**Breeding bird monitoring data from the Midwestern USA**

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**Summary**

Many avian diversity metrics exhibit negative trends worldwide. The International Union for Conservation of Nature’s Red List Index reveals a steady deterioration in the conservation status of birds globally over the past three decades (Lees et al. 2022). Overall, 21% of bird species worldwide are currently prone to extinction and 6.5% are functionally extinct (i.e., contributing negligibly to ecosystem processes) (Sekercioglu et al 2004). It has been estimated that by 2100, 6 –14% of all bird species will be extinct, and 7–25% will be functionally extinct (Sekercioglu et al 2004 et al 2004).

In North America, the avifauna has experienced a loss of almost 30% of its overall abundance over the past 50 years (Rosenberg et al. 2019). Grassland birds had the largest reduction of abundance (53%), with 74% of grassland species in decline (Rosenberg et al. 2019). Factors driving declines in bird species richness and abundance include increasingly synergistic interactions among threats such as habitat loss, climate change, and overexploitation (Lees et al. 2022, Lauck et al. 2023).

Long-term monitoring is critical in documenting bird population trends and determining appropriate conservation actions (Dunn 2002). Point counts, in which an observer records birds seen or heard from a single point for a standardized time period, represent the most widely used avian survey method (Rosenstock et al. 2002, Thompson 2002). The Heartland Inventory and Monitoring Network (HTLN) of the U.S. National Park Service (NPS) monitored bird populations using point count methodology in 12 NPS units in the Midwestern USA (Table 1, Figure 1). These park units are located within seven different Bird Conservation Regions (i.e., ecologically distinct regions in North America with similar bird communities, habitats, and resource management issues; https://nabci-us.org/resources/bird-conservation-regions/). A peer reviewed protocol (Heartland Inventory and Monitoring Network 2023a), along with 10 standard operating procedures (SOPs), are used to ensure consistency in data collection among park units and over time.

The data obtained from this protocol are used to produce park-specific status and trend reports at intervals of 4 years, which are published in the NPS National Resource Report Series (https://www.nps.gov/im/reports-nrr.htm) (also available at https://irma.nps.gov/Portal/; enter search terms “HTLN” and “birds”). An evaluation of the effect of grid spacing on observed species richness has also been published (Morrison and Peitz 2020) using data from this dataset.

**Data description**

This dataset contains bird observations collected using a long-term monitoring protocol (Heartland Inventory and Monitoring Network 2023a) at 12 NPS units in the Midwestern U.S. (Table 1, Figure 1). Most parks were a mixture of grassland and woodland habitat types; the predominant habitat type is listed in Table 1. The dataset contains 65,962 records, including 212 named species representing 47 avian families. The dataset also contains data on distances from observers, and information on prevailing conditions at the time of the surveys, including temperature, wind, rain, cloud cover and ambient noise. See Table 2 for a complete description of all data fields.

The earliest data were collected in 2001, and the most recent available data were collected in 2022. Surveys were not conducted at all parks in all years (see Table 3 for a comprehensive list). This long-term monitoring effort has no scheduled end date, and the database will be continuously updated as additional data become available.

The dataset (Peitz 2023), along with a metadata file, can be found at: https://doi.org/10.57830/2300777. The dataset is a CSV plain text file “BirdObservationsThru2022\_3.csv”. Metadata are in the XML file “HTLNBreedingBird\_metadata.xml”. This dataset is released to the public domain under U.S. Government Works No Rights Reserved (see: http://www.usa.gov/publicdomain/label/1.0/).

**Methods**

At each park unit, a sample frame was established that excluded developed areas (e.g., buildings, parking lots, roads). Birds were surveyed using a point count method. Survey points were selected by overlapping a systematic grid originating from a random starting point on park maps. The orientation of the systematic grid at most park units was rotated to prevent survey points from aligning with artificial features (e.g., roads, fences) oriented along cardinal directions. Spacing between points ranged from 100 to 400 m, depending upon park size (Table 1). The number of survey points at a park ranged from 27 to 259 (Table 1). Maps of each park and locations of all survey points are available at Heartland Inventory and Monitoring Network (2023a). See Standard Operating Procedure #3, Establishing and Marking Sample Plots (Heartland Inventory and Monitoring Network 2023b), for detailed information on the establishment of survey grids.

All birds seen or heard at each survey point, regardless of distance from the observer, were recorded during a 5-minute sampling period, along with an estimate of distance from the observer. Laser range finders (Elite 1600, Bushnell, Kansas, USA) were used to measure distances when birds could be seen. Birds flying over plots, and those seen or heard while walking to or from plots were also recorded and coded separately in the dataset. For most species, individuals were recorded as separate observations. For species that occurred in flocks, flock size was used as the record. Field surveys occurred during the breeding season (early May to mid- June). Surveys were conducted from first light to 4 h after sunrise. See Standard Operating Procedure #4, Conducting the Variable Circular Plot Count (Heartland Inventory and Monitoring Network 2023c), for a full description of field data collection procedures.

Field data forms were checked for completeness either before leaving a site or within 24 hours of data recording. Following data entry, computer records were verified for accuracy against paper field data forms. See Standard Operating Procedure#6, Data Management (Heartland Inventory and Monitoring Network 2023d), for a full description of data verification and validation procedures.

**User Notes**

The protocol was designed to allow direct comparison with the North American Breeding Bird Survey (https://www.pwrc.usgs.gov/bbs/), which utilizes point counts of 3 min intervals. Each record in the database has a time stamp of 0-3 min, >3-5 min or >5 min (if observed while traveling between plots), which allows for exclusion of records outside a 3 min interval. The protocol was also designed to apply the distance method of accounting for variable detection probabilities (Buckland et al. 1993, 2001), and thus most records have an estimate of distance from the surveyor (with the exception of flyovers and birds observed outside the 5 min survey intervals).

Grid size varied among parks (100 x 100 m, 200 x 200 m, or 400 x 400 m), depending on overall park size. Some birds may have been recorded from multiple points, particularly at the smaller grid sizes. In the dataset there exists a data field to indicate whether this was known to occur (Table 2). Using larger grid sizes at the smallest parks would result in too few survey points to adequately characterize the community. Rarefaction curves of the available data at five parks using the smallest (100 x 100 m) grid indicated that increasing the grid size to 200 x 200 m resulted in a 27-48% reduction in species recorded (Morrison and Peitz 2020).

HTLN staff conducted surveys approximately every fourth year (and sometimes more frequently) (Table 3). In other years, volunteers conducted the surveys (i.e., citizen science that is common in bird studies [Greenwood 2007]). Volunteers were experienced birders who were familiar with the avifauna of the region, and followed the same protocol and used the same data forms, although they underwent no formal training or evaluation. HTLN staff were required to complete a training regime prior to surveys (Standard Operating Procedure #2, Training Observers, Heartland Inventory and Monitoring Network 2023e). Although the identities of the observers are not included in the database, it is possible to obtain the identities of the observers involved by searching for the most recent park-level monitoring reports at https://www.nps.gov/im/reports-nrr.htm or https://irma.nps.gov/Portal/.

Not all parks were surveyed for birds in all years, and not all survey points were visited every time surveys were conducted (Table 3). For parks in which there were large discrepancies in the number of survey points visited over time, a core set of survey points was identified and the same set visited each time surveys were conducted. These core survey points were spatially representative of the sample frame in each park.

After 2006, bird monitoring at AGFO was transferred to the Northern Great Plains Network of the NPS.

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**DISCLAIMER** Views, statements, findings, conclusions, recommendations, and data in this report are those of the author(s) and do not necessarily reflect views and policies of the National Park Service, U.S. Department of the Interior. Mention of trade names or commercial products does not constitute endorsement or recommendation for use by the National Park Service.

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**Table 1.** List of NPS units included in the database, four-character park code, survey grid size, number of survey points, and the most abundant habitat type in the sample frame.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **National Park** | **Park Code** | **Grid size** | **Number of points** | **Primary habitat** |
| Agate Fossil Beds National Monument, Nebraska | AGFO |  |  |  |
| Arkansas Post National Memorial, Arkansas | ARPO | 200 x 200 m | 36 | Woodland |
| Effigy Mounds National Monument, Iowa | EFMO | 400 x 400 m | 36 | Woodland |
| George Washington Carver National Monument, Missouri | GWCA | 100 x 100 m | 70 | Grassland |
| Herbert Hoover National Historic Site, Iowa | HEHO | 100 x 100 m | 38 | Grassland |
| Hopewell Culture National Historical Site, Ohio | HOCU | 400 x 400 m | 27 | Grassland |
| Homestead National Monument of America, Nebraska | HOME | 100 x 100 m | 44 | Grassland |
| Lincoln Boyhood National Memorial, Indiana | LIBO | 100 x 100 m | 35 | Woodland |
| Pea Ridge National Military Park, Arkansas | PERI | 400 x 400 m | 99 | Woodland |
| Pipestone National Monument, Minnesota | PIPE | 100 x 100 m | 68 | Grassland |
| Tallgrass Prairie National Preserve, Kansas | TAPR | 400 x 400 m | 259 | Grassland |
| Wilson’s Creek National Battlefield, Missouri | WICR | 400 x 400 m | 37 | Woodland |

|  |  |
| --- | --- |
| **Column label** | **Column description** |
| ParkUnit | Name of National Park unit where data was collected |
| Plot | Four-character park code and survey point identification number |
| EventID | Park code, date and time of sampling |
| EventDateTime | Date and time of sampling |
| Temperature\_C | Temperature in degrees Celsius |
| WindSpeed | Wind speed in km/h (categorical) |
| WindDesc | Description of wind effects |
| Rain | Amount and type of precipitation (categorical) |
| PercentCloud | Percent cloud cover (to nearest 10%) |
| Noise | Ambient noise (categorical) |
| NoiseSummary | Description of ambient noise effects |
| Interval | Time interval during which bird was observed (0-3, >3-5, or >5 min) |
| ObservationNumber | Observation number for the plot |
| AOUCode | Four-character American Ornithological Union species identification code |
| TSN | Taxonomic Serial Number (www.itis.gov) |
| ScientificName | The scientific name, including Genus and Species |
| Family | The scientific name of the Family |
| CommonName | The common name |
| Distance | Distance in m from the plot center to the location where the bird was first detected (missing values coded as -9999) |
| DetectionType | Type of detection: audial, visual |
| Sex | Sex (male, female or unknown) |
| Age | Age (adult, juvenile or unknown) |
| FlockSize | For species that occur in flocks, number of birds in flock |
| IsPreviousPlot | Indicates whether the bird was already detected in a previous plot |
| IsFlyover | Indicates whether the bird was only observed flying over the plot |
| Comments | Any relevant comments, none required. |

**Table 2.** Description of the dataset. See Standard Operating Procedure #4, Conducting the Variable Circular Plot Count (Heartland Inventory and Monitoring Network 2023c) for a more detailed description of the column labels.

**Table 3.** Number of survey points sampled by park and year. \* indicates HTLN staff member(s) conducted all or part of the surveys;

otherwise volunteers conducted the surveys. -- no data collected.

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Year | AGFO | ARPO | EFMO | GWCA | HEHO | HOCU | HOME | LIBO | PERI | PIPE | TAPR | WICR |
| 2001 | 27\* | -- | -- | -- | -- | -- | -- | -- | -- | -- | 176\* | -- |
| 2002 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | 260\* | -- |
| 2003 | 54\* | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| 2004 | 54\* | -- | -- | -- | -- | -- | -- | -- | -- | -- | 97 \* | -- |
| 2005 | 54\* | -- | -- | -- | 9 \* | 27 \* | -- | -- | -- | -- | 97 \* | -- |
| 2006 | 54\* | -- | -- | -- | 9 \* | 27 \* | -- | -- | -- | -- | 99 \* | -- |
| 2007 | -- | 36 \* | -- | -- | -- | 27 \* | -- | 35 \* | -- | -- | 89\* | -- |
| 2008 | -- | -- | -- | 70 \* | 38 | 27 | -- | -- | 99 \* | -- | 95 \* | 36 \* |
| 2009 | -- | -- | 34 \* | 24 | 38 \* | 27 | 44 \* | -- | 97 | 68 \* | 58 | 38 |
| 2010 | -- | 36 | 44 | 24 | 38 | 27 | 47 | -- | 36 | 67 | 260\* | 33 |
| 2011 | -- | 27 \* | 39 | 23 | 38 | 26 \* | 42 | 35 \* | -- | 68 | 58 | 38 |
| 2012 | -- | 36 | 35 | 70 \* | 38 | 27 | 43 | -- | 98 \* | 67 | 54 | 35 \* |
| 2013 | -- | 36 | 21\* | 24 | 11 \* | 27 | 9 \* | 8 | 24 | 17 \* | 58 | 33 |
| 2014 | -- | 36 | 38 | 20 | 11 | 27 | 9 | 8 | -- | 17 | 259\* | 35 |
| 2015 | -- | 36 \* | 40 | 66 | 11 | 27 \* | 9 | 35 \* | -- | 17 | 58 | 21 |
| 2016 | -- | 36 | 39 | 70 \* | 11 | 26 | 9 | 8 | 99 \* | 17 | 58 | 37 \* |
| 2017 | -- | 27 | 36 \* | 24 | 38 \* | 27 | 44 \* | 8 | 40 | 68 \* | 58 | 38 |
| 2018 | -- | 34 | 31 | 23 | -- | 27 | 9 | 8 | -- | 17 | 255\* | 37 |
| 2019 | -- | 27 \* | 34 | 12 | -- | 27 \* | 9 | 35 \* | -- | -- | 58 | 27 |
| 2020 | -- | 31 | 32 | 70 \* | -- | -- | 9 | 8 | -- | -- | 58 | 36 \* |
| 2021 | -- | -- | 37 | -- | 15 | 27 | 19 | 8 | 99 \* | 68 | 56 | 36 |
| 2022 | -- | 30 | 39 \* | 26 | 38 \* | 25 | 44\* | 8 | -- | 68 \* | 79 | 37 |

A map of different regions of the united states

Description automatically generated

**Figure 1.** Map of the Midwestern USA, showing the locations of the twelve National Park Service units surveyed, and the extent of the seven surrounding Bird Conservation Regions. NOTE: Figure does currently contain AGFO; will be remade to include it.