Abundance, distribution, and habitat relationships of Grace’s Warblers and Red-faced Warblers in pine forests of New Mexico
Conservation Status

Grace's Warbler - *Setophaga graciae*
Red-faced Warbler - *Cardellina rubrifrons*

- USFWS: National and SW Region Bird of Conservation Concern
- NMDGF: Species of Greatest Conservation Need
- PIF: GRWA on National Yellow Watch List (reverse decline) for species of high conservation concern at continental, range-wide scale (RFWA not on national watch list)
- NMACP: Level 1 Priority Species of Conservation Concern

Vulnerability: small populations and restricted distributions, magnitude of long-term population declines, threats to breeding and non-breeding areas
Population Trends

GRWA: decline in NM of -2.05% per year since the 1960s (USGS/BBS 2017)
52% loss of range-wide population since 1970 (PIF Landbird Conservation Plan 2016)

Source: USGS/BBS Data

RFWA: BBS sample size too small to estimate trends
Breeding Distribution

**Grace’s Warbler**

**Red-faced Warbler**

(Stacier and Guzy 2002)

(Martin and Barber 1995)
Habitat

**Grace's Warbler**

- Ponderosa pine specialist
- Dry, park-like habitats
- Mesas and canyon bottoms

**Red-faced Warbler**

- Ponderosa pine, Douglas fir, fir, spruce with oak or aspen, maple component
- Montane riparian
- Mesic drainages, canyon bottoms, steep forested slopes

High elevation (1,800-2,800 m) pine and pine-oak forests
Study Area

Survey Route Locations

Miles

2015
Sandia
Manzano
San Mateo
Magdalena
Zuni
Jemez Mtns.

Cibola NF
Santa Fe NF
Study Area

2016
San Juan
Jemez
Sangre de Cristo
Sacramento Mtns.

Carson NF
Santa Fe NF
Lincoln NF
Study Area

2017
- Black Range
- Pinos Altos Range
- Gallo
- Mogollon
- San Francisco
- Tularosa Mtns.
- Gila NF
- Apache NF
Methods

71 routes – 2,432 points – 136 surveys, 2015-2017

• 10 min point counts, 3 time intervals for detection probability, 100 m survey radius

• Density estimated using time-removal modeling

• Population size calculated from densities and suitable habitat
Results

State-wide, in ponderosa pine, pine-oak, and mixed-conifer forests:

- 125 species
- 24 SGCN
- 28,235 bird records

In total:

- 1,508 Grace’s Warbler detections
- 447 Red-faced Warbler detections
Distribution

Grace’s Warblers were widely distributed, detected at 46% of 2,432 survey points

- all project areas
- along every survey route
- elevations 2,059-2,789 m (6,755-9,150 ft)
Distribution

Red-faced Warbler widely distributed in mtn ranges where they occur, detected at 27% of 1,312 points in SW and south-central NM

• 33 of 39 routes

• elevations 2,067-2,761 m (6,781-9,058 ft)

• more broadly distributed in Gila region (29% of all points) than in study in Sky Island mtns of SE Arizona, detected at 24% of points in pine-oak, ponderosa pine, and mixed-conifer forests (Kirkpatrick et al. 2006)
## Density

<table>
<thead>
<tr>
<th>National Forest</th>
<th>Ranger District</th>
<th>Grace's Warbler</th>
<th>Red-faced Warbler</th>
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</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>D ± SE</td>
<td>D ± SE</td>
</tr>
<tr>
<td>Carson</td>
<td>Camino Real</td>
<td>0.28 ± 0.01</td>
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<tr>
<td></td>
<td>El Rito</td>
<td>0.31 ± 0.03</td>
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<tr>
<td></td>
<td>Tres Piedras</td>
<td>0.31 ± 0.03</td>
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<tr>
<td></td>
<td>Questa</td>
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<tr>
<td></td>
<td>Canijilon</td>
<td>0.30 ± 0.02</td>
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<td></td>
<td>Jicarilla</td>
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<td>Santa Fe</td>
<td>Espanola</td>
<td>0.38 ± 0.004</td>
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<tr>
<td></td>
<td>Jemez</td>
<td>0.29 ± 0.08</td>
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<td></td>
<td>Pecos-Las</td>
<td>0.20 ± 0.01</td>
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<tr>
<td></td>
<td>Vegas</td>
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<tr>
<td></td>
<td>Cuba</td>
<td>0.28 ± 0.04</td>
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<tr>
<td></td>
<td>Coyote</td>
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<tr>
<td></td>
<td>Sandia</td>
<td>0.34 ± 0.05</td>
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<td></td>
<td>Mountainair</td>
<td>0.39 ± 0.02</td>
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<td></td>
<td>Mt. Taylor</td>
<td>0.28 ± 0.04</td>
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<tr>
<td></td>
<td>Magdalena</td>
<td>0.14 ± 0.008</td>
<td>0.14 ± 0.01</td>
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<tr>
<td></td>
<td>Sacramento</td>
<td>0.14 ± 0.01</td>
<td>0.04 ± 0.01</td>
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<td></td>
<td>Smokey Bear</td>
<td>0.14 ± 0.01</td>
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<tr>
<td></td>
<td>Guadalupe</td>
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</tr>
<tr>
<td>Cibola</td>
<td>Black Range</td>
<td>0.20 ± 0.02</td>
<td>0.16 ± 0.02</td>
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<tr>
<td></td>
<td>Glenwood</td>
<td>0.07 ± 0.005</td>
<td>0.21 ± 0.007</td>
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<td></td>
<td>Reserve</td>
<td>0.21 ± 0.05</td>
<td>0.13 ± 0.001</td>
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<tr>
<td></td>
<td>Silver City</td>
<td>0.15 ± 0.03</td>
<td>0.05 ± 0.01</td>
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<tr>
<td></td>
<td>Wilderness</td>
<td>0.15 ± 0.01</td>
<td>0.13 ± 0.02</td>
</tr>
<tr>
<td></td>
<td>Quemado</td>
<td>0.13 ± 0.02</td>
<td>0.03 ± 0.003</td>
</tr>
<tr>
<td></td>
<td>Douglas</td>
<td>0.15 ± 0.03</td>
<td>0.05 ± 0.01</td>
</tr>
</tbody>
</table>

0.39 singing birds ha⁻¹

0.07 singing birds ha⁻¹

0.21 singing birds ha⁻¹

0.03 singing birds ha⁻¹
Density Distribution

The graph illustrates the density distribution of singing birds across different locations, specifically in Carson, Santa Fe, Cibola, Apache, Gila, and Lincoln. The density is measured in singing birds per hectare (ha). The graph shows two categories: GRWA and RFWA, represented by black and gray dots, respectively. The density values range from 0.0 to 0.4 singing birds per hectare, with error bars indicating variability. Locations such as El Rito, Tres Piedras, Camino Real, Esparaza, Jemez, Pecos Las Vegas, Sandia, Mt. Taylor, Mountainair, Magdalena, San Mateo, Quemado, Reserve, Glenwood, Black Range, and Silver City are indicated along the X-axis, with North (N) and South (S) directions indicated at the bottom of the graph.
## Population Size

<table>
<thead>
<tr>
<th>National Forest</th>
<th>Grace's Warbler</th>
<th>Red-faced Warbler</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carson</td>
<td>96,069 (83,766-108,372)</td>
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<tr>
<td>Santa Fe</td>
<td>143,563 (107,476-179,650)</td>
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<tr>
<td>Cibola</td>
<td>106,963 (82,790-131,137)</td>
<td>12,507 (10,493-14,522)</td>
</tr>
<tr>
<td>Lincoln</td>
<td>26,496 (22,607-30,384)</td>
<td>5,232 (1,737-8,727)</td>
</tr>
<tr>
<td>Gila</td>
<td>115,239 (80,045-150,432)</td>
<td>93,472 (76,000-110,944)</td>
</tr>
<tr>
<td>Apache</td>
<td>23,236 (14,354-32,117)</td>
<td>6,266 (5,160-7,372)</td>
</tr>
<tr>
<td>Coronado</td>
<td>92 (54-130)</td>
<td>35 (17-52)</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>511,657 (391,092-632,222)</td>
<td>117,512 (93,407-141,617)</td>
</tr>
</tbody>
</table>

~28% ~23% ~85%
Habitat Relationships

- Presence-absence data, GIS datasets
- Multi-scale occupancy estimation used to model species-habitat relationships
- Preliminary results
PRELIMINARY Habitat Relationships
GRWA

Overall occupancy ($\psi$)
PRELIMINARY Habitat Relationships
GRWA

Overall occupancy (ψ)
PRELIMINARY Habitat Relationships
GRWA

Overall occupancy ($\psi$)

CARLOS QUEZADA

Proportion of plot with tree canopy height 5-10m

Occupancy

0.0 0.2 0.4 0.6 0.8 1.0

0.0 0.2 0.4 0.6 0.8 1.0

0.0 0.2 0.4 0.6 0.8 1.0
PRELIMINARY Habitat Relationships
GRWA

Local availability (theta (Θ))
PRELIMINARY Habitat Relationships
GRWA

Local availability (theta (Θ))

![Graph showing the relationship between the proportion of Ponderosa Pine Forest occupancy and local availability.](image)
PRELIMINARY Habitat Relationships
RFWA

Overall occupancy ($\psi$)
PRELIMINARY Habitat Relationships

Overall occupancy (ψ)
Overall occupancy ($\psi$)
Local availability ($\theta$)
Conservation Planning

- Baseline assessments of density and population size using statistically rigorous methods
- Population status
- Monitor changes in populations
- Evaluate impacts of disturbance or habitat restoration
- Evaluate effectiveness of conservation actions and management strategies
Additional density estimates
(given sample sizes and estimates for ponderosa pine, pine-oak, or mixed-conifer habitats are of biological interest)

• Priority SGCN
  Virginia’s Warbler \((n = 125)\), Pygmy Nuthatch \((n = 1,186)\), Pinyon Jay \((n = 118)\), Western Bluebird \((n = 567)\), Clark’s Nutcracker \((n = 94)\)

• Common species with significant declines in NM
  Mountain Chickadee \((n = 1,805)\), Violet-green Swallow \((n = 174)\), Steller’s Jay \((n=1,341)\)

• Species with high threats in NM
  Brown Creeper \((n = 149)\), House Wren \((n = 397)\), Chipping Sparrow \((n = 462)\)

• Species of concern with high stewardship responsibility in NM
  Broad-tailed Hummingbird \((n = 587)\), Townsend’s Solitaire \((n = 167)\), Bushtit \((n = 73)\),
  Green-tailed Towhee \((n = 117)\), Band-tailed Pigeon \((n = 82)\), Olive Warbler \((n = 63)\)

• Species of research, conservation, or management interest
Surveys conducted by Envirological Services Inc.: Kirsten Cruz-McDonnell, Octavio Cruz-Carretero, Corrie Borgman, and Ken Babcock, with support by Marianne Wootten. Special thanks to Ginny Seamster and Peggy Darr for their support and interest in this project. Funding provided by the New Mexico Department of Game and Fish Share with Wildlife Program and the U.S. Fish and Wildlife Service State Wildlife Grant Program.