

Bird Monitoring Protocol for Mangrove Forest Ecosystems (Adapted from the Southeast Region Bird Monitoring Protocol for Forest Interior Birds)

Listed below are the four primary objectives for counting landbirds in the Southeast Region. Each objective is followed by a strategy with alternative approaches for achieving the stated objective. These strategies have been modified to conform with the rather unique situations confronted when monitoring in mangrove forest ecosystems. Regardless of the approach, it is important to remember that the primary objective is to derive baseline information (Objective 1; e.g., species composition and relative abundance) and do it in a manner that will also contribute to other objectives, as well as the development of habitat management plans. To accomplish this, we recommend the use of variable circular plot point counts (see SOP #1 for details).

It should also be pointed out that there is nothing magical about conducting counts every year. That is, it is acceptable to skip a year between counts or to divide the work load into a 2-3 year rotation (e.g., year 1= North Unit, year 2= South Unit) on large management areas or areas with limited personnel. Further, the collection of baseline data on bird species composition and relative abundance can likely be obtained with a minimum of 2-3 years of data. However, a minimum of 5-10 annual years of data may be necessary to estimate population trends.

PART I - ABUNDANCE OF FOREST BREEDING BIRDS

Objective 1: Inventory (Baseline Data)

Strategy - Implement variable circular plot point counts.

Approach #1: Randomly allocate points across the entire management area.

Approach #2: Stratify the allocation of points by management unit. That is, x number of points are randomly located within each management unit. This approach provides a basis for evaluating the impacts of management strategies on bird communities, as well as, providing basic inventory data and allowing the data to be used in regional trend analysis (see below).

Approach #3: Stratify the allocation of points according to habitat type and sample proportional to size. That is, allocating sample units (transects or points) proportional to the area of each habitat. For instance if there are 3 habitats making up 70%, 20% and 10% of the area respectively and 10 transects can be accomplished, allocate 7 to habitat 1, 2 to habitat 2 and 1 to habitat 3. Ideally, the samples would be allocated proportional to the amount of variability in each habitat, but some data are needed before that can be done.

Approach #3 is the preferred alternative for allocating points in mangrove ecosystems. It will likely be impossible to obtain a completely random sample in mangrove forest habitats because of the difficulty in accessing these areas. There is some value in stratifying points by

management unit, if differences in distribution, abundance, or population trend are expected. However, it is unlikely that sample sizes will be sufficient to separate differences between management units.

Objective 2: Evaluation of Management Actions

Strategy - Analyze point count data from individual management areas (i.e., pooled across the region) or coordinate focused research projects.

Approach #1: (Local Scale) As the response variable in these types of evaluations will likely be nest success or density estimates, it is probably unrealistic to assume that public land managers will be able to conduct such evaluations with their current staff. Although point counts may have been conducted within a management unit (objective #1, approach #2) it is questionable that enough data will have been collected to allow definitive determination of management impacts. However, these data will be important for detecting early warning signs of potentially negative impacts. Thus, the best approach will likely be to coordinate research through universities, non-profit science organizations, USGS scientists, or other research biologists.

Approach #2: (Regional Scale) If point counts have been conducted within individual management units (approach #2 from objective #1), those management units with similar histories can be pooled across management areas to assess the impacts of management actions on bird species composition and abundance within a habitat or region (e.g., mangrove forest, tropical hardwood hammocks, etc.). This approach allows for increased sample size and replication across the region. However, this approach does not take demographic trends into consideration, which are needed to understand the cause of population change.

Objective 3: Testing Assumptions / Parameters Underlying Biological Models

Strategy - Develop a large-scale sampling design that will permit the evaluation of model parameters (e.g., block-size density objectives).

Approach #1: To address assumptions underlying the biological model for forest breeding birds (e.g., forest block size objectives [10,000ac will support 500 pairs of area sensitive species]) will likely require extensive sampling effort. Again, this is probably an unrealistic task for public land managers given their current staffing levels. However, baseline inventories conducted within each management area could contribute to the total density estimate for that forest block. Thus, the best approach will likely be to develop a large-scale sampling design and coordinated sampling through universities, USGS scientists, or other research biologists.

Objective 4: Detecting Trends at multiple scales (e.g., local, regional, national)

Strategy - *Analyze point count data to assess bird species trends at both, local and regional scales, as well as to ensure all BBS routes in the region are being conducted annually.*

Approach #1: (Local Scale) Analyze point count data collected on the individual management areas to assess trends in species abundance and composition over time.

Approach #2: (Regional Scale) Pool point count data collected at individual management areas to generate a point estimate for species abundance and composition on public lands in the region (e.g., Partners in Flight Physiographic Strata 1 – Subtropical Florida). This data can then be used to track trends over time on public lands or used in conjunction with Breeding Bird Survey (BBS) data to track trends for the entire region (i.e., public and private lands).

Approach #3: (Regional and National Scale) To date, the primary means of assessing breeding bird trends across North America is the Breeding Bird Survey (BBS). However, the BBS program is based on roadside counts, which are conspicuously absent in mangrove habitats. The few routes that include mangrove habitat should be conducted each year. However, any effort under this protocol will constitute the national scale survey.

Standard Operating Procedure (SOP) # 1

Conducting Variable Circular Plot Point Counts

Since the publication of "A Land Managers Guide to Point Counts of Birds in the Southeast (Hamel et al. 1996), several papers have been published suggesting that "unadjusted" point counts do not provide accurate estimates of bird abundance or estimates of density (see overview by Thompson [2002]). That is, birds vary in their detectability in response to: (1) variables that affect the observers ability to detect and correctly identify birds (e.g., experience, hearing acuity); (2) environmental factors (e.g., wind, vegetation); and/or (3) physical and behavioral attributes of birds themselves (e.g., plumage coloration, singing rate). As a result, several methods, both field and analytical have recently been proposed as a means for incorporating detection probabilities, to adjust abundance and density estimates generated from point counts. For example, Bart and Earnst (2002) suggested double sampling and Nichols et al. (2000) suggested double observer sampling. Both of these methods are modifications to field sampling and as their name suggest, they essentially double the amount of time personnel spend in the field. Other methods described by Farnsworth et al. (2002) and Rosenstock et al. (2002) utilize computer programs to analyze data that were recorded in temporal intervals and distance bands, respectively.

Although we do not discount the need for or the importance of double sampling and the use of double observers, these methods are labor intensive and reduce the number of points that can be counted during a give year (i.e., reduce sample size). As such, we believe the basic requirement for calculating detection probabilities while maintaining sample size is through both a temporal and spatial approach. That is, use of methods described by Farnsworth et al. (2002) and Rosenstock et al. (2002) should permit the calculation of detection probabilities and not detract from sample size. Usage of these methods requires only slight modifications to current point count protocols (Hamel et al. 1996). For example, point count duration must be 10 minutes with birds recorded separately for three distinct time intervals (0-3 min, 4-5 min, and 6-10 min). Also, the distance bands in which birds are recorded have been redefined (0-25 m, 25-50 m, 50-100 m, and >100 m with flyovers recorded separately). Because these data are collected in discrete time and distance categories, these modifications will remain compatible with past data collections, require very minor adjustments to existing data sheets and should provide data necessary to calculate detection probabilities.

This SOP provides step-by-step instructions for conducting the recommended 10 minute variable circular plot point count, with birds recorded separately for three time periods (0-3 min, 4-5 min, and 6-10 min), and four distance bands (0-25 m, 25-50 m, 50-100 m, and >100 m). The reader is referred to Hamel et al. (1996), "A Land Managers Guide to Point Counts of Birds in the Southeast" for more details.

It is strongly encouraged that exact distances (to the nearest meter) be estimated and recorded on the "bulls-eye" data form designed with four distance bands. At a minimum we will be able to use the four distance bands. Recording exact distances will allow us to calculate more precise

detection probabilities, while maintaining the integrity of the regional protocol.

PROCEDURE FOR COUNTING BIRDS:

1. Prior to the day of the counts, determine which points will be sampled and the order they are to be counted (the transect). Points should be spaced at least 250m apart in heavily forested areas and 500m apart in more open areas. This spacing will minimize the chances of detecting the same individual at multiple points. When selecting points in coastal areas, choose locations where greater than 50% of the area is upland habitat. Locating points between islands, in coves, and along rivers and streams is ideal. The transect should be scouted in advance to insure that all points are accessible and to minimize delays the day of the count. Coordinates of each point should be recorded and stored in a GPS for use the day of the count. Points can also be flagged if necessary.
2. Counts should be conducted after all breeding birds have arrived on territory, after the majority of migrants have passed through the area, during the time that song detection rates are stable, and before song detection rates decline precipitously. In the mangrove forests of south Florida, that time period appears to be from May 8 to June 7. One week before or after that time may be suitable, depending on local conditions.
3. Sampling will occur in the morning. In mangrove forest habitats, surveys will start exactly 15 minutes after sunrise and end no later than 3.5 hours after sunrise. Setting start and end times relative to sunrise is important because detection rates vary relative to sunrise. Logistically, it is difficult to start earlier than that because many of the sampling areas can only be accessed by boats and require some light for safe travel. This will allow surveys that require boats and those that don't to be standardized. Starting after sunrise also eliminates the variability in detections that can occur during the half hour before sunrise. Detection rates decline precipitously after that time. Results will be comparable as long as start and end times are the same each year.
4. Counts should not be conducted if there is persistent fog (Table 2, Sky Code 4), rain (Table 2, Sky Code 8), or winds exceeding 12 mph (Table 3, Beaufort Scale 4). Occasional light drizzle (Table 2, Sky Code 4) or wind gusts exceeding 12 mph are acceptable if they do not persist. If unsuitable weather conditions are encountered, either wait until the weather improves or cancel the sampling for the day and reschedule.
5. Approach the location, noting any birds within 100 m of the counting station that are flushed, fly away, or retreat. Mark these birds in the appropriate distance band on a "bull's-eye" data sheet. Concentric circles on the data sheet indicate distances of 0-25 m, 25-50 m, 50-100 m, and > 100 m.
6. Orient the bull's-eye data sheet to a fixed direction, record the wind and sky conditions (Tables 2 and 3), temperature, date, time, and observer.

7. Position a GPS unit and start it recording, if exact location is not already known.
8. As soon as possible, start the count. Use a pocket timer or watch to keep track of time.
9. Record each bird seen or heard with the appropriate species codes (Appendix C in Hamel et al. (1996). Count family groups of juveniles with a single adult as a single bird.
10. Mark birds on the data sheet in the appropriate distance band and approximate spatial location indicating distance to the nearest meter. Use standard coding symbols included on the data sheet to aid in separating individuals (4 letter species alpha codes can be found in Appendix C of Hamel et al. 1996).
11. Record data for different time intervals (0-3 min, 4-5 min, and 6-10 min) of the count in different ways. Some people like to use different color pens; alternatively, detections can be underlined or double underlined to indicate the different time periods. Be sure to record a legend of the chosen coding scheme on the data sheet for future reference.
12. Holding the sheet in a fixed position, spend part of the time facing in each of the cardinal directions in order to better detect birds.
13. Mark each bird once, using the mapped locations to judge whether subsequent songs are from new or already recorded individuals. All birds greater than 100 m from point center are recorded outside of the 100 m band; likewise, flyovers are recorded at the bottom of the page. The recorded distance should be the horizontal distance between the location a bird was first detected and the plot center. For species that occur in flocks, record the flock (e.g., species) and flock size in the appropriate distance band. There is no need to record each bird in a flock individually.
14. Circle any detections believed to have been recorded at previous points.
15. At the end of 10 minutes, stop recording bird observations. Do not record any new birds seen or heard after the 10 minutes have passed.
16. Record the latitude and longitude coordinates from the GPS unit and mark the location.
17. Field notations from the bull's-eye data sheet can be transcribed to a point count summary form before they are entered into the National Point Count Database (www.pwrc.nbs.gov). The transcription process will facilitate data entry. Enter the exact detection distance by species under the appropriate time and distance band column.

Literature Cited

Bart, J., and S. Earnst. 2002. Double sampling to estimate density and population trends in

birds. Auk 119: 36-45.

Farnsworth, G. L., K. H. Pollock, J. D. Nichols, T. R. Simons, J. E. Hines, and J. R. Sauer. 2002. A removal model for estimating detection probabilities from point count surveys. Auk 119:414-425.

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. New Orleans, LA: U.S. Dept. Of Agriculture, Forest Service, Southern Research Station. 39 pp.

Nichols, J. D., J. E. Hines, J. R. Sauer, F. W. Fallon, J. E. Fallon, and P. J. Heglund. 2000. A double-observer approach for estimating detection probability and abundance from point counts. Auk 117:393-408.

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: 46-53.

Thompson, W. L. 2002. Towards reliable bird surveys: accounting for individuals present but not detected. Auk 119:18-25.

Table 1. Description of variables recorded at point count locations. Not all variables need be recorded, if they do not apply to your locality (e.g., route #, slope, aspect).

Variable	Description
State	State
Station	Name of forest, management area, refuge, etc...
Unit	Name of management unit within the station.
Compartment	Name of management compartment within the unit and/or station.
Road	Yes = on road count; No = off road count.
Route #	Number of the route within the compartment, unit, and/or station.
Point #	Number of the point within the compartment, unit, and/or station.
Date	MM/DD/YYYY
Observer	Observer identification (e.g., initials).
Time	Time of day; 2400 hour clock (e.g., 0732).
Temp EC	Temperature in degrees Celsius.
Sky	Sky condition, combining cloud cover and precipitation (see Table 2).
Wind	Wind speed from Beaufort scale (see Table 3).
Slope	Percent slope.
Aspect	Aspect (e.g., north-facing slope).
Habitat	General habitat characterization (e.g., forest, grassland, urban).
Habitat Type	Cover type (e.g., oak-elm-ash, wire-grass, long-leaf savanna).
Habitat Quality	Status of habitat (e.g., scrub-shrub, poletimber, sawtimber, old growth, disease/dead, cut/cleared).
N - S Coordinate	UTM (Northing - 7 digits) or latitude (DDMMSS) = (30E42'33").
E - W Coordinate	UTM (Easting - 6 digits) or longitude (DDMMSS) = (089E14'59").
Zone	UTM Zone or 0 if latitude / longitude recorded.
Flyovers	Birds observed flying over the plot.
Data Compiler	Identification of person compiling / entering data (e.g., initials).
Comments	Notes and specific remarks about the count.

Table 2. Codes and descriptions for sky conditions (Weather Bureau Codes)¹.

Sky Conditions:	
Code #	Description
0	Clear or a few clouds
1	Partly cloudy (scattered)
2	Cloudy (broken) or overcast
4	Fog or Smoke
5	Drizzle
7	Snow
8	Showers

¹ These codes are the same codes used in the Breeding Bird Survey. Acceptable conditions for counting birds include a sky condition of 0,1, or 2 and wind speeds less than 20 km / h (12 mi/h), preferably less than 13 km / h (8 mi / h).

Table 3. Codes and descriptions for wind speeds (Beaufort Scale)¹.

Wind Speed Codes:			
Code #	km / h	mi / h	Description
0	< 2	< 1	Smoke rises vertically
1	2 to 5	1 to 3	Wind direction shown by smoke drift
2	6 to 11	4 to 7	Wind felt on face; leaves rustle
3	12 to 20	8 to 12	Leaves, small twigs in constant motion; light flag extended
4	21 to 32	13 to 18	Small branches are moved
5	33 to 30	19 to 24	Small trees begin to sway

¹ These codes are the same codes used in the Breeding Bird Survey. Acceptable conditions for counting birds include a sky condition of 0,1, or 2 and wind speeds less than 20 km / h (12 mi/h), preferably less than 13 km / h (8 mi / h).

Table 2. Sample size calculations for nine of the most abundant species detected on 88 points surveyed in 2000 and 101 points surveyed in 2000 and 2001 on the Ten Thousand Islands NWR.

Species	Coefficient of Variation (s/x)			Sample Size for 90% Certainty of a					
				20% change			10% change		
	2000	2001	2002	2000	2001	2002	2000	2001	2002
Red-bellied Woodpecker	54.2%	51.9%	68.3%	20	19	32	84	75	129
White-eyed Vireo	74.4%	69.8%	67.0%	38	34	31	153	135	124
Northern Cardinal	70.4%	81.1%	89.1%	34	46	55	137	182	220
Black-whiskered Vireo	97.3%	107.7%	113.6%	66	80	89	262	322	357
Prairie Warbler	114.4%	102.5%	137.2%	91	72	130	363	290	522
Pileated Woodpecker	104.8%	149.7%	167.8%	76	155	195	304	621	780
Mangrove Cuckoo	121.1%	195.4%	188.6%	102	265	246	406	1058	985
Great-crested Flycatcher	145.5%	135.0%	179.9%	147	126	224	587	505	896
Carolina Wren	204.1%	194.1%	199.3%	289	261	275	1154	1044	1100

Table 1. Relative abundance of the nine most common species detected on 88, 10-minute point counts conducted from 7-26 May 2000, 12 May - 14 June 2001, and 4 May - 3 June 2002 in mangrove forest habitat of the Ten Thousand Islands NWR.

Species	Total Individuals			Average
	2000	2001	2002	
Red-bellied Woodpecker	174	176	145	165.0
White-eyed Vireo	156	150	177	161.0
Northern Cardinal	122	107	95	108.0
Black-whiskered Vireo	104	79	75	86.0
Prairie Warbler	54	51	38	47.7
Pileated Woodpecker	57	31	34	40.7
Mangrove Cuckoo	64	24	29	39.0
Great-crested Flycatcher	42	43	21	35.3
Carolina Wren	19	28	27	24.7

Coastal Forest Landbird Monitoring Program in S. Florida and the Caribbean
Nov. 7, 2003
Comfort Inn, Naples FL

9:00 – 9:15 Opening remarks

- Introductions
- Background and purpose
- Goals of meeting

9:15 – 10:15 Biological objectives

- Habitats to be monitored – mangroves, coastal hammock
- Species to be monitored – species across the region
- Scope of area – how the Caribbean fits in
- Sub-regions within the s. FL and Caribbean area?
 - SW coast, Florida and Biscayne Bay, Keys, Caribbean

10:15 – 11:15 Monitoring methods/data storage

- Presentation – (Terry Doyle)
- FWS monitoring standards
- Other methods
- Regional database

11:15 – 12:00 Future Plans/needs

- Funding
 - Funding needs – within and among sites
 - Grant sources
 - FWS
 - Neotropical Migratory Bird Conservation Act
 - Coastal wetland grants
 - State nongame program (K. Miller)
- Working group
- Other Tasks/ Actions to implement?

What information is known?

Point counts
NARMS with American Laptor Monitoring System