THE RUSTY BLACKBIRD BLITZ: PREDICTING THE ENVIRONMENTAL NICHE OF WINTERING & MIGRATING RUSTY BLACKBIRDS

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Overview

1) Goal: Predict hot spots for large flocks of Rusty Blackbirds

2) Habitat distribution modeling: The pros and cons of the MaxEnt approach

3) Methods (Model development)

4) Results
Thinking about niche ...
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Using flocking behavior to inform niche
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• Benefits of flocking
  • Anti-predatory behavior
  • Local enhancement
• The relationship between flock size and niche
1) Does environmental niche width decrease with flock size?

2) Do different flock sizes represent different environmental niches?

3) Which environmental variables best predict the distribution of Rusty Blackbird flocks?
Methods: Distribution modeling overview

• **MaxEnt limitations**, models:
  – Describe distribution in realized niche space
  – Tend to be overfit
  – May be heavily influenced by sampling bias
  – Observations are spatially autocorrelated
Model building: observational data

- Data collected from RUBL Blitz and eBird
- Summarize by date and flock size classes (Winter vs. Migration!)
- Extracted to 4 km resolution grid
Model building: Environmental data

- Land cover: US GAP Analysis Project, 30 m resolution
  - Reclassified
  - Aggregated to 4 km resolution

- Climate: precipitation (ppt) and minimum temperature (tmin): 4 km resolution
  - Winter: Mean across period
  - Spring: Mean within sampling periods
Model building/processing example: Black Belt Alabama

- Reclassified land cover
- Binary land cover, floodplain
- Proportional land cover

Maximum entropy model output: Probability of habitat suitability
Model building

• Sampling bias:
  – **Background points** generated from non-RUBL observations with eBird during sampling periods.

• Model overfitting
  – Interactions and quadratic terms added individually prior to modeling
  – AIC used for selection of beta parameter
Results: Winter Blitz
Probability maps: Winter

- Small
- Medium
- Large
Does niche width vary by flock size?

Small flocks | Medium flocks | Large flocks

![Maps showing habitat suitability for different flock sizes.](image-url)

- **Predicted/Expected ratio** vs **Suitability**
  - Small flocks: The ratio is lower at lower suitability values and increases sharply as suitability increases.
  - Medium flocks: A similar trend is observed, with a more gradual increase.
  - Large flocks: The ratio increases significantly more rapidly at lower suitability levels, indicating a wider niche width for larger flocks.

Legend:
- **UNFIT**: Blue
- **Marginal Habitat**: Yellow
- **Suitable Habitat**: Orange
- **Optimal Habitat**: Red
Do different flock sizes occupy different realized niche space?

- **Large vs. small flocks**
- **Large vs. medium flocks**
- **Small vs. medium flocks**
Variable contribution: Winter

Variable contribution (%)

Relative variable contribution

Flock size Class

Small	Medium	Large

Small	Medium	Large

Other	Highly developed	Pasture	Precipitation	Row crop	Floodplain	Minimum temperature
Which environmental variables contribute the most to habitat suitability for small, medium, and large flock observations?
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Conclusions: Winter

1. Environmental “niche width” decreases with increasing flock size but was similar for medium and large flocks.

2. Realized ecological niches differed across flock size classes.

3. **Minimum temperature** and **floodplain forest** were most predictive of the RUBL distributions across flock size classes.

4. For large flock and individual sightings, Blitz data improved suitability estimates.
Aside: Did Blitz data improve suitability estimates?
Results: Spring Migration Blitz
Period 1: March 1 - 11
Period 2: March 12 - 25
Period 3: March 26 – April 8
Period 4: April 9 – April 22
Period 5: April 23 – May 5
Period 1:
March 1 - 11
Period 2: March 12-25
Period 2: March 12-25
Period 2:
March 12 - 25
Period 2: March 12 - 25
Period 2: March 12-25
Period 3: March 26 – April 8
Period 3: March 26 – April 8

Habitat suitability

- flood
- forh
- other
- tmin
- weth
- wetw

Variable contribution (%)

- large
- medium
- small

Flock size

- small
- medium
- large

Average minimum temperature

- large
- medium
- small
Period 3: March 26 – April 8
Period 4: April 9 – April 22
Period 4: April 9 – April 22
Period 5: April 23 – May 5
Period 5: April 23 – May 6
Period 5: April 23 – May 6

Habitat suitability

- flood
- forh
- other
- tmin
- weth
- wetw

Variable contribution (%)

- Flock size class

Predicted/Expected

- large
- medium
- small

Average minimum temperature

-20 -10 0 10 20
Aside: An interesting temperature relationship
Aside: An interesting temperature relationship

![Graph showing temperature relationship](image-url)
Aside: An interesting temperature relationship
Aside: An interesting temperature relationship
Aside: An interesting temperature relationship
Conclusions: Spring

1. Environmental “niche width” decreases with increasing flock size but was similar for medium and large flocks.

2. Realized ecological niches differed across flock size classes.

3. Minimum temperature and was most predictive of the RUBL distributions across flock size classes – importance of other wetland types!

4. For large flock and individual sightings, Blitz data improved suitability estimates.