Beyond occurrence: Monitoring bird populations with atlas data.  
*Insights from the Second Atlas of Breeding Birds in Ohio*

Matthew Shumar  
The Ohio State University
Birds as Environmental Indicators

- Birds can be effective indicators of environmental conditions

- Many species visible and/or vocal and can be surveyed
Management Goals

• Partners in Flight
  • Ensure an active scientifically-based conservation design process that identifies and develops solutions to threats and risks to landbird populations

• USFWS Migratory Bird Program
  • ensure long-term ecological sustainability of all migratory bird populations
Need for long-term population data

- Broad-scale programs are needed to monitor population trends for both sensitive and common species.

How do biologists acquire broad-scale, long-term data?

Red-winged Blackbird

Ohio BBS trend for RWBL
Monitoring programs

- N. American Breeding Bird Survey (1966)
- Christmas Bird Count (1900)
- Bird banding
- Breeding Bird Atlases

*These data wouldn’t be collected without Citizen Science!*
Citizen Science - volunteers, often with less formal training in the sciences, collect research-related observations.
Unpaid volunteers vs. paid surveyors

lower cost

simpler design

{ }

higher cost

advanced methods
Citizen Science & the Future

Citizen Science is growing exponentially:
- Use of internet for education, planning, data entry, recruit/retain
- Advances in Smart Phone technology and GPS allow participants to upload geo-referenced observations

A few current examples:
- iNaturalist
- eBird
**Avian Citizen Science at Cornell**

**eBird** is a program that allows birders to submit and keep track of their bird observations.

**Great Backyard Bird Count** is a 4-day count in mid-February. In 2013 GBBC went global for the first time. Over 35,000,000 birds were reported, including 3600 species from over 100 countries!!
Citizen Science is not new!

Robert Marsham (1708-1797), British naturalist recorded phenology of 27 spring-time events (arrival dates of migrant birds, first flowering & bud break dates). Considered the Father of Phenological Studies.

Generations of his family continued the practice and now the Marsham Family Record is a nearly 300-year data set!
Avian Citizen Science

North American Breeding Bird Survey

>4,100 BBS routes in North America
Avian Citizen Science

Breeding Bird Atlases

- Grid-based distribution surveys
- Volunteers record breeding bird data within Atlas blocks
- Fine-scaled data, multi-species
History of Breeding Bird Atlases

- Concept originated in the U.K.
- Atlases began in U.S. in mid 1970s (Massachusetts, Vermont)
- 43 states & 8 provinces have completed or initiated atlases
Second Breeding Bird Atlases

- National interest in repeating state atlases
- Comparisons over a broad temporal scale (~25 yrs)
- Fairly new resource for Ornithology in North America (e.g. Ontario, NY, PA, VT, MI)

American Redstart

Photo by Matthew Shumar
Second Breeding Bird Atlases

- Increase in peer-reviewed papers using BBA
- 2\textsuperscript{nd} Atlases important given need to quantify impacts of environmental change and make informed conservation decisions

Research involving BBA data

- Interpreting bird atlas data using logistic models: an example from Lesotho, Southern Africa. \textit{Osborne and Tigar 1992}

- Can bird data be used to estimate population size? A case study using Namibian endemics. \textit{Robertson et al. 1994}

- The use of BBA and remotely sensed data provides a means to determine the minimum area of different land cover types needed for species persistence. \textit{Bongard 2008}

- Poleward shifts in breeding bird distributions in New York State. \textit{Zuckerberg et al. 2009}
Ohio’s First Breeding Bird Atlas

- Fieldwork from 1982-1987
- Coordinated by Ohio Division of Natural Areas and Preserves
- Bruce Peterjohn & Dan Rice (1991)

Photo courtesy of the Ohio Division of Natural Areas & Preserves
Ohio’s First Breeding Bird Atlas

- Species accounts with distribution maps
- Focus on natural history and distribution
  - *no abundance data*

Chestnut-sided Warbler

*photo by Matthew Shumar*
Ohio Breeding Bird Atlas II

- Ohio is among 15 states conducting second BBAs
- Field work: 2006-2011
- ~25 years since the first Ohio Breeding Bird Atlas
• ODNR-Division of Wildlife
• OSU School of Environment & Natural Resources
• U.S. Fish & Wildlife Service
Project Staff

- Paul Rodewald, Ph.D., Principal Investigator / Project Director
- Matthew Shumar, M.S., Research Assoc./Project Coordinator
- Aaron Boone, M.S., Research Assoc./Project Coordinator
- Erin Cashion, M.S., Research Aide
- Katharine Batdorf, M.S., Graduate Research Assistant
- Andrew Wilson, Ph.D., Abundance Analysis
- Nathan Stricker, M.S., Publication Committee
- Jim McCormac, Publication Committee
- David Slager, M.S., Publication Committee
- Molly McDermott, Ph.D., Publication Committee
- + ~30 seasonal field technicians
- + ~1,000 volunteers
Organizational Support

- Ohio Ornithological Society
- 2nd Pennsylvania Breeding Bird Atlas
- Cornell Lab of Ornithology

...and many other nature clubs, Audubon groups
OBBA II - Project Goals

- Increase public interest and understanding of birds
  - Engage birders, outdoor enthusiasts, and other Ohioans
  - ~100 presentations to groups around state
OBBA II - Project Goals

- **Determine status & distribution of breeding birds in Ohio**
  *(similar to first OBBA)*

Black-and-white Warbler
photo by Matthew Shumar

Black-and-white Warbler nest
photo by Matthew Shumar
OBBA II Coverage

- Survey all atlas blocks (4,437)
- Only 1 in 6 blocks surveyed during first atlas (1982-1987)
- Emphasis on “priority blocks”
What is an Atlas block?

- Survey grid created by dividing USGS Topographic Quads into 6 Atlas Blocks
OBBA II - Project Goals

Evaluate changes in Distributions between 1st and 2nd Atlases

...timely information given current concern about global climate change
OBBA II - Project Goals

Estimating bird abundance

- 8 point-counts in \( \frac{1}{2} \) total blocks
- Trained surveyors collect data
- Estimating detectability

*Farnsworth et al. 2002*
OBBA II – Abundance Surveys

Breeding Bird Survey
~3,450 Points (69 Routes)
within 654 blocks (15%)

OBBA II Abundance Surveys
~14,391 Points
within 1,904 blocks (43%)
OBBA II - Abundance Analyses

- Species specific removal/distance models
  - variable buffer for habitat covariates according to $R_{\text{max}}$ in model
  - key environmental covariates for each species
  - diel and seasonal corrections
- Adjusts for roadside biases
- Accounts for observer/spatial variation

*Willow Flycatcher*

*Indigo Bunting*

\[ y = 0.0744e^{0.193x} \]
\[ R^2 = 0.6755 \]

\[ y = 0.0073x - 0.581 \]
\[ R^2 = 0.5314 \]

*see Wilson et al. 2012 (Pennsylvania BBA 2)*
OBBA II - Abundance Results

Benefits:

• Statewide population estimates
• Baseline data to test for future population change
• Abundance contour maps
Since 2006...

- 4,437 blocks have data (100%)
- ~200 breeding species
- 197 “confirmed” breeders
- >1,000,000 observations
- >70,000 effort hours
- >400,000 miles
- ~14,400 abundance surveys

Photo courtesy of The Columbus Dispatch
Survey Coverage
Survey Coverage
Survey Coverage
Survey Coverage
What are we learning about birds in Ohio?
1. Evidence of species recoveries for Ohio

Bald Eagle
photo courtesy of the Ohio Division of Wildlife
1. Evidence of species recoveries for Ohio

Bald Eagle

photo courtesy of the Ohio Division of Wildlife

OBBA II Distribution Results (all blocks)
2. Evidence of range expansions: New breeding species for Ohio

- 5 new species
  - Canvasback
  - Common Merganser
  - Black-necked Stilt
  - Mississippi Kite
  - Eurasian Collared-Dove
2. Evidence of range expansions: Returning breeding species for Ohio

Four species not known to have bred in 50-100 years

- Merlin
- Purple Gallinule
- Common Raven
- Black-throated Blue Warbler

Black-throated Blue Warbler
photo by Molly McDermott

Common Raven
photo by Aaron Boone
3. Species showing population declines or range contractions

Northern Bobwhite

Change results (priority blocks only)
3. Species showing population declines or range contractions

Northern Bobwhite
photo courtesy of the Ohio Division of Wildlife

OBBA II Distribution Results (all blocks)
3. **Species showing population declines or range contractions**

- **Kentucky Warbler**
  - Photo courtesy of the USFWS
3. Species showing population declines or range contractions

Kentucky Warbler

Photo courtesy of the USFWS

OBBA II Distribution Results (all blocks)
4. Range expansions predicted/expected from climate change

Northern Parula

photo by Dan Pancamo

Change results (priority blocks only)
4. Range expansions predicted/expected from climate change

Northern Parula

photo by Dan Pancamo

OBBA II Distribution Results (all blocks)
5. Southern range expansions

Yellow-bellied Sapsucker (Change map)

- Ohio Endangered to Species of Concern

Change results (priority blocks only)
5. Southern range expansions

Yellow-bellied Sapsucker (2006-2011)
- Ohio Endangered to Species of Concern


OBBA II Distribution Results (all blocks)
Distributional changes in Ohio’s breeding birds: the importance of climate & land cover change

Katharine E. Batdorf - M.S. Thesis Defense
School of Environment & Natural Resources - The Ohio State University

Co-advisors: Paul Rodewald, Stephen Matthews
Distributional changes in Ohio’s breeding birds: the importance of climate & land cover change

- K. Batdorf 2012
  - Have the distributions of Ohio’s breeding birds responded to recent climate & land cover change?
Distributional changes in Ohio’s breeding birds: the importance of climate & land cover change

- Looked at 17 breeding species
- Climate ‘signal’ weaker than expected in explaining distributional changes, over the 25-year study
- Land cover change, esp. in forest and agric. lands was most important in characterizing current distributions

Atlas 1
1982-1987

Atlas 2
2006-2011

~25 Years
Distributional changes in Ohio’s breeding birds: the importance of climate & land cover change

- K. Batdorf 2012
  - Have the distributions of Ohio’s breeding birds responded to recent climate & land cover change?

Landcover or Climate alone may not provide complete insight into trends
## Individual species shifts

<table>
<thead>
<tr>
<th>Common Name</th>
<th>Distribution Position</th>
<th>Boundary Shift (km)</th>
<th>Center Shift (km)</th>
<th>Change in Occurrence</th>
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</thead>
<tbody>
<tr>
<td>Blue Grosbeak</td>
<td>Southerly</td>
<td>126.02</td>
<td>25.32</td>
<td>1.20</td>
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<td>Black Vulture</td>
<td>Southerly</td>
<td>118</td>
<td>41.26</td>
<td>1.58</td>
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<td>Northern Parula</td>
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<td>25.66</td>
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<tr>
<td>Pine Warbler</td>
<td>Southerly</td>
<td>94.66</td>
<td>44.03</td>
<td>0.23</td>
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<td>Sharp-shinned Hawk</td>
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<td>53.6</td>
<td>26.96</td>
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<td>Carolina Wren</td>
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<td>Prothonotary Warbler</td>
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<td>29.25</td>
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<td>Red-breasted Nuthatch</td>
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<td>Yellow-breasted Chat</td>
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<td>-25.05</td>
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<td>Swamp Sparrow</td>
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<td>1.00</td>
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</tbody>
</table>

*see Batdorf 2012 (OSU M.S. Thesis)*
Data Availability

- >1,000,000 observations
- currently by request \textit{(through website)}
- book results - 2014
- collaborating with NY & VT on threshold analyses
- future collaboration with PA
- online database/mapping tool ~2014?
Citizens contributing to science & conservation

- Helped create a large, fine-scale data set
- Important for conservation decision-making
- A better data set to assess 25-yr change in 2030!!
Citizens contributing to science & conservation

- Second Ohio Breeding Bird Atlas book ...due in 2014!
- Currently working on writing & analysis
- 200+ species, 600+ pp

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