>20</td>
<td>23</td>
</tr>
<tr>
<td></td>
<td>Unknown</td>
<td>12</td>
<td>0</td>
<td>12</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>15</td>
<td>31</td>
<td>46</td>
</tr>
<tr>
<td>Outside DMA</td>
<td>Female</td>
<td>0</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Male</td>
<td>0</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Unknown</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>0</td>
<td>4</td>
<td>4</td>
</tr>
</tbody>
</table>
### Mortality thresholds (2016 Conservation Strategy, Table 2)

<table>
<thead>
<tr>
<th>Total mortality rate</th>
<th>Total Grizzly Bear Population Estimate*</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>&lt;674</td>
</tr>
<tr>
<td>Total mortality rate for independent <strong>FEMALES</strong>.</td>
<td>&lt;7.6%</td>
</tr>
<tr>
<td>Total mortality rate for independent <strong>MALES</strong>.</td>
<td>15%</td>
</tr>
<tr>
<td>Total mortality rate for dependent young.</td>
<td>&lt;7.6%</td>
</tr>
</tbody>
</table>
## Estimated percent mortality for population segments (DMA only)

<table>
<thead>
<tr>
<th>Population segment</th>
<th>Estimated N</th>
<th>Documented mortality</th>
<th>Estimated total mortality</th>
<th>Estimate % mortality</th>
</tr>
</thead>
<tbody>
<tr>
<td>Independent aged females (≥2yrs old)</td>
<td>250</td>
<td>11</td>
<td>20</td>
<td>8.0</td>
</tr>
<tr>
<td>Independent aged males (≥2yrs old)</td>
<td>250</td>
<td>20</td>
<td>33</td>
<td>13.2</td>
</tr>
<tr>
<td>Dependent young (&lt;2yrs old)</td>
<td>217</td>
<td>12</td>
<td></td>
<td>5.5&lt;sup&gt;b&lt;/sup&gt;</td>
</tr>
</tbody>
</table>

<sup>a</sup> Unknown/Unreported estimate is not applied to loss of dependent young

<sup>b</sup> Estimated from documented human-caused mortalities only
Number of mortalities by cause for 2008-2016 (average) and 2017
Known and probable mortality from vehicle strikes 2001–2017
Captures and Known-Fate Monitoring
Grizzly bear captures 2017

- Total captures = 98
  - Research = 61
  - Management = 37
- Individuals bears = 86
  - Females = 26
  - Males = 54
  - Unknown = 6
- New bears = 57
Grizzly bear captures 2015-2017

- **Total captures** = 312
  - Research = 154
  - Management = 158
- **Individuals bears** = 235
  - Females = 79
  - Males = 156
Number of individuals and percent new captures 1998–2017
Grizzly bears radio-monitored 2017

Total monitored = 112
  Adult females = 38

Current = 59
  Females = 37
  Males = 22

Bears missing = 2
Telemetry 2015-2017

**VHF**
- Individuals bears = 161
- VHF locations ≈ 2,600

**GPS**
- Individual bears = 60
- Iridium GPS locations more than 172,000
Body Condition and Genetic Monitoring
Average % body fat by month, 2000–2016 vs. 2017
Genetic monitoring

- Results through 2016
- 1053 individuals genotyped (20 microsatellite markers)
- No evidence of non-GYE ancestry in any of the individuals genotyped to date
Genetic clustering based on 20 microsatellite markers
Food Monitoring
Lake trout removal on Yellowstone Lake, 1998–2017

- **Lake trout number**
- **Gillnet effort unit**
- **Catch/unit effort**

Yellowstone Center for Resources
Spawning cutthroat trout activity on front-country tributary streams 1989–2017
Grizzly bear activity on front-country tributary streams 1989–2017
Army cutworm moths

- 31 confirmed sites
  Multiple observations of bears feeding during more than 1 year

- 14 possible sites
  Single observation of bear(s) feeding
Army cutworm moths 2017

- 438 grizzly bears
- 21 of the 45 sites
- 12 of 58 initial observations of unique females with cubs (21%)
Confirmed moth sites and percent used 1986–2017
Grizzly bear sightings on moth sites observation flights 2004–2017

![Bar chart showing the number of bear sightings and bear groups over the years from 2004 to 2017. The chart displays a significant increase in sightings and groups in 2014.]

Preliminary data – do not cite
Whitebark pine transects 2017

- 21 transects
- 185 trees surveyed
- Average no. of cones/tree = 23.1
Whitebark pine cone production 1980–2017

The bar chart shows the mean cones per tree for each year from 1980 to 2017. The chart indicates variability in cone production, with peaks in 1988 and 1996, and generally lower production in the other years.

Preliminary data — do not cite
Whitebark pine tree mortality on cone production transects 2002–2017

Year

Number of live trees


Preliminary data – do not cite
Summary

• Population
  ▪ High count for females with cubs \((n = 58)\)
  ▪ Population estimate = 718
  ▪ Relatively constant since early 2000s
  ▪ No evidence of bears leaving core of ecosystem

• Mortality
  ▪ Only 8% of mortalities occurred outside the DMA
  ▪ Primary causes inside DMA: hunting related, livestock, and site conflicts
  ▪ 2017 mortality rates in DMA
    ▪ Within thresholds for independent females (8%)
    ▪ Within thresholds for independent males (13%)

• Year of relatively good food supply
  ▪ Good berry production
  ▪ Average whitebark pine cone production
Annual Reports, data, maps, and other products available at IGBST website

Google “IGBST”
Acknowledgments 2017


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• USFWS: S. Becker, L. Connell, S. Conrad, H. Cooley, J. Fortin-Noreus, P. Hnilicka, M. Mazur, S. Stoinski

• USGS: C. Dickinson, M. Ebinger, M. Haroldson, B. Karabensh, M. Kurzen, F. van Manen, V. Villalobos, C. Whitman

• WS: C. Hoover, G. McDougal, M. Foster, K. Meidtke, R. Merrell