

Standard Operating Procedure 1: Site Selection and Plot Establishment

Mid-Atlantic Network Breeding Bird Monitoring Program
Version 1.0 (September 2018)

Overview

This Standard Operating Procedure (SOP) outlines how sampling locations for the Mid-Atlantic Breeding Bird Monitoring Program are selected, and provides step-by-step instructions for establishing count stations and documenting site information.

Site Selection

Using a GIS, permanent sampling locations can be selected by overlaying a 250-m grid on park maps. This grid is similar to the grid used for selecting vegetation monitoring plots (Comiskey et al. 2009), but offset by 125m. Using offset points allows for point count locations to be co-located with vegetation monitoring plots, but reduces trampling or otherwise influencing vegetation monitoring data from repeat visits. The grid shapefile (MIDN_Bird_Hawth_Points.shp) is located on the MIDN server:
Z:\Monitoring\Birds\Master\SpatialData\MIDN

Potential sampling locations are further reduced by excluding points meeting the criteria listed below. Using a GIS, create buffers for each scenario listed, and use them to exclude any points that fall within the buffers.

1. less than 15 m away from hiking trails to avoid visitor interruption of counts
2. less than 50 m away from primary roads (e.g. interstates and major highways) which may influence bird behavior and can reduce detection ability due to background noise
3. less than 15 m away from secondary and tertiary roads (e.g. local or park roads)
4. less than 50 m from buildings which are frequented by visitors and may influence bird behavior and
5. less than 50 m from the park boundary to restrict the study to habitats that are managed by the park.

Furthermore, any potential sampling points that could be potentially hazardous to observers (e.g. steep slopes, extremely dense forests) or that are located in archeological sites should be excluded. You can create buffers using a GIS of a size described above, or use aerial photography to note which points will not meet the criteria for inclusion. Work with each Park's Natural Resource Manager to determine which areas may pose risks to volunteers and field staff, or park resources.

Once you have reduced the number of potential sampling points using the GIS, categorize each potential sampling point, as either forest or grassland based on vegetation maps available for each park. Note that edge buffers between habitat types should not be applied because our interest is on the overall characterization of each habitat type rather than a comparison across types (Ralph et al. 1993).

Using the GRTS algorithm

The remaining points will be further reduced using the Generalized Random Tesselation Stratified (GRTS) algorithm (Stevens and Olsen 2004) to reduce the number of points, while maintaining a spatially balanced design. Using software like S-Draw or R, create an ordered list of points. Potential sampling points must be chosen in order from the resulting list. If a point is rejected for any of the reasons stated above, replace the point with the next point in the ordered list. It is important to note that each 5 sampling points requires an observer to perform 2 visits each for a total of 10 point counts for a season. This algorithm should be used to estimate the number of observers needed for any sampling design using this protocol. Work with Park NRM staff to determine the number of sampling points that can be fully sampled by the estimated volunteer base at each park. For parks that are newly adopting the protocol, a power analysis will need to be performed to determine the number of points that ideally would be sampled per season.

If, after the establishment of park sampling regime, new lands are later acquired that Park NRM staff wish to monitor, follow the steps above using the same grid, and determine the number of potential additional points. These additional points are outside the established sampling design and will need to be analyzed separately from the points chosen the original GRTS draw.

Establishing Sampling Stations

Using your ordered list of sampling points, examine park topographic maps to determine the best route to your selected locations. Using GPS and/or compass, travel to a proposed plot location to evaluate its suitability for sampling.

Upon arrival at the site, determine if the site should be rejected. Any of the reasons below are grounds for rejection or moving the site:

Accessibility

- Point over 1.5km from a road
- Slope more than 30% (too steep)
- River, creek between road and point that cannot be easily crossed
- Private land that must be crossed

Safety

- Slope more than 30%
- Dangerous path (unstable bridges etc.)
- Rocky habitat that may increase risk of falls or may contain snakes (Copperheads at Valley Forge National Historical Park)
- Asbestos Release Sites (Valley Forge National Historical Park)

Frequency of visitors

- Heavily used recreational area that may result in noise or distractions
- On interpretive walk route

Vegetation/habitat

- Mowed lawn
- Dense and impenetrable vegetation

Sampling design

- Point too close to a road (not removed by 15/50m buffer)
- Point too close to building/ frequented area
- On private land

Cultural significance

- In a cemetery
- On an archeologically sensitive site (e.g. on a civil war earthworks)

If the initial location is not suitable (e.g., site is on an earthwork), the plot may be relocated using the following directions:

- Move point 5m in north direction
- If north is also unacceptable, return to original point and repeat relocation process this time east, then south, and finally west.
- If after checking each new location in all four cardinal directions it is determined that all points are unsuitable, then the site is discarded, and the next site on the ordered GRTS list is evaluated.

Once a site is accepted, it is marked as follows, except at parks that prefer not to use permanent markings. Choose a tree closest to the center of the site (if in a forested location). Tag the tree 6-7 inches above ground and on the north side of the tree. If the north side of the tree faces a trail or road frequented by visitors, place tag on opposite side of tree. Prior to the field season, tagged trees should be marked with orange flagging tape, to provide a visual marker for volunteers.

After tagging and flagging the tree, set the GPS to average readings for a waypoint, and allow it to collect at least 100 readings (SOP 6). Label the waypoint as PARKPlotNumberA (e.g. RICH04A; the A distinguishes it from the point you originally navigated to).

Data Collection

Fill out the Point Check Datasheet at each site, even if the site was rejected.

Point number: Record the plot identification number

Tag number: Record the tree tag number

Date: Record the date the site was established

Accepted, rejected, point moved: Check appropriate box to indicate if the site was accepted, rejected or moved

Coordinates:

E – Record GPS East Universal Transverse Mercator value at tagged tree

N – Record GPS North Universal Transverse Mercator value at tagged tree

Accuracy – Record the positional accuracy of the UTMN and UTME coordinates, as determined by GPS

Point movement: Provide description of why point was moved and in what direction

Reason for rejecting: Provide reason for why site was rejected if applicable

Point access directions: Record directions for driving and walking to the plot, including landmarks, distances, and bearings. Include parking recommendations where applicable.

Easy, moderate, difficult: Check appropriate box to indicate if navigation to site is likely to be easy, moderate, or difficult for a volunteer.

Comments: Record reason for choice of difficulty level if necessary or any other additional notes.

Point Count Station Check Forms

Point check [PARK] [YEAR]			Checked By:		
Point number:	Tag number:	Date:	Point number:	Tag number:	Date:
☐ Accepted ☐ Rejected ☐ Point moved			☐ Accepted ☐ Rejected ☐ Point moved		
If accepted or moved: ☐ Point tagged ☐ Point flagged ☐ No tagging/flagging			If accepted or moved: ☐ Point tagged ☐ Point flagged ☐ No tagging/flagging		
Coordinates: E _____ Accuracy: N _____ <u>Point movement:</u>			Coordinates: E _____ Accuracy: N _____ <u>Point movement:</u>		
<u>Reason for rejecting:</u>			<u>Reason for rejecting:</u>		
<u>Point access directions:</u>			<u>Point access directions:</u>		
☐ Easy ☐ Moderate ☐ Difficult			☐ Easy ☐ Moderate ☐ Difficult		
<u>Comments:</u>			<u>Comments:</u>		
Point number:			Point number:		
Tag number:			Tag number:		
Date:			Date:		
☐ Accepted ☐ Rejected ☐ Point moved			☐ Accepted ☐ Rejected ☐ Point moved		
If accepted or moved: ☐ Point tagged ☐ Point flagged ☐ No tagging/flagging			If accepted or moved: ☐ Point tagged ☐ Point flagged ☐ No tagging/flagging		
Coordinates: E _____ Accuracy: N _____ <u>Point movement:</u>			Coordinates: E _____ Accuracy: N _____ <u>Point movement:</u>		
<u>Reason for rejecting:</u>			<u>Reason for rejecting:</u>		
<u>Point access directions:</u>			<u>Point access directions:</u>		
☐ Easy ☐ Moderate ☐ Difficult			☐ Easy ☐ Moderate ☐ Difficult		
<u>Comments:</u>			<u>Comments:</u>		

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 that establishes standards for data quality.

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 Service's integrated resource management information portal (<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 data quality standards document.

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 #

Literature Cited

- Comiskey, J. A., J. P. Schmit, and G. Tierney. 2009. Mid-Atlantic Network forest vegetation monitoring protocol. Natural Resource Report NPS/MIDN/NRR—2009/119 National Park Service, Fort Collins, Colorado
- Johnson, M. J., and S. M. Wakamiya. 2018. Breeding bird monitoring protocol for the Mid-Atlantic Network. Natural Resource Report NPS/MIDN/NRR—2018/1769. National Park Service, Fort Collins, Colorado.
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Standard Operating Procedure 2: Preparations and Equipment Setup Prior to Field Season

Mid-Atlantic Network Breeding Bird Monitoring Program
Version 1.0 (September 2018)

Overview

This Standard Operating Procedure (SOP) defines the planning, coordination, training, and equipment preparations to be completed prior to the field season. Preparations should be completed by the week of May 25.

Planning and Coordination

Because the bird monitoring protocol is a volunteer-based program, and because park resource managers are most familiar with the local birding community, preparations for the field season is a joint effort with the network protocol lead and the Park's Natural Resource Manager (NRM). Prior to the field season, typically March or April, the Protocol Lead will contact each Park NRM to coordinate planning for the upcoming field season, determine equipment needs, and set a date for volunteer training. The table below outlines the roles and responsibilities for field season preparation.

Table 1. Roles and responsibilities for field season planning and implementation.

Role	Responsibilities
Protocol Lead	• Coordinates with Park NRM staff on all protocol implementation activities • Applies changes to protocol materials based on yearly protocol review • Purchases field equipment as needed • Provides all printed materials and equipment (see below and Table 2) • Provides training to volunteers • Provides protocol guidance and feedback during the field season
Natural Resource Staff	• Coordinates with returning volunteers and recruits new volunteers as needed • Coordinates training participation and training schedule with protocol lead • inventories, organizes, and prepares field equipment and coordinates equipment pickup • Provides safety instruction and updated park contact information • Manages volunteer sampling effort (see below) • Notifies Park Law Enforcement Rangers of volunteer activities as appropriate • Oversees return of field equipment and completed data forms
Field Staff and Volunteers	• Attends provided protocol training • Coordinates with Park NRM staff to complete field survey work • Returns equipment and completed data sheets in a timely fashion
Data Manager	• Advises on data and information management activities • Provides GIS, GPS data and map products

Training

Within one month prior to the beginning of the field season, the protocol lead conducts training sessions for new and returning volunteers on protocol implementation. If new volunteers are recruited, the protocol lead will conduct a full onsite training session. Otherwise, the protocol lead or resource manager may conduct a refresher course depending on volunteer needs. It is important to coordinate with park NRM staff to determine each park's individual needs, and gather feedback from volunteers to continuously improve training and protocol implementation. Recruitment and training of volunteers is outlined in Standard Operating Procedure 3: Volunteer Recruitment and Training.

Equipment Preparation

At least one month prior to the field season, the protocol lead will prepare the following:

- Volunteer manual (see SOP 4)
- Field mapping cards and field data forms (see SOP 4)
- Any recently published program resource briefs, data summaries, or reports

Park NRM or assigned staff will:

- Visit survey stations and determine if the site needs to be retagged/reflagged (where applicable) by May 15
- Inventory, organize, and prepare field equipment (Table 2) for volunteers to pick up
- Create new, or print existing, maps of each volunteer's station locations and sampling routes
- Upload coordinates to GPS units

Table 2. Field equipment list for breeding bird monitoring

Item	Number required
AOU bird species list	1
Binder	1 per crew member
Binoculars	1 (Not provided)
Compass	1
Emergency contact list	1
Field Data Form	4 per point count
Field Mapping Card	4 per point count
First Aid Kit	Highly recommended
GPS Unit	1
Map of point locations	1
Park map	1
Parking permit	Where applicable
Pens or pencils	Many
Safety SOP	1
Spare AA batteries	2
Stopwatch	1
Thermometer	1
Volunteer Manual	1
Water and Snacks	Bring Plenty

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Standard Operating Procedure 3: Volunteer Recruitment and Training

Mid-Atlantic Network Breeding Bird Monitoring Program
Version 1.0 (September 2018)

Overview

This Standard Operating Procedure (SOP) outlines the procedures necessary for recruiting and training volunteers to collect data for the Mid-Atlantic Network (MIDN) breeding bird monitoring program.

Recruiting volunteers

The MIDN relies on the Natural Resource Management (NRM) staff of each participating parks 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.

Participating volunteers and field staff must meet the following requirements:

1. Ability to identify most Mid-Atlantic breeding birds by sight and sound (~3-5 years of experience in the Mid-Atlantic Region)
2. Capable of hiking on varied terrain
3. Ability to navigate with a GPS, or compass and map (Training will be provided)
4. Ability to follow protocol procedures and fill out field forms legibly
5. Willingness to attend the protocol training seminar

Training

In order to capture meaningful data, it is imperative that data is collected in a consistent manner by highly-trained volunteers. To participate in the program, volunteers must already be skilled in breeding bird identification for the Eastern United States. Therefore, training sessions will not cover species identification. However, a list of species found in the park is provided to each volunteer to help familiarize themselves with the local bird community. The training session should cover the following:

- Overview of I&M program and purpose of breeding bird monitoring
- Safety (see Safety Plan)
- Point count methodology (see SOP 4)
- Capturing environmental conditions during a point count (see SOP 4)
- Recording data on the field mapping cards (see SOP 4)
- Proper transcription of data onto field data forms (see SOP 4)
- Using GPS units (see SOP 5)
- Procedures for compass, stopwatch, and thermometer (see SOP 5 and 6)
- Distance estimation (see Appendix A)

Prior to the field season, the project lead and resource manager will discuss the need for a training session. First-time volunteers must either attend a full training session or work with an experienced

volunteer who has participated in a full training session. A shortened version of the full training session can be conducted for volunteers that have participated in the past, but may need a refresher on particular topics.

All volunteers, regardless of the training schedule, must review the volunteer manual (SOP 5) prior to the beginning of the field season. The manual covers program objectives, assumptions, and sampling procedures, and will re-enforce the lessons learned in previous training. Volunteers are encouraged to practice point count procedures and use the equipment at home prior to conducting surveys in the field.

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Appendix A. Distance Estimation



National Park Service
Mid-Atlantic Network
Inventory and Monitoring
Program

Bird Monitoring Program Observer Training: Estimating Distances

The two most critical aspects of conducting point counts for this protocol are to ensure that species are identified correctly and double-counting of individual birds is avoided. Additionally, to correctly estimate bird abundance within study plots, it is important that observers accurately estimate distances to detected individuals. Participants should read through the self-administered distance training procedures below, and practice distance estimation in a habitat similar to the one they will be surveying during the field season. At a minimum, all observers should “recalibrate” themselves by practicing these procedures at the beginning of each field season.

Training Procedure:

1. In a habitat similar to the one in which you will be conducting point counts, begin by placing flagging at 10m, 25m and 50m from a marked central point (e.g. the point count station). To do this, volunteers will either need a 25m (or longer) tape, a laser rangefinder, or a measured length of rope.
2. Place additional flagging of an unknown distance at 4 or 5 locations within your mock study site. Make sure that you can see them from the central location. Return to the center point and estimate the distances to these flags. For this protocol, a critically important skill is to estimate whether a bird is within 50m of your location or beyond 50m. Record your distance estimates in a field book. Using a measuring device, determine the distance to each flag and compare your initial estimate to the actual distance. Repeat this exercise several times until you can consistently estimate distances correctly.
3. The majority of birds detected by an observer are usually heard but not seen, and estimating distances to birds that are only heard is often the greatest source of error in point counts. Standing at the central point, listen for vocalizing birds. Choose one consistently vocalizing individual and estimate the distance (within 50m or beyond 50m) to the bird. It is important to note that the horizontal distance should be estimated to a point on the ground beneath the bird, as if a plumb-bob was lowered to the ground from the bird's location. Try to visually identify the tree or branch where the bird is vocalizing, and estimate the horizontal distance to an object that can be seen directly below the location of the individual. Now, with one end of your measuring device affixed to the central point, slowly walk toward the vocalizing bird until you can either see it or accurately estimate its location. Compare your initial estimate to the actual distance. Repeat this exercise for several birds at various distances.

Standard Operating Procedure 4: Conducting Unlimited Radius Point Counts

Mid-Atlantic Network Breeding Bird Monitoring Program
Version 1.0 (September 2018)

Overview

This Standard Operating Procedure (SOP) provides step-by-step instructions for conducting 10 minute variable circular plot point counts. Procedures in this SOP are based on methodologies used by the Northeast Temperate Network (NETN) (Faccio et al. 2015) and National Capital Region Network (NCRN) (Dawson and Efford 2013). The NETN program uses more than two distance bands, however the MIDN decided that additional bands would decrease accuracy and consistency among volunteer observers (Buckland 1987). Despite differences in distance bands and time intervals, the dataset is robust enough to compare across a variety of bird monitoring programs.

In order to accurately estimate bird abundance, it is necessary to estimate the probability of detecting an individual. Doing so will help determine the number of birds that were **not** seen or heard during the count. Distance sampling (Buckland et al. 2001) and removal modeling (Farnsworth et al. 2002) are two methods MIDN uses in estimating this probability and they are based on the assumptions listed below. For more detailed information regarding the rationale for this protocol's sampling methods, please refer to the protocol narrative (Johnson and Wakamiya 2018)

1. Birds are correctly identified to species
2. Each individual is recorded only once
3. All birds at a zero distance are always detected
4. Birds are accurately recorded in the correct distance band
5. Observers are equally likely to detect a bird in minute 1 as in minute 9
6. Time of detection is recorded the first time the individual is detected

All point count observers should make every effort to meet these assumptions.

Survey Conditions

Point counts are to be conducted between sunrise and 5 hours after, when birds are most active and vocal. Birds should not be surveyed when rain or winds interfere with an observer's ability to perceive bird sounds, when fog or rain affects visibility, or when extreme weather conditions affect bird activity.

Survey Procedures

1. Navigate to point using the NPS-issued GPS unit. Approach the survey station with as minimal disturbance as possible to avoid flushing birds. Upon arrival at the sampling point, record the following information:
 - **Park unit** (provided) – Four-letter park unit code

- **Plot number** – Number assigned to survey station
- **Observer** – Name of observer conducting the survey
- **Recorder** – Name of recorder if different from primary observer
- **Date** – Date survey is conducted
- **Start time** – Time survey was started
- **Visit number** – Note a ‘1’ if it is the first time you are conducting a point count at this site this year, ‘2’ if it is the second time, etc.
- **Temperature** – Temperature in degrees Fahrenheit.
- **Sky** – Code for sky condition (see Table 1)
- **Wind speed (WS)** – Code for wind condition (see Table 2)
- **Noise** – Code for noise condition (see Table 3)

Table 1. Code, descriptions, and requirements for sky conditions

SKY/ PRECIPITATION		
Sky Code	Explanation	Point counts?
0	Clear or a few clouds	Yes
1	Partly cloudy (scattered)	Yes
2	Cloudy (broken) or overcast	Yes
4	Fog or Smoke	No
5	Drizzle	No
6	Rain	No
7	Snow	No

Table 2. Code, descriptions, and requirements for wind conditions

WIND			
Wind Speed (Beaufort Scale)	mph	Explanation	Point counts?
0	<1	Smoke rises vertically	Yes
1	1 to 3	Light air; smoke drifts	Yes
2	4 to 7	Light breeze; wind felt on face	Yes
3	8 to 12	Gentle breeze; leaves in constant motion	(Yes)
4	13 to 18	Dust raised; small branches move	No
5	19 to 24	Small trees begin to sway	No
6	25 or more	Strong breeze; large branches in motion	No

Table 3. Code, descriptions, and requirements for noise conditions

BACKGROUND NOISE			
Noise Code	Decibel (dB)	Explanation	Point counts?
0	<40	No background noise (BN) during most of the survey	Yes
1	~40-45	Faint BN during at least half of the survey	Yes
2	~45-50	Moderate BN; difficulty hearing birds >100m away	Yes
3	~50-60	Loud BN; difficulty hearing birds >50m away	(Yes)
4	>60	Intense BN; difficulty hearing birds 25m away	No

2. After the site information has been recorded, orient the field mapping card in a fixed direction, start the NPS-issued countdown timer, and begin your point count. During the 10-minute count, record all birds seen and heard. The following information should be recorded on the field mapping card.

- **Species code** – Use the standard 4-letter AOU codes referenced in your volunteer manual. If the observer is unsure of the AOU code, the full common name should be recorded.
- **Minute** – The minute the bird was **first** encountered. Make sure to use the countdown timer (first minute = 9, last minute = 0) (See SOP 6, Using the Adanac 100M stopwatch).
- **Detection type** – Note if the type of detection for each unique observation using the following codes: V = visual only, A = aural only, B = both visual and aural, or F = flyover of the sampling location.
- **Distance** – The distance band the bird was **first** encountered in (<50m or ≥50m). Distance should be the horizontal distance between the location a bird was first detected and the plot center. Flyovers do not require a distance.
- **Flock size** – Record a flock size of 1 for individual birds, unless an individual is part of a flock. All individuals in a flock are recorded together. For example if you observe a family group or breeding pair interacting with each other in the same minute, that would be considered a flock. This is because the group was detected together and are not independent detections. This would also be correct for large flocks of birds, like starlings and grackles. It is important to note that when recording a flock, to not record each bird in the flock individually, they should be transcribed as one row of data to the Field Data Form (Figure 3).
- **Sex (optional)** – If the sex of the individual can be determined, record it in the notes.
- **Age (optional)** – If the individual is a juvenile, record how many are juveniles in the notes.

Additional guidance:

- No attracting devices or techniques (e.g., recordings or pishing) should be used during a point count survey.
 - During the count, be sure to periodically rotate your body so that you do not spend the entire count facing the same direction; you must do your best to track birds around you in all directions.
 - If you are working in pairs or teams, only one person should be making the detections. The second person may act as a recorder, but should not add any encounters the primary observer may have missed. This protocol is based on a single observer sample design, and using two observers would inflate the number of birds detected, invalidating any data analysis.
 - Be sure to only record each bird once. Field notations may be used to help keep track of individual movements, but when data is transcribed, use only the time and distance band of the first detection. See Figures 1 and 2 for instructions and an example of field notations.
3. At the end of 10 minutes, stop recording bird detections. Do not record any new birds seen or heard after the 10 minutes have passed. New birds that are not species previously detected during the survey may be recorded as incidentals, by using time code “11”.
 4. Before leaving the point, the observer should check over the field mapping card thoroughly to make sure it is complete and legible. Remember, this is the only record of what happened during the survey. Take the time to clarify anything illegible or out of the ordinary. Also, check to make sure you have gathered all of your field gear before moving to the next point.

Look at the countdown timer when bird was seen first and record the minute

Use the following symbols to keep track of bird locations and to report your observations:

Species name:

Use the AOU 4-letter code (see separate list), or write full name if unsure of code

Detection type:

Visual=V Auditory=A Both=B Flyover=F

Sex etc.:

Male=  Female=  Pair=  Sex unknown= 

Nest= * Flock= 

Known change of position: 

Assumed change of position: 

Example:

To report a Magnolia Warbler male, heard in the second minute ('8' on countdown-timer) of the point count:

Species name + Detection type + Sex + Minute

MAWA + A +  + 8

Flock:
To report the flock size, add the number above the specie code. (To avoid confusing it with time!)

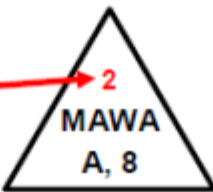
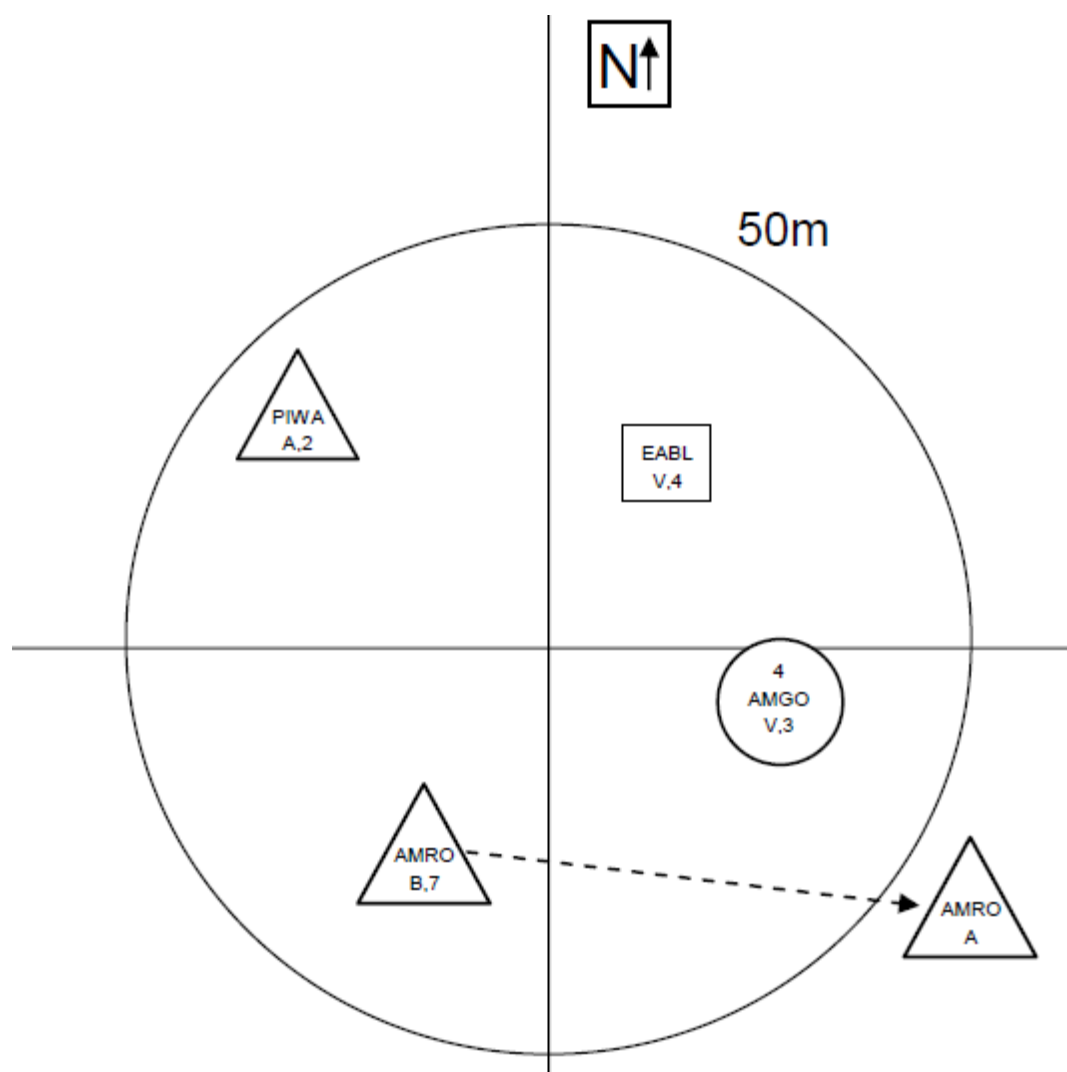


 MAWA
 A, 8

Figure 1. Notation instructions for the field mapping card.



Explanation

The observer made following observations:

- A flock of 4 American goldfinches was seen in the seventh minute ('3') of the point count
- An American Robin male was both seen and heard in the third minute ('7'); the observer assumes that this bird changed its location (the second location must not be reported on the FIELD DATA FORM!)
- A female eastern bluebird was seen in the sixth minute ('4') of the point count
- A male pine warbler was heard in the eighth minute ('2') of the point count

Figure 2. Example of a field mapping card and explanations of notations.

Park Unit: FRSP Plot Number:

Obs.: Rec.:

Date: Start time: Visit:

Temp(°F): Sky: WS: Noise:

	Species	Min (9,8,...0)	Type (A,V,B,F)	Flock (#)	Dist. (0/1)	Comments
1						
2						
3						
4						
5						
6						
7						
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27						
28						
29						

Figure 3. Sample Field Data Form

Data Transcription

Data should be transcribed from the Field Mapping Card to the Field Data Sheet as soon as possible following the completion of field activities. This will reduce the possibility of uninterpretable data. Make sure that only the first encounter is transcribed and that each individual is only recorded once. Upon completion of transcription of each Mapping Card, 100% of the records should be reviewed to ensure that data has been accurately and completely transcribed to the Field Data Form. If an error is found on the Field Mapping Card, it should be crossed out with a single line, corrected by the observer, initialed, and dated.

Sampling Frequency

Each point should be sampled at least twice during the breeding season, up to a maximum of four visits. All surveys of a point should be completed at least 2 weeks apart. If you complete your second survey of all of your assigned points, it is very important to contact your Park's Natural Resource Manager or designated staff before completing a third visit. Park staff is responsible for managing survey effort across the entire park. You may be asked to perform counts at other points in the Park to help complete the minimum of two surveys for all of the Park's points. This will ensure that volunteer effort is being used as efficiently as possible to meet protocol objectives.

Close Out

At the end of the season, all volunteers should return their equipment, datasheets, Field Mapping cards, and Field Data Forms to their point of contact (i.e. park resource manager or project lead) no later than August 15.

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 that establishes standards for data quality.

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 Service's integrated resource management information portal (<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 data quality standards document.

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 #

Literature Cited

- Buckland, S. T. 1987. On the Variable Circular Plot Method of Estimating Animal Density. *Biometrics* 43(2):363-384
- Buckland, S. T., D. R. Anderson, K. P. Burnham, J. Laake, D. Borchers, and L. Thomas. 2001. *Introduction to Distance Sampling: Estimating Abundance of Biological Populations*, Oxford University Press, Oxford.
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Johnson, M. J., and S. M. Wakamiya. 2018. Breeding bird monitoring protocol for the Mid-Atlantic Network. Natural Resource Report NPS/MIDN/NRR—2018/1769. National Park Service, Fort Collins, Colorado.

Standard Operating Procedure 5: Volunteer Manual and Field Datasheets

Mid-Atlantic Network Breeding Bird Monitoring Program
Version 1.0 (September 2018)

Overview

This Standard Operating Procedure (SOP) contains the volunteer manual and field datasheets used for the Mid-Atlantic Network Breeding Bird Monitoring Program. The volunteer manual contains a brief synopsis of the protocol and sampling procedures, field activity and equipment checklists, and reference tables needed to conduct field sampling. The pages of the manual and field datasheets are formatted to fit a 4.6 by 7 inch write in the rain paper for use in the field binder provided to all field observers. Volunteers and field staff should refer to the manual before performing any field sampling, and when transcribing their data to the Field Data Form (See SOP 4 - Conducting Unlimited Radius Point Counts) using the AOU codes provided in the manual.

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 that establishes standards for data quality.

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 Service's integrated resource management information portal (<https://irma.nps.gov/DataStore/Reference/Profile/2256611>).

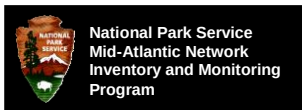
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Bird Monitoring Program Survey Instructions Version 1.0

Survey Schedule

Season Begins May 25 th and Ends July 15 th	
1 st Survey	As soon as you can
2 nd Survey	At least 2 weeks after 1 st
3 rd Survey	At least 2 weeks after 2 nd
4 th Survey	At least 2 weeks after 3 rd

Background

Avian species in the mid-Atlantic region face numerous habitat threats including urbanization, conversion to agriculture, and fragmentation. National parks provide refuge from such threats, containing contiguous tracts of various habitat types suitable for breeding birds, such as forests, wetlands, and grasslands. Many of the network parks have bird species that are declining throughout their range, emphasizing the need for understanding their status and trends.

Monitoring landbirds (species that occupy terrestrial habitats) will not only provide information on the long-term trends of avian species composition and relative abundance, but will also provide a measure for assessing ecological integrity.

Neotropical-migratory songbirds (i.e., warblers, tanagers, and vireos) are sensitive to habitat fragmentation and, hence, are excellent barometers of environmental change or degradation. Birds are also good indicators of local and regional ecosystem changes because of their high body temperature, rapid metabolism, and prominent position in most food webs.

Detecting early changes in bird population trends may help us identify stressors such as invasive species, fragmentation, and management practices that will help guide future management actions.

Goals & Objectives

1. Determine annual changes and long-term trends in species composition and relative abundance.
2. Improve our understanding of the relationship between breeding birds, habitats, and park management.

Sampling Design

In this study, we use the point count methodology; a similar technique is employed by the Breeding Bird Survey. Point counts provide a standardized methodology for obtaining information on landbird distribution, diversity, and abundance, and are the most commonly used.

Within the network parks, point count stations are set up 250m to 500m apart and, in some parks, a tree is tagged and flagged to denote the location of the station (if in a forested area). Each observer will navigate to their station using a GPS and conduct a 10-minute point count. During the 10-minute timeframe, all birds seen or heard are recorded, along with the time (minute of the count), and distance from the observer (<50m or >50m).

Assumptions

In order to accurately estimate bird abundance, we need to estimate the probability of detecting an individual. This will allow us to determine the number of birds that were **not** seen or heard during the count. Distance sampling and removal modeling are two methods we will use in estimating this probability and they are based on several assumptions:

1. Birds are correctly identified to species.
2. Each individual is recorded only once.
3. All birds within the 50 m band (the first distance band) are always detected.
4. Birds are accurately recorded in the correct distance band.

5. Observers are equally likely to detect a bird in minute 1 as in minute 9.
6. Time of detection is recorded the first time the individual is detected.

Please aim to ensure these assumptions are met. If you feel they may have not been, make sure you take notes as these will help considerably in data analysis.

Safety Precautions

The Mid-Atlantic Network (MIDN) considers the health and safety of its volunteers to be of utmost importance. While we hope your surveys are fun, educational, and filled with interesting birds, there are hazards you should be aware of. In addition to reviewing and signing the Job Safety Analysis, we ask that you familiarize yourself with the safety precautions below prior to the field season to help minimize the risk of an incident.

Teamwork

Because much of the monitoring for this protocol is off-trail in somewhat inaccessible areas, MIDN recommends that participants work in teams for monitoring. Working with another person makes it more likely that someone will be able to obtain help in the event of an accident, and working with someone else usually makes field work more enjoyable. If you are unable to find a partner and would like to work with one, notify your park contact and they will determine if a partner is available.

Personal Health

- Dress appropriately for the weather conditions and hiking off trail.
- Use appropriate methods for reducing risk of exposure to ticks (e.g. insect repellent or Permethrin) or poison ivy (Ivy Block).
- Bring a first aid kit and ensure you have adequate food and water.

Field Preparations

- Notify your park contact when and where you will be surveying and provide your vehicle license number.
- Be sure to let someone know your departure and arrival times and your route and check in with them when you return.
- Make sure you bring a cell phone and have park emergency contact information (in a life-threatening emergency, dial 9-1-1).
- Go over the Survey Procedure Checklist, below, prior to going out in the field.

Vehicle/Road Safety

- Ensure your vehicle is in safe working condition before leaving your home.
- Adhere to all federal and state vehicle regulations.
- Watch out for traffic hazards, wild animals, and suspicious-looking persons.

Survey Procedure Checklist

One month to one week prior to survey

- ☐ Review Volunteer Manual.
- ☐ Review, sign, and return all safety documents.
- ☐ Brush-up on bird songs in the field or with recordings.
- ☐ Conduct a pre-survey visit.
 - This will help familiarize you with your equipment, sites, and the types of birds you will see.
 - Practicing distance estimation at sites will also help you make better estimates during the real counts.
- ☐ Notify park contact (park resource manager or project lead) of planned survey dates.

Day before or day of survey

- ☐ Notify park contact of any changes to your plan.
- ☐ Plan your survey route.
 - Make sure you know where you will be going, which sites you will visit, and how to get back to your vehicle.
- ☐ Check weather forecast and plan accordingly.
- ☐ Check equipment list.
- ☐ Notify your emergency contact where you will be.
- ☐ Check-in with your emergency contact on return.

Field equipment:

Item	Number needed	✓
AOU bird species list	1	
Binder	1 per crew member	
Binoculars	1 (Not provided)	
Compass	1	
Emergency contact list	1	
Field Data Form	4 per point count	
Field Mapping Card	4 per point count	
First Aid Kit	Highly recommended	
GPS Unit	1	
Map of point locations	1	
Park map	1	
Parking permit	Where applicable	
Pens or pencils	Many	
Safety SOP	1	
Spare AA batteries	2	
Stopwatch	1	
Thermometer	1	
Volunteer Manual	1	
Water and Snacks	Bring Plenty	

Point Count Procedures:

1. Sampling in pairs:
 - If you are sampling in a pair, you must designate one person as the observer who conducts the actual survey, and one person as the recorder who records observer 1's detections.
 - **It is important that only one person be designated as the observer and that the second person, if available, only records the data and does not provide their own observations.**
2. Point count conditions:
 - Conduct point counts on **May 25 – July 15** between **sunrise and 5 hours after**. Check the weather and point conditions (details see above).

General rule: Only conduct surveys in weather that is unlikely to reduce count numbers (i.e. impairs your ability to see or hear birds).

3. Upon arrival at the sampling point:
 - Place thermometer in a fixed location away from your body. This will allow you to record an accurate temperature once sampling is complete.
 - Record the following information:
 - Park unit
 - Plot number
 - Plot conditions (Sky, Wind, Noise)
 - Date
 - Observer
 - Recorder (if applicable)
4. Begin the count after you are finished recording the site information:
 - Record the start time.
 - Use the NPS-issued timer to keep track of time.
5. During the point count:
 - Count all birds seen and heard during the **10-minute sampling period**.

- Note in which minute birds are first encountered; use the countdown (first minute = '9', last minute = '0').

6. Counting:

- Map all observations (both visual and auditory) on the field mapping card.
 - Use the codes V(visual), A(auditory), or B(both) to report the detection type.
 - Mark location and note movements to help you track individuals.
 - Different symbols help you keep track of observation status (see Field Mapping Card [FMC] instructions).
 - Use standard AOU species codes to identify species (see AOU species list). **If you cannot remember the code write the full name.**
- Hold the mapping card in a fixed direction, and make sure you spend time facing each direction.
- Use your mapped locations to determine if a bird is really a new individual, or one that has already been recorded and has recently moved.
- Estimate distance to encountered bird: Record if it is within the 50m buffer or beyond 50m.
 - Distance should be the horizontal distance between the location a bird was first detected and the plot center.
- Keep an eye out for flyovers, mark them with an F
- Record flocks and flock size (do not record each bird within a flock individually). Circle the flock number to be sure you don't confuse flock size and time!
- Do not record any birds believed to have been counted at previous stations.

7. At the end of the point count:

- Stop recording bird observations at the end of the 10 minute period.
- Do **not** record any new birds.

- Incidental observations of new species not detected during the point count may be recorded using a time code of 11.
 - There are no bird detections with a time code of 10. Only 0 through 9 or 11 are acceptable.
 - Record Temperature (°F) with the provided thermometer.
8. After the survey or at the end of the sampling day:
- Transcribe the notations from the field mapping card to the Field Data Form – do this as soon as possible while information is fresh in your mind.
 - Verify each record to make sure data matches what is on your field mapping card.

How to report birds on the Field Mapping Card

Look at the countdown timer when bird was seen first and record the minute

Use the following symbols to keep track of bird locations and to report your observations:

Species name:

Use the AOU 4-letter code (see separate list), or write full name if unsure of code

Detection type:

Visual=V

Auditory=A

Both=B

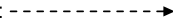
Flyover=F

Sex etc.:

Male=  Female=  Pair=  Sex unknown= 

Nest= * Flock= 

Known change of position: 

Assumed change of position: 

Example:

To report a Magnolia Warbler male, heard in the second minute ('8' on countdown-timer) of the point count:

Species name + Detection type + Sex + Minute

MAWA

+

A

+

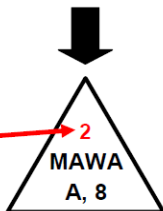


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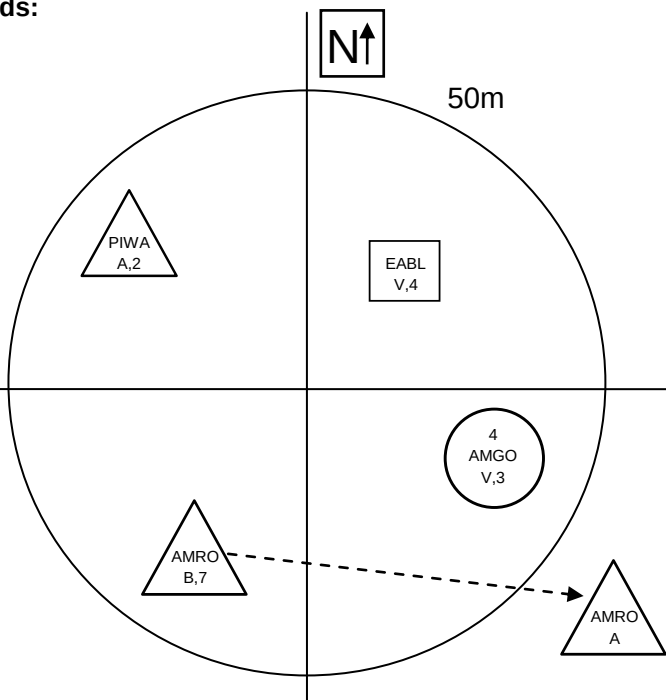
8

Flock:

To report the flock size, add the number above the specie code. (To avoid confusing it with time!)



Example of Field Mapping Card with several detected birds:



Explanation

The observer made following observations:

- A flock of 4 American goldfinches was seen in the seventh minute ('3') of the point count
- An American Robin male was both seen and heard in the third minute ('7'); the observer assumes that this bird changed its location (the second location should NOT be reported on the FIELD DATA FORM!)
- A female eastern bluebird was seen in the sixth minute ('4') of the point count
- A male pine warbler was heard in the eighth minute ('2') of the point count

SKY/ PRECIPITATION		
Sky Code	Explanation	Point counts?
0	Clear or a few clouds	Yes
1	Partly cloudy (scattered)	Yes
2	Cloudy (broken) or overcast	Yes
4	Fog or Smoke	No
5	Drizzle	No
6	Rain	No
7	Snow	No

WIND			
Wind Speed (Beaufort Scale)	Mph	Explanation	Point counts?
0	<1	Smoke rises vertically	Yes
1	1 to 3	Light air; smoke drifts	Yes
2	4 to 7	Light breeze; wind felt on face	Yes
3	8 to 12	Gentle breeze; leaves in constant motion	(Yes)
4	13 to 18	Dust raised; small branches move	No
5	19 to 24	Small trees begin to sway	No
6	25 or more	Strong breeze; large branches in motion	No

BACKGROUND NOISE			
Noise Code	Decibel (dB)	Explanation	Point counts?
0	<40	No background noise (BN) during most of the survey	Yes
1	~40-45	Faint BN during at least half of the survey	Yes
2	~45-50	Moderate BN; difficulty hearing birds >100m away	Yes
3	~50-60	Loud BN; difficulty hearing birds >50m away	(Yes)
4	>60	Intense BN; difficulty hearing birds 25m away	No

Data to note and to report on both Field Mapping Card and Field Data Form	
Park Unit = Name of a certain unit (e.g. FRSP, VAFO)	Plot number = Every point count site has a unique number
Obs. = Observer conducting point count	Rec. = Recorder of data to data sheets
Date = Day, when point count is conducted (mm/dd/yy)	Start time = Time, when point count is started (hhmm)
Temp = Temperature in degrees Fahrenheit	Sky = Sky code (see plot conditions check above)
WS = Wind speed (see plot conditions check above)	Noise = Noise code (see plot conditions check above)
Data to note and report on Field Data Form	
Species: enter the AOU 4-letter code	Min. = minute during point count the bird was first detected (0-9, or 11; do not use 10)
Type = How was the bird first detected? (A,V,B,F)	Flock= birds moving and behaving in a group (How many?)
Dist. = distance (0= 0-50m; 1= ≥50m)	Comments: problems, uncertain species, etc.

AOU bird species list

Code	Common Name
ACFL	Acadian flycatcher
ALFL	Alder flycatcher
ABDU	American black duck
AMBI	American bittern
AMCO	American coot
AMCR	American crow
AMGO	American goldfinch
AMKE	American kestrel
AMPI	American pipit
AMRE	American redstart
AMRO	American robin
AMWI	American wigeon
AMWO	American woodcock
ATSP	American tree sparrow
BAEA	Bald eagle
BANS	Bank swallow
BAOR	Baltimore oriole
BARS	Barn swallow
BAWW	Black-and-white warbler
BBCU	Black-billed cuckoo
BBWA	Bay-breasted warbler
BCCH	Black-capped chickadee
BCNH	Black-crowned night-heron
BADO	Barred owl
BEKI	Belted kingfisher
BEWR	Bewick's wren
BGGN	Blue-gray gnatcatcher
BHCO	Brown-headed cowbird
BHVI	Blue-headed vireo
BITH	Bicknell's thrush
BLBW	Blackburnian warbler
BLGR	Blue grosbeak
BLJA	Blue jay
BLPW	Blackpoll warbler
BLSC	Black scoter

Mid-Atlantic Network

BLVU	Black vulture
BANO	Barn owl
BOBO	Bobolink
BOGU	Bonaparte's gull
BRCR	Brown creeper
BRTH	Brown thrasher
BRWA	Brewster's Warbler
BTBW	Black-throated blue warbler
BTNW	Black-throated green warbler
BUFF	Bufflehead
BWHA	Broad-winged hawk
BWTE	Blue-winged teal
BWWA	Blue-winged warbler
CACH	Carolina chickadee
CAEG	Cattle egret
CANG	Canada goose
CANV	Canvasback
CARW	Carolina wren
CAWA	Canada warbler
CEDW	Cedar waxwing
CERW	Cerulean warbler
CHSP	Chipping sparrow
CHSW	Chimney swift
CLRA	Clapper rail
CLSW	Cliff swallow
CMWA	Cape may warbler
COGO	Common goldeneye
COGR	Common grackle
COHA	Cooper's hawk
COLO	Common loon
COME	Common merganser
COMO	Common moorhen
CONI	Common nighthawk
CORA	Common raven
CORE	Common redpoll
COTE	Common tern
CONW	Connecticut warbler
COYE	Common yellowthroat
CSWA	Chestnut-sided

AOU bird species list

	warbler
DCCO	Double-crested cormorant
DEJU	Dark-eyed junco
DICK	Dickcissel
DOWO	Downy woodpecker
EABL	Eastern bluebird
EAKI	Eastern kingbird
EAME	Eastern meadowlark
EAPH	Eastern phoebe
EASO	Eastern screech owl
EATO	Eastern towhee
EAWP	Eastern wood-pewee
EUST	European starling
EVGR	Evening grosbeak
FICR	Fish crow
FISP	Field sparrow
FOSP	Fox sparrow
GADW	Gadwall
GBBG	Great black-backed gull
GBHE	Great blue heron
GCFL	Great crested flycatcher
GCKI	Golden-crowned kinglet
GCTH	Gray-cheeked thrush
GHOW	Great horned owl
GLIB	Glossy ibis
GOEA	Golden eagle
GRCA	Gray catbird
GREG	Great egret
GRHE	Green-backed heron
GRSC	Greater scaup
GRSP	Grasshopper sparrow
GRYE	Greater yellowlegs
GWFG	Greater white-fronted goose
AGWT	Green-winged teal
GWWA	Golden-winged warbler
HAWO	Hairy woodpecker

Mid-Atlantic Network

HERG	Herring gull
HESP	Henslow's sparrow
HETH	Hermit thrush
HOFI	House finch
HOGH	Horned grebe
HOLA	Horned lark
HOME	Hooded merganser
HOSP	House sparrow
HOWA	Hooded warbler
HOWR	House wren
INBU	Indigo bunting
KEWA	Kentucky warbler
KILL	Killdeer
KIRA	King rail
LAGU	Laughing gull
LBBG	Lesser black-backed gull
LBHE	Little blue heron
LEBI	Least bittern
LEFL	Least flycatcher
LEOW	Long-eared owl
LESA	Least sandpiper
LESC	Lesser scaup
LEYE	Lesser yellowlegs
LISP	Lincoln's sparrow
LOSH	Loggerhead shrike
LTDU	Long-tailed Duck
LOWA	Louisiana waterthrush
MALL	Mallard
MAWA	Magnolia warbler
MAWR	Marsh wren
MERL	Merlin
MODO	Mourning dove
MOWA	Mourning warbler
MUSW	Mute swan
NAWA	Nashville warbler
NOBO	Northern bobwhite
NOCA	Northern cardinal
NOFL	Northern flicker
NOGO	Northern goshawk
NOHA	Northern harrier

AOU bird species list

NOMO	Northern mockingbird
NOPA	Northern parula
NOPI	Northern pintail
NSHO	Northern shoveler
NOWA	Northern waterthrush
NRWS	Northern rough-winged sw.
NSHR	Northern shrike
OCWA	Orange-crowned warbler
OROR	Orchard oriole
OSFL	Olive-sided flycatcher
OSPR	Osprey
OVEN	Ovenbird
PAWA	Palm warbler
PBGR	Pied-billed grebe
PEFA	Peregrine falcon
PESA	Pectoral sandpiper
PHVI	Philadelphia vireo
PIGR	Pine grosbeak
PISI	Pine siskin
PIWA	Pine warbler
PIWO	Pileated woodpecker
PRAW	Prairie warbler
PROW	Prothonotary warbler
PUFI	Purple finch
PUMA	Purple martin
RBGR	Rose-breasted grosbeak
RBGU	Ring-billed gull
RBME	Red-breasted merganser
RBNU	Red-breasted nuthatch
RBWO	Red-bellied woodpecker
RCKI	Ruby-crowned kinglet
RECR	Red crossbill
REDH	Redhead
REVI	Red-eyed vireo
RHOW	Red-headed woodpecker

Mid-Atlantic Network

RLHA	Rough-legged hawk
RNDU	Ring-necked duck
RNGR	Ring-necked grebe
RNPH	Ring-necked pheasant
ROPI	Rock pigeon
RSHA	Red-shouldered hawk
RTHA	Red-tailed hawk
RTHU	Ruby-throated hummingbird
RUBL	Rusty blackbird
RUDU	Ruddy duck
RUGR	Ruffed grouse
RWBL	Red-winged blackbird
SAVS	Savannah sparrow
SCTA	Scarlet tanager
SEPL	Semipalmated plover
SESA	Semipalmated sandpiper
SEWR	Sedge wren
SNEG	Snowy egret
SNGO	Snow goose
SORA	Sora
SOSA	Solitary sandpiper
SOSP	Song sparrow
SPSA	Spotted sandpiper
SSHA	Sharp-shinned hawk
SUTA	Summer tanager
SWSP	Swamp sparrow
SWTH	Swainson's thrush
SWWA	Swainson's warbler
TEWA	Tennessee warbler
TRHE	Tricolored heron
TRES	Tree swallow
TUSW	Tundra swan
TUTI	Tufted titmouse
TUVU	Turkey vulture
UNIN	Unknown
UPSA	Upland sandpiper
VEER	Veery
VESP	Vesper sparrow

AOU bird species list

Mid-Atlantic Network

VIRA	Virginia rail
WAVI	Warbling vireo
WBNU	White-breasted nuthatch
WCSP	White-crowned sparrow
WEVI	White-eyed vireo
WEWA	Worm-eating warbler
WIFL	Willow flycatcher
WITU	Wild turkey
WIWA	Wilson's warbler
WIWR	Winter wren
WODU	Wood duck
WOTH	Wood thrush
WPWI	Whip-poor-will
WTSP	White-throated sparrow
WWCR	White-winged crossbill
WWSC	White-winged scoter
YBCH	Yellow-breasted chat
YBCU	Yellow-billed cuckoo
YBFL	Yellow-bellied flycatcher
YBSA	Yellow-bellied sapsucker
YCNH	Yellow-crowned night-heron
YWAR	Yellow warbler
YRWA	Yellow-rumped warbler
YTVI	Yellow-throated vireo
YTWA	Yellow-throated warbler

Name _____ Park Unit: _____

Field Season Completion Checklist. This checklist is an important part of our quality control procedures. Please initial and date each task as it is completed, and return this sheet with equipment (by 15 August).

Initials	Date	Task	Due Date
		Attend Volunteer Training and/or read/review Volunteer Manual	Mid- to late-May
		Sign and return all safety documents	Mid to late - May
		Conduct 1 st field survey	
		Conduct 2 nd field survey	
		Conduct 3rd field survey (optional)	
		Conduct 4th field survey (optional)	
		Enter field data onto the Field Data Forms and validate your entries	Within 1 day of conducting field survey
		Total up volunteer hours contributed to project this season and enter below.	No later than 15 August
		Return Field Mapping Cards, Field Data Forms equipment, and this checklist to park contact.	No later than 15 August
Total Volunteer Hours:			
Comments:			

Standard Operating Procedure 6: Using the Garmin 76CS Global Positioning System Unit

Mid-Atlantic Network Breeding Bird Monitoring Program
Version 1.0 (September 2018)

Overview

This Standard Operating Procedure (SOP) was adapted from a SOP written by Shenandoah National Park for the Garmin 76CS. It explains the basic methods that all field observers should follow to learn to use Global Positioning System (GPS) with the Garmin eTrex Vista HCX unit (Figure 1). The GPS is used to help navigate to and locate pre-existing point count locations. This SOP does not contain information regarding advanced functions of the unit. For advanced functions please refer to the Garmin GPS eTrex Vista HCX Owner's Manual. If you are having trouble using the unit or you think it is malfunctioning, please contact your Park coordinator.

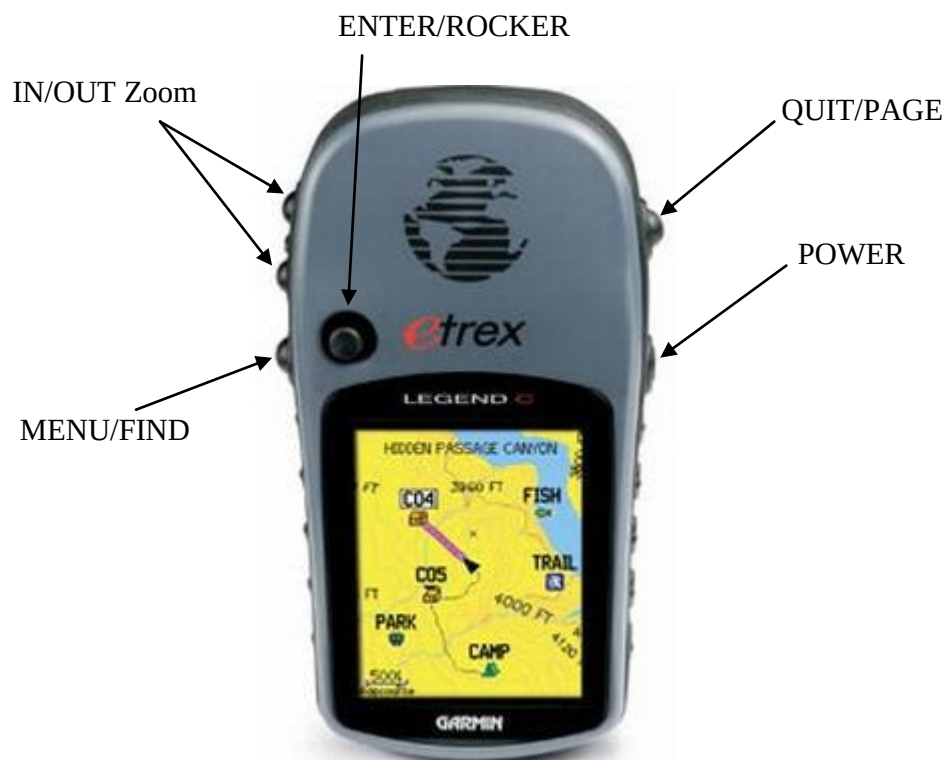


Figure 1. The Garmin GPS eTrex Vista HCX with labeled user input buttons

Using the GPS Unit in the Field

The GPS is used in the field to navigate to the predetermined location of existing bird monitoring plots. The device provided will be already set up for proper use, and is already loaded with waypoints to each point count location. When going into the field, be sure to carry at least one full set of replacement of batteries (AA) for the GPS receiver. Battery power can be checked by pressing 'POWER' once or by looking at the top right of the menu page. The batteries are replaced by removing the battery cover on the back of the device. Turn the locking ring ¼ turn counter clockwise to unlock. Lift off the cover. Refer to the Garmin GPS eTrex Vista HCX Owner's Manual if you have trouble.

A. Getting Started

To turn the unit on press and hold 'POWER' on the lower right until you see a display. If you have trouble seeing the display you can hit power 2 or 3 times to increase the backlight. At any time you can press 'QUIT/PAGE' on the upper right to cancel data entry or exit a page

B. Searching for Satellites

As soon as you turn the unit on, it starts searching for satellites. It is important to let the unit finish its satellite search before trying to navigate to a point. The GPS can pick up satellites quickest when it is positioned horizontally (i.e. screen facing sky). The location of satellites in the sky changes from day to day, and thus sometimes satellite reception is more difficult to achieve. Openings in forest canopy can increase the strength of satellite signals reaching the GPS unit.

1. Your GPS should immediately take you to the satellite page (Figure 2). If not, you can track the status of the satellites by pressing 'Page' until you reach the Satellite screen. The GPS is most accurate when it has at least four satellites and a 3D position.

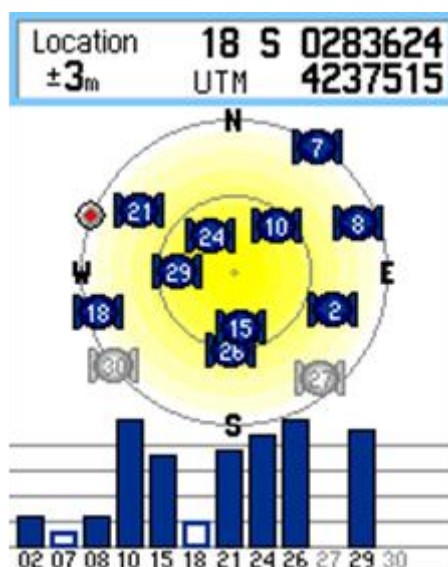


Figure 2. Garmin GPS eTrex Vista HCX satellite displaying the satellites in range of the device and current signal strength. Location accuracy is displayed in the upper left and point coordinates are in the upper right.

2. Once the receiver has at least four satellites, it will display the estimated accuracy on the upper left. The accuracy fluctuates as satellite signals are gained and lost.
3. To check if the unit has a 3D position, press 'POWER' once. If the unit has a 3D position, it will show 3D icon  on the bottom left.
4. Once you are confident that the unit has enough satellites, you can use the unit to navigate to your first point count location.

C. Navigating to a site

1. Press and hold the 'MENU/FIND' key to get to the 'Find' menu.
2. Navigate to 'Waypoints' and press 'ENTR'.
3. Use the keypad to search for the point you wish to navigate to or click 'QUIT' to manually scroll to the appropriate waypoint. To select the point press 'ENTR'.
4. The waypoint screen (Figure 3) will give you detailed information about the waypoint including the Note field (displays point name) and the distance to the point. 'Go To' should already be highlighted, so press 'ENTR'.
5. The Map Page, Highway Page, or Compass Page can be used to navigate to the waypoint (Figure 4). At the top of the Map Page and Highway Page, the direction you are heading, the distance to the waypoint, the estimated time of arrival (ETA), and time to destination will be displayed.

Please Note: Navigation with the Garmin GPS eTrex Vista HCX works best if you are moving. Standing still will cause the bearing and distance numbers to bounce around. If you need to, use your map and compass to get a general idea of the direction to your point, and begin walking in that direction. Then use the GPS to navigate to the point. When you get to within 15-20 meters of the point, you should begin to look more carefully in the direction of the point to see if you can see flagging for the point count location. Your Park coordinator will tell you in advance what sort of flagging to look for that is specific to your park. You may notice that when you get within 5-10 meters of the point that the bearing on the GPS unit will change direction more frequently due to the varying accuracy of the unit.

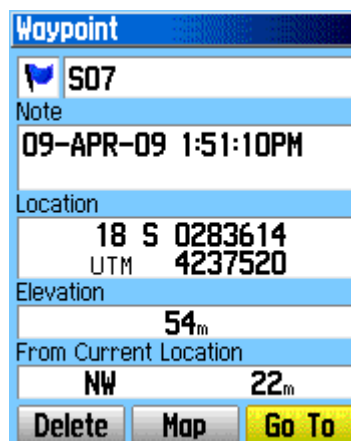


Figure 3. Garmin GPS eTrex Vista HCX waypoint screen displaying the point name (S07), date and time waypoint was recorded, the location coordinates, the elevation of the point, and the direction and distance to the waypoint from the current location.

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 that establishes standards for data quality.

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 Service's integrated resource management information portal (<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 data quality standards document.

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.

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Literature Cited

Johnson, M. J., and S. M. Wakamiya. 2018. Breeding bird monitoring protocol for the Mid-Atlantic Network. Natural Resource Report NPS/MIDN/NRR—2018/1769. National Park Service, Fort Collins, Colorado.

Standard Operating Procedure 7: Using the Adanac 100M stopwatch

Mid-Atlantic Network Breeding Bird Monitoring Program
Version 1.0 (September 2018)

Overview

This Standard Operating Procedure (SOP) explains how to use the Adanac 100M stopwatch. The stopwatch is used for recording time bands during bird monitoring point count surveys. Only features used in this protocol will be discussed.

Suggested Reading

Adanac 100 Lap Multi-Function Stopwatch/Watch User Manual which is included with your field equipment.



Using the timer to conduct a 10 minute point count

For additional details on the use of the stopwatch modes described below, see additional information section.

- If the stopwatch is in the Power Saving Mode (screen is off), **press any button** to turn it on.
- Pressing the **[M]** button at the top, navigate to the **Countdown Timer Mode**. You will see **Timer1** scroll across the top. You should also see a **TR1** and **CS** on the top of the screen. The countdown timer is already set to count down for 10 minutes (for 10-minute point counts). It is unnecessary to adjust the countdown time after every point count.
- **Press [S/S] on the right** to start the countdown.
- **Press [S/S] on the right** to silence the alarm or interrupt the countdown if needed.
- Hold **[L/R]** on the left to reset the timer.
- To put the stopwatch back into **Power Saving Mode**, press the **[M]** button until you reach **Current Time Mode** (you will see the day of the week and year on the top), then press and hold the Lap/Reset **[L/R]** on the left, until it turns off (approximately 5 seconds).

Note: Please, always place the stopwatch into sleep mode at the end of your field day, as changing the batteries is extremely difficult.

Additional Information:

Current Time Mode Adjustments

The Current Time Mode shows the date, time, and day of week.

- To navigate to the Current Time Mode, press the **[M]** button until you see the day of the week and year.
- Time and Date adjustments if needed:
 - Press and hold the **[M]** button for approximately 3 seconds or digits start flashing. Use the **[M]** button at the top to select the position and the **[S/S]** button on the right to increase or the **[L/R]** button on the left to decrease. When finished making adjustments, press the **[M]** button once to set.

Countdown Timer Mode Adjustments

The Countdown Timer Mode is the mode used during the actual point count and presents the countdown time on the bottom row and how much time is set on the top row. To navigate to the Timer Mode, press the **[M]** button until you see **Timer1** scroll across the top. You should also see a **TR1** and **CS** on the top of the screen.

Troubleshooting: It is unnecessary to adjust the countdown time after every point count. **Just hold [L/R] to reset.**

- If you see **TR2**, press **[L/R]** to toggle back to **TR1**.
- If you see **CR** or **LK**, press and **hold [M]** until the digits start to blink. Toggle to where it says **CR** or **LK** using the **[M]** button, then use the **[S/S]** or **[L/R]** button to change to **CR**. Press and hold **[M]** to set.

Battery Replacement

Please notify park staff if battery replacement is needed.

Revision History

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Standard Operating Procedure 8: Data Entry and Analysis Database

Mid-Atlantic Network Breeding Bird Monitoring Program
Version 1.0 (September 2018)

Overview

This Standard Operating Procedure (SOP) outlines how to use the Mid-Atlantic Network's Breeding Bird Monitoring Data Entry and Analysis database to perform data entry activities.

Connecting the Front and Back End databases

The MIDN Breeding Bird Monitoring Data Entry and Analysis Database is a Microsoft Access database consisting of a backend file named "MIDN_BBM_BackEnd_DATE" and a frontend file named "MIDN_BBM_Entry_Analysis_DATE" (Fig. 1.). The backend file (.mdb file extension) contains the storage tables that hold all of the entered data. The frontend file (.accdb file extension) contains the electronic data entry forms used to enter data from the Field Data Forms (see SOP 4). In order to enter data, the front end file must be opened and connected to the appropriate back end file. The Data Manager will provide access to a copy of the most up to date files to use for data entry.

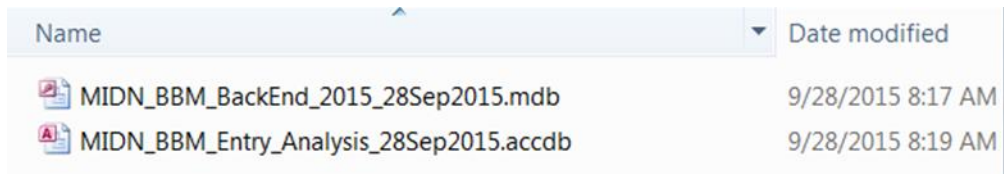


Figure 1. A screenshot of sample backend (.mdb) and frontend (.accdb) databases.

To begin, open the frontend file by double clicking on it. If you receive a security warning like the one shown in Figures 2 and 3, Click the "Stop all Macros" button (Figure 2), then click the "Enable Content" button (Figure 3).

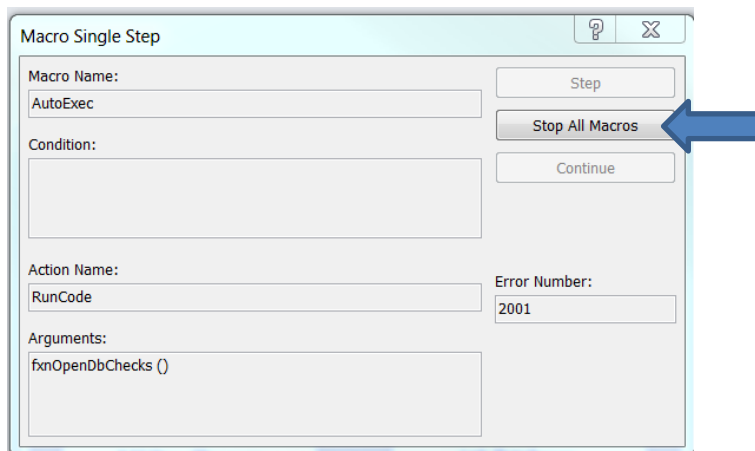


Figure 2. Microsoft Access dialog box shown during a security event.

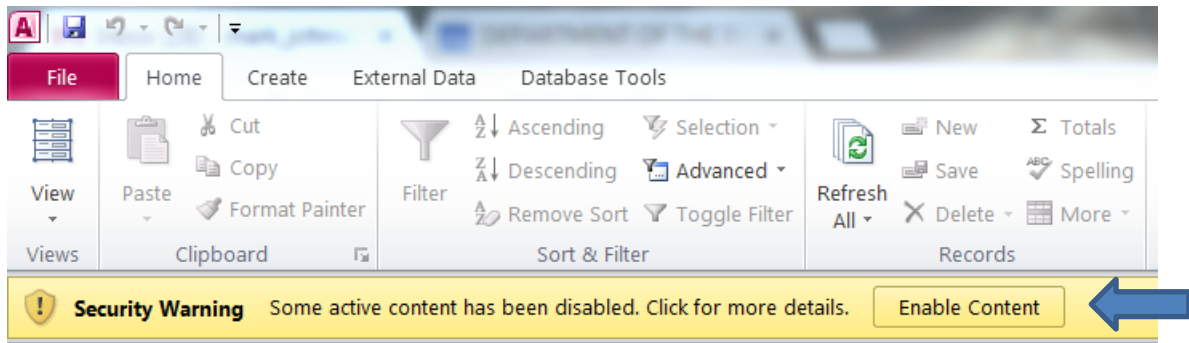


Figure 3. Microsoft Access warning bar displayed during a security event.

Once you are able to access the main database switchboard, select the “Link databases” button (Figure 4).

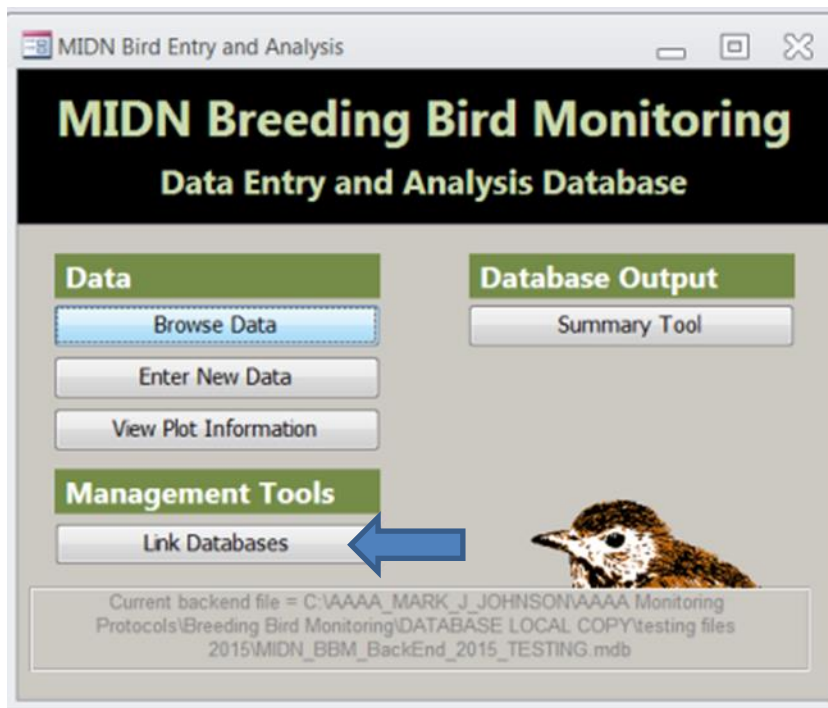


Figure 4. A screen showing an example backend database (.mdb) and frontend Switchboard form showing the Browse Data button used to open the Data Gateway form.

A dialog box will open (Figure 5). Click the “Browse” button, and navigate to the appropriate backend file, then click the “Update links” button. A dialog box will notify you that the update is complete. Click “Ok” on the resulting dialog window.

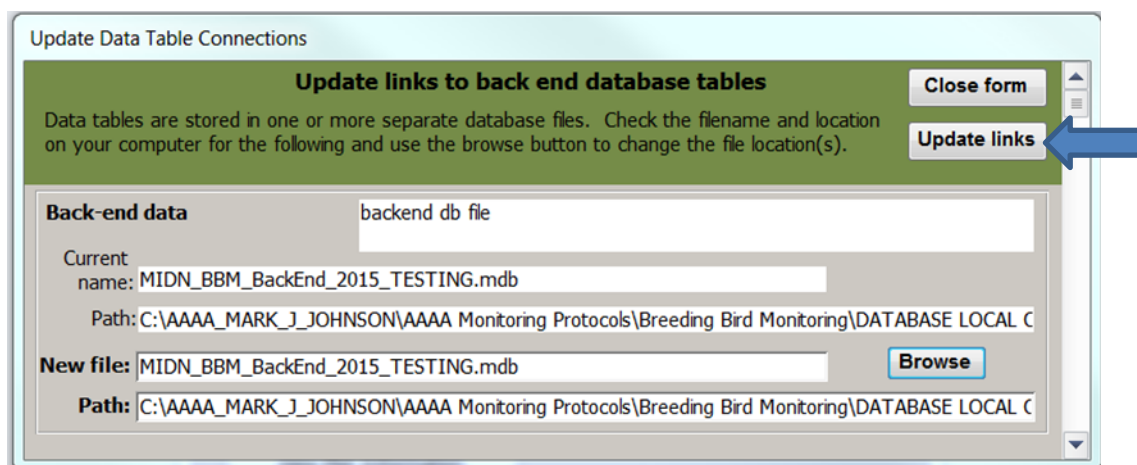


Figure 5. The Update Data Table Connections dialog, displaying the current backend and new file backend paths.

Entering Data

To begin entering new data, click the “Enter New Data” button under “Data” on the switchboard form (Fig.6.). This will open the point count data entry form (Fig. 7.). This form will allow you to enter all of the data recorded for one point count event.

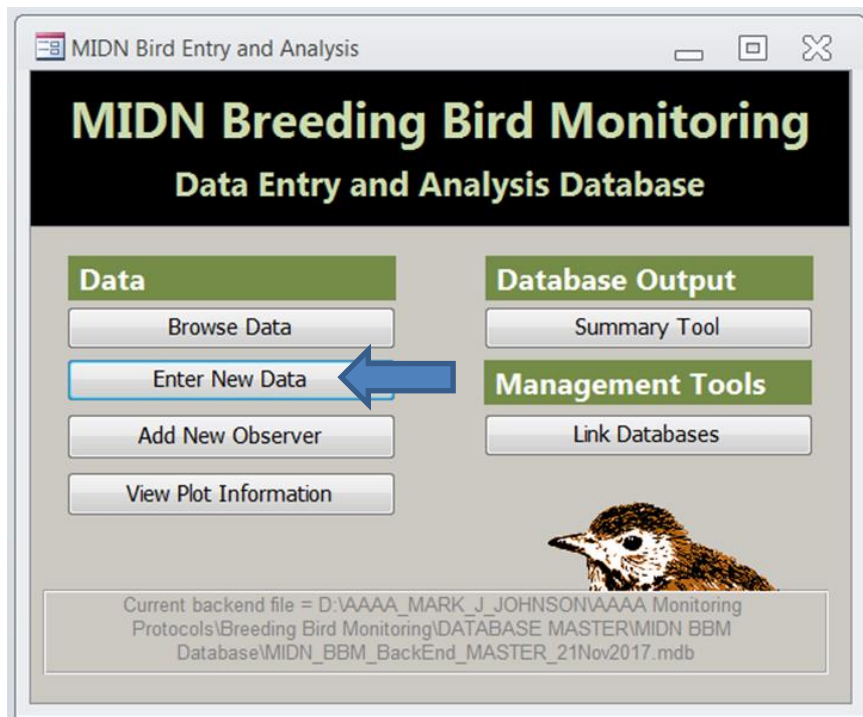


Figure 6. The main switchboard interface of the MIDN BBM database highlighting the “Enter New Data” button.

To enter data into the Point Count Data Entry form, you must first unlock the form by clicking the “Mode” button in the top right of the form (Figure 7). Starting with the “Entered By:” field you can tab through the rest of the fields in the order in which they should be entered. Most fields have a validation rule that will trigger a pop up message if a required field is left blank, or an out of range value has been entered. A list of data entry fields, their definitions, and expected values are found below (Table 1). Once you have completed entering all of the data for a point count with no errors, you can click the “Add a new record” button in the bottom right of the form and a blank form will be displayed.

Figure 7. The Point Count Data Entry form of the MIDN BBM database highlighting the “Enter New Data” button.

Table 1: List of data entry fields found on the Point Count Data Entry form.

Required	Field Name	Description	Format
Yes	Entered By	The name of the person completing the electronic data entry	Lastname, First
Yes	Plot Number	The name of the Plot that the visit occurred	PARK.UNIT.PLOT
Yes	Observer	Name of the birder making the point count observations	Lastname, First
Yes	Recorder	Name of the person recording the point count data (can be the same as Observer)	Lastname, First
Yes	Survey Date	Date of the point count survey	MO/DY/YEAR
Yes	Survey Time	Time of the point count survey	12:12
No	Visit	Number of visit for the season	1, 2, 3, 4
Yes	Temp	Ambient temperature at the time of the point count survey	Fahrenheit
Yes	Sky	Sky code	0, 1, 2, 3, 4, 5, 6, 7, 9
Yes	Wind	Wind code	0, 1, 2, 3, 4, 5, 6, 9
Yes	Noise	Noise code	0, 1, 2, 3, 4, 9
	Survey Notes	Notes applicable to the entire survey	

Yes	Species	4-letter species code	ABCD
Yes	Minute	Minute detection recorded during 10 minute point count	0-9, 11, NR
Yes	Type	type of observation made (Audio, Both, Flyover, Visual)	A, B, F, V
Yes	Flock	number of individuals detected	integer
Yes	Distance	Distance band for the bird observed	0, 1
No	Notes	Notes specific to the observation	

Editing Existing Data

If you need to edit data that you have already entered, click the “browse Data” button on the main switchboard form (Figure 8). This will open the Data Gateway form that displays all of the survey records already entered (Figure 9).

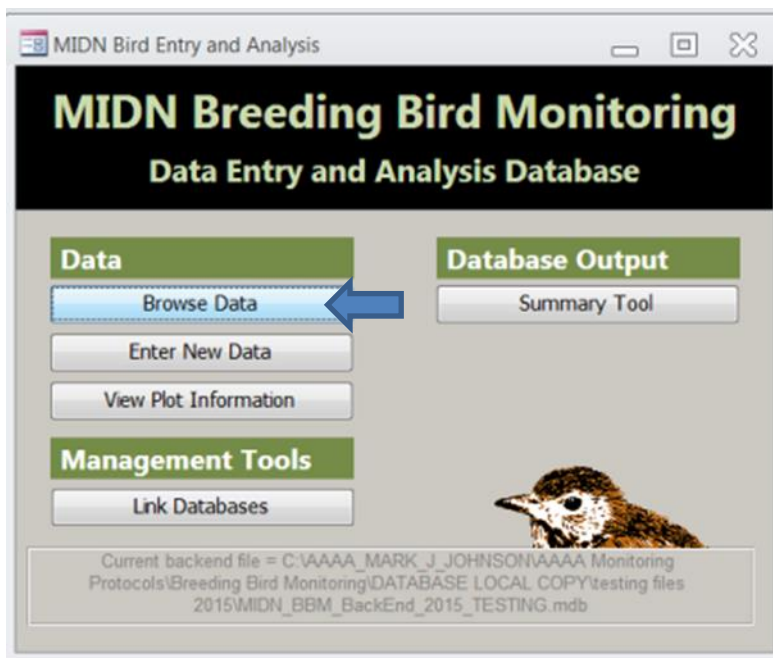


Figure 8. Switchboard form showing the Browse Data button used to open the Data Gateway form.

You can use the filters at the top of the Data Gateway form to make it easier to locate the record you are trying to edit. Once you have found the record you want to edit, double click on the blue visit date hyperlink, and the Point Count Data Entry form (Figure 7) will open to the correct visit. You can then proceed to unlock the data and make any changes required.

Data Gateway - List of data that have been entered

*Double-click on a Visit Date to open the Data Entry form for that record.

Filters 

Park: Plot Name: Visit Date: Year: Data Verified?: Records: 22 **Filter is On** **Clear Filter**

Park	<i>Plot Name</i>	Visit date*	Verified?
APCO	APCO.NA.004	12 Mar 2015 	1
APCO	APCO.NA.011	10 Sep 2015	1
APCO	APCO.NA.011	28 Apr 2015	1

Figure 9. Data Gateway form showing the available event filters and visit date hyperlink.

Closing the Database

To close the database, close any open forms by clicking on the close button in the top right of the form. Close the Access application by clicking the close button at the top right of the application window.

Revision History

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Standard Operating Procedure 9: Data Management

Mid-Atlantic Network Breeding Bird Monitoring Program
Version 1.0 (September 2018)

Overview

This Standard Operating Procedure (SOP) outlines the procedures for proper transcription, verification and stewardship of Mid-Atlantic Network (MIDN) breeding bird monitoring (BBM) data after field data collection. In addition, data certification, storage, archiving, and a timeline for project deliverables are addressed.

Data Collection

Field data are collected on Rite-in-Rain paper datasheets (i.e. Field Mapping Cards). All fields in the header of the Field Mapping Cards must be completed before leaving the survey point at the end of a point count. Observers are required to write in clear, legible handwriting as much as possible to prevent the collection of uninterpretable data. Periods of increased bird activity can occur during a point count, necessitating rapid note-taking. Since this often leads to reduced legibility of handwriting, observers are asked to review their datasheets at the completion of each point count, and clarify any notations on the Field Mapping Cards that are incomplete or illegible. This will reduce the amount of uninterpretable data, and make later transcription easier.

Data Transcription and Verification

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 processes outlined below must be completed.

All observers are required to transcribe the records from their Field Mapping Cards directly to Field Data Form, prior to submitting their complete data to park staff. Volunteers and field staff are encouraged to transcribe their data as soon as possible after leaving the field, again to reduce the possibility of uninterpretable data.

1. Field Mapping Card to Field Data Forms

Volunteers and field staff transcribe data from the Field Mapping Cards to Field Data Forms to reorganize it into a tabular format that can be easily and accurately transcribed into the MIDN BBM database. Upon completion of transcription of each Mapping Card, 100% of the records should be reviewed to ensure that data has been accurately and completely transcribed to the Field Data Form. If an error is found on the Field Mapping Card, it should be crossed out with a single line, corrected by the observer, initialed, and dated.

2. Field Data form to MIDN BBM Database

MIDN staff or designated volunteers are responsible for entering data from the Field Data Forms in the MIDN BBM Database. After each data sheet is entered, 100% of the records are compared to the complete data entry form to ensure that data entry has been completed accurately. If any records are unclear on the Field Data Form, data entry staff should refer to the original Field Mapping Card or contact the volunteer directly for clarification.

Data Entry and Quality Assurance

All field data is manually entered into the MIDN BBM database by MIDN staff or designated volunteers. The front end forms of the database are designed for ease of data entry, and each data entry field has coded validation rules in place to check each value as they are entered to prevent

typographic and logic errors. For additional information regarding the Quality standards in place for this protocol, please reference the MIDN BBM Data Quality Standards document. Instructions for entering data into the database may be found in SOP 8: Data Entry.

Data Quality Control

After the field data has been entered, it is reviewed for quality, completeness, and logical consistency. MIDN staff or trained volunteers will review 100% of the records entered to ensure that values present on field forms were accurately and completely transcribed into digital form. An effort will be made to prevent the same staff member, who entered the data, from conducting the 100% verification check. Further checks for transcription errors and other common errors are outlined below. For additional information regarding the Quality standards in place for this protocol, please reference the MIDN BBM Data Quality Standards document.

Transcription Errors

The Data Manager, Project Lead, or designated staff will review a 10% random sample of each volunteer's records to check for transcription errors. The reviewer should compare all fields on the Field Mapping Cards to the corresponding entries in the MIDN BBM database, paying close attention to the following:

- Species
- Detection type
- Time of detection
- Distance
- Flock size

If errors are discovered, the data will be corrected in the database, and any comments or changes to the data sheets are to be annotated with the initials of the staff member making the change. If a significant transcription error (e.g., incorrect values or missing records) is found in one out of 10 of the datasheets during the 10% review, then 100% of the volunteer's datasheets should be reviewed (i.e., repeat the 100% and subsequent 10% checks until the protocol lead is satisfied with the data quality). The protocol lead will go over any changes with the data reviewer before they are completed.

Common Errors

There are several other common errors that a data reviewer should watch out for when checking datasheets. These include:

- **Missing entries** - detections on the Field Mapping Card may have been overlooked on transcription to Data Coding Sheet or to the database
- **Flyovers (F) being listed as visual detections (V)** - Typically these can be identified by the lack of "flyover" detection types and lots of "visual" detection types for typical flyover species (e.g. Vultures, American Goldfinches, Canada Geese, etc.). This is an important distinction because these types of detections are analyzed differently and can have a significant impact on final counts. Flyovers are individuals that flyover the site and are not using the habitat, whereas visuals are actively using the site (either perched or foraging in the site).
- **Recording multiple detections for the same individual** - Sometimes the observer detects the same individual multiple times and will track it on their field mapping card (indicated by arrows), but the FIRST detection is the only record that should be entered into the database.
- **Detection times of "10"** - Detection time should only be values between 0-9, or 11 for incidental bird observations.

- **Flocks or pairs** - volunteers sometimes list flocks or pairs on the field mapping card but then separate them into individuals on the Field Data Forms. Verify that they should be either individuals or flocks.
- **Pairs** - volunteers may record the symbol for pair (“house” symbol, see SOP 4) on the Field Mapping Card indicating a pair, but won’t record a 2 for the flock size. Make sure flock size of 2 is recorded on the Field Data Form.

Unusual Species

After the data has been reviewed for transcription and other common errors, the project lead or other designee with the required expertise, should check for unusual species, or species that are not typically found in the region during the breeding season. If an unusual species is found in the database, the project lead will first check the source field forms to ensure there was not a transcription error, and then should contact the observer to find out their level of confidence in the identification. Species that the protocol lead deems as possibly incorrect should be flagged in the database and not used in analysis.

Aggregate Data Review

Aggregate data review is the last step performed by the Protocol Lead, Data Manager or designated staff. A series of 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. Any errors found and all actions taken are documented as above, and placed on the network server.

Data Certification and Archiving

At the end of the season, the Data Manager will compile all raw and processed data and metadata. Seasonal closeout procedures as documented in the MIDN Seasonal Closeout Procedure SOP should be followed to ensure:

1. The data are complete for the period of time indicated on the form.
2. The data have undergone the quality assurance and quality controls checks indicated in the Bird Monitoring Protocol SOPs and Data Quality Standards document.
3. Metadata for all data has been provided (when applicable).
4. Project timelines are being followed and all products from the field season have been submitted.
5. The correct level of sensitivity is associated with the deliverables.
6. All data have been properly archived.

All original Field Mapping Cards and Field Data Forms will be sent to the MIDN office for archiving. MIDN staff will scan datasheets to PDF format and archive them on the network server. All field forms should be organized by park, observer, plot, and visit, scanned in batches by observer, and given a file name following the convention below:

[4-LetterParkCode]_ [Year(XXXX)]_Observer]

For example, the datasheets for data collected at in Booker T. Washington by observer Sheds in 2011 would be named “BOWA_2011_Sheds.pdf.”

All electronic documents will be compiled and archived with a Project Data Certification Form (Appendix B) and Seasonal Closeout Checklist (Appendix C) on the network server.

Appendix A. Project Data Certification Form

Data certification is a benchmark in the project data life cycle that indicates that: a) the data are complete for the period of record; b) they have undergone and passed the quality assurance checks; and c) that they are appropriately documented and in a condition for archiving, posting and distribution as appropriate. Certification is not intended to imply that the data are completely free of errors or inconsistencies which may or may not have been detected during quality assurance reviews.

1) Certification date: _____

2) Certified by: _____

Title: _____

Affiliation: _____

3) Project title: _____

4) Range of dates for certified data: _____

5) Description and scope of data being certified:

6) List the parks covered in the certified data set, and provide any park-specific details about this certification.

Park	Details

7) ____ This certification refers to data in accompanying files. Check all that apply, and indicate file names to the right:

____ Database file(s): _____

____ Spatial data file (s): _____

____ Geodatabase file(s): _____

____ Other (specify): _____

____ Certified data are already in the master version of a park, MIDN, or NPS databases (e.g., NPSpecies, NPSTORET).

Please indicate the database system(s): _____

8) Is there any sensitive information in the certified data which may put resources at greater risk if released to the public (e.g., spotted owl nest sites, cave locations, rare plant locations)?

____ No ____ Yes Details:

9) Description of data processing, quality assurance measures, and results and summary of quality assurance reviews, including details on steps taken to rectify problems encountered during data processing and quality reviews. (Note: Can be a reference to appropriate sections of the protocol or a separate document.)

Database

1. Do locations in the database match those in the shapefile?
2. Does any data appear to be missing?
3. Do any fields or table names have unacceptable characters?
4. Do all tables have primary keys and have appropriate relationships with referential integrity enforced?
5. Are field descriptions complete for all tables?

Spatial Data

1. Verify X, Y coordinates in raw data
2. Verify projection, zone, datum, units
3. Do features in the final shapefile line up with other park data?
4. Do shapefile locations match those in the database and final report?
5. Does the attribute table have a key field to link to database?
6. Do field names in the shapefile attribute table have unacceptable characters?
7. Are data values truncated because field lengths are too short?

Metadata

1. Does spatial metadata exist?
2. Does biological metadata (for database) exist?
3. Does metadata include NPS distribution liability statement?
4. Does metadata parse without error?

Appendix B. Seasonal Closeout Checklist

Yes	No	Seasonal Closeout Checklist	
Data			
☐	☐	Field data received?	
		Yes: ☐	No: ☐ Paper data sheets used, scanned, and received?
		Yes: ☐	No: ☐ Electronic data received?
		Yes: ☐	No: ☐ Field data reviewed for logical errors, proper formatting, and completeness?
		Yes: ☐	No: ☐ Field data has complete metadata?
☐	☐	Digital photos received?	
		Yes: ☐	No: ☐ Digital photos have complete metadata?
☐	☐	Spatial data product(s) received?	
		Yes: ☐	No: ☐ Spatial data reviewed for proper formatting and completeness?
		Yes: ☐	No: ☐ Spatial data has complete metadata?
☐	☐	Data set contains sensitive information? If so, describe:	
		Yes: ☐	No: ☐ If data is considered sensitive does metadata reflect its status? Use constraints listed as "NPS permission"
☐	☐	Annual data set archived?	
☐	☐	Master data set updated?	
Reporting			
☐	☐	Report contains sensitive information? If so, describe:	
		Yes: ☐	No: ☐ If document contains sensitive information has disclaimer been added?
☐	☐	NRR/NRDS report number received and added to report?	
☐	☐	TIC number received and added to report?	
☐	☐	Final report received and approved?	
☐	☐	Annual report archived with MSF form?	
Data Dissemination			
☐	☐	Project citation added to / updated in IRMA	
		Yes: ☐	No: ☐ Report citation created and report uploaded?
		Yes: ☐	No: ☐ Data citation created and data uploaded?
		Yes: ☐	No: ☐ Citations reflect sensitivity level?
☐	☐	Parks given data or notified of data availability?	
☐	☐	Report sent to eTIC?	
☐	☐	Data/report posted to Network Internet site?	

Revision History

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Standard Operating Procedure 10: Data Analysis and Reporting

Mid-Atlantic Network Breeding Bird Monitoring Program
Version 1.0 (September 2018)

Overview

This Standard Operating Procedure (SOP) provides details of analysis and reporting of data collected in the Mid-Atlantic Network (MIDN) breeding bird monitoring program. The purpose of this SOP is to ensure that the data and results are consistent with the program's objectives, and are available to the MIDN parks, the scientific community, and the public. Two types of reports will be produced: annual data summaries and multi-year synthesis reports.

Annual Data Summary

The annual data summary reports will describe each year's survey effort, and provide general population and community statistics at the network and park levels. Each annual report will also provide a description of methods used to collect and assess data. Yearly topics of interest may also be included in resource briefs, which can be used as outreach items for each park. As interactive data visualization technology becomes more readily available, annual data summaries may be provided electronically in lieu of static reports.

Survey Effort Metrics

Each annual report will include the total number of stations surveyed, the average number of surveys conducted, and the number of volunteers participating across the network and within each park. A map will also be provided for each park showing the locations of stations surveyed each year and the number of surveys conducted at each point. This map will provide feedback to Park coordinators regarding how well they were able to balance their volunteer effort across their point count locations.

Population and Community Metrics

A variety of population and community level metrics are to be included in the annual report including:

Number of Species

This metric aims to document the total diversity of species across the parks surveyed. All detections, including flyovers and incidentals, are included in species counts.

Species of Concern

Special note is taken for species of conservation concern. Partners in Flight (PIF), a cooperative effort to address the conservation of birds, produced a list of species of conservation concern in their North American Landbird Conservation Plan (Rosenberg et al. 2016). They define two sets of species of concern, "Watchlist" species that face immediate threats due to habitat alteration, declining populations, small population size, and limited distributions, and "Stewardship" species that are representative species of avifaunal biomes that may or may not be in immediate danger. These lists have been developed at the continental and regional scale. Counts of both continental and regional (e.g. Piedmont and Southeastern Coastal Plain BCRs) Watchlist and Stewardship species detected during the year are included in yearly reporting.

Relative Abundance

Relative abundance is calculated by dividing the total detections by the number of monitoring stations surveyed not including flyovers and incidentals. The maximum number of detections per species across repeat visits are used in the calculation of relative abundance to avoid upward-biased results (e.g. inflating abundance estimates by double-counting the same individual bird across multiple visits).

Percent Occurrence

The total number of monitoring stations at which a species is detected is divided by the total number of stations surveyed, providing a measure of the prevalence of a species. As with relative abundance, flyovers and incidentals are removed in calculations of percent occurrence.

Ecological Integrity Metrics

Changes in ecological condition can variably impact avian guilds, resulting in alterations to the bird community as a whole (Severinghaus 1981, Verner 1984). Bird community indices (BCIs), yield a quantitative metric that can be used to define the ecological integrity of a sampled area based on the avian community present. BCIs assume that changes in habitat quality or extent result in corresponding changes in the representation of the guild dependent upon the habitat affected. Within the BCI, guilds are ranked based on specialization, with specialist guilds receiving higher weight over generalist guilds. This ability to use the bird community to reflect ecological condition, particularly in urban areas where impacts can be multi-faceted, provides a valuable and informative indicator for avian monitoring programs.

BCI scores and ratings are based on ecological criteria. However, due to cultural landscape objectives within the park and surrounding land use conditions, parks may not ever attain “high ecological integrity”. However, shifts in ecological integrity over time may be indicative of community stressors. Additionally, a management scorecard could be developed by park and MIDN staff that would reflect progress towards avian and ecological management goals for individual parks.

BCIs are designed to represent major habitat types, as bird communities vary markedly by ecosystem. Two major habitat types dominate the parks in the MIDN: forest and grassland. O’Connell et al. (2003) developed a combined forest integrity index for the Piedmont and Southeastern Coastal Plain ecoregions that can be applied to the MIDN points located in forested areas. The MIDN, however, is still exploring metrics for the assessment of grassland bird communities.

Forest Integrity

For forest BCI analysis, data from grassland stations, incidentals, flyovers, and unknown species are removed. Only members of the following families are used in BCI analyses: Passeriformes, Columbiformes, Apodiformes, Piciformes, and Cuculiformes. Furthermore, only bird species that were included in the original development of these indices are considered (O’Connell et al. 2003).

If a station is visited more than once, detections for that station are aggregated. Forest integrity estimates based on O’Connell et al. (2003) are built from percent guild representation rather than counts of individuals, so multiple visits provide a more complete picture of the community and not an upward biased BCI score (e.g. from double-counted individuals).

Often, ecological integrity reports aggregate individual integrity metrics to create indices of overall ecosystem scores (Karr 1991, O'Connell et al. 2003). However, some believe that by aggregating metrics, individual ecosystem components which may need attention are obscured (Faccio et al. 2015). Therefore, we will summarize the data in both manners: across each individual guild and as an aggregated score.

Calculating BCI scores

All species detected at forested stations are assigned to appropriate guilds that were defined by O'Connell et al. (2003) and shown to respond most strongly to changing forest structure (Appendix A). Proportional guild representation is then calculated for each station. For example, if 2 of 10 species detected at a station were forest interior species, then that station had 20% forest interior species. That guild percentage is then assigned a rank score of 1, 2, 3, or 4 (Table 1) using thresholds derived by O'Connell et al. (2003) for the Piedmont and Southeastern Coastal Plain. This is done for each guild and a final BCI score for a station is then calculated as follows:

$$V1 = \frac{\sum \text{Structural Guild Ranks}}{4}$$

$$V2 = \frac{\sum \text{Functional Guild Ranks}}{4}$$

$$V3 = \frac{\sum \text{Compositional Guild Ranks}}{4}$$

$$BCI = \frac{V1 + V2 + V3}{9}$$

This final BCI score which ranges from 0.25 – 1.00 can then be assigned a rank that falls on the Humanistic to Naturalistic scale of 1 to 4 (Table 1). Thus for each station, we can derive individual guild rank scores and an aggregate rank score. Station aggregate scores are then averaged to provide scores for each park and the network.

Table 1. Rank scores by percent guild representation for forested sites based on O’Connell et al. (2003). See details on these guild assignments in Appendix A.

Guild		Percent Guild Representation			
		Rank = 1 Humanistic	Rank = 2 Moderately Disturbed	Rank = 3 Largely Intact	Rank = 4 Naturalistic
Structural Guilds	Forest Interior	0 -10.0	10.1 - 20.0	20.1 - 28.0	28.1 - 100
	Pine Associated	0	0.1 - 2.0	2.1 - 5.0	5.1 - 100
	Urban/Suburban	60.1 - 100	47.1 - 60.0	20.1 - 47.0	0 - 20.0
Functional Guilds	Bark Prober	0 - 9.0	9.1 - 16.0	16.1 - 20.0	20.1 - 100
	Upper Canopy Forager	0 - 4.0	4.1 - 12.0	12.1 - 18.0	18.1 - 100
	Ground Forager	0	0.1 - 3.0	3.1 - 7.0	7.1 - 100
Compositional Guilds	Single Brooded	0 - 16.0	16.1 - 34.0	34.1 - 46.0	46.1 - 100
	Nest Predator/Brood Parasite	23.1 -100	16.1 - 23.0	0.1 - 16.0	0
	Exotic	11.1-100	1.1 - 11.0	0.1 - 1.0	0
Final BCI Score		0.250-0.460	0.461-0.600	0.601-0.730	0.731-1.00

Multi-year Synthesis Reports

The network will start producing multi-year synthesis reports addressing detectability, site occupancy, and population trends once ten complete years of data have been collected and a code base for analysis has been developed by the network or in cooperation with network partners. These reports would be updated every 5 years. At this time, the network plans to produce multi-year synthesis reports that will address the following:

Detectability and Density Estimation

While relative abundance can be derived for all species detected, its use as an accurate measure of population size and as an index of population change has been heavily criticized (Rosenstock et al. 2002, Thompson 2002, Farnsworth et al. 2005) because it does not take into account detection probability which may vary across space and time. When an observer fails to detect a bird, the bird may have been absent, or the observer may not have detected the bird (MacKenzie et al. 2002). A failure to detect a bird that is present can result from many environmental or survey-related obstacles (i.e. wind, distance, weather, observer error).

Various statistical methods and software packages have been developed to estimate population densities while accounting for detection probability including program DISTANCE (distance sampling) (Thomas et al. 2010), program MARK (removal modeling) (White and Burnham 1999), and the “unmarked” package in program R (hierarchical modeling) (Fiske and Chandler 2011). Because a minimum of 80-100 detections of each species per observer are needed in order to calculate detection probabilities (and particular observer effects on detection probability) with sufficient precision, several years of data collection will be needed for all but the most common species (Bibby et al. 1998). When enough data has been collected, an analysis of factors influencing

detection rates will be conducted and population densities will be estimated using the best available statistical methods and software packages.

Population Trend Detection

More complex analyses of population trends will be included in the second type of analysis and synthesis reports, which may require consultation with a qualified statistician. A variety of regression methods that model population size (or index) versus time exist. The network will consult with qualified statisticians and regional Inventory and Monitoring Program staff to determine the best available statistical methods that will allow us to share and compare results across networks.

Evaluating Park Management effects

Analysis results generated by this protocol will be evaluated in the context of park management. Park management actions can have impacts both positive and negative on breeding birds and it is important to interpret the results of any analysis in the light of past changes, both natural and human influenced. The MIDN will use a GIS system to track management actions like exotic plant management, fire, and land use changes to evaluate potential effects on breeding birds at participating parks. This GIS will be updated on a yearly basis by park Natural Resource staff, NPS Fire Management, and Exotic Plant Management Team. The protocol lead will use these data to provide feedback to the park if significant changes to bird populations are seen in treatment areas.

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Appendix A. Forested guild assignments

Several guild categories were considered in the development of the forested guild BCI and ultimately, only a subset of these guilds was found to be responsive to forest structure change (O'Connell et al. 2003). For that reason, some of the guild categories below do not cover the guild a species belongs to. For example, Acadian Flycatchers are aerial salliers under the functional guild category. As this guild is not part of the final structure of the BCI, this space is left blank.

Species	Guild		
	Structural	Functional	Compositional
Acadian Flycatcher	forest interior		single brood
American Crow	urban/suburban		nest predator/brood parasite
American Goldfinch	urban/suburban		
American Redstart	forest interior		single brood
American Robin	urban/suburban		
Bachmans Sparrow	pine associated		
Baltimore Oriole		upper canopy forager	single brood
Black-and-White Warbler	forest interior	bark prober	single brood
Black-billed Cuckoo			single brood
Black-capped Chickadee		bark prober	single brood
Black-throated Green Warbler		upper canopy forager	single brood
Blue Jay	urban/suburban		nest predator/brood parasite
Blue-gray Gnatcatcher		upper canopy forager	
Boat-tailed Grackle			nest predator/brood parasite
Bobolink			single brood
Brown Thrasher			single brood
Brown-headed Nuthatch	pine associated		single brood
Carolina Chickadee		bark prober	single brood
Carolina Wren	urban/suburban		
Cedar Waxwing	urban/suburban		
Cerulean Warbler	forest interior	upper canopy forager	single brood
Chimney Swift	urban/suburban		single brood
Chipping Sparrow	urban/suburban		
Common Grackle	urban/suburban		nest predator/brood parasite; single brood
Downy Woodpecker	urban/suburban	bark prober	
Eastern Kingbird			single brood
Eastern Towhee	forest interior		
Eastern Wood-Pewee	forest interior		single brood
Eurasian Collared Dove	urban/suburban		exotic
European Starling	urban/suburban		nest predator/brood parasite; exotic
Fish Crow			nest predator/brood parasite; single brood
Gray Catbird	urban/suburban		
Great Crested Flycatcher			single brood
Hairy Woodpecker	forest interior	bark prober	single brood
Hooded Warbler	forest interior		
House Finch	urban/suburban		exotic
House Sparrow	urban/suburban		nest predator/brood parasite; exotic

Species	Guild		
	Structural	Functional	Compositional
Kentucky Warbler	forest interior	ground forager	single brood
Loggerhead Shrike			nest predator/brood parasite
Louisiana Waterthrush	forest interior	ground forager	single brood
Mourning Dove	urban/suburban		
Northern Cardinal	urban/suburban		
Northern Flicker		ground forager	single brood
Northern Mockingbird	urban/suburban		
Northern Parula	forest interior	upper canopy forager	single brood
Northern Rough-winged Swallow			single brood
Orchard Oriole			single brood
Ovenbird	forest interior	ground forager	single brood
Pileated Woodpecker	forest interior	bark prober	single brood
Pine Warbler	pine associated	bark prober	
Prairie Warbler			single brood
Purple Martin	urban/suburban		single brood
Red-bellied Woodpecker	urban/suburban		nest predator/brood parasite
Red-cockaded Woodpecker	pine associated	bark prober	single brood
Red-eyed Vireo		upper canopy forager	single brood
Red-headed Woodpecker			nest predator/brood parasite
Rock Dove/Pigeon	urban/suburban		exotic
Rose-Breasted Grosbeak	forest interior	upper canopy forager	
Ruby-throated Hummingbird	urban/suburban		
Scarlet Tanager	forest interior	upper canopy forager	single brood
Song Sparrow	urban/suburban		
Summer Tanager		upper canopy forager	single brood
Swainsons Warbler	forest interior	ground forager	single brood
Tree Swallow			single brood
Tufted Titmouse		bark prober	
Veery	forest interior		single brood
Warbling Vireo		upper canopy forager	
White-breasted Nuthatch	forest interior	bark prober	single brood
Willow Flycatcher			single brood
Wood Thrush	forest interior		single brood
Worm-eating Warbler	forest interior		single brood
Yellow Warbler			single brood
Yellow-billed Cuckoo		upper canopy forager	single brood
Yellow-throated Vireo	forest interior	upper canopy forager	single brood
Yellow-throated Warbler			single brood

Guild Descriptions

Individual guilds are broadly categorized as “specialist” or “generalist” based on their relationship to specific elements of ecosystem structure, function, and composition (O'Connell et al. 2003). A specialist can be a species with a narrow range of habitat tolerances, while a generalist can be a species with a wide range of habitat tolerances. For our purposes, specialist guilds may be thought of as “guilds indicative of a high-integrity condition” while generalist guilds are “guilds indicative of a low-integrity condition.”

Structural Guilds

These species guilds are based on nesting or foraging habitat requirements.

Forest Interior (Specialist)

This guild includes species that require large blocks of interior forest. Few to none of the species in this guild are typically supported in small forest fragments (<10ha) (Robbins et al. 1989, Freemark and Collins 1992) and numbers typically decline with increasing human disturbance (O'Connell et al. 2003, Glennon and F. Porter 2005).

Examples include the Ovenbird, Louisiana Waterthrush, Yellow-throated Warbler, and Eastern Wood Peewee.

Pine Associated (Specialist)

This guild is comprised of species that require pine forest or plantations for foraging and nesting. The proportion of pine associated guild species is typically low compared to other species, but is positively correlated with habitat quality.

Examples include the Pine Warbler, Brown-headed Nuthatch, and Red-Cockaded Woodpecker.

Urban/Suburban (Generalist)

These are species that typically occur in human dominated environments. They nest and forage in a wide range of habitats and many prefer edges. Exotic species fall in this guild and hence large proportions of these species are indicative of poor-quality habitat.

Northern Mockingbird, House Finch, Gray Catbird, and Song Sparrow are all examples of Urban/Suburban guild species.

Functional Guilds

These species guilds are based on foraging habit.

Bark Prober (Specialist)

Insectivorous species that primarily forage via bark probing fall in this guild. They require standing snags, large diameter coarse woody debris (CWD), or mature trees with deeply furrowed or flaking bark which provide substrates that support abundant insect populations. Increasing proportions of these guilds indicate higher forest integrity.

Examples include the woodpeckers, nuthatches, and chickadees.

Upper Canopy Forager (Specialist)

This guild includes species that forage high in the forest canopy. These species are typically restricted to mature forests, and many are considered forest interior obligates. The majority of the

species in this guild are insectivorous warblers. Like the Forest Interior guild the proportion of species in this guild increases with forest integrity.

Examples of species in this guild are the Baltimore Oriole, Black-throated Green Warbler, Blue-gray Gnatcatcher, and Cerulean Warbler.

Ground Forager (Specialist)

Species that primarily forage by gleaning insects from the ground fall into this guild. They include specialized insectivores that pick insects from the leaf litter or directly from the ground. Like species in the Pine Associated guild, numbers of these species are low and hence detections are difficult to rare, but higher proportions of these species are indicative of good forest integrity.

The Kentucky Warbler, Louisiana Waterthrush, Northern Flicker, and Swainson's Warbler are examples of species form this guild.

Compositional Guilds

The species guilds are based on factors that are not functional or structural (e.g. interspecific dynamics, breeding phenology)

Single-brooded (Specialist)

This guild is comprised of species that typically raise only one brood per breeding season. Many single-brooded species are restricted to interior forest habitat, and are absent from smaller forest fragments due to increased competition and higher rates of predation and nest parasitism associated with edge habitats (Freemark and Collins 1992). Hence, proportional species richness for this guild increases with forest integrity.

Species in this guild include Red-eyed Vireos, Tree Swallows, Yellow-billed Cuckoos, and Wood Thrush.

Nest Predator / Brood Parasite (Generalist)

This guild includes species that are nest predators or brood parasites. Nest predators and brood parasites have been shown to negatively affect the distribution, abundance, and nesting success of other bird species, particularly neotropical migrants (Wilcove 1985), and these effects increase significantly in fragmented and edge habitats (Robinson et al. 1995). Hence high proportions of species in this guild are indicative of poor forest integrity.

Many species of the family Corvidae fall into this guild along with European Starlings, Red-bellied Woodpeckers, and Red-headed Woodpeckers.

Exotic (Generalist)

This guild is comprised of species that are not native to the study region. Species in this guild typically prefer edge habitat, are generalists, and are indicative of poor forest integrity. Additionally, species in this guild often disrupt natural communities and compete with native species for nesting sites.

Species such as the House Finch, Rock Dove, and European Starling fall in this guild.

Literature Cited

O'Connell, T. J., R. P. Brooks, M. J. Lanzone, and J. A. Bishop. 2003. A bird community index for the Mid-Atlantic Piedmont and Coastal Plain. Final Report to the USGS Patuxent Wildlife Research Center. Report No. 2003-02, Penn State Cooperative Wetlands Center, University Park, Pennsylvania.

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