



Breeding Bird Monitoring Protocol for the Mid-Atlantic Network

Quality Assurance Plan Version 1.0

Natural Resource Report NPS/MIDN/NRR—2018/1815



ON THE COVER

Photograph of Chipping Sparrow (*Spizella passerina*)

Photograph by Bill Tucker

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Quality Assurance Plan Version 1.0

Natural Resource Report NPS/MIDN/NRR—2018/1815

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Revision History

The Mid-Atlantic Network breeding bird monitoring protocol consists of a narrative (Johnson and Wakamiya 2018), Standard Operating Procedures (SOPs) that outline specific aspects of the monitoring protocol, and a Quality Assurance Plan (QAP) that establishes and documents standards for data quality (this document).

The latest version of each and additional supporting information can be accessed online at the National Park Service's Mid-Atlantic Network website (<https://www.nps.gov/im/MIDN/>) and at the National Park Service's Data Store (<https://irma.nps.gov/DataStore/Reference/Profile/2256611>).

The narrative, each SOP, and the quality assurance plan have respective revision history logs to document changes. The following revision history log is for the quality assurance plan.

Version numbers will be incremented by a whole number (e.g., Version 1.0 to 2.0) when a change is made that significantly affects requirements or procedures. Version numbers will be incremented by decimals (e.g., Version 1.3 to Version 1.4) when there are minor modifications. Rows are added to the log as needed for each change or set of changes tied to an updated version number.

Prev. Version #	Revision Date	Author	Changes Made	Reason for Change	New Version #
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Abstract

In accordance with guidelines set forth by the National Park Service Inventory & Monitoring Division, a Quality Assurance Plan (QAP) has been created for use by the Mid-Atlantic Network in the implementation of Breeding Bird Monitoring Protocol (Johnson and Wakamiya 2018). This QAP documents the standards, policies, and procedures used by the Mid-Atlantic Network for activities related to the collection, processing, storage, analysis, publication, and sharing of monitoring data. The policies and procedures documented in this QAP are consistent with the quality assurance plans for other monitoring activities conducted by the Mid-Atlantic Network and supplement the National Inventory & Monitoring Division Quality Management Plan (DeVivo *in preparation*).

Introduction

The National Park Service (NPS) Inventory & Monitoring Program was established by an act of Congress in 1999 to provide more than 270 national park system units a core suite of baseline scientific information (inventories) and to identify and implement long-term monitoring of high-priority measurements of resource condition in those units (Fancy et al. 2009). The overarching purpose of natural resource monitoring in parks is to develop scientifically sound information on the current status and long-term trends in the composition, structure, and function of park ecosystems, and determine how well current management practices are sustaining those ecosystems.

Policies and procedures were designed to ensure that all scientific work conducted by or for the NPS Inventory and Monitoring Division (IMD) including data, reports, and associated decision support tools is appropriate for its intended use and of documented quality. Transparently communicating information about data quality also ensures continuity and comparability of data over time.

The IMD is responsible for developing a quality management plan (QMP; DeVivo *in preparation*) that documents the policies, procedures, memoranda, Director's orders, training requirements (e.g., Department of Interior Scientific Integrity Training) etc. that apply to all IMD activities Service-wide. Data quality standards and procedures for ensuring them are documented in protocol-specific quality assurance plans (QAPs).

This QAP is based on the QAP created for the Eastern Rivers and Mountains Network (Marshall and Callahan 2018) to maximize compatibility with other networks in the Northeast Region. This QAP outlines the data quality standards for breeding bird monitoring within the Mid-Atlantic Network (MIDN), one of 32 ecoregional "networks" of parks that were grouped by geography and shared natural resource characteristics. In addition to the QAP, the breeding bird monitoring protocol consists of a narrative (Johnson and Wakamiya 2018) and Standard Operating Procedures (SOPs) that outline specific aspects of the monitoring protocol.

The intent of the QAP is to provide all potential end-users of protocol data a single source with adequate information to understand what data are being collected and how, as well as to what standards those data are being collected, so that they can independently determine whether or how those data may be interpreted and used.

The QAP outlines the quality assurance and quality control procedures implemented during all levels of data collection and processing. Data that have undergone all quality assurance and quality control procedures and either meet stated data quality standards or are appropriately identified as not meeting the standards, are considered "certified" by the NPS. All data and reports disseminated for general (public) use will be based on certified data. Data certification and the processes entailed by that designation (as documented in this QAP) is the primary means by which data quality is communicated to end users.

The latest version of the protocol narrative, SOPs, QAP, and additional supporting information can be accessed online at the MIDN website (<https://www.nps.gov/im/midn/>) and at the NPS Data Store (<https://irma.nps.gov/DataStore/Reference/Profile/2256611>).

Protocol Overview and Objectives

Preserving the condition of park resources, including breeding birds, unimpaired in perpetuity is the fundamental management objective of the NPS. Indeed, this “anti-degradation” or “no decline in condition” management objective captures the essence of the NPS mission and forms the underpinnings of the NPS ecological monitoring program. The purpose of the breeding bird monitoring protocol is to collect and analyze data and report information that will help park management maintain or improve the ecological condition of the breeding bird community.

Primary monitoring objectives of the MIDN breeding bird monitoring protocol are to:

1. Estimate status and long-term trends in species composition, occupancy, and other indices of abundance for breeding bird populations within MIDN parks.
2. Estimate status and trends in measures of biotic integrity (Bird Community Indices) for breeding bird communities within MIDN parks.
3. Evaluate changes in bird populations in forest and grassland habitats relative to park management regimes.

The sampling design was developed to address the priorities of each network park through consultation with park NRM staff and engagement with subject matter experts. The design should provide enough power to both address the status of breeding bird populations in network parks, as well as detect changes in trends in these data over time. Protocol procedures were developed to meet protocol objectives, address resource management needs, and provide opportunities for citizen scientists to contribute significantly to their local park and the MIDN network as a whole.

Protocol Activities

Data are collected as a part of the Breeding Bird Monitoring Protocol for the Mid-Atlantic Network (Johnson and Wakamiya 2018) and Standard Operating Procedure documents and described in 3 different activities or modules below (Table 1). Data collection for this protocol is performed by NPS staff and citizen scientists through avian point counts. Point counts are the most widely used quantitative method for monitoring landbird populations (Ralph et al. 1995, Rosenstock et al. 2002). These surveys utilize a standardized methodology to record (“count”) all birds seen or heard during a fixed amount of time at specific point locations (“points”). The MIDN protocol uses 10 minute counts performed at points randomly selected from a 250-m grid of points overlaid on park maps. Once selected, these points are permanent and are sampled at least twice every year. The resultant counts are used to estimate bird distribution, diversity, abundance, density, occupancy, and can be used to calculate Bird Community Indices like those developed by O’Connell for the for the Mid-Atlantic and Coastal Plain (O’Connell et al. 2003).

The basic procedure is to navigate to an established site and first point count station (Activity 1) and record basic information about the event (Activity 2), then conduct the 10 minute avian point count

(Activity 3) and navigate to the next point count station. This process is repeated until all scheduled point count stations have been sampled. Activities 2 and 3 occur at the center of each permanent and previously established point count station.

Table 1. Protocol activity matrix for the breeding bird monitoring protocol (Johnson and Wakamiya 2018).

Category	Activity Number	Activity	Description
Site Establishment	1	Site Establishment, Maintenance	To establish points, the project lead or delegated MIDN staff navigates to pre-selected potential point count locations and evaluates their suitability, and if acceptable marks the location according to MIDN BBM SOP 1 - Site Establishment. Point maintenance is done on a yearly basis and requires MIDN staff or volunteers navigate to sampling locations and replace sight markings as needed according to procedures outlined in MIDN BBM SOP 2 - Preparations and Equipment Setup Prior to Field Season.
Field Observations	2	Sampling Event Data	During each 10 min point count the following information about the environmental conditions at the point are recorded 1) the start time of the point count; 2) sky code; 3) wind code; 4) noise code; 5) site visit number; 6) ambient temperature; 7) any notes that help interpret the data. Detailed procedures for conducting point counts are found in MIDN BBM SOP 4 - Conducting Unlimited Radius Point Counts.
	3	Avian Point Counts	During each 10 min point count the following information for each observed individual (or flock) is recorded: 1) species identity; 2) type of detection (e.g., Audio, Visual, Both Audio and Visual, or Flyover); 3) the distance band of first detection (<50 m, or >50 m from the point count station); 5) the minute from the start of the point count to first detection of each individual or flock. Detailed procedures for conducting point counts are found in MIDN BBM SOP 4 - Conducting Unlimited Radius Point Counts.

Sampling Design

Within each park or park unit being sampled, sampling points are selected using a Geographical Information System (GIS) by overlaying a 250-m grid of points on park maps. These points are assessed for sampling suitability according to the procedures described in Standard Operating Procedure (SOP) 1 - Site Selection and Plot Establishment.

We further reduced the number of points sampled using the Generalized Random Tessellation Stratified (GRTS) algorithm. The resulting points are sampled twice annually. Table 2 provides the revisit design for each participating park. More details regarding the sampling design and maps of each participating park are provided in the protocol narrative.

Table 2. Revisit design for each participating park for the Breeding Bird Monitoring Protocol for the Mid-Atlantic Network (Johnson and Wakamiya 2018). Revisit Design notation follows McDonald (2003 and 2012).

Park Code	Park Name	Revisit Design
BOWA	Booker T. Washington National Monument (NM)	Twice Annually at 10 sites [(1,0)10]
FRSP	Fredericksburg & Spotsylvania National Military Park (NMP)	Twice Annually at 36 sites [(1,0)36]
PETE	Petersburg National Battlefield (NB)	Twice Annually at 36 sites [(1,0)36]
RICH	Richmond National Battlefield Park (NBP)	Twice Annually at 34 sites [(1,0)34]
VAFO	Valley Forge National Historical Park	Twice Annually at 80 sites [(1,0)80]

Data Quality Objectives

The data quality objective of the breeding bird monitoring protocol is to consistently produce data of sufficient quality to meet protocol objectives outlined above and in Johnson and Wakamiya (2018) and to produce data of known and documented quality for all potential end-users of data and information generated by this protocol.

To meet this objective, four data quality standards are defined and documented: 1) performance standards, 2) taxonomic standards, 3) policy & protected data standards, and 4) accreditation standards.

In addition, several qualitative descriptors will be used to help interpret and document the degree of acceptability or utility of the data to the user. These are variously referred to as “data quality indicators” (USEPA 1997) and “data quality values” (DeVivo, *in preparation*) and include the representativeness, completeness, comparability, and timeliness of the overall protocol dataset. Two other indicators or values (bias and precision) relate to individual measures and are included with the performance standards.

Data Quality Values

The concept of *representativeness* within the context of this monitoring protocol refers to the ability of the protocol to precisely estimate bird species occupancy and abundance for the specified target population within MIDN parks. Target sampling areas and populations as well as the methodology used to specify the sampling frame and site selection (and appropriate scope of statistical inference) are summarized above and discussed in great detail in the protocol narrative sections dealing with this topic (Johnson and Wakamiya 2018). Repeat visits to each sampling site allow for a suite of analysis approaches that can account for imperfect detection for species with sufficient data (see Johnson and Wakamiya 2018 for details).

Sampling *completeness* is defined following Stanley and Verner (1985) as “a measure of the amount of data collected from a measurement process compared to the amount that was expected under the conditions of measurement.” A completeness goal of 100% has been established for the various measures included in this protocol (both the number of sampling events each year as well as the required measures during each event).

Data *comparability* refers to the confidence with which one data set can be compared to another. To achieve maximum utility, this protocol must yield data that are consistent and comparable from one year to the next, among MIDN parks, and to the extent possible with other NPS, state and Federal programs. Comparability among parks and between years is achieved through strict adherence to the standard operating procedures documented in this protocol including thorough documentation of any changes or revisions to procedures. Implementation of a generic and standardized “point count” procedure also allows comparison with other NPS, state, and Federal programs.

Timeliness refers to the length of time required to collect, process, and certify data relative to the intended uses of the data. Data collection and processing for the breeding bird protocol occurs on an

annual basis with all field work (i.e., data collection) completed by the middle of July each year. Data processing takes roughly three months and, as a result, all data are certified and available for general use by the end of October. As such, the use of provisional data will not routinely occur and should be limited to rare circumstances. See the Data Certification and Dissemination section below.

Data Quality Standards

Four data quality standards are defined and documented below: 1) performance standards, 2) taxonomic standards, 3) policy & protected data standards, and 4) accreditation standards.

Performance Standards

Performance standards are data quality requirements specifying the level of bias and precision (and in some cases resolution, sensitivity, etc.) of equipment, sensors, or observers to reliably measure characteristics of the target population. Bias is a systematic difference between a measured value and the true value and represents an estimate of systematic measurement error; precision is the degree of mutual agreement among repeated measurements and represents an estimate of random measurement error. Collectively these data characteristics provide an estimate of the total uncertainty surrounding any measurement (typically referred to as accuracy). In some cases assessing bias is not meaningful because true values are not known.

Performance standards are also referred to as measurement quality objectives and performance measures in DeVivo (*in preparation*).

Performance standards for the activities associated with the breeding bird monitoring protocol (Table 1) are presented and summarized in Table 3.

Table 3. Performance standards for the MIDN breeding bird monitoring protocol.

Category	Measure Number	Measure	Performance Standard
Site Establishment, Maintenance	1	Site Location	+/- 5m horizontal accuracy
Field Observations	2	Sampling Event Data	Standards are not applicable
	3a	Avian Point Count: Taxonomic Resolution	Species level
	3b	Avian Point Count: Identification Completeness	99.9% of identifications are made to species level
	3c	Avian Point Count: Identification Accuracy	>90% accuracy
	3d	Avian Point Count: Distance Accuracy	+/- 10m

Taxonomic Standards

The MIDN breeding bird protocol has adopted the taxonomy of the American Ornithological Society available at <http://checklist.aou.org/> and referred to as the Birds of North and Middle America Checklist. All data collection and reporting of information from the breeding bird monitoring protocol will use this taxonomy.

The “Birds of North and Middle America Checklist” is widely accepted as the official source on the taxonomy of birds found in North and Middle America, including adjacent islands. This list is produced by the North American Classification Committee (NACC), an official committee of the American Ornithological Society (formed by the merger of the American Ornithologists' Union and Cooper Ornithological Society). Accepted changes to taxonomy are summarized in annual supplements to the checklist which are published in a scientific journal (The Auk) in July of each year. Subsequent to this publication the MIDN will also make annual updates to the protocol taxonomy (SOP 2 – Preparations and Equipment Setup Prior to Field Season).

Field identifications (visual and auditory) are based on the Sibley guide to birds (audio available online and through the App) which, in turn, is based on the NACC taxonomy. The recording of field observations of bird species common names (and four letter acronyms) is based on the taxonomy described above. Four letter acronyms for bird names are maintained by the Institute for Bird Populations (<https://www.birdpop.org/pages/birdSpeciesCodes.php>), follow the taxonomy of the NACC, and are updated annually (SOP 2 – Preparations and Equipment Setup Prior to Field Season).

Policy & Protected Data Standards

No data associated with the MIDN breeding bird monitoring protocol are considered sensitive and/or protected other than personally identifiable information (PII) associated with non-NPS personnel (e.g., field crew members). PII are legally protected and all PII will be redacted from public dissemination.

Accreditation Standards

No professional or lab accreditations are required for the MIDN breeding bird monitoring protocol.

Quality Assurance and Quality Control Procedures

This section outlines the quality assurance and quality control procedures implemented during all levels of data collection and processing. Quality assurance (QA) procedures are targeted at minimizing errors in data collection while ensuring that data are collected to established and documented standards (to the greatest extent possible). Quality control (QC) is an evaluation of data, once collected, to ensure they meet documented standards, and to rectify any data that do not by using a combination of correction, annotation, etc.

Quality Assurance

This section describes quality assurance procedures implemented for data collection and processing activities beginning with an overview of the design of the protocol database.

Database Design

The MIDN breeding bird monitoring protocol database is a custom relational database to store all data collected for the protocol. This database is made up of a front-end that contains the data entry forms, and a back-end file that stores all of the data. The front end forms are designed for ease of data entry, and each database field has coded validation rules in place to check each value as they are entered to prevent typographic and logic errors. The back-end file contains three related core tables that house location, event, and observation data. Additional look-up tables for species, contacts, and other attributes provide standardized values for data fields to minimize data entry errors. The front end database is designed for ease of data entry and each field has validation rules in place to check values as they are entered to prevent typographic and logic errors.

Before the Field Season

Achieving the data quality objective for this protocol is a continuous process that follows an annual cycle. The cycle begins before each field season by reviewing, updating, and thoroughly documenting changes to all SOPs, ensuring proper equipment is available and in working order, reviewing and updating the expected species list in the database, among numerous other tasks as outlined in SOP 2 – Preparations and Equipment Setup Prior to Field Season. These tasks are completed by the protocol lead and data manager.

Recruitment and Training

The MIDN relies on the Natural Resource Management (NRM) staff of each participating park to recruit volunteers, as they are most familiar with their local birding community. Volunteers may be recruited from local birding clubs, Audubon Chapters, birding listservs, or simply by word of mouth. In order to capture meaningful data, it is imperative that data is collected in a consistent manner by highly-trained volunteers. SOP 3: Volunteer Recruitment and Training, outlines the specific procedures for recruitment and training of volunteers for this protocol.

The topics presented here and the related SOPs are among the most important parts of the quality assurance of this protocol because they summarize the essential qualifications and skills field crew members must possess, provide guidance on recruiting qualified volunteers, and outline the required training. The quality of the observer, combined with appropriate training, oversight and

communication will largely determine the quality of the data. Moreover, most of the performance standards outlined in Table 3 are assessed and achieved during preparation for the field season and field observer training:

Site Establishment, Maintenance, and Relocation

All point count stations were permanently established within +/- 10m of the Geographic Information System (GIS) waypoint generated during the site selection and evaluation process as described in SOP 1 – Site Selection and Plot Establishment. The +/- 10m deviation from the waypoint was based on a field assessment of safety, access, and site suitability for conducting an avian point count. Once established, the station location was recorded with a Garmin eTrex Vista HCX GPS unit with +/- 5m horizontal accuracy (includes bias and precision). These locations were validated in the protocol GIS and are used by all subsequent field crew members to navigate to (i.e., relocate) the sampling sites or to re-establish the site if markers disappear.

While the performance standard for this activity (Table 3) was +/- 5m accuracy at the time of site establishment, this standard is now largely evaluated through completeness measures. In other words, can observers successfully navigate to and find all required point count stations? Should a crew member not be able to locate a point count station, they will re-establish the station using the same coordinates and ensuring GPS accuracy within +/- 5m as outlined in SOP 1 – Site Selection and Plot Establishment.

Taxonomic Resolution and Identification Completeness

Birds detected during point counts are identified to the species level (see also Taxonomic Standards). Field crews are trained to use an “unknown bird” identifier only when they are sure that they have identified a unique individual not previously identified at any point during the 10 minute count. This standard was established based on a review of over 41,000 bird observations between 2009 and 2017 where < 0.1% of identifications was coded as “unknown bird”. The standard will now be assessed annually.

Identification Accuracy

Adherence to this standard is admittedly difficult to assess in this protocol where all point counts are conducted by a single observer working independently and the “true” species composition is unknown. The >90% standard is based on the results of a series of experiments designed to evaluate the auditory detection process of avian point counts (Alldredge et al. 2007a, Alldredge et al. 2007b, Simons et al. 2007) where trained, experienced observers misidentified an average of 4% (range 0 - 10%) of individual birds. Because the data in this protocol are also collected by trained, experienced observers we *assume* identification accuracy is similar and that this standard is being met.

To further support this assumption, the MIDN initiated a cooperative agreement with the University of Delaware to evaluate our existing avian monitoring protocol in 2015. We coordinated with the National Capital Region Network to use their crew of paid observers to collect data in two of MIDN’s parks. This allowed us to test for differences in volunteer versus paid observers and determine if there could be any potential observer-type bias that could arise in larger-scale regional analyses. The resulting analysis found no significant relationship between observer type and

detection probability within forest or grassland monitoring points (Shriver and Ladin 2016). These results support our contention that using volunteers for breeding bird monitoring yields quality data that is comparable to other monitoring programs in North America, and meets the standards we have outlined above.

Distance Accuracy

Similar to identification accuracy, adherence to the specified distance accuracy standard is difficult to assess since all point counts are conducted by a single observer working independently and the “true” distance to a detected bird is unknown. As above, the +/- 10m standard is based on the results of a series of experiments designed to evaluate the auditory detection process of avian point counts (Alldredge et al. 2007a, Alldredge et al. 2007b, Simons et al. 2007) where the average distance measurement error across all distances, species, and observers was 9.0 m (SD = 25.8 m) for the untrained observer experiment and 7.6 m (SD = 21.4 m) for the trained observer experiment (Alldredge et al. 2007b). Because the data in this protocol are also collected by trained, experienced observers we *assume* distance measurement accuracy is similar and that this standard is being met. In support of this assumption, distance measurement is specifically covered during training and observers are encouraged to complete practice exercises (See SOP 3 – Volunteer Recruitment and Training). Ultimately, we acknowledge that observers are likely assigning the wrong distance band to an unknown number of birds and cannot explicitly quantify the extent to which it occurs.

Oversight and Communication

Maintaining oversight of the volunteers during the field season and fostering open communication between observers, park natural resource staff, and the protocol lead is another key factor in obtaining quality field data and balancing sampling effort equally across sampling points. Volunteers must work with park staff to sample correctly and be willing to ask questions whenever they are unclear of the proper procedures.

Data Collection

Quality assurance processes associated with each of the data collection activities of the breeding bird monitoring protocol (Table 1) include training, oversight and communication, and strict adherence to guidance in SOP 3 – Volunteer Recruitment and Training and SOP 4 – Conducting Unlimited Radius Point Counts. This SOP thoroughly details proper procedures for every step of the data collection process including properly recording observations and measures on field data sheets.

Data Entry and Verification

All point count data are collected on paper datasheets called Field Mapping Cards and then transcribed onto tabular type of data sheet called a Field Data Form that is more amenable to data entry into the MIDN breeding bird monitoring database (See SOP 9 – Data Management). To ensure quality data transcription, it is critically important that proper verification occurs at each stage of transcription from the original source. To minimize the possibility of carrying data entry errors forward into analysis, the data verification processes outlined in SOP 9 must be properly completed. The protocol lead will work with the biotechnician or volunteer entering bird data to resolve any questionable data found on the data sheets. Volunteers will be contacted to clarify any issues found during data entry and review, and any remediation will be annotated on the datasheets and archived.

Quality Control

Data Validation

Upon completion of data entry and verification, the verified data (described above) are given to the protocol lead to check for completeness and logical consistency both visually and through queries (see SOP 9 – Data Management). The protocol lead compiles any questions or concerns regarding the data in an Excel spreadsheet and works with the biotechnician and volunteers to correct or annotate the data as needed.

SOP 9 – Data Management outlines a series of procedures designed to further evaluate and clean the data. These steps include: complete data validation of volunteer data that is found to have signification transcription errors, a review of all data for a list of known common errors using queries, and reviewing the species list of each park for unusual species. This last step is accomplished by reviewing the species list of each park for any species identifications that are questionable. The protocol lead will review any field notes provided by the observer (e.g., “bird was located and observed to verify species after the point count was completed”), check external data sources such as eBird (<https://ebird.org>), and use their professional judgment to determine if any action is warranted. If a species-level observation is questionable and cannot be sufficiently supported by the observer it will be changed to “unknown bird” with the original identification documented in the notes field.

Not all errors and inconsistencies can be fixed, in which case a description of the resulting errors and why edits were not made is then documented and, when necessary, notes placed into the database. Data that is not usable for data analysis will be flagged as such in the database, and removed from any data products produced by the protocol. At this stage the data is considered provisional.

The protocol lead conducts a second round of Quality Control procedures at the end of the field season as part of the certification process (see SOP 9 – Data Management). These Quality Control checks will be run on the yearly aggregated data using SQL or R code and, again, is checked for completeness, and logical consistency. The protocol lead may also compare aggregate data across years to look for outliers. Once this last round is complete and all of the certification procedures outline in SOP 9 are completed, the data is considered certified and is placed on the MIDN server and made available on the NPS data store.

Roles and Responsibilities

Table 4 identifies organizations and individuals involved in the implementation of the MIDN breeding bird monitoring protocol (Johnson and Wakamiya 2018).

Table 4. Roles, responsibilities and contact information for persons or organizations affiliated with implementation of breeding bird monitoring protocol.

Affiliation / Position	Role
NPS NER IMD Regional Program Manager	QAP approval, protocol approval, ensuring that data meet quality objective
NPS MIDN Program Manager and Protocol Lead	Protocol implementation, ensuring that data meet quality objective, data certification, data dissemination, reporting
NPS MIDN Data Manager	Protocol data management, database development, GIS and GPS management, ensuring that data meet quality objective
NPS Biotechnician and Volunteer observers	Protocol implementation, data collection, ensuring that data meet quality objective

Protocol Quality Assessment

This section outlines a series of periodic reviews and evaluations to be conducted as part of the implementation of the MIDN breeding bird monitoring protocol (Table 5). These quality checks promote a cyclic process of continuous feedback and improvement of both the data and the quality planning process. The protocol lead is responsible for organizing and conducting the reviews and assessments and for ensuring that summary information, deviations from SOPs, data nonconformities, new ideas and methods, etc. are properly documented (revisions to the protocol narrative, SOPs, QAP and/or safety documents).

Five evaluations occur annually at the completion of the field season and at the time of data certification and archiving (Table 5).

A separate protocol review (which includes a full scientific review and overall assessment of whether the collected data are sufficient to meet protocol objectives) occurs periodically. These should occur when substantial changes are made to protocol objectives or processes, concurrent with a significant data analysis/trend detection report, or as requested by a supervisor. Based on these criteria, approximately every five years should be a reasonable timeframe for a protocol review.

Table 5. Data quality evaluations to be conducted as a part of implementing the breeding bird monitoring protocol.

Evaluation	Purpose & Description	Frequency
Field Season Review	Protocol lead meets with Natural Resource Management staff at each participating park to identify lessons learned in terms of operational efficiencies, logistical or technical challenges, unexpected field conditions, safety issues, etc. Based on these discussions, the SOPs are clarified or updated as needed to provide better guidance to future field crews. See SOP 2 – Preparations and Equipment Setup Prior to Field Season.	Annually at completion of field season.
Data Quality Evaluation: Data Completeness	Measure of the number of sites sampled and requisite measures recorded compared to the anticipated totals. See SOP 9 – Data Management.	Annually as data are certified.
Data Quality Evaluation: Data Timeliness	Measure of time required to certify data. See SOP 9 – Data Management.	Annually as data are certified.
Data Quality Evaluation: Data Quality Assessment	Measure of the number of data points that do not meet performance standards. See SOP 9 – Data Management.	Annually as data are certified.

Table 5 (continued). Data quality evaluations to be conducted as a part of implementing the breeding bird monitoring protocol.

Evaluation	Purpose & Description	Frequency
Annual Operational Review	Protocol lead obtains feedback from staff and supervisor on protocol implementation. Ensures that the protocol remains in sync with annual monitoring activities. Documents changes in procedures and equipment. Captures lessons learned and any changes to be made going forward. Provides MIDN staff with an opportunity to discuss the state of the science of the protocol. Based on these discussions, protocol documents are clarified or updated as needed. See SOP 2 – Preparations and Equipment Setup Prior to Field Season.	Annually during season close out.
Protocol Review	Assess Data Quality Objective: Are data sufficient to meet protocol objectives?	Periodically.

Documentation

Data Certification

Data that have undergone all quality assurance and quality control procedures described above are considered “certified” by the NPS.

Data certification is the process confirming that:

- Data have been through all QA/QC procedures outlined herein.
- Data either meet specified quality standards and/or that data that do not meet those standards are appropriately identified.
- Data are suitable for general use.

Data certification is documented in the protocol database at the Event level. Data certification is the final data processing level (i.e., all data in the database application are considered *provisional* while they undergo the various QA and QC procedures). All subsequent changes to certified data are documented in an Event table metadata field where a description of the change is provided along with the date of change and the individual who made the change.

Metadata

At the time of writing in 2018, IMD has convened a working group that will ultimately issue guidance on required metadata and its dissemination.

Information Dissemination

All reports including protocol data disseminated for general (public) use will be based on certified data. In general, data will be certified prior to internal use for supporting park-, regional-, or national-level resource management decisions.

However, in some cases the use of provisional data (data that have not undergone complete QA/QC as defined in this QAP, may be warranted to base decisions on best-available science. These situations are likely to be rare given that data certification is completed within approximately 90 days of data collection.

Communicating Data Quality

Data certification and the processes entailed by that designation (as documented in this QAP) is the primary means by which data quality is communicated to end users. A descriptive paragraph or document for each report or data set will include the following link (<https://irma.nps.gov/DataStore/Reference/Profile/2256611>) to the MIDN Breeding bird monitoring Protocol in the NPS Data Store to ensure that data can be traced to the latest version of the protocol, all associated standard operating procedures, and this QAP.

Archive of Records

The following files are archived annually on the MIDN Server after data certification:

- A copy of the back-end database files containing all certified data to date.

- “Flat” data file export from database; (*.csv file type) containing the most recently certified and all previously certified data. This file is also posted annually to the NPS Data Store with appropriate metadata.
- Version of the breeding bird monitoring protocol, SOPs, and QAP used for data collection and certification.
- Electronic copies of all field data sheets scanned to the .pdf data type after data verification (i.e., the raw data).
- Shapefile with metadata of all point count station locations, if applicable.
- Project Data Certification Form, Seasonal Closeout Checklist, and minutes from the annual operational review.

For all reports generated from MIDN breeding bird monitoring protocol data, the following files are archived on the MIDN Server:

- Final manuscript.
- Draft of report submitted for peer review, along with peer review comments and author response to those comments.
- Analytical code (e.g., R scripts) and flat data file (e.g., *.csv files) used for data analysis presented in the report.

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The Department of the Interior protects and manages the nation's natural resources and cultural heritage; provides scientific and other information about those resources; and honors its special responsibilities to American Indians, Alaska Natives, and affiliated Island Communities.

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