National Park Service
U.S. Department of the Interior

Natural Resource Stewardship and Science

Landbird Monitoring in the Arctic Network

ARCN Inventory and Monitoring Networks, Data Quality Standards

Natural Resource Report NPS/ARCN/NRR—2018/1727

ON THE COVER
Bluethroat in Noatak Preserve
(NPS/JARED HUGHEY)

Landbird Monitoring in the Arctic Network

ARCN Inventory and Monitoring Networks, Data Quality Standards

Natural Resource Report NPS/ARCN/NRR—2018/1727

Jeremy Mizel[1]

[1]National Park Service
Arctic Network
4175 Geist Road
Fairbanks, AK 99709

September 2018

U.S. Department of the Interior
National Park Service
Natural Resource Stewardship and Science
Fort Collins, Colorado

The National Park Service, Natural Resource Stewardship and Science office in Fort Collins, Colorado, publishes a range of reports that address natural resource topics. These reports are of interest and applicability to a broad audience in the National Park Service and others in natural resource management, including scientists, conservation and environmental constituencies, and the public.

The Natural Resource Report Series is used to disseminate comprehensive information and analysis about natural resources and related topics concerning lands managed by the National Park Service. The series supports the advancement of science, informed decision-making, and the achievement of the National Park Service mission. The series also provides a forum for presenting more lengthy results that may not be accepted by publications with page limitations.

All manuscripts in the series receive the appropriate level of peer review to ensure that the information is scientifically credible, technically accurate, appropriately written for the intended audience, and designed and published in a professional manner.

This report received formal peer review by subject-matter experts who were not directly involved in the collection, analysis, or reporting of the data, and whose background and expertise put them on par technically and scientifically with the authors of the information.

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

This report is available in digital format from the Arctic Network website and the Natural Resource Publications Management website. If you have difficulty accessing information in this publication, particularly if using assistive technology, please email irma@nps.gov.

Please cite this publication as:

Mizel, J. D. 2018. Landbird monitoring in the Arctic Network: ARCN Inventory and Monitoring Networks, data quality standards. Natural Resource Report NPS/ARCN/NRR—2018/1727. National Park Service, Fort Collins, Colorado.

NPS 953/148288, September 2018

Contents

Page

Figures and Tables iv

Executive Summary v

Acknowledgments v

Introduction 1

Protocol Overview 1

Conceptual Framework for Monitoring 1

Protocol Activities 2

Sampling Design 2

Bird Surveys 5

Data Quality Objectives 7

Representativeness and Data Comparability 7

Completeness 7

Literature Cited 9

Figures and Tables

Page

Figure 1. ARCN landbird study sites 3

Table 1. Protocol activity matrix for landbird monitoring protocol in Arctic Network Parks. 5

Table 2. Proposed schedule for landbird surveys in the Arctic Network park units. 6

Table 3. Data Quality Values (DQVs). 7

Table 4. Quality Objective table for landbird monitoring protocol. 8

Executive Summary

The purpose of this report is to document the standards used by the National Park Service (NPS) Arctic (ARCN) Inventory and Monitoring Network for activities related to the collection, processing, analysis, and publication of landbird monitoring data as described in Landbird Monitoring Protocol for the Arctic Network (Mizel 2018). This plan also serves as a guide for all ARCN personnel who are involved in protocol/program activities and as a resource for identifying memoranda, publications, and other literature that describe associated techniques and requirements in more detail.

Acknowledgments

Funding for this project was provided through the National Park Service, Inventory and Monitoring Program. The creation of the protocol narrative involved the contributions of numerous individuals.

Introduction

The purpose of this report is to document the standards used by the Arctic Network (ARCN) for activities related to the collection, processing, storage, analysis, and publication of monitoring data as described in the Landbird Monitoring Protocol for the Arctic Network (Mizel 2018). The policies and procedures documented in this quality-assurance plan for activities follow the quality-assurance plan for other monitoring activities conducted by the ARCN and supplement the National Inventory & Monitoring Division Quality Management Plan. The Standard Operating Procedures provide detailed protocol/program activities associated with landbird monitoring. This plan serves as a guide for all personnel who are involved in protocol/program activities and as a resource for identifying memoranda, publications, and other literature that describe associated techniques and requirements in more detail.

Protocol Overview

This protocol outlines how monitoring data will be collected, managed and reported for the Landbird "Vital Sign", as part of the NPS Vital Signs Inventory and Monitoring program and as described in the ARCN Monitoring Plan (Lawler et al. 2009).

Conceptual Framework for Monitoring

Landbird species are highly mobile, short-lived, select particular habitat types and structures for breeding and foraging, and consequently, exhibit considerable sensitivity to environmental change (Martin 1995). Specifically, by virtue of their high mobility, landbird species have the capacity for rapidly adapting to changes in vegetation by modifying their breeding distributions. Thus, monitoring of the montane-breeding bird assemblage may be useful in indicating ecological responses to climate change in the Arctic. Further, landbird species lend themselves to study and as indicators of environmental change because they are ubiquitous and form assemblages that integrate a diverse set of life history and ecological characteristics (Martin 1995). Thus, monitoring of landbird populations may provide insight into local and regional environmental change and, consequently, was selected as a component (or vital sign) of the Inventory and Monitoring Program in the Arctic Network of National Parks (Lawler et al. 2009).

Protocol Activities

Specific objectives of the ARCN landbird monitoring program include: 1) documenting temporal trends in abundance and occupancy of montane-nesting birds; and 2) documenting changes in spatial distribution through time.

Sampling Design

Budgetary restrictions and the considerable logistical challenges of surveying breeding landbirds in the Arctic Network restricted our study design to one comprised of three reference sites (Mizel 2018) (Figure 1). Survey areas were located at montane sites that were accessible by daily air service (Anaktuvuk Pass) or wheeled multi-passenger bush plane (Primus Creek and Kelly Bench). We excluded areas that were only accessible by helicopter due to cost, potential disturbance to migrating caribou, and designation of portions of the network as wilderness. We did not consider sites that were only accessible by aircraft on floats because lakes in the Brooks Range generally become ice-free after June 15, precluding sampling during the period of peak passerine singing (and detectability) at these sites. River bar landing strips were often marginal due to the potential for these to be covered in aufeis or washed out in some years. We learned of tundra-bench landing strips accessible by multi-passenger planes primarily through conversations with bush plane pilots. Selection was also based on the restriction that sites contain a relatively large area of moderate terrain; i.e., an area containing terrain with <25 degree slope in which we could locate ≥12 survey routes within 8 km of the airstrip. The two remote sites that we selected are regarded as good-condition landing strips that are accessible by multi-passenger bush planes. Further, data from MODIS satellite (Moderate Resolution Imaging Spectroradiometer) indicates that both landing strips are on average snow-free on or before May 24, permitting sampling during peak singing.

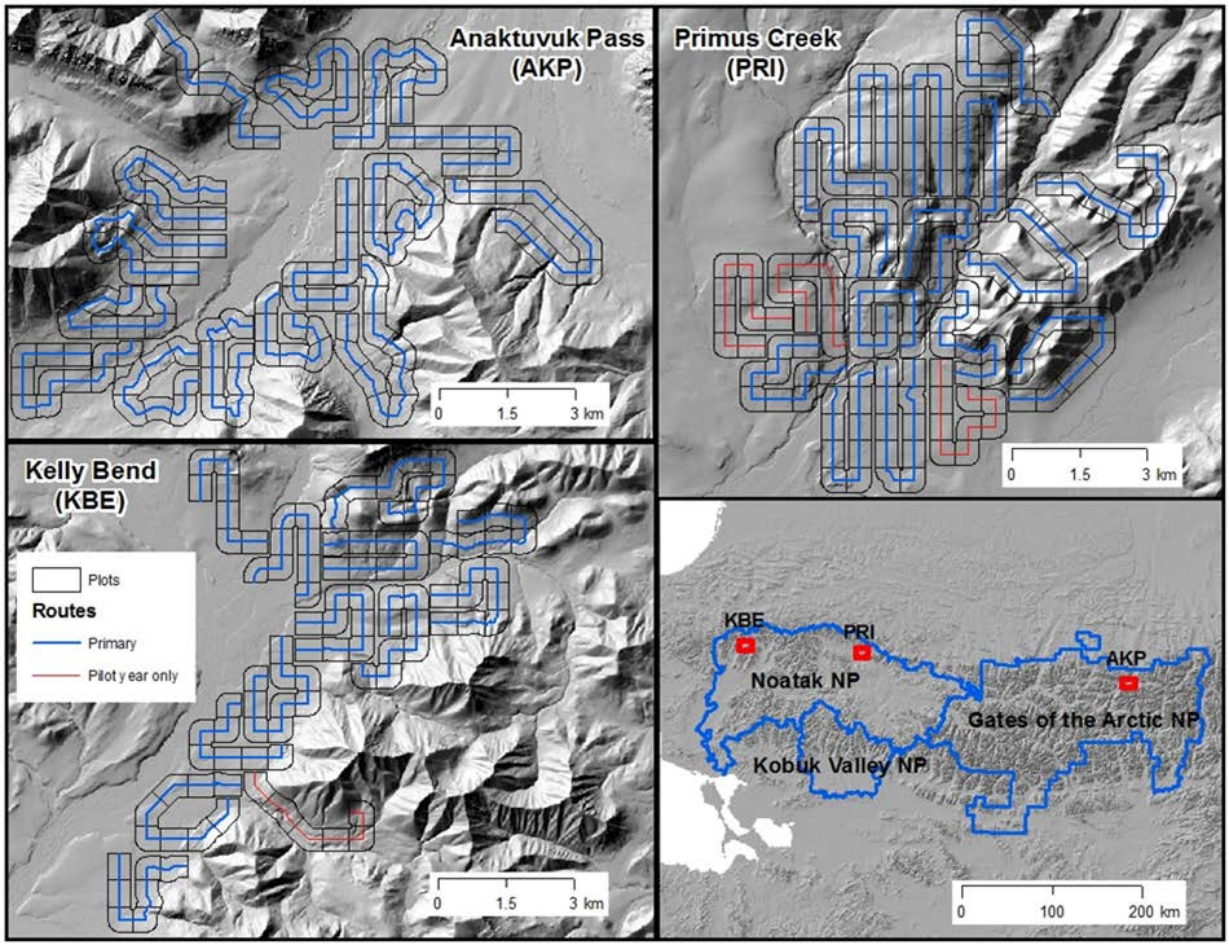

Figure 1. ARCN landbird study sites. The Anaktuvuk Pass (AKP) study area is located on Nunamiut Corporation and Arctic Slope Regional Corporation (ASRC) inholdings. We did not locate any surveys within 1.8 km of the village.

All three survey areas cover elevational gradients from lowland to alpine habitats with open shrublands, *Dryas* and/or mixed dwarf shrub tundra, and barren slopes. Such characteristics provide an opportunity for inferences about passerine distributional shifts along elevational and vegetation gradients. In addition, the study areas are widely spaced across the north side of the Brooks Range within Noatak National Preserve (NOAT) and Gates of the Arctic National Park and Preserve (GAAR).

Lastly, our survey protocol involves conducting repeat surveys to estimate detection probability. Both from a logistical and budgetary standpoint, we could not rely on constant air support to survey across a broad area in a probabilistic scheme while also conducting 3-4 repeat visits to each sample unit. Therefore, a feasible annual effort was to establish a basecamp at one site and conduct repeat surveys in an outward fashion. We envision a three-year rotation of study sites. Anaktuvuk Pass, Primus Creek, and Kelly Bench were first surveyed in 2015, 2016, and 2017, respectively.

Grids comprised of 600 m x 600 m cells were centered on access points including: the village of Anaktuvuk Pass in GAAR, an airstrip near Primus Creek in NOAT, and an airstrip near the confluence of Kuruk Creek and the Kelly River in NOAT. The Anaktuvuk Pass (AKP) study area is located on Nunamiut Corporation and Arctic Slope Regional Corporation (ASRC) inholdings. We did not locate any surveys within 1.8 km of the village. See Tables 1 and 2 for protocol activities and annual sampling effort.

Bird Surveys

Surveys are conducted by two-person teams comprised of one experienced bird surveyor and one data recorder. Observers navigate the survey routes as displayed on their GPS units and communicate observations (species, detection type, bearing, distance, etc.) to the recorder. Each route is surveyed as if it is one continuous line transect; i.e., only one observation per individual bird is recorded during a given route-visit. Upon detecting a bird, the observer takes a waypoint and estimates a distance and bearing to bird, allowing us to later derive the bird's location. Following the field season, observations are associated with plots by projecting them over the plot polygons in ArcGIS. Routes are revisited multiple times in a season (e.g., 3-5 visits/route). See SOP #2 for further details. Table 1 outlines the activity matrix for the protocol, and Table 2 shows the proposed schedule for landbird surveys in the Arctic Network Parks.

Table 1. Protocol activity matrix for landbird monitoring protocol in Arctic Network Parks.

Category	Activity	Activity Description
Pilot year for each individual site	Route establishment	The survey routes are established during the first field season at each of the 3 sites and are fixed in subsequent seasons (see section 2.4 in Mizel 2018).
Site access (Anaktuvuk Pass only)	Notification of intent to survey on non-NPS lands	Notify the Nunamiut Corporation and Arctic Slope Regional Corporation (ASRC) of intent to survey on lands surrounding in Anaktuvuk Pass.
Pre-field procedures	GPS and laptop setup	SOP #1: Prepare GPS units and laptop for data collection and downloading.
Conducting the surveys	Conducting the surveys	SOP #2: Conduct aural and visual surveys for birds.
Processing GPS data in the field	Download GPS data	SOP #3: Download waypoint and track data from GPS units upon the return of survey crews to basecamp.
Post-field processing of the observational data	Data entry and Quality Control (QC)	SOP #4: Enter and proof all datasheets.
Post-field processing of the spatial data	Processing GPS data and deriving bird locations	SOP #5: Prepare spatial data (i.e., observer waypoints) for joining with observational data (i.e., datasheets) in order to derive bird locations.
Product Archival, Seasonal Closeout and Dataset Certification	Archive and certify data	SOP #6: Certify data and archive in IRMA.
Data analysis	Data analysis	SOP #7: The spatial distance sampling model of Mizel et al. 2018 is a potential inference framework.

Table 2. Proposed schedule for landbird surveys in the Arctic Network park units.

Park Unit / Survey Area	2015[1]	2016	2017	2018	2019[2]	2020
Anaktuvuk Pass (GAAR)	X	–	–	X	–	–
Primus Creek (NOAT)	–	X	–	–	–	X
Kelly Bench (NOAT)	–	–	X	–	–	–

[1] 2015 served as a pilot season. Routes were subsequently shifted. Thus, 2018 will be the first complete data collection season for this site.

[2] No data will be collected in 2019 so that the protocol may be implemented at CAKN off-road sites (also shaded in gray).

Data Quality Objectives

This section is intended to demonstrate how this project generates data of known and documented quality, resulting in complete, accurate and transferable information.

Representativeness and Data Comparability

We adopt a repeat survey approach while also recording the spatial locations of individuals. This allows us to accommodate spatial and random temporary emigration processes in a point process model (Kéry and Royle 2016, Mizel et al. 2018) or a distance sampling analysis (Chandler et al. 2011). Overall, repeat survey methods require fewer assumptions about temporary emigration processes and, consequently, should have greater sensitivity for assessing population and spatial dynamics. When the components of temporary emigration are not directly estimated, inference is limited to some unknown proportion of the superpopulation and abundance estimates are negatively biased (Nichols et al. 2009, Chandler et al. 2011, Schmidt et al. 2013). Thus, single-visit surveys including the Breeding Bird Survey (BBS) and the Alaska Landbird Monitoring Survey (ALMS) have a different population of inference than the one targeted by the ARCN survey. However, data from the different survey protocols could be analyzed together under several potential integrated frameworks.

Completeness

If surveys are unable to be completed in a scheduled year due to funding or logistical issues, they will be attempted in the next year if possible to provide abundance information. Although completing surveys on all routes at a given study site is desirable, it is not required. Due to the flexibility of the analytical framework, valid estimates can still be produced if some routes are not surveyed.

Data quality values and standards for implementation are provided in Tables 3 and 4.

Table 3. Data Quality Values (DQVs).

Type	Data Quality Value	Definition	Protocol Considerations
Intrinsic Data Quality	Accuracy	Measurements reflect the true value of the parameter being observed. This applies to measures (length, width, position) or classes (species, types, or categories). Includes components of precision and bias.	Accommodate imperfect detection including temporary emigration processes through repeat surveys. Frame inference in terms of individual encounter in space for increased sensitivity to underlying population and spatial dynamics.
	Representativeness	Measurements represent conditions at a permanent sampling location over time. Combined with accuracy, leads to robust data collection.	Parameters and methods are chosen such that they measure representative conditions.

Table 3 (continued). Data Quality Values (DQVs).

Type	Data Quality Value	Definition	Protocol Considerations
Contextual Data Quality	Comparability	Measurements are comparable through space and time.	Only experienced bird surveyors are used and training in provided. Detection probability covariates are recorded to help accommodate heterogeneity in detection.
	Timeliness/Currency	The level of temporal and spatial replication allow inference at spatial and temporal scales appropriate to the ecological system under study.	Logistical and budgetary restrictions limit sampling to 1 site/year (i.e., surveying each site every 3 years). However, the spatially-explicit (encounter-location based) design, coupled with repeat surveys, theoretically allows stronger inference.

Table 4. Quality Objective table for landbird monitoring protocol.

Measure	Quality Indicator	Quality Objective
Field Observations	Location accuracy	+/- 40m
	Species identification	100%
	Observation-level attributes	Wayoint ID, time of detection (also recorded in waypoint attributes), detection type, certainty level for estimated location (uncertain or certain), and territorial behavior detection types (e.g., mated pair).
	Site-visit attributes	Observer identity, route and cell ID, GPS unit used (i.e., A, B, or C), background noise rating, start and end times for site-visit.
Estimated quantities	Abundance	Spatial distance sampling, temporary emigration model (Mizel et al. 2018) or other inference framework (in development).

Literature Cited

Chandler, R. B., J. A. Royle, and D. I. King. 2011. Inference about density and temporary emigration in unmarked populations. Ecology 92:1429–1435.

Kéry, M., J. A. Royle, and H. Schmidt. 2005. Modeling avian abundance from replicated counts using binomial mixture models. Ecological Applications 15:1450–1461.

Kéry, M., and J. A. Royle. 2016. Applied Hierarchical Modeling in Ecology: Analysis of Distribution, Abundance and Species Richness in R and BUGS. Academic Press.

Lawler, J. P., S. D. Miller, D. M. Sanzone, J. Ver Hoef, and S. B. Young. 2009. Arctic Network vital signs monitoring plan. Natural Resource Report NPS/ARCN/NRR-2009/088. National Park Service, Fort Collins, Colorado.

MacKenzie, D. I., J. D. Nichols, J. A. Royle, K. H. Pollock, L. L. Bailey, and J. E. Hines. 2006. Occupancy estimation and modeling. Elsevier, San Diego, California.

Martin, T. E., and D. M. Finch, eds. 1995. Ecology and management of neotropical migratory birds: a synthesis and review of critical issues. Oxford University Press.

Mizel, J. D. 2018. Landbird monitoring protocol for the Arctic Network. Natural Resource Report NPS/ARCN/NRR—2018/1623. National Park Service, Fort Collins, Colorado.

Mizel, J. D., J. H. Schmidt, and M. S. Lindberg. 2018. Accommodating temporary emigration in spatial distance sampling models. Journal of Applied Ecology 55:1456–1464.

Royle, J.A. 2004. N-mixture models for estimating population size from spatially replicated counts. Biometrics 60:108–115.

Royle, J. A., and R. M. Dorazio. 2008. Hierarchical modeling and inference in ecology. Academic Press, San Diego, California.

Schmidt, J. H., C. L. McIntyre, and M. C. MacCluskie. 2013. Accounting for incomplete detection: what are we estimating and how might it affect long-term passerine monitoring programs? Biological Conservation 160:130–139.

.

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

NPS 953/148288, September 2018

National Park Service
U.S. Department of the Interior

Natural Resource Stewardship and Science
1201 Oakridge Drive, Suite 150
Fort Collins, CO 80525