Interagency Grizzly Bear Study Team
Research and Monitoring Summary 2016

This presentation contains preliminary data

Do not cite these data

Photography by Jake Davis
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[Logos]
“When you are studying any matter, or considering any philosophy, ask yourself only what are the facts and what is the truth that the facts bear out. Never let yourself be diverted either by what you wish to believe, or by what you think would have beneficent social effects if it were believed. But look only, and solely, at what are the facts.”

– Bertrand Russell
Overview

- Population estimates and trend
- Mortalities and mortality rates
- Occupancy by females with offspring
- Known-fate monitoring
- Food monitoring

Some results are preliminary
Greater Yellowstone Ecosystem

- National Parks = 10,344 km$^2$
- Recovery Zone = 23,828 km$^2$
- Demographic Monitoring Area (DMA) = 49,931 km$^2$
Greater Yellowstone Ecosystem

- National Parks = 10,344 km\(^2\)
- Recovery Zone = 23,828 km\(^2\)
- Demographic Monitoring Area (DMA) = 49,931 km\(^2\)
- Grizzly bear distribution 2000-2014 = 58,914 km\(^2\)

Preliminary data – do not cite
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 2016

- 54 aerial observation areas
  - Round 1: 53 units
  - Round 2: 42 units
  - 1 unit not flown (BMU 38)
- 193 survey hours
- 307 groups (441 grizzly bears)
Females with cubs 2016

- 144 observations
  - 68 aerial (47%)
  - 76 ground (53%)

Preliminary data – do not cite
Females with cubs 2016

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  - 68 aerial (47%)
  - 76 ground (53%)

- 50 unique $F_{COY}$ in the GYE
  - Mean litter size = 1.96
  - Litter sizes
    - 15 single (30%)
    - 22 twins (44%)
    - 13 triplets (26%)

Preliminary data – do not cite
Females with cubs 2016

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- 50 unique $F_{COY}$ in the GYE
  - Mean litter size = 1.96
  - Litter sizes
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- 45 unique females with cubs in DMA

- 9 individuals partially, 5 individuals fully outside the DMA
Initial sightings of females with cubs inside and outside the DMA 1973–2016
Initial sightings of females with cubs 2014–2016

Preliminary data – do not cite
Number of females with cubs 2016 (DMA only)

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Estimate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unique females with cubs</td>
<td>45</td>
</tr>
<tr>
<td>Chao2</td>
<td>50</td>
</tr>
<tr>
<td>Model-averaged Chao2</td>
<td>54</td>
</tr>
</tbody>
</table>
Trend in annual estimates of females with cubs 1983–2016 (DMA only)

- Chao2

Females with cubs vs. Year

Preliminary data – do not cite
Trend in annual estimates of females with cubs 1983–2016 (DMA only)

- Chao2
- Model average

Preliminary data—do not cite
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
## 2016 total population estimate

**Chao2 estimator (DMA only)**

<table>
<thead>
<tr>
<th>Population segment</th>
<th>Estimate</th>
<th>Lower</th>
<th>Upper</th>
</tr>
</thead>
<tbody>
<tr>
<td>Independent females (≥2 yrs old)</td>
<td>238</td>
<td>190</td>
<td>287</td>
</tr>
<tr>
<td>Independent males (≥2 yrs old)</td>
<td>238</td>
<td>186</td>
<td>291</td>
</tr>
<tr>
<td>Dependent young (cubs and yearlings)</td>
<td>213</td>
<td>192</td>
<td>234</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>690</td>
<td>615</td>
<td>764</td>
</tr>
</tbody>
</table>
Bias in Chao2 estimator

Schwartz et al. (2008)

IGBST
Occupancy by females with young (cubs, yearlings, or 2-year-olds) 2016

- 18 of 18 Bear Management Units (BMUs) occupied during 2016
- 18 of 18 BMUs occupied at least 4 of last 6 years (2010-2015)

Preliminary data – do not cite
Grizzly Bear Mortalities and Evaluating Annual Mortality Rates in the DMA
Known and probable mortalities 2016

- 33 known and probable mortalities in DMA
  - 30 human-caused
  - 2 natural
  - 1 undetermined cause
- 20 outside the DMA
  - All 20 human-caused
- 1 additional mortality from 2015 documented, sex unknown

IGBST
## Known and probable mortalities by area, sex, and age class 2016

<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>6</td>
<td>6</td>
<td>12</td>
</tr>
<tr>
<td></td>
<td>Male</td>
<td>2</td>
<td>18</td>
<td>20</td>
</tr>
<tr>
<td></td>
<td>Unknown</td>
<td>1</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>9</td>
<td>24</td>
<td>33</td>
</tr>
<tr>
<td>Outside DMA</td>
<td>Female</td>
<td>1</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>Male</td>
<td>2</td>
<td>14</td>
<td>16</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>3</td>
<td>17</td>
<td>20</td>
</tr>
</tbody>
</table>

*IGBST*
Mortality causes inside and outside of DMA 2016

Preliminary data – do not cite
9 mortalities from vehicle strikes in 2016

- 7 males (5 subadults)
- 2 females (both subadults)
- Average 2001–2015 = 1.9/year
Known and probable mortality from vehicle strikes 2001–2016

**Chart:**
- **Y-axis:** Road kills
- **X-axis:** Year (2001-2016)

The chart shows a bar graph with the number of road kills from 2001 to 2016. The highest number of road kills is observed in 2016.
3 grizzly bears drowned in 2016

- All adult males
## 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 females (≥2yrs old)</td>
<td>238</td>
<td>6</td>
<td>12</td>
<td>5.0</td>
</tr>
<tr>
<td>Independent males (≥2yrs old)</td>
<td>238</td>
<td>18</td>
<td>34</td>
<td>14.3</td>
</tr>
<tr>
<td>Dependent young (&lt;2yrs old)</td>
<td>213</td>
<td>9</td>
<td>34</td>
<td>4.2</td>
</tr>
</tbody>
</table>
Grizzly Bear Captures and Monitoring for Known-Fate Estimation of Population Trend
Grizzly bear captures 2016

- Total captures = 108
  - Research = 59
  - Management = 49
- Individuals bears = 96
  - Females = 33
  - Males = 63
- New bears = 57
Number of individuals and percent new captures 1998–2016

Preliminary data – do not cite
Number of individuals and percent new captures 1998–2016
Research captures 2014–2016

- Total captures = 144

Preliminary data – do not cite
Management captures 2014–2016

- Total captures = 151

Preliminary data – do not cite
Grizzly bears radio-monitored 2016

Total monitored = 106
  - Adult females = 28

Currently radio-marked = 64
  - Females = 30
  - Males = 34
  - Bears missing = 0
VHF telemetry
2014-2016

VHF
- Flight hours = 790
- Observations of radio-marked bears = 548

Preliminary data – do not cite
Estimating body condition (% body fat)

Preliminary data – do not cite
% body fat by month 2000–2015 and 2016

Mean ± 2 SE % Fat

Month

Sex

F

M

Compare 2016

I 2000-2015

Preliminary data – do not cite
% body fat by month 2000–2015 and 2016
Genetic monitoring

- Results through 2014
- Over 900 individuals genotyped (20 microsatellite markers)
- No evidence of non-GYE ancestry in any of the individuals genotyped to date
Foods Monitoring
<table>
<thead>
<tr>
<th>Survey Area</th>
<th>Total carcasses</th>
<th>Elk</th>
<th>Bison</th>
<th>Mule deer, pronghorn, bighorn</th>
<th>Carcasses /km</th>
</tr>
</thead>
<tbody>
<tr>
<td>Firehole</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0.01</td>
</tr>
<tr>
<td>Norris</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Heart Lake</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Mud Volcano</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>0.15</td>
</tr>
<tr>
<td>Northern Range</td>
<td>35</td>
<td>14</td>
<td>4</td>
<td>17</td>
<td>0.22</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>36</strong></td>
<td><strong>14</strong></td>
<td><strong>5</strong></td>
<td><strong>18</strong></td>
<td><strong>0.13</strong></td>
</tr>
</tbody>
</table>
Lake trout removal on Yellowstone Lake 1998–2016

Number (x 1,000) or Effort

Year

Lake trout number

Gillnet effort unit


Yellowstone Center for Resources
Spawning cutthroat trout and grizzly bear activity on front-country tributary streams
1989–2016

Year

Mean cutthroat trout / survey

Mean grizzly activity / survey

Cutthroat Trout

Yellowstone Center for Resources

Preliminary data – do not cite
Spawning cutthroat trout and grizzly bear activity on front-country tributary streams 1989–2016

Yellowstone Center for Resources
Army cutworm moths

- 30 confirmed sites – multiple observations of bears feeding during more than 1 year

- 14 possible sites – single observation of bear(s) feeding

Preliminary data – do not cite
Army cutworm moths

- Observations of 301 grizzly bears on 19 (43%) of the 44 sites
- 26% ($n = 13$) of 50 initial observations of unique females with cubs
Confirmed moth sites and percent used 1986–2016

Preliminary data – do not cite
Confirmed moth sites and percent used 1986–2016
Grizzly bear sightings on moth sites observation flights 2004–2016

No. bears

- Groups
- Bears

Year

- 2004
- 2005
- 2006
- 2007
- 2008
- 2009
- 2010
- 2011
- 2012
- 2013
- 2014
- 2015
- 2016

Preliminary data – do not cite
Whitebark pine transects 2016

- 21 transects
- 185 trees surveyed
- Average no. of cones/tree = 35.9

Preliminary data – do not cite
Whitebark pine cone production 1980–2016
Whitebark pine tree mortality on cone production transects 2002–2016

Live WBP trees

Preliminary data – do not cite
Summary

• Population
  - Population estimate = 690
  - No major change in trend since early 2000s
  - No evidence of bears leaving core of ecosystem

• Mortality
  - 38% of all mortalities occurred outside the DMA
  - Primary causes: livestock, accidental (road kills and drownings), and site conflicts
  - 2016 DMA mortality limits not exceeded to date

• Year of relatively good food supply
  - Low availability of winter-killed carcasses
  - Good berry production
  - Above average whitebark pine cone production
Annual Report, data, maps, and other products available at IGBST website:

Google “IGBST”
Acknowldgments 2016

- MSU: S. Cherry, C. Peck;
- Pilots and Observers: S. Ard, N. Cadwell, J. Ortman, M. Packila, T. Schell;
- Shoshone and Arapaho Tribes: A. Lawson, B. Snyder, W. Thayer;
- USFS: A. Pils, S. Pils, D. Tyers, J. Wilder;
- USGS: C. Dickinson, M. Ebinger, M. Haroldson, B. Karabensh, M. Kurzen, F. van Manen, V. Villalobos, C. Whitman;
- WS: J. Rosst;