A Field Guide to Southeast Bird Monitoring Protocols and Programs

PARTNERS IN FLIGHT
Southeastern Working Group

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Introduction

Bibby et al.'s (1992) review of bird census techniques opens with the statement that 'birds are counted for a wide variety of reasons by a bewildering range of methods'. In the southeastern United States, a number of different survey techniques and protocols are used. Some form the foundation of regional, national and international avian monitoring programs, while others have the potential to do so. In order to promote awareness of what programs and protocols are available, this guide summarizes popular, multi-species bird monitoring programs and protocols that are currently used, or could be used, within the Southeast Partners in Flight region.

Audience - Graduate students and biologists who are looking for ways to collect data that can be analyzed using current methods and are compatible with other data sets in clearinghouses such as the Avian Knowledge Network.

The guide is meant as a starting point for individuals seeking out information to assess the pros and cons of various protocols in addressing their project objectives. In those cases where the protocols are inextricably linked to a broader monitoring program, the program itself (e.g., North American Breeding Bird Survey) and/or the sampling scheme (e.g., Strategic Multi-scale Grassland Bird Population Monitoring) is summarized along with the protocol. Our focus was primarily on those protocols designed to measure abundance and demographic parameters.

The summaries are organized in the following manner. Each one is:

1) Grouped into either Abundance or Demographic protocol so that it is easier to find and compare alternative options for a given project.

2) Summarized in terms of:
   a. General overview
   b. Strengths and weaknesses
   c. Examples of how the protocol has been used to advance bird conservation or collaborations
   d. Where to find more information

We have purposefully kept these descriptions short so that they may serve as a quick reference instead of a comprehensive resource. The selection of protocols was based on our experiences; we selected protocols that have provided, or we think have potential to provide, long-term benefits to bird conservation as a science and regional collaboration. Some additional protocols, including "citizen science" programs are listed at the end of the document.

We cannot over-emphasize that, prior to selection of an abundance or demographic protocol, careful thought must be given to establishing a clear purpose, placing monitoring into a decision context, and considering the end users of this information. Well-designed and executed monitoring programs are essential to informed conservation and management of birds. A few references that may help the reader to clearly define monitoring objectives and sampling frameworks include:

- The Northeast Bird Monitoring Handbook (2009; http://www.nebirdmonitor.com/handbook/) provides a step-by-step process for optimizing the value of bird monitoring programs.

- The sample decision framework (Knutson et al. 2011; http://www.fws.gov/bmt/documents/Landbird%20Monitoring%20Protocol%202008.pdf) is intended to help readers clarify the need for monitoring, decide what to monitor, and determine how to structure the effort.
- Bart's (2011) user's manual for sampling large landscapes with small scale stratification http://pubs.usgs.gov/of/2011/1247/ describes an approach for the geographic distribution of sampling locations.

Unfortunately, there is no catch-all monitoring protocol that addresses all biases and error inherent in the process of describing ecological systems or assessing the effects of management and conservation actions. However, by defining target populations, spatial resolution and extent of inference, and monitoring objectives at the onset of monitoring program development, one can begin to ensure scientific rigor in the monitoring process. Consulting with a statistician or biometrician early in the process of developing a monitoring program is also an important step in a statistically robust approach to sampling and data analysis. Collection and maintenance of metadata (i.e., data describing data) along with the data is also paramount for data-sharing and facilitating the proper care and use of data over time.

Study objectives should always dictate what, how, where and when to monitor. Other important considerations are where and how to store the data, how the data will be analyzed, and who will make the reports. We have therefore included a section that briefly introduces the topics of Data Storage and Access by describing a few collaborative databases. One advantage of contributing to existing databases is that dedicated expert attention is often provided for the storage, maintenance and access of data sets. Database managers may also provide periodic analysis of the entire data set, and contribute tools that can be used to analyze all or subsets of the data.

We also provided a short section on Sampling Grids because grids are becoming increasingly popular during the design and analysis phases of field studies. Several grids are already available at a variety of scales, so it is rarely necessary for a project to go through the time and effort of developing new ones. Further, there may be cost-savings and other benefits to using the same grid as other projects. For example, landscape attributes (e.g., elevation, land cover) may have already been determined for grid cells in some areas and be available by request or download.

At the end of this document we provide a list of abundance, demographic, and "citizen science" protocols or programs with links for more information. Some of these were excluded from full summaries because we felt they did not meet our initial criteria listed above. Others were excluded because we were not aware of them prior to the expert review of this document. However, we wished to mention them in case one or more could be helpful to readers. There are likely many other programs and protocols that are appropriate for this document that we did not include. If you know of one, please contact an author so that we may add it to the document.

Literature cited

Bibby, C.J., N.D. Burgess and D.A. Hill (1992): Bird Census Techniques. London: Academic Press.

Abundance Protocols

Within a monitoring context, abundance data have been used to quantify the status of bird populations and to measure changes in population status over time (Lambert et al. 2009). Avian abundance has also been used as a response variable in evaluating the effects on bird populations of natural or anthropogenic environmental changes, and of management and conservation decisions (Lambert et al. 2009). Abundance data can be collected at a variety of scales (Lambert et al. 2009), ranging from the local to state, regional, national and international scales. Avian abundance data may be collected through a census that aims at a complete count of all birds within a survey boundary, or through a sampling approach that focuses on a representative subset of locations within that boundary (Gregory et al. 2004). Species that are spatially highly-clumped, conspicuous, or rare and occurring within a restricted range or at a limited number of sites are more amenable to censuses (Gregory et al. 2004). Census-based protocols and programs are not dealt with in this Guide (except see Arctic PRISM / double sampling).

In this section we present information on a number of sampling-based protocols designed to collect abundance (and other) data for different functional or habitat-based avian groupings, including land birds, marsh birds, shorebirds and waterbirds. While the majority of these protocols are designed as breeding season surveys, programs that include protocols for surveys of wintering landbirds (Christmas Bird Count) and migrating shorebirds (PRISM) are also included.

Literature Cited

Gregory, R.D., D.W. Gibbons and P.F. Donald. 2004. Bird census and survey techniques. Pages 17-56 in W.J. Sutherland, I. Newton and R.E. Green, editors. Bird Ecology and Conservation; a Handbook of Techniques. Oxford University Press, Oxford.

Lambert, J. D., T. P. Hodgman, E. J. Laurent, G. L. Brewer, M. J. Iliff, and R. Dettmers. 2009. The Northeast Bird Monitoring Handbook. American Bird Conservancy. The Plains, Virginia. 32 pp.

The Landbird Monitoring Protocol for the U.S. Fish and Wildlife Service, Midwest and Northeast Regions (2008)

Description
This protocol was designed as an all purpose way to monitor breeding landbirds that allows estimation of detection probabilities via a time-removal method.The goal was to promote the use of compatible field sampling methods among land managers in the Midwest and Northeastern U.S. and facilitate interagency habitat conservation and monitoring in the future. The protocol was developed in cooperation with the National Park Service, Great Lakes Network and Northeast Temperate Network, and the Northeast Coordinated Bird Monitoring project. The protocol evolved from a passerine monitoring protocol used by the National Park Service, U.S. Geological Survey, and other agencies in Alaska since 2004. The authors welcome use of the protocol by other FWS Regions and partners, as appropriate for their bird monitoring objectives (Knutson et al., 2008).

Strengths
The protocol includes an Introduction and a set of 11 Standard Operating Procedures (SOPs) and adheres to national standards of protocol content and organization. The Protocol Introduction describes the history and need for the protocol and summarizes the basic elements of objectives, sampling design, field methods, training, data management, analysis, and reporting. The SOPs provide more detail and specific instructions for implementing the protocol. The centralized, online Point Count Database (http://www.pwrc.usgs.gov/point/) is managed by the U.S. Geological Survey and is available for archiving the data to prevent loss and promote data sharing (Knutson et al., 2008).

This protocol has been extensively tested and reviewed, and it allows for analysis of detection probabilities using time-removal methods (Farnsworth et al. 2002; Farnsworth et al. 2005) and distance methods (Buckland et al. 1993), although the distance analysis is limited by pooling observations into distance bands. Data collected can be analyzed by various tools such as unmarked (http://cran.r-project.org/web/packages/unmarked/index.html), Presence (http://www.mbr-pwrc.usgs.gov/software/presence.html) and abundanceR (http://tools.sepif.org/abundancer). Tools are also available for converting the data into GIS data layers.

Weaknesses
The protocol is relatively new and has not yet been widely implemented in the Southeast. While affordable to monitor relatively small management units, this protocol requires substantial effort and costs to implement regionally.

Examples of use
The Landbird Monitoring Protocol is being used by National Wildlife Refuge biologists in the Midwest and Northeast. It is also being considered for use throughout the National Wildlife Refuge System's Inventory and Monitoring Network.
The NPS Great Lakes Inventory and Monitoring Network has adapted the Knutson protocol and rolled out a landbird monitoring protocol, found here:
http://science.nature.nps.gov/im/units/GLKN/monitor/landbird/landbird.cfm
The NPS Northeast Temperate Network similarly adapted the Knutson protocol; their protocol is found here:
http://science.nature.nps.gov/im/units/NETN/monitor/birds/docs/NETN_Landbird_Protocol_FINAL_20100519.pdf

For more information
http://www.fws.gov/bmt/documents/Landbird%20Monitoring%20Protocol%202008.pdf

Strategic Multi-scale Grassland Bird Population Monitoring

Description
This Grassland Bird monitoring protocol is an enhancement of the North American Breeding Bird Survey (BBS) protocol. This protocol was developed in response to some concern that the BBS under-surveys grassland habitats in the forest dominated eastern US, and to allow for multi-scaled inference. The protocol uses counties as management units based on the assumption that the county is an appropriate size for tracking local scale management actions and population responses. Like the BBS, the protocol employs survey routes: each route consists of thirty point count stations stratified in open habitats in pre-determined focal counties, with five roadside routes per county. Data are collected within distance bands to allow calculation of detection distances. Points are stratified by open area (survey only points with >50% "open" habitat), and one visit for four routes/county, two visits for one route/county. Habitat data are collected within a 100 m radius of each survey point, allowing for analysis with bird detection data collected. This project monitors 11 species that observers can easily learn, provide reliable results, and cater to a larger observer base.

Strengths
This protocol allows for periodically and annually collected Agricultural Census data to be analyzed with bird data. In this case, counties were used as management units for grassland birds to match the scale of Agricultural Statistics collected by the US Department of Agriculture. Counties can serve as a functional unit for state agencies and are a reasonable size for monitoring. This allows for greater spatial precision than BBS data, because BBS sample sizes are generally too small for county level analyses. This method was designed to evaluate the effects of management and document habitat conditions (e.g., habitat availability, management effort, land use change) by monitoring specific grassland type areas based upon predictive models and partner selected focal areas. Routes are stratified across focal habitat, such that grassland bird communities are better targeted than they are through the randomized placement of BBS routes to track population trends at meaningful scales. It is statistically rigorous, extensive in nature, cost effective, and implementable by Joint Venture/BCR partners providing a balanced sample design (scalable from point – route – county – state – BCR).

Weaknesses
This protocol has similar weaknesses to other point count methods like the Breeding Bird Survey (e.g., detection probabilities in time and space, detection of rare species, roadside bias), although, in the Central Hardwoods Joint Venture region, efforts were made to address detection probabilities (removal model) and potential roadside bias by assessing differences in detection and occupancy with distance from road.

Examples of use
Central Hardwoods JV grassland bird monitoring.
Southeast PIF 2011 meeting presentation
http://sepif.org/images/meetings/2011/8lituma_sepif.pdf

For more information
Dr. David Buehler at University of Tennessee (dbuehler@utk.edu)
Southeast PIF 2011 meeting presentation http://sepif.org/images/meetings/2011/8lituma_sepif.pdf

Standardized North American Marsh Bird Monitoring Protocol

This protocol (Conway 2009) is designed to be used in surveys of secretive marsh birds (rails, bitterns, coots, grebes, and moorhens). It employs playback of target species' vocalizations to increase their detectability. The protocol makes recommendations as to time of day and season during which to survey, frequency of surveys, placement of survey points, and equipment to be used. Data collection includes distance to bird, which can improve density estimation, type of call detected, as well as period of detection, which can be used to calculate components of detection probability. The protocol also includes the collection of coarse vegetation data. Data are stored in a centralized online database managed by the USGS Patuxent Wildlife Research Center, in cooperation with the University of Idaho and the USFWS Office of Migratory Birds.

Strengths
The protocol has been field-tested for its efficacy in increasing detection probability of target species using broadcasts of calls compared to passive surveys; its effect of broadcasting calls of multiple marsh birds on the vocalization probability of each target species; and the calculation of observer bias associated with passive and call-broadcast surveys. The protocol is flexible in allowing for customization of broadcast contents, such that vocalizations of target species can be added or subtracted based on local species assemblage. The use of an online database maintains data quality (reduces entry errors) and ensures that data collected through the protocol can be stored, managed and analyzed in a centralized location which ensures that the data collected is easily available to analysts and managers in perpetuity

Weaknesses
Preliminary results indicate that the effectiveness of call-broadcasting on increasing detections of target species is less pronounced for Least Bittern and American Bittern than it is for other species (Conway and Nadeau 2010).

Examples of use
The protocol has enjoyed widespread use in recent years, including its adoption by various USFWS National Wildlife Refuges in their marsh bird monitoring projects. This protocol is also being piloted in several states throughout the US (e.g., New York, Wisconsin, Michigan, Ohio, Idaho, and Florida) to inform development of a National Marsh Bird Monitoring Program, to inform harvest regulations of hunted species and to determine status of and evaluate conservation effectiveness for secretive marsh birds.

For more information
http://ag.arizona.edu/research/azfwru/NationalMarshBird/

Literature Cited
Conway, C. J. 2009. Standardized North American Marsh Bird Monitoring Protocols, version 2009-2. Wildlife Research Report #2009-02. U.S. Geological Survey, Arizona Cooperative Fish and Wildlife Research Unit, Tucson, AZ.

Conway, C. J., and C. P. Nadeau. 2010. Effects of broadcasting conspecific and heterospecific calls on detection of marsh birds in North America. Wetlands 30(2):358-368.

Integrated Waterbird Management and Monitoring Program

Description

This innovative program uses monitoring information in an adaptive management framework integrated across three spatial scales to inform management decisions for waterbirds. The goal is to optimize resource management decisions at the flyway, regional and local scales by collecting information needed to guide decisions that managers have agreed upon are the most important. It relies upon strong collaboration among conservation partners located along the Atlantic and Mississippi Flyways. The focal species are wetland-dependent migratory birds (i.e. waterfowl, shorebirds and wading birds) surveyed throughout the non-breeding period.

The objective of the Integrated Waterbirds Management and Monitoring (IWMM) Initiative is to "sustain continental waterbird population goals by providing the information to guide future management decisions regarding where to focus staff time, funding and other resources on habitat acquisition, restoration, and management along migration routes." At the flyway scale, the primary decisions relative to resource allocations should result in an appropriate quantity and quality of habitat at a set of stop-over and wintering sites that meet the energetic demands of the target population of migrating and wintering waterbirds. At the regional scale, resources are allocated to those management sites where the greatest waterbird return on investment can be realized. At the local scale, managers collect monitoring data and use adaptive management to improve habitat quality and optimize waterbird use at each site.

Vegetation and bird protocols were developed to match bird counts to management objectives and habitat characteristics. Vegetation variables recorded for each survey unit include: salinity, top four co-dominant plant species, stem density, vegetation height, interspersion, and a photo of the survey unit. Variables recorded for each bird count include: an estimate of the numbers of birds by species, disturbance severity score, disturbance source, weather, water depth, water gauge reading (if available), and flooding regime.

Strengths

Monitoring is set within a decision framework designed to improve habitat delivery and management with the long-term goal of sustaining waterbird populations. Data sheets and protocols are available online, and data can be entered online. The website also includes forums for teams developing the surveys and collecting data, allowing for interactive development of a monitoring effort.

Weaknesses

Complexity of the project has led to long development time and will require a sustained commitment or reprogramming of resources to transition it to an operational program.

Examples of use

The first pilot season was completed in Fall/Winter 2010-11. Surveys were completed at 89 pilot sites across the Midwest, Northeast and Southeast. A total of 2800+ individual bird counts were conducted that recorded over 1.7 million birds. The recently formed Avian Health and Disease Program within the U.S Fish and Wildlife Service Migratory Bird program is partnering with the IWMM to establish a baseline for measuring avian health across large spatial scales.

For more information

http://iwmmprogram.ning.com/

United States Nightjar Survey Network

Description
The primary objective of this program is to determine the population distribution and trends of Nightjar species across the United States. There is a general sense that populations of these species are declining. Information on the precise scale and magnitude of population changes are necessary in order to plot a course for conservation. However, prior to this program, there has been no widespread or long-term effort to monitor Nightjar populations. This effort is coordinated by the Center for Conservation Biology at the College of William and Mary and Virginia Commonwealth University. Nightjar surveys are standardized population counts conducted along roadside census routes at night. Each survey route consists of 10 roadside stops spaced 1-mile apart. Each route is surveyed only one time per year, but during a very specific survey window when Nightjars are typically most vocal. Success of this monitoring program is dependent on dedicated volunteers willing to conduct Nightjar surveys.

Strengths
The initial sampling strategy was to conduct surveys along existing North American Breeding Bird Survey (BBS) routes in an effort to capture a broad volunteer base and replicate the BBS sampling locations. This approach allowed for rapid assessment that will guide future sampling design. Volunteers were also allowed to create their own standardized route in an effort to recruit volunteers who could place an additional survey route near an existing one did or for those not want to travel a long distance for a night-based survey. Data collected since 2007 has served as the foundation for a new "best effort" approach to stratify landscapes according to species distribution and habitat composition Participation is garnered by a larger group of citizen scientists than many other survey efforts because routes typically do not take more than two hours to complete, and the only experience necessary is a familiarity with 2-3 Nightjars species within their respective region. The protocol is self-explanatory, and all details (survey window, moonrise/sunset calendar, data sheets, etc.) are provided by the network coordinators, making it very easy for individuals to participate regardless of previous experience with surveys. The protocol uses six one-minute time blocks so that data may be compared with studies using shorter time periods.

Weaknesses
As with any survey that relies on citizen scientists, there is the potential for inaccuracy. Statistical inferences with observer-created routes are limited, and locations of existing routes may limit detectability by under-sampling suitable Nightjar habitat, though this is being addressed with a new sampling approach. In addition, multi-regional analysis of standardized Nightjar data from the Northeast, Midwest, and US Nightar Survey programs (currently underway) should improve route placement in terms of volunteer retention and Nightjar detectability. Currently, there is not an online data entry option for participant.

Examples of use
Although it is nationwide in scope, the US Nightjar Survey Network has its strongest presence in the southwestern and southeastern United States. This protocol is also being implemented by partners in the Northeast US (Northeast Nightjar Survey) and several Midwestern states (Illinois, Wisconsin, and Michigan). Survey data has provided inferences to the response of Nightjars to varying composition of habitats within landscapes.

For more information
http://www.ccb-wm.org/nightjar/protocols.htm
http://www.nightjars.org

North American Breeding Bird Survey (BBS)

Description

The BBS is a cooperative effort between the U.S. Geological Survey's Patuxent Wildlife Research Center, Environment Canada's Canadian Wildlife Service, and the Mexican National Commission for the Knowledge and Use of Biodiversity to monitor the status and trends of North American bird populations. Following a strict protocol, BBS data are collected by dedicated participants along randomly established roadside routes throughout the continent. Professional BBS staff works closely with researchers and statisticians to compile and deliver these population data and trend analyses on more than 400 bird species, for use by conservation managers, scientists, and the general public. Each year during the height of the breeding season, participants collect bird population data along survey routes. Each route is approximately 24.5 miles long with stops at approximately 0.5-mile intervals. At each stop, a 3-minute point count is conducted, during which every bird seen within a 0.25-mile radius or heard is recorded. Surveys start one-half hour before local sunrise and take about 5 hours to complete. Approximately 3000 routes are sampled annually. These data provide indices of population abundance that are used to estimate population trends and relative abundances at various geographic scales.

Strengths

Established in 1966, the BBS is arguably the largest and longest running data set available for breeding birds. In addition to its large temporal and geographic extents, keys to BBS success include a scientifically rigorous sampling design, a relatively simple field protocol, and a highly skilled and dedicated volunteer workforce. Moreover a variety of online resources are available, including raw data, summary estimates of population change by species, graphs of annual indices, abundance maps, trend maps, and online analysis modules that permit estimation of population change by species for any region and time period of interest.

Weaknesses

The BBS is effective in estimating population trends for about 420 species. However, quality of information varies widely among species, and the BBS tends to provide imprecise results for species 1) associated with habitats that are underrepresented along roadsides (e.g. wetlands, forest interiors); 2) that are nocturnal/crepuscular (e.g. owls, nightjars); 3) that are less detectable (e.g. some raptors); and 4) that are rare or with restricted distributions. The roadside count-based design of the BBS has been criticized because roadsides may not be representative of the entire landscape, and the point count protocol employed by the BBS does not allow for estimation of detection probabilities.

Examples of use

The BBS provides scientifically credible population measures to inform sound avian research, conservation and management actions. In addition to alerting managers of widespread declines of neotropical migrants in 1989 and subsequent grassland bird declines, spurring further research and conservation action on those taxa, BBS trends along with other indicators are used by Federal and State agencies, and many others, to assess national and regional avian conservation priorities. Over 450 scientific publications have relied heavily, if not entirely, on BBS data. See the BBS Bibliography for more data use examples (www.pwrc.usgs.gov/bbs/about/bbsbib.pdf).

For more information

http://www.pwrc.usgs.gov/BBS/ or to participate and sign up for a route:
http://www.pwrc.usgs.gov/bbs/participate/

Christmas Bird Count

Description
A program of the National Audubon Society, The Christmas Bird Count (CBC) is a citizen-science based early-winter bird survey involving volunteers across the US, Canada and many countries in the Western Hemisphere since 1900. Over a 24 hour period, participants follow specified routes through a designated 15-mile diameter circle, counting every bird they see or hear. Birds are counted throughout the day, giving an indication of the total number of birds in the circle that day. Compilers are responsible for collating and submitting the data for their circle. All individual CBC's are conducted in the period from December 14 to January 5 each season, and each count is conducted in one calendar day.

Strengths
The long term perspective made possible by the Christmas Bird Count is useful for conservationists. It informs strategies to protect birds and their habitat, and helps identify environmental issues with implications for people as well. For example, local trends in bird populations can indicate habitat fragmentation or signal an immediate environmental threat, such as groundwater contamination or poisoning from improper use of pesticides. Long-term, broad-scale analyses can inform continental conservation planning efforts and guide further research by revealing regional or continental patterns of population change. CBC is an easy way for people to become involved in counting birds; 30,000 participants counting birds in 2000 circles per year. Current and historical data are available on-line by count circle, state and species displayed graphically and numerically (raw count data). Most of the field methods and standardizations currently employed date to 1950, providing the ability to assess patterns of populations change for the past 60 years, at least for some species and some regions of the country.

Weaknesses
While the CBC's historical longevity is an advantage, the inferences that one can make are limited due to its biases: coarse spatial scale, unequal sampling intensity, and lack of ways to correct for observer skill differences, time-of-day, mode of transportation, and circle coverage. CBC count circles are set up based on volunteer interest with no stratification or statistical design employed. If any inferences are to be made from CBC data, they should first be standardized by the number of hours of observer participation on that count. However, new analytical tools are being employed that have greatly improved the ability to draw reasonable inferences about population change with the CBC data and statistically account for some biases. Bayesian methods are now used to fit hierarchical models that estimate change at the strata level (states, BCRs, etc.) and this addresses some concerns. These methods also provide the additional advantage of improving the comparability to BBS analyses because they are analogous. A disadvantage, however, is that these analyses are complex, so not easily implemented.

Examples of use
The data collected by observers over the past century allow researchers, conservation biologists, and other interested individuals to study the long-term health and status of bird populations across North America. When combined with other surveys such as the Breeding Bird Survey (Link and Sauer 1999), the CBC provides a picture of how the continent's bird populations have changed in time and space over the past hundred years. This link provides examples of several species specifically addressed through CBC: http://birds.audubon.org/how-christmas-bird-count-helps-birds

For more information:
http://birds.audubon.org/christmas-bird-count\
http://birds.audubon.org/sites/default/files/documents/104_021-25ANALYSISfeature.pdf

Link, W.A and J. R. Sauer. 1999. Controlling for Varying Effort in Count Surveys: An Analysis of Christmas Bird Count Data. *Journal of Agricultural, Biological, and Environmental Statistics* 4(2):116-125 http://www.jstor.org/stable/1400592

Program for Regional and International Shorebird Monitoring (PRISM)

Description
PRISM is a complementary monitoring effort to the International Shorebird Survey (ISS) coordinated by the Manomet Center for Conservation Sciences. ISS originated in 1974 to gather data on shorebirds and wetland use. Since then it has grown such that in 2009 almost 80,000 census counts were completed at 1200 locations in 47 states of the U.S., with additional counts from Central and South America. PRISM was later developed as a complementary project aimed at better tracking population change in shorebirds and at better informing the U.S. Shorebird Conservation Plan. It expanded the ISS survey effort to increase the power of statistical analyses and more clearly define shorebird conservation issues on a continental scale. PRISM goals were most recently revised in 2007 to include the following: 1) identify species at risk, 2) contribute to the identification of causes of declines or other disturbing trends, 3) help develop, evaluate, and refine management/conservation programs, 4) document progress towards, or away from, management/conservation objectives, and 5) assist managers and policy-makers in meeting their shorebird conservation goals. Data are collected primarily from ISS/PRISM focal sites but surveyors can select their own sites using data entered by the volunteer into the ISS eBIRD portal. Volunteers are asked to count all birds they see to the species level. If the tally is a count, volunteers are asked to submit an estimate or a guess of the total number. Birds are recorded as "identified" if observers can identify to species level; otherwise they are simply quantified to a group (e.g., peeps). Guidelines are available online and provide dates for fall and spring migration survey periods, time of day and location, and includes pointers to improve count accuracy.

Strengths
PRISM demonstrates peer-reviewed methods, scientifically sound data collection, and a collaborative approach with multi-partner support. Among the benefits of PRISM surveys is long term trend data and the establishment of annual peak migration periods by species. In areas where human disturbance is a factor, these surveys may offer some insight on shorebird impacts resulting from habitat perturbations. Volunteers collect data based on a clearly defined protocol (specific survey periods, time of day, locations) with explanations for count accuracy and species identification. Data entry is online through the ISS eBird website.

Weaknesses
Data is primarily collected by volunteers interested in contributing to the database. Like all volunteer populated databases effort can vary within and across sampling periods and years but without volunteers this type of monitoring effort would be cost prohibitive. The protocol may be less effective in geographic areas where configuration and uneven topography of the habitat interferes with detectability of target species. For instance, salt marshes are often interspersed with mudflats surrounded by vegetation that make it virtually impossible to locate foraging shorebirds, which can lead to substantial underestimates of birds in a given system. There is a potential of double counting when conducting migratory bird surveys over large areas which may take several days to complete.

Examples of use
PRISM is being implemented by a Canada-U.S. Shorebird Monitoring and Assessment Committee formed by the Canadian Shorebird Working Group and the U.S. Shorebird Council.

For more information
http://www.manomet.org/our-initiatives/shorebird-recovery-project/iss-prism (protocol and data entry)
http://www.shorebirdworld.org/fromthefield/PRISM/PRISM1.htm - General info on PRISM
http://www.fws.gov/shorebirdplan/downloads/ArcticPrismPeerReview.pdf - Peer review of PRISM methods

Arctic PRISM/double sampling

Description

This protocol was included in this guide because it is an example of double sampling that could be used in the Southeastern U.S. In double sampling, a large sample of plots is surveyed for species' abundance using a rapid method of unknown accuracy, and a subset of the plots are surveyed using an intensive method that yields unbiased estimates of abundance. The ratio of counts obtained using the rapid and intensive methods (on the subset of plots surveyed using both methods) is then used to adjust the results from all plots surveyed. Double sampling has been used for decades on aerial surveys of waterfowl. During the past decade the method was refined and used in the Arctic PRISM program throughout the arctic regions of Alaska and Canada. Recently, it has been widely used for landbirds, especially in the southwestern United States.

Strengths

Double sampling yields unbiased estimates of density, population size, and trend in size that are subject only to the assumptions that the nominal sampling plan is followed and that estimates from the intensive plots are unbiased. Thus, differences or changes in observer skill, effects of weather or traffic noise, and change in phenology can all occur without causing any bias in the estimates. Rapid surveys have usually been made using area searches, point counts, or aerial surveys, but any method can be used. Thus, rapid surveyors could use distance, double observer, or removal methods, and the intensive surveys would then reveal how accurate the rapid method was. If the rapid method turned out to yield unbiased estimates, then the intensive surveys could be discontinued. The intensive surveys also yield substantial additional information, such as nesting success, that may be useful in other ways. For example, in the Arctic PRISM surveys, intensive surveyors also conduct predator scans, record plant phenology, and trap invertebrates.

Weaknesses

The intensive surveys take time to conduct and may require 25-50% of the total survey effort, so they should only be included if there is uncertainty about accuracy of the rapid counts (or if the other information they provide justifies their inclusion). The method also requires that plots be thoroughly searched, which means surveyors cannot count solely from roads.

Example of use

In addition to its use in aerial surveys and Arctic PRISM, double sampling has recently been used by the Bureau of Reclamation on the Lower Colorado River, by the Arizona Department of Game and Fish in a Statewide survey of riparian areas, by the Great Basin Bird Observatory in the Nevada Bird Count, by the Sonoran Joint Venture in Mexico, and in a multi-agency survey of birds in the Sonoran desert. It has also been selected by several Department of Defense installations for upcoming projects.

For more information

Bart, J. and S.L. Earnst. 2002. Double sampling to estimate density and population trends in birds. Auk 119:36-45.

Brown, S., J. Bart, R.B. Lanctot, J.A. Johnson, S. Kendall, D. Payer, and J. Johnson. 2007. Shorebird abundance and distribution on the coastal plain of the Arctic National Wildlife Refuge. Condor 109:1-14.

Smith, P.A., J. Bart, R.B. Lanctot, B.J. McCaffrey, and S. Brown. 2009. Probability of Detection of Nests and Implications for Survey Design. Condor 111:414-423.

Ralph et al. (1995) Point Count Protocol

Description
This point count-based protocol appears as a summary chapter in a 1995 US Forest Service technical report. The chapter outlines agreed-upon standards and their applications to point count methodology that resulted from a 1991 workshop to evaluate point counts and to work toward the standardization of methods to monitor bird populations by census. The protocol allows for collection of landbird data in a variety of habitat types for the purposes of conducting inventories, estimating relative abundance, estimating densities, estimating population trends, or determining associations between birds and their habitats. It organizes data collection into temporal and spatial bins and provides guidance on survey point placement, replication and timing of surveys (in relation to time of day, season, and weather). The protocol has been widely adopted by researchers and land managers over the many years since its publication in 1995, and has served to provide a level of standardization in bird point count data collection that was previously missing.

Strengths
One of the protocol's greatest strengths is that of providing guidance for implementation of bird surveys based on the stated objectives of the end user. This allows for great flexibility and adaptability of the protocol to a variety of situations, while still maintaining standardization in the manner in which data are collected. Collection of bird abundance data in temporal bins of 3, 2 and 5 minutes allows for comparison with data collected under other protocols (ex. North American Breeding Bird Survey).

Weaknesses
In recent years, greater emphasis has been placed on applying detectability-based correction factors to bird abundances to more accurately estimate the number of birds at a site. Detection probabilities can be estimated through the Ralph et al. (1995) protocol through repeated measurements at a point, or by recording distance to individuals through a variable circular plot method. Because the latter technique requires a relatively precise estimation of distances, it is best applied using highly trained observers and only in bird communities with relatively few and conspicuous species (Verner 1985 in Ralph et al. 1995). Enhancement of the protocol to include a greater number of distance bins can also allow calculation of detection probabilities (Rosenstock et al. 2002).

Examples of use
The protocol has enjoyed nearly universal use in landbird surveys and monitoring since its publication. Note that Hamel and others (1996) developed a similar protocol (see below) which was targeted specifically for use in the Mississippi Alluvial Valley and the broader southeastern US region and which has been adopted by the USDA Forest Service Southeast Region.

For more information
http://www.fs.fed.us/psw/publications/documents/gtr-149/pg161_168.pdf

Literature Cited
Ralph, C.J., S. Droege and J.R. Sauer. 1995. Managing and Monitoring Birds Using Point Counts: Standards and Applications. Pages 161-168 in C. J. Ralph, J. R. Sauer, and S. Droege, Eds. Monitoring Bird Populations by Point Counts, USDA Forest Service, Pacific Southwest Research Station, General Technical Report PSW-GTR-149.

Rosenstock, S.S., D.R. Anderson, K.M. Giesen, T. Leukering, and M.F. Carter. 2002. Landbird Counting Techniques: Current Practices and an Alternative. *Auk* 119(1):46-53.

Verner, J. 1985. Assessment of counting techniques. Current Ornithology 2: 247-302.

A Land Manager's Guide to Point Counts of Birds in the Southeast (Hamel et al. 1996)

Description

This USDA Forest Service General Technical Report was designed as a unified resource for land managers to plan and implement avian point count-based surveys in southeastern habitats. Like similar point count protocols (ex. Ralph et al. 1995, summarized above), it organizes data collection into temporal and spatial bins. In addition the Report provides treatments of sample size determination, distribution of counts among habitats, cooperative monitoring networks of neighboring land managers, vegetation sampling, standard data formats, and data input and management. Appendices provide equipment lists, wind speed and sky condition classes, North American Bird Banding Manual species codes, suggestions for point count data schema, and a power method for determining sample size.

Strengths

The report presents a succinct and easy to understand introduction to the use of point counts for bird monitoring. It includes a decision tree for matching information needs with various approaches to bird monitoring, a method for determining appropriate sample sizes, and recommendations for data management. The methods presented in this report are commonly used for point count surveys by the USDA Forest Service and the US Fish and Wildlife Service.

Weaknesses

The single annual survey per point and distance bins (<25m, 25-50m and >50m) recommended in the protocol are insufficient to accurately estimate detection probabilities, although the protocol can be enhanced to allow for such estimation by increasing the number of distance bins (Rosenstock et al. 2002). The suggested time of detection strata (3, 5, and 10 minute) are not equal intervals, and therefore inappropriate to use for repeated count analysis. Vegetation measurements are described in terms of documents that are difficult to obtain.

Examples of use

The USDA Forest Service Southeast Region uses the Hamel et al. (1996) protocol for collecting point count data on National Forests that is stored in the R8Bird database. This is done in fulfillment of the Southern National Forest's Migratory and Resident Landbird Conservation Strategy where point count data are used to access and track the status of forest breeding bird populations and their habitats over time. A key goal of this landbird monitoring program is to provide implementation, effectiveness, and validation monitoring for Forest Plans.

For more information

Download the guide here: http://www.dodpif.org/downloads/point-counts-SE.pdf

Literature Cited

Hamel, P.B., W.P. Smith, D.J. Twedt, J.R. Woehr, E. Morris, R.B. Hamilton, and R.J.Cooper. 1996. A land manager's guide to point counts of birds in the Southeast. Gen. Tech. Rep. SO-120. U.S. Department of Agriculture, Forest Service, Southern Research Station. 39 p.

Rosenstock, S.S., D.R. Anderson, K.M. Giesen, T. Leukering, and M.F. Carter. 2002. Landbird Counting Techniques: Current Practices and an Alternative. Auk 119(1):46-53.

Mountain Birdwatch

Description
Mountain Birdwatch (MBW) is a point-count based, long-term monitoring program for Bicknell's Thrush and other montane forest birds. MBW began under the Vermont Center for Ecostudies' (VCE) Forest Bird Monitoring Program. Volunteers surveyed 12 mountains from 1993-1999 in order to monitor changes in the status of Bicknell's Thrush (*Catharus bicknelli*) and other high-elevation songbirds. In 2000, VCE biologists launched MBW as an independent program with fifty additional routes in Vermont and offered observers the option to concentrate on five species: Bicknell's Thrush, Swainson's Thrush (*Catharus ustulatus*), Blackpoll Warbler (*Dendroica striata*), White-throated Sparrow (*Zonotrichia albicollis*), and Winter Wren (*Troglodytes troglodytes*). In 2010, VCE and collaborators launched a revised, expanded monitoring program, Mountain Birdwatch 2.0 (MBW2). MBW2 incorporates randomly-selected routes, an improved survey protocol, an eleven-species focus, and a collaboration with Canadian partners to systematically monitor Bicknell's Thrush across its entire breeding range.

Strengths
MBW has been field tested for over ten years and has evolved and updated protocols and routes during that time. Rigorous new protocols are based on the guiding principles of *Opportunities for Avian Monitoring*, a report of the Monitoring Subcommittee of the north American Bird Conservation Initiative (U.S. NABCI 2007), and random selection of routes across appropriate habitat will allow scientists to draw broad conclusions about the status and trends of high-elevation breeders of the Northeast. Until recently, MBW has been implemented in VT, ME, NH and NY. An ongoing partnership between VCE and Bird Studies Canada, Regroupment QuébecOiseaux, and the Canadian Wildlife Service has allowed for expansion of the program to the montane spruce-fir forests of Canada.

Weaknesses
Currently, the biggest challenge with MBW is making it work in all of its participating regions- the U.S., the Canadian Maritimes, and Quebec. The route selection protocol was based on a model of potential habitat for Bicknell's Thrush in the U.S. and Canada, with most of this potential habitat in Canada. However, the highest densities of Bicknell's Thrush seem to be in the U.S., and much of the "potential" habitat in CA is not currently usable habitat (for example, some of it has been logged). Right now, Canada has a very large proportion of their routes on which the flagship species is not detected. With such low detection rates, it may be difficult for the program to meet its analysis goals in the desired time period; also, it is difficult for Canadian partners to financially sustain a program with such low numbers of detections of the flagship species. Currently, MBW is looking at ways to focus efforts in Canada on routes that are more likely to yield Bicknell's Thrush detections without sacrificing the protocol's randomness entirely. While survey protocols are set, the route selections may change somewhat in upcoming years.

Examples of use
Data collected from MBW have been used to: detect population trends (Lambert et al. 2001) examine the influence of landscape structure on high-elevation bird communities (Lambert et al. 2002) measure habitat characteristics on 45 survey routes (Lambert 2003) quantify short-term population trends (Lambert 2005)produce and validate a Bicknell's Thrush distribution model (Lambert et al. 2005); and project effects of climate change on Bicknell's Thrush distribution (Lambert and McFarland 2004). MBW data has also identified key management units and conservation opportunities for Bicknell's Thrush (Lambert 2003).

For more information: http://www.vtecostudies.org/MBW/

Project Prairie Birds

Description
Southern grasslands are the primary destination for more than a dozen species of Nearctic migratory grassland birds. However, there are large gaps in information concerning winter distribution, habitat requirements and population changes in this group of nationally-recognized declining species. The pilot project area for Project Prairie Birds (PPB) in 1998-1999 was the Upper Texas Coast. This is home to the largest urban area in the state of Texas, an area of exponential human growth and development. For example, the greater Houston area once contained extensive prairie habitat, but it is rapidly disappearing. The goal of this program was to facilitate the collection of important data that will be included in the Partners in Flight planning process.

Project objectives are to: (1) determine area-distribution of priority grassland species, (2) identify habitat preferences for target species, (3) utilize data to develop land management guidelines and recommendations for conservation planning, and (4) give concerned citizens a project toward which they can contribute their efforts.

The monitoring method consists of flush transects 100m long. Three participants use light-weight poles to form the survey line about 20m wide. Walking slowly in a line and brushing the vegetation with the poles flushes the secretive grassland birds, allowing identification and counts.

Strengths
This method allows for flush transects in grass habitats with small shrubs and trees where rope dragging would be impractical. The use of poles for flushing also reduces the number of required personnel while maximizing the area covered in a sample.

Weaknesses
It is difficult to identify small birds as they flush out of the grass and dive into a different patch of grass. The flight patterns of these birds can help, as described on the website, but accurate identification requires practice and expertise.

Examples of use
Texas wintering Henslow's Sparrow report.
http://www.tpwd.state.tx.us/huntwild/wild/birding/project_prairie_birds/

For more information
See http://www.tpwd.state.tx.us/huntwild/wild/birding/project_prairie_birds/ for full information and methods including winter sparrow identification tips.

Demographic Protocols

Monitoring demographic rates can be used to quantify measures of productivity and survival, like nesting success, number of nesting attempts, nest parasitism, young produced per successful nest, annual adult and juvenile survival, and seasonal survival (e.g., winter, breeding, post-fledging). These measures of productivity can be used as response variables to evaluate management and conservation actions, or they can be combined to measure population growth rates (λ). These methods usually require more effort than the many abundance protocols, but the results can better answer "why" populations are increasing or decreasing. In most cases, the efforts to monitor demographic rates are focused on specific species within a defined area (i.e., Breeding Biology Research and Monitoring Database), or individual contributions are combined to build a database of information across a species range (i.e., NestWatch). More recent methods like the Monitoring Avian Productivity and Survivorship program, use passive netting to sample common species within an area, and do not target any individual species.

NestWatch

Description
NestWatch is a nest-monitoring project launched in 2008 by the Cornell Lab of Ornithology. By building upon previous regional nest-monitoring programs, such as The Birdhouse Network and the Cornell Nest Record Card Program, NestWatch aims to provide a unified nest-monitoring scheme to track reproductive success for all breeding birds in the United States. This effort is designed to generate a broad temporal and geographic data set in order to better understand and manage the impacts of environmental change on bird populations. The project also seeks to engage the public to connect with nature and science in their backyards. Volunteers collect information on nests during the egg-laying, incubation, hatching, nestling, and fledging periods. Data collected include the species, location, habitat and other variables relating to nest placement and configuration; reproductive data including estimates of egg-laying, hatching and fledging dates, as well as number of eggs and number of young; and data on nest parasitism and predation. Data collection is focused on species commonly found in rural, suburban and urban areas, which are accessible for nest monitoring. However, nesting data for any North American species is accepted. Data are entered by observers into a centralized online database.

Strengths
Current data are publicly available through the NestWatch website. Future incorporation of decades of historic Nest Record Card data will make the NestWatch database one of the largest repositories of avian reproductive data in North America; the database will house nearly 400,000 nest records spanning over four decades and 500 species.

Weaknesses
As with any monitoring program that relies on citizen scientists, there is the potential for inaccuracy, although the database filtering system was built to avoid mistakes in data entry. There is a bias in the NestWatch database toward species that use nest boxes, and toward nests located in habitat easily accessible to humans. Very few of the commonly monitored species are high priorities for conservation.

Examples of use
The following journal articles utilize data from NestWatch's predecessors; The Birdhouse Network and the Cornell Nest Record Card Program. Similar application of NestWatch data is expected.

Cooper, C.B., W.M. Hochachka, T.B. Phillips, and A.A. Dhondt. 2006. Geographic and seasonal gradients in hatching failure in Eastern Bluebirds reinforce clutch size trends. Ibis 148:221-230.

Cooper, C.B., W.M. Hochachka, and A.A. Dhondt. 2005. Latitudinal trends in within-year reoccupation of nest boxes and their implications. Journal of Avian Biology 36:31-39.

Winkler, D.W., P.O. Dunn, and C.E. McCulloch. 2002. Predicting the effects of climate change on avian life-history traits. Proceedings of the National Academy of Sciences 99:13595-13599.

For more information
http://www.nestwatch.org

BBIRD - Breeding Biology Research and Monitoring Database

Description

The Breeding Biology Research and Monitoring Database (BBIRD) program was a national, cooperative program that used standardized field methodologies for studies of nesting success and habitat requirements of breeding birds. BBIRD participants contributed their data to the national BBIRD database to allow examination of large-scale patterns and trends. The national database includes 1997-2002 data on nearly 60,000 nests and associated vegetation, representing more than 210 species of birds. BBIRD monitors nesting success and habitat of nongame birds by finding and monitoring nests at replicate plots across North America. Standardized nesting data collection and associated vegetation sampling was conducted at nest sites, non-use plots, and point count stations to allow detailed analysis of microhabitat requirements for successful nesting.

BBIRD protocols provided detailed instructions to potential investigators for initiating BBIRD sites and maintaining standardized data collection. Ultimately, BBIRD enabled scientists to provide true replication of studies and increase the power of their analyses through collaborative data-sharing. This allowed for estimation of relative population health and habitat requirements for a wide range of species in response to dynamic landscapes and global change. The BBIRD program was managed under the Biological Resources Division, U.S. Geological Survey and is supported in part by this program and by the USDA Forest Service. Data were provided by cooperators with wide sources of funding.

Strengths

This program provides standardized methods for data collection for nesting birds and the habitat used for nesting sites. Also included are protocols for grassland bird populations and habitats.

Weaknesses

In providing a fairly comprehensive list of possible information to record, the methods are very detailed and may require much more effort than a land manager is willing to expend. The database includes nest records from 1997 through 2002.

Examples of use

Martin, T.E., and G.R. Geupel. 1993. Protocols for nest monitoring plots: locating nests, monitoring success, and measuring vegetation. J. Field Ornithol. 64:507--519.

Martin, T.E. and J.J. Roper. 1988. Nest predation and nest-site selection of a western population of the hermit thrush. Condor 90:51--57.

Lloyd, P., T. E. Martin, R. L. Redmond, M. M. Hart, U. Langner, and R.D. Bassar. 2006. Assessing the influence of spatial scale on the relationship between avian nesting success and forest fragmentation: a case study. Pp: 255-269 in: J. Wu, K. B. Jones, H. Li, and O. Loucks (Editors). Scaling and Uncertainty Analysis in Ecology: Methods And Applications. Springer, Netherlands.

For more information

http://www.umt.edu/bbird/default.aspx
http://www.umt.edu/bbird/protocol/monitor.aspx

Monitoring Avian Productivity and Survivorship (MAPS)

Description

The Monitoring Avian Productivity and Survivorship (MAPS) Program comprises a continent-wide cooperative network of hundreds of constant-effort mist netting stations operated each year (> 1,000 stations in total). The MAPS Program was pioneered in 1989 by The Institute for Bird Populations (IBP) to assess and monitor the vital rates and population dynamics of North American landbirds, and inform bird conservation efforts. Each summer dedicated volunteers operate bird-banding stations across North America to collect data on "birds-in-the-hand" representing nearly 200 species (DeSante and Kaschube 2009). About 1.5 million MAPS data records now exist.

Strengths

The MAPS field protocol (DeSante et al. 2011), coupled with state-of-the-art capture-mark-recapture (CMR) analysis, provides much needed annual estimates of adult survival, recruitment, residency, and lambda for over 160 landbird species that can be sampled through passive mist-netting during the breeding season (Saracco et al. 2010, 2011). Effort-corrected annual productivity indices are also estimated from capture rates of young and adult birds. Survival and productivity estimates are provided at continent-wide and regional scales on the IBP website, along with station and habitat information. Other performance metrics can also be derived from MAPS data, including age structure, body condition, breeding condition, and breeding phenology. MAPS provides a great opportunity for outreach and education because students and volunteers are often incorporated into a station's operations. MAPS data are submitted to at least two centralized databases (USGS Bird Banding Lab and IBP MAPS database) and have been archived with the Avian Knowledge Network (e.g., Saracco et al. 2009b). Staff are available at IBP to answer questions.

Weaknesses

MAPS data are most valuable for making inferences at larger scales (Nott 2011a, b, c). Although capture rates at individual stations are generally too low to provide precise station-specific survival estimates, pooling of data from clusters of six stations has been shown to provide reliable survival estimates at that spatial scale. MAPS productivity estimates (ratio of juvenile to adult captures) represent the local landscape (4-km-radius area surrounding the station). MAPS productivity indices tend to be biased low because of differences in capture probabilities between young and adult birds. MAPS productivity indices for a species can be compared among years and regions, but cannot necessarily be directly related to measures of productivity derived from direct nest monitoring, such as proportion of successful nests. The operation of MAPS stations is also somewhat labor intensive, such that operating six stations on a single landholding can require resources comparable to nest searching and monitoring of selected species on that landholding. Tests designed to compare productivity indices derived from the MAPS protocol to productivity estimates obtained from other methods are needed and are currently underway. Finally, capture rates from passive mist-netting vary by habitat, with rates tending to be lower in mature forest and higher in successional habitats.

Examples of use

Provided management strategies and recommendations for landbirds on a number of US military installations, Northwest National Forests, National Wildlife Refuges, and National Parks.

For more information

See http://www.birdpop.org/maps.htm
Kaschube, MAPS Coordinator, (609) 892-0445; email: dkaschube@birdpop.org

References

DeSante, D.F., and D.R. Kaschube. 2009. The Monitoring Avian Productivity and Survivorship (MAPS) Program 2004, 2005, and 2006 report. Bird Populations 9:86-169.

DeSante, D.F., K.E. Burton, P. Velez, D. Froehlich, and D. Kaschube. 2011. MAPS Manual, 2011 Protocol. The Institute for Bird Populations. http://birdpop.net/pubs/files/desante/2009/554_DeSante2009.pdf

Nott M.P. 2011a. Demographic Monitoring, Modeling, and Management of Landbird Populations in Forests of the Pacific Northwest: An Application of the MAPS Dataset *in* Stephens, J. L., K. Kreitinger, C. J. Ralph, and M.T. Green, eds. 2011. Informing ecosystem management: science and process for landbird conservation in the western United States.U.S. Department of Interior, Fish and Wildlife Service, Biological Technical Publication, FWS/BTP-R1014-2011, Washington, D.C.

Nott, M. P. 2011b. Landscape modeling of Midwest landbird population performance – online access to regional species-landscape models and data. An access guide to the results of a report to the U.S. Fish and Wildlife Service Midwest Region 3. [September 30, 2011]. Contribution Number 424 of The Institute for Bird Populations.

Nott, M. P. 2011c. Landscape modeling of PacificNorthwest landbird population performance – online access to regional species-landscape models and data.An access guide to the results of a report to the U.S. D.A. Forest Service Pacific Northwest Region Six and the Bureau of Land Management. [September 30, 2011]. Contribution Number XXX of The Institute for Bird Populations.

Saracco, J. F., D. F. DeSante, and D. R. Kaschube. 2008. Assessing landbird monitoring programs and demographic causes of population trends. Journal of Wildlfe Management 72:1665-1673.

Saracco, J. F., D. F. DeSante, M. P. Nott, and D. R. Kaschube.2009a. Using the MAPS and MoSI programs to monitor landbirds and inform conservation. Pp. 651-658 in: Proceedings of the Fourth International Partners in Flight Conference: Tundra to Tropics (T. D. Rich, C. D. Thompson, D. Demarest, and C. Arizmendi, editors). University of Texas-Pan American Press.

Saracco, J. F., D. F. DeSante, M. P. Nott, W. M. Hochachka, S. Kelling, and D. Fink. 2009b. Integrated bird monitoring and the Avian Knowledge Network: using multiple data resources to understand spatial variation in demographic processes and abundance. Pp. 659-661 in: Proceedings of the Fourth International Partners in Flight Conference: Tundra to Tropics (T. D. Rich, C. D. Thompson, D. Demarest, and C. Arizmendi, editors). University of Texas-Pan American Press.

Saracco, J. F., J. A. Royle, D. F. DeSante, and B. Gardner. 2010. Modeling spatial variation in avian survival and residency probabilities. Ecology 91:1885-1891.

Saracco, J. F., J. A. Royle, D. F. DeSante, and B. Gardner. 2011. Spatial modeling of survival and residency and application to the Monitoring Avian Productivity and Survivorship program. Journal of Ornithology. doi: 10.1007/s10336-010-0565-1.

Data Storage and Access

Facilitated databases for storing and accessing bird monitoring data are summarized in the Southeast Partners in Flight Field Guide to Web Technologies
http://webtechguide.sepif.org/xwiki/bin/view/Main/Facilitated+database

Avian Knowledge Network (AKN): http://www.avianknowledge.net/content/
http://webtechguide.sepif.org/xwiki/bin/view/Main/AKN

Point Count Database: http://www.pwrc.usgs.gov/point/
http://webtechguide.sepif.org/xwiki/bin/view/Main/Point+Count+Database

eBird http://ebird.org/content/ebird/
http://webtechguide.sepif.org/xwiki/bin/view/Main/eBird

We recommend that researchers and institutions partner with other institutions such as PRBO Conservation Science for the development of on-line data storage, management and visualization tools, such as those recently implemented for the Midwest Avian Data Center: http://data.prbo.org/partners/mwadc/. A southeast regional node of the Avian Knowledge Network would be a useful resource for consolidating and providing access and tools to analyze point count data across the region.

In addition, the Coordinated Bird Monitoring Database, which the USGS maintains in Boise, ID allows users to store data of any kind. If requested, data can be uploaded to the Avian Knowledge Network. The Coordinated Bird Monitoring Databases currently stores more than 100 data sets, including several from the southeast. The website is:
http://cbmdms.dev4.fsr.com/toolbox/Default.aspx

Sampling Grids

Description

Sampling designs for bird population monitoring and habitat surveys are being increasingly implemented at landscape and regional levels. Some of the statistical methods used to sample natural resources over large areas involve subdividing the sampling area into smaller equal area units. This creates a mesh or grid of cells that are used to conduct systematic, random or stratified sampling in each cell of the grid. For example, grids are often generated prior to establishing Generalized Random Tessellation Stratified (GRTS) spatially-balanced survey designs. These kinds of sampling schemes are becoming increasingly popular within the U.S. Department of Agriculture's Forest Service, the National Park Service, the Environmental Protection Agency, and more recently the U.S. Fish and Wildlife Service's Landscape Conservation Cooperatives.

Strengths

In bird monitoring, grids not only provide a means to identify points, but most importantly to identify areas where sampling should, has, or has not occurred, and to describe results of monitoring projects in a spatially comparable way. Grids may be generated with cells of different shapes (e.g. squares, rectangles, hexagons, triangles, etc.), and as hierarchical systems that allow aggregation of cells at different scales. The cells (units of subdivision of a grid) can be named and described in terms of size, relative location within the grid, and other attributes (e.g. field data) occurring at the same location. This allows users to stratify, summarize and query grid cells for many purposes.

Weaknesses

Although grid sampling could facilitate generation of natural resource samples across scales, grids for bird monitoring are often generated on a project-by-project basis using an arbitrary reference point and cell naming system. The result is that most sampling grids used in bird population and habitat studies are independent from one another. This lack of coordination has resulted in repeated expenditures of time and resources to generate grids and to incorporate cell attributes into those grids. Furthermore, cells of independent grids often do not spatially overlap or nest within each other, and hence hinder development of location-based services for these data.

Examples of use

Rocky Mountain Bird Observatory is using the U.S. National Grid for developing sampling designs across the Intermountain West.

EMAP--Environmental Monitoring and Assessment Program

Description

Many products have been developed using various geometrical shapes to stratify the Earth's surface. One program focused on developing grid products is the Environmental Monitoring and Assessment Program (EMAP) that was run by the Environmental Protection Agency. EMAP grids are composed of tessellated equal-area hexagons. Different cell size products are available.

Strengths

EMAP hexagon products do allow for scaling up of data from several different locations (i.e., local site, state, bioregion, continent). EMAP is built upon a probability-based sampling design , and it takes samples at regular intervals starting with a randomly selected location.

Weaknesses

EMAP hexagon products of different cell sizes do not nest within each other, which is important for spatial sub-sampling. Also, many potential grid users have indicated that they are only interested in using square cells because hexagons can be difficult and expensive to delineate on the ground.

Examples of use

EMAP products have been used by the USGS Gap Analysis Program and USDA Forest Service Forest Inventory and Assessment Program, among others. The National Marsh Bird Monitoring Program (http://ag.arizona.edu/srnr/research/coop/azfwru/NationalMarshBird/) uses the EMAP grid as the basis for its flexible sampling framework that allows for inferences at multiple spatial scales.

For more information

http://www.epa.gov/emap/index.html

Military Grid Reference System

Description

The Military Grid Reference System (MGRS) and the U.S. National Grid (USNG), an MGRS derived product are, gridded reference systems that describe areas of the Earth based on the Universal Transverse Mercator (UTM) coordinate system between latitudes 84° N and 80°S and the Universal Polar Stereographic (UPS) system for areas north of 84° N and south of 80°S. They use the metric measurement system, widely adopted throughout the world, and report position as distance from the equator (Northing) and distance from the zone central meridian (Easting) following the convention used by the UTM coordinate system. The primary difference between the MGRS and USNG is their datums, which describe the 3 dimensional shape of the Earth. The MGRS uses the WGS84 datum and the USNG uses the NAD83 datum. When the USNG is used with the World Geodetic System of 1984 (WGS84) datum, it is spatially the same as MGRS but there are spaces in the USNG labeling structure that are not present in MGRS. Otherwise, the maximum offset between the datum is less than 2 meters (Natural Resources Canada (http://www.geod.nrcan.gc.ca/faq_e.php#23) which is negligible for most applications.

Strengths

The framework used by the Military Grid Reference System (MGRS) has the qualities needed for a grid standard that could be applicable to bird monitoring sampling. These qualities include:
1. Resolutions as fine as 1-meter cells, providing sufficient spatial precision for integrating data collected at most scales;
2. Use of squared cells;
3. Global extent for application to any area of the world;
4. Naming convention for grid cells based on multiples of 10 (e.g. 1, 10, 100, and 1000 meters).
6. Use of gridded coordinate system widely used by satellites and global positioning systems.

Weaknesses

Until recently, access to MGRS products at scales finer than 100 km were difficult to acquire because they are administered primarily by the National Geospatial Intelligence Agency. Efforts are currently underway through a partnership among American Bird Conservancy, Rocky Mountain Bird Observatory, USGS, and the University of Florida to generate 100 m and 1 km MGRS products for portions of the Western Hemisphere on an as-needed basis. Grids for North America are now available at 100 m, 1 km, 10 km, and 100 km scales from http://mgrs-data.org/.

Examples of use

MGRS has a long history of use by the U.S. military forces. It is also increasingly being used for emergency planning around the world.

For more information

http://mgrs-data.org/
http://en.wikipedia.org/wiki/Military_grid_reference_system

A naming convention exists for the USNG and MGRS cells and is described here:
http://www.andrewlesley.freeserve.co.uk/gps/UTMMGRS.html
http://earth-info.nga.mil/GandG/coordsys/grids/referencesys.html

U.S. National Grid

Description
The US National Grid (USNG) is a ground-based gridded coordinate system based on the Universal Transverse Mercator (UTM) System and derived from the Military Grid Reference System (MGRS). As such, the basic unit of measure is the meter and positions are reported as distance north from the equator (Northings) and distance from the zone central meridian (Eastings). It provides a nationally consistent language of location in a user friendly format. The purpose of USNG is to provide a seamless, standardized system of reference for nationwide use. The primary difference between the MGRS and USNG is their datums, which describe the 3 dimensional shape of the Earth. The MGRS uses the WGS84 datum and the USNG uses the NAD83 datum. When the USNG is used with the World Geodetic System of 1984 (WGS84) datum, it is exactly the same as MGRS. Otherwise, the maximum offset between the datum is less than 2 meters (Natural Resources Canada http://www.geod.nrcan.gc.ca/faq_e.php#23), which is negligible for most applications. Relationships among the UTM coordinate system, MGRS and USNG are described here: http://www.andrewlesley.freeserve.co.uk/gps/UTMMGRS.html

Strengths
The U.S. National Grid (USNG) (Federal Geographic Data Committee 2001), has the qualities needed for a grid standard that could be applicable to bird monitoring sampling. These qualities include:
1. Sufficient spatial precision for integrating data collected at any scale (no minimum resolution);
2. Use of squared cells;
3. National extent for application to any area of the conterminous United States;
4. Naming convention for grid cells based on multiples of 10 (e.g. 1, 10, 100, and 1000 meters).
5. Use as a national standard grid in the United States with existing documentation issued by the Federal Geographic Data Committee (FGDC);
6. Use of gridded coordinate system widely used by mapping programs such as the US National Map.

Weaknesses
The USNG is only available for the conterminous United States.

Examples of use
The US National Grid is the standard set forth by the FGDC (http://www.fgdc.gov/usng) to "create a more favorable environment fo developing location-based services within the United States and to increase the interoperability of location services applicanced with printed map products by establishing a nationally consistent grid reference system as the preferred grid for the National Spatial Data Infrastructure".

For more information
The USNG is currently available for online download as 1 km cell products, with cells labeled by 1 km and 100 km name from The USNG National Implementation Center (TUNIC) at Delta State University. These products are organized by state and UTM zone: http://mississippi.deltastate.edu/

List of Additional Protocols

Abundance

Eastern Painted Bunting Population Assesment and Monitoring Program
http://www.pwrc.usgs.gov/point/pabu/index.cfm?fa=public.about
http://www.paintedbuntings.org/

The National CP-33 Monitoring Protocol
(http://www.fwrc.msstate.edu/bobwhite/monitoring/index.asp)

Demographic

Iowa DNR Bird Nest Monitoring
http://www.iowadnr.gov/wildlife/diversity/vwmp.html

Golden-winged Warbler Atlas Project
http://www.birds.cornell.edu/gowap/

Citizen Science

eBird
http://ebird.org/

Program FeederWatch
http://www.birds.cornell.edu/pfw/

Winter Raptor Survey
http://www.hmana.org/wrs.php

Project Safe Flight
http://nycaudubon.org/NYCASBirdWatch/TabHowToHelp.asp

Fatal Light Awareness Program
http://flap.org/who-we-are.php

Great Backyard Bird Count
http://www.birdsource.org/gbbc/