Influence of Demographic and Habitat Parameters on Sage-Grouse Chick Survival

Guttery, Dahlgren, Messmer, and Koons
Utah State University
Public Service Statement

Sage-grouse trapping can cause pink eye!!

Hold your bird correctly!!
The Danger Zone
Influence of Demographic and Habitat Parameters on Sage-Grouse Chick Survival

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Utah State University
Study Site

- Parker Mountain, UT
- Approx 100,000 ha
- Primarily grazing land
- Elev = 2,500 to 2,800 m
- Precip = 40 to 50 cm

Utah Greater Sage-Grouse Management Plan 2009
Methods

- Captured hens on/around leks.
- Captured chick soon after hatching.
- 1.5 g suture style transmitter
- Located every other day for 42 days.
- Habitat measurements taken at every other location.
Data and Analysis

- Demographic parameters: Hen Age (Yearling or Adult)
  - Hatch Date (Standardized Ordinal Date)
  - Brood Type (Mixed or Normal)
Brood Mixing
Data and Analysis

- Demographic parameters: Hen Age (Yearling or Adult)
  - Hatch Date (Standardized Ordinal Date)
  - Brood Type (Mixed or Normal)

- Habitat parameters: Cover type (Black or Big Sagebrush)
  - % Shrub Cover (Line Intercept)
  - Mean Shrub Height
  - % Forb Cover (Daubenmire Frame)
  - Mean Forb Height
  - % Grass Cover (Daubenmire Frame)
  - Mean Grass Height
  - PCA
Data and Analysis

• Survival modeled using a known fate max likelihood estimator.

• Allows for variable observation intervals and changes in brood size due to adoption or missing chicks.

• Accounts for lack of independence between brood mates using a quasi-likelihood model.

Data and Analysis: Modeling

Intra-Annual Time Effects

Inter-Annual Time Effects

Demographics (All combinations)

Habitat (Candidate Set)
Results

- Marked 335 chicks from 76 broods over 5 years.
- 10 chicks died as a result of capture injury / transmitter attachment and were excluded from analyses.
- 95 chicks (29.2%) went missing prior to reaching 42 days.
Results

• Brood-mixing occurred in 25 of 76 broods.

• Mixing occurred in 44% of yearling hen broods but only 29% of adult hen broods.

• Mixing occurred through the survival period with most incidences occurring during weeks 2-4.
# Results: Top Models

<table>
<thead>
<tr>
<th>Models</th>
<th>Model Weight</th>
<th>% Reduction in Deviance</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Base Model</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Intercept + Linear Time Trend + Year Effect</td>
<td>--</td>
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</tr>
<tr>
<td><strong>Top Demography Model</strong></td>
<td>0.52</td>
<td>61.9</td>
</tr>
<tr>
<td><strong>BT + HA + HD + (BT × HA) + (BT × HD)</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Top Habitat Model</strong></td>
<td>0.38</td>
<td>63.0</td>
</tr>
<tr>
<td><strong>DST + GH + (DST × GH)</strong></td>
<td></td>
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</tr>
</tbody>
</table>
Results : Top Demo Model

Brood Type × Hen Age
CHICK SURVIVAL IN RELATION TO BROOD TYPE AND HEN AGE
YEAR AND HATCH DATE HELD CONSTANT

CHICK SURVIVAL

CHICK AGE

0.62

0.42
CHICK SURVIVAL IN RELATION TO BROOD TYPE AND HEN AGE
YEAR AND HATCH DATE HELD CONSTANT
Discussion: BT*HA

- Survival of chicks hatched to Adult hens is very steady.
- Survival of chicks hatched to Yearling hens is highly variable.
Discussion: BT*HA

• Why would hatching to a Yearling hen be beneficial?
  • Hen selection

• Why does hatching to an Adult hen result in such stable survival?
  • Higher resource allocation

• Why do chicks hatched to Yearlings hens who engage in brood mixing have 0% survival?
  • These are the stupid chicks
Results : Top Demo Model

Brood Type × Hatch Date
CHICK SURVIVAL IN RELATION TO BROOD TYPE AND HATCH DATE
YEAR AND HEN AGE HELD CONSTANT

CHICK AGE

CHICK SURVIVAL

EARLY, NORMAL
MID, NORMAL

0.55
0.47
CHICK SURVIVAL IN RELATION TO BROOD TYPE AND HATCH DATE
YEAR AND HEN AGE HELD CONSTANT

- EARLY, NORMAL
- MID, NORMAL
- LATE, NORMAL

CHICK AGE

CHICK SURVIVAL

0.55
0.47
0.38
CHICK SURVIVAL IN RELATION TO BROOD TYPE AND HATCH DATE
YEAR AND HEN AGE HELD CONSTANT

CHICK AGE

0.0 0.1 0.2 0.3 0.4 0.5 0.6 0.7 0.8 0.9 1.0

CHICK SURVIVAL

EARLY, NORMAL
LATE, NORMAL
MID, NORMAL
EARLY, MIXED
MID, MIXED
CHICK SURVIVAL IN RELATION TO BROOD TYPE AND HATCH DATE
YEAR AND HEN AGE HELD CONSTANT

CHICK AGE

CHICK SURVIVAL

- **EARLY, NORMAL**
- **LATE, NORMAL**
- **EARLY, MIXED**
- **MID, MIXED**
- **LATE, MIXED**
Discussion: BT*HD

- Survival is lower for later hatching chicks.
- Huge discrepancy between Mixed and Normal broods.
Discussion: BT*HD

• Normal broods maintain a level playing field.

• Hatching early then brood mixing allows one to take advantage of naïve younger chicks.

• Hatching late and then brood mixing results in being the young naïve brood member.
Discussion: Demography

• Protecting adult hens may result in more consistent chick production.

• Brood Mixing appears to be fairly common and important in chick survival.
  • Why does it happen?
    • Hen initiated?
    • Chick initiated?
    • Random?
  • Why is it more common in broods of Yearling hens?

• Is adoption into marked broods occurring?

• Characteristics of adoptive hens.
Results: Top Habitat Model

Shrub Type × Grass Height
CHICK SURVIVAL IN RELATION TO SHRUB TYPE AND GRASS HEIGHT
YEAR HELD CONSTANT

CHICK SURVIVAL

CHICK AGE
CHICK SURVIVAL IN RELATION TO SHRUB TYPE AND GRASS HEIGHT
YEAR HELD CONSTANT

- BLACK, SHORT
- BLACK, MEDIUM
- BLACK, TALL
- BIG, SHORT
- BIG, MEDIUM

CHICK SURVIVAL

0.65
0.54
0.39
0.30
0.26

CHICK AGE
Discussion: Habitat

• Black sagebrush appears to be very important.
  • Possibly related to food sources.
• Big sagebrush with tall grass may provide good escape cover.
• Surprising, forb cover did not appear in any top models.
Conclusions

• The importance of black sagebrush has been under appreciated.

• Temporal patterns in chick survival exist and are significant.

• The influence of Hen Age and Brood Type on chick survival are surprising and difficult to explain.

• Overall average survival to 42 days was 39%.
Questions