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Prepared in cooperation with the NORTH COAST AND CASCADES NETWORK, NATIONAL PARK SERVICE

Landbird Monitoring Protocol for National Parks in the North Coast and Cascades Network

Chapter 6 of

Section A, Biological Science
Book 2, Collection of Environmental Data

Techniques and Methods 2-A6

U.S. Department of the Interior
U.S. Geological Survey

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Contents

Figures

Tables

Conversion Factors

Multiply	By	To obtain
centimeter (cm)	0.3937	inch (in.)
kilometer (km)	0.6214	mile (mi)
meter (m)	3.281	foot (ft)

Landbird Monitoring Protocol for National Parks in the North Coast and Cascades Network

By Rodney B. Siegel[1], Robert L. Wilkerson[1], Kurt J. Jenkins[2], Robert C. Kuntz II[3], John R. Boetsch[4], James P. Schaberl[5], and Patricia J. Happe[4]

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Introduction

This protocol narrative outlines the rationale, sampling design and methods for monitoring landbirds in the North Coast and Cascades Network (NCCN) during the breeding season. The NCCN, one of 32 networks of parks in the National Park System, comprises seven national park units in the Pacific Northwest, including three large, mountainous,

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natural area parks (Mount Rainier [MORA] and Olympic [OLYM] National Parks, North Cascades National Park Service Complex [NOCA]), and four small historic cultural parks (Ebey's Landing National Historical Reserve [EBLA], Lewis and Clark National Historical Park [LEWI], Fort Vancouver National Historical Park [FOVA], and San Juan Island National Historical Park [SAJH]). The protocol reflects decisions made by the NCCN avian monitoring group, which includes NPS representatives from each of the large parks in the Network as well as personnel from the U.S. Geological Survey Forest and Rangeland Ecosystem Science Center (USGS-FRESC) Olympic Field Station, and The Institute for Bird Populations, at meetings held between 2000 (Siegel and Kuntz, 2000) and 2005. The protocol narrative describes the monitoring program in relatively broad terms, and its structure and content adhere to the outline and recommendations developed by Oakley and others (2003) and adopted by NPS. Finer details of the methodology are addressed in a set of standard operating procedures (SOPs) that accompany the protocol narrative. We also provide appendixes containing additional supporting materials that do not clearly belong in either the protocol narrative or the standard operating procedures.

1. Background and Objectives

A. Background and History

Reported declines of many Neotropical migratory bird species and other bird species breeding in North America have stimulated interest in avian population trends and mechanisms driving those trends (Robbins and others, 1989; DeSante and George 1994; Peterjohn and others, 1995). Data from the North American Breeding Bird Survey indicate that many landbird populations in Pacific Northwest coniferous forests are declining (Andelman and Stock 1994a, 1994b; Sharp, 1996; Saab and Rich, 1997; Altman, 2000, 2005; Sauer and others, 2001). Indeed, Altman (2005) reported that 30 species exhibit statistically significant, recent and/or long-term declining trends, while only 14 species in the region have statistically significant increasing trends.

Threats to bird populations breeding in Pacific Northwest coniferous forests include outright habitat loss as well as forest management practices that discourage the development of old-growth conditions. Since European settlement, large tracts of low-elevation coniferous forest have been lost to residential and agricultural development, with the overall extent of old-growth forest reduced by more than one-half since World War II (Bolsinger and Waddell, 1993). Landscapes that have been managed for timber production are now dominated by early- and mid-successional forests (Bunnell and others, 1997), and exhibit increased fragmentation as well as a variety of altered structural characteristics that likely affect bird community composition and structure (Meslow and Wight, 1975; Hagar and others, 1995; Bunnell and others, 1997; Altman, 2005).

Pacific Northwest landbirds breeding in habitats other than coniferous forests face substantial threats as well. Species that breed in the subalpine and alpine zones may face ecological changes resulting from visitor impacts, alterations to natural fire regimes, or changing climate. Indeed, Oregon-Washington Partners in Flight has explicitly called on the NPS to take responsibility for monitoring birds in high-elevation areas throughout the Pacific Northwest (Altman and Bart, 2001).

Additional threats face migratory landbirds that breed in Pacific Northwest. For example, land use changes on both the wintering grounds and along migration routes may influence overwinter survival of migratory species.

The three large parks in the NCCN—Olympic, North Cascades, and Mount Rainier—range from sea level to nearly 4,400 m and contain huge tracts of late-successional, coniferous forest on the Olympic Peninsula and the west slope of the Cascades, as well as large areas dominated by subalpine and alpine plant communities. North Cascades National Park Service Complex also includes substantial tracts of coniferous forest typical of the east side of the Cascades, which hosts a somewhat distinct avifauna (Altman, 2000). San Juan Island National Historical Park in the rainshadow of the Olympic Mountains includes small but important examples of coastal prairie and Garry Oak woodlands; plant communities that are fairly rare in western Washington (Atkinson and Sharpe, 1985) and host distinct bird communities (Lewis and Sharpe, 1987; Siegel and others, 2002). Lewis and Clark National Historical Park includes lowland wetlands as well as coastal and upland forests, and extends our program's area of inference substantially southward. We have opted to exclude Ebey's Landing and Fort Vancouver from this monitoring program because they provide very limited habitat for breeding birds.

National Parks in the NCCN can fulfill vital roles as both refuges for bird species dependent on late-successional forest conditions, and as reference sites for assessing the effects of land-use and land-cover changes on bird populations throughout the larger Pacific Northwest region (Silsbee and Peterson, 1991). These changes may result from regional activities such as land conversion and forest management, or from broader-scale processes such as global climate change. Indeed, monitoring population trends at 'control' sites in national parks is especially important because the parks are among the few sites in the United States where population trends due to large-scale regional or global change patterns are relatively unconfounded with local changes in land use (Simons and others, 1999). Additionally, long-term monitoring of landbirds throughout the NCCN is expected to provide information that will inform future decisions about important management issues in the parks, including visitor impacts, fire management, and the effects of introduced species.

B. Rationale for Selecting this Resource to Monitor

Landbird populations provide an excellent resource to monitor for several reasons. First, landbird monitoring is particularly efficient—many species can be monitored simultaneously with the same survey protocol, and costs are relatively low. Preliminary analyses indicate that our project design will allow monitoring of population trends with a reasonable degree of statistical power for numerous species (see Section 2E, Level of Change That Can Be Detected for the Amount/Type of Sampling Being Instituted). The capacity to capture a fairly broad sector of park resources (for example, numerous bird species) elevates the desirability of monitoring landbirds over some other taxa for which expensive projects may only monitor a single species (Croze, 1982; Manley and others, 2004). Relative to other animal taxa, landbirds are easy to detect, at least during the breeding season. They generally occupy a high position on the food web and they provide important ecological functions, such as seed dispersal and insect control, making them good indicators of changes in ecosystems (Furness and others, 1993; Greenwood and others, 1993).

Well-developed, standardized data-collection methods and analytical procedures for estimating landbird population density already exist, and will facilitate comparisons between NCCN results and data from other regional and national efforts. The existence of other regional and national landbird monitoring efforts, such as the Breeding Bird Survey (Droege, 1990; Peterjohn and Sauer, 1993) does not suggest that monitoring efforts in the NCCN are unnecessary or redundant. Oregon-Washington Partners in Flight has explicitly called on the NPS to take responsibility for monitoring birds in high-elevation areas throughout the Pacific Northwest (Altman and Bart, 2001). Such areas, which are poorly sampled by the Breeding Bird Survey (Altman and Bart, 2001), are well-represented in the NCCN, and will be a major focus of our efforts. Even in mid- and low-elevation forests, late-successional conditions generally are poorly sampled by the Breeding Bird Survey and other regional bird monitoring activities, but are well represented in the NCCN parks. Additionally, although the BBS (Breeding Bird Survey) has been very valuable in documenting geographically broad population changes, BBS data are collected exclusively at roadsides and are thus of limited value for extending inferences to areas not adjacent to roads (O'Connor, 1992; DeSante and George, 1994; Sauer, 2000), and the resolution of trends generally is too coarse for regional (let alone park-level) decision-making (Sauer and Cooper, 2000; Hutto and Young, 2002).

Substantial knowledge about habitat relationships and bird community structure in the Pacific Northwest (for example, Huff and others, 1985; Lewis and Sharpe, 1987; Gilbert and Allwine, 1991; Manuwal, 1991; Hansen and others, 1995; Smith and others, 1997), as well as more specific information about the current status of landbirds in the NCCN, already exists and has been used in developing our project design. Jenkins and others (2000) conducted a pilot study to field-test geographically extensive survey techniques at Olympic National Park, and to quantify sources of variance in the analysis of point count data. More recently, spatially extensive landbird inventories have been completed in North Cascades National Park Service Complex (Siegel and others, 2004b), San Juan Island National Historical Park (Siegel and others, 2002), Olympic National Park (Siegel and others, 2004a), Mount Rainier National Park (Wilkerson and others, 2005), and Lewis and Clark National Historical Park (Siegel and others, 2007). These research and inventory efforts provided opportunities to test and streamline field methodologies and analytical approaches, and produced datasets that we used to assess statistical power of the proposed monitoring program (Section 2E, Level of Change That Can Be Detected for the Amount/Type of Sampling Being Instituted).

Finally, landbirds hold high and growing public interest (Cordell and others, 1999; Cordell and Herbert, 2002) and are perhaps the most visible faunal component of park ecosystems.

C. Measurable Objectives

The primary and secondary objectives of this monitoring project are:

1. To detect trends in the density of as many landbird species (including passerines, near-passerines, and galliformes) as possible throughout accessible areas of five NCCN parks during the breeding season.
2. To track changes in the breeding season distribution of landbird species throughout accessible areas of the large wilderness parks.

In testing the statistical power of our project design (see appendix 5), we assessed whether the proposed sampling would likely detect a 4 percent per annum decline in avian population trend assessed over a 20-year period (that is, about a 50 percent decline) for a large suite of species at either the level of individual parks or for the network of parks. The exact ability of the proposed monitoring program to detect change, however, will vary immensely among species depending on species abundances and sampling variation. For many common species, we will be able to detect a lesser magnitude of change at the individual park level. For some rarer species and habitat specialists that occur only in alpine, riparian, or other limited habitats, it may not be possible to infer population trends at the geographic scale of the individual park, but it will be possible to infer at the network-wide scale. For some particularly uncommon species, statistical assessment of trends in estimated abundance may still not be possible, but changes in detection rates will be important for qualitatively assessing regional occurrence. Uses of these data will depend on the magnitude of trend, the conservation status of individual species, as well as societal and cultural values and the potential for management actions to effect change.

The monitoring program is limited to the three large wilderness parks (MORA, OLYM, NOCA) and two cultural area parks with significant natural landscapes (SAJH) and (LEWI). It was necessary to limit inference to accessible areas of parks because substantial areas of the three large wilderness parks in the network are virtually inaccessible to ground crews during spring and early summer, due to safety concerns stemming from high water flows and steep slopes. For commonly detected species, we will be able to detect trends at the level of individual parks, allowing comparisons between trends at the different parks. A shared methodology between five parks across the NCCN will ensure consistency and allow us to avoid the pitfalls that can make comparisons between parks difficult or misleading (Quinn and van Riper, 1990; Sauvajot and others, 1990; Silsbee and Peterson, 1991).

Tracking distributional shifts provides an additional metric for assessing changes in bird communities throughout the Network, as some important ecological changes, such as populations moving upslope in response to climate change, may not be discernible by simply looking at aggregate population trends.

2. Sampling Design

A. Rationale for Selecting this Sampling Design Over Others

In concordance with other NPS bird monitoring protocols that have recently been developed or are currently under development (Coonan and others, 2001; Peitz and others, 2002; Siegel and Wilkerson, 2005), this protocol surveys landbirds with 5-minute point counts incorporating distance sampling (Reynolds and others, 1980; Fancy, 1997; Nelson and Fancy, 1999; Buckland and others, 2001; Rosenstock and others, 2002). Incorporating distance sampling (Buckland and others, 2001) into point counts facilitates the estimation of detection probability—a parameter that may vary greatly by species, habitat, observer, or other factors. Estimates of detection probability permit the estimation of absolute density or abundance of birds across the landscape; much more meaningful metrics than the relative abundance indices that can be produced without methods that quantify detectability. Distance sampling is rapidly becoming a standard method of the NPS Inventory and Monitoring Program for estimating detection biases associated with avian monitoring (Fancy and Sauer, 2000).

We chose a largely off-trail sampling design for monitoring birds in the NCCN. For the safety and logistical reasons outlined below, each of the point count transects emanates from a park road (a small proportion of the transects) or backcountry trail (the vast majority of transects). Although the sampling area of each park is constrained to a 2-km corridor surrounding park roads and trails, the sampling plan extends inference away from roadsides (thus addressing a common criticism of Breeding Bird Surveys) and covers a significant portion of wilderness in each of the three large parks. Specific features of the proposed sampling design address several very significant challenges in working in vast, rugged parks with large roadless areas. These challenges include:

1. *Safety concerns.* Substantial portions of all three large parks are rendered essentially inaccessible by prohibitively steep slopes or dangerous river crossings. Even areas that do not present these extreme challenges can still require great care to access, as traveling off-trail nearly anywhere in the large parks generally involves traversing steep, often wet terrain, and climbing over numerous fallen logs. Personnel at each of the large parks have considerable experience sampling remote park areas and have suffered high accident rates attempting to do so. Each of the parks has now adopted a safety-based work culture that places safety of workers above project objectives.
2. *High travel costs.* Substantial portions of the large parks are not only many kilometers away from the nearest road, they also are many kilometers away from the nearest trail. There are places in the more remote parts of NOCA and OLYM, in particular, where just a single transect could require over a week of a crew's time to reach, sample, and return. Given the tight financial constraints on the implementation of this project, attempting to reach such remote places would consume an inordinate proportion of available resources, and would greatly reduce the number of transects that could be surveyed each year.
3. *Navigation.* Tall, dense forests of the Pacific Northwest wilderness areas make relocating plots with the use of Global Positioning Systems unreliable. Furthermore, there is great sensitivity over the visual impacts of excessively marking plots to facilitate relocating them in successive years. Hence, there are realistic questions about the repeatability of surveys in remote areas of the park.
4. *Diverse habitats*. All three large parks span enormous elevational gradients, producing substantial intra-park variation in avian community composition, breeding phenology, and average date of accessibility by crew members. The parks (particularly NOCA, but the others as well) also contain ecologically important east-west gradients in habitat conditions and avian community composition.

Because each of the five parks in the NCCN pose such different constraints in safety, travel, and logistics costs, we utilize two separate sampling schemes: one for the three large wilderness parks (MORA, OLYM, NOCA) and one for the two smaller parks (SAJH, LEWI). In the large parks, we will sample avian populations along primarily off-trail and off-road point count transects accessible from the parks' road and trail systems. Because travel and logistics do not pose significant problems in the two smaller parks, we will sample avian populations from points distributed as a systematic grid covering each park area in its entirety.

Large-Park Sampling Scheme

To address the first three constraints in sampling large wilderness parks (safety issues, travel costs, navigational issues), we have restricted our sampling frame to accessible areas of the parks within 1 km of a road or trail. We are defining the more remote portions of the parks (areas farther than 1 km from a road or trail) as a separate stratum, which, under current funding and staffing constraints, will not be sampled at all. We considered sampling this 'remote' stratum as part of the current program, with effort stratified in a manner that would ensure that most of our sampling would still occur in the 'accessible' stratum. Unfortunately, with just a two-person crew working in each park, there is no minimal amount of effort that could be channeled into the remote stratum without siphoning substantial resources away from sampling in the 'accessible' stratum. If, for example, the crew spent one of their 6 week-long tours each year working in the remote stratum, this might yield just a single transect, as traveling to and from the starting point could consume the rest of the week. Given the heterogeneity of habitat conditions (including elevation, aspect, weather, and plant community) covered by the 'remote' stratum, a single transect each year could not adequately 'represent' the stratum, and would likely yield spurious results.

Additionally, most of us have been involved with previous attempts to conduct wildlife or plant surveys in the 'remote' areas of one or more NCCN parks in the past—including attempts to inventory landbirds in the remote stratum at NOCA, as well as parkwide lichen surveys at NOCA and amphibian surveys at OLYM. These efforts have fared poorly. Such projects that were not abandoned altogether had to be redesigned and/or resulted in poor crew morale and a failure to meet data-collection goals.

Additionally, in previous inventory and monitoring projects, we have had extraordinary difficulties defining *a priori* the target population off trails. The unfortunate fact is that we frequently cannot get to plots in the sampling frame we have defined due to high river flows, unseasonable snow, or wet, steep slopes. Typically, we have dealt with this problem by 'over-selecting' randomly chosen plots, and then using expert staff to determine which plots were feasible to access, and for the potentially accessible ones, which times of year were feasible. To define safely accessible areas in advance requires a very subjective delineation of park areas that can be safely navigated and a very imprecise statement of the target population. We opted for a precise definition of the sampled population as areas within 1 km of a road or trail. Doing so enhances safety and sample size (hence power), and minimizes costs and logistical problems associated with finding plots. In our judgment, the premium on safety, costs, and trend detection will greatly enhance the likelihood that this project will persist over a temporal scale of decades rather than years.

Although we will conduct our point counts off-trail, transects will 'start' from selected on-trail points, and run perpendicularly away from the trails. Extending transects from trails will greatly facilitate relocating survey points in successive years, as starting points will be much easier to find, even without the aid of GPS, than would starting points that were hundreds or even thousands of meters off-trail in large, undifferentiated tracts of forest. Thus, crews will expend less time searching for starting points (which will be marked in a visually unobtrusive manner), and consistently will be able to find the starting points, which will mean they are able to find the remaining points along the transects with a much greater level of accuracy.

Under current budgetary and logistical constraints, sampling the 'remote' stratum would incur excessive opportunity costs and safety risks, for little if any real benefit. In the future, if existing financial and staffing constraints are relaxed (and safety concerns can somehow be resolved), the survey could be augmented with transects in the 'remote' stratum. We recognize, however, that our near-term decision not to sample the remote stratum means that our inferences will be limited only to the areas of the parks that we have defined as 'accessible'. If visitor impacts—which would likely be felt exclusively or primarily in the accessible areas—increase over the life of the monitoring program, it is conceivable that population trends for some species in the accessible stratum may differ from their trends in the remote stratum.

To address the issue of habitat diversity and complexity in the large parks, we have selected an 'augmented, serially alternating' panel design (Urquhart and others, 1998), wherein one-half of the annual survey effort will be devoted to surveying transects that are revisited annually, while the remaining survey effort will be devoted to one of five panels of additional transects that will be sampled every 5 years. A panel design with effort split between annually revisited transects, and transects in the 5-year serially alternating panels allows a much larger number of transects (hence, greater representation of habitats and regions of the parks) to be included in the sampling scheme than if each transect were to be revisited annually, but still allows for a substantial amount of year-to-year continuity (Breidt and Fuller, 1999; Urquhart and Kincaid, 1999; McDonald, 2003).

To optimize allocation of effort while maintaining sample-size requirements, we have chosen to visit survey points no more than once each year. Although some studies recommend resampling points in a season to account for missed detections and seasonal effects (Ralph and Scott, 1981), other researchers have suggested that increasing the number of points sampled, rather than the number of visits to a point, can be more efficient under some conditions (Smith and others, 1995). At an avian sampling workshop held at North Cascades National Park Service Complex in September 2000, avian sampling experts reached consensus in recommending that we sample more locations at the expense of resampling points throughout a breeding season (Siegel and Kuntz, 2000).

Small Park Sampling Scheme

We will sample landbird populations in the small parks from a series of point counts distributed as a systematic grid established in the N-S and E-W directions with a random grid starting point. Each grid point will be 350 m apart, yielding 54 points at SAJH (including 38 points at American Camp and 16 points at British Camp) and 91 points at LEWI (including 33 points at Fort Clatsop, 5 points at Sunset Beach, 4 points at Clark's Dismal Nitch, and 49 points at Cape Disappointment). Our intention is to sample all points in each small park every second year, alternating between the two parks each year. It is possible, however, that our sampling regime at LEWI is overly ambitious, and represents more work than can be completed under anticipated funding and staffing constraints. We will assess the feasibility of our LEWI sampling regime after the 2006 pilot season.

B. Site Selection

Criteria for Site Selection; Definition of the Boundaries of the Population Being Sampled

Sampling will take place during the breeding season (late May-July). Crew members in the large parks will survey the low-elevation transects at the beginning of the field season, and then work their way upslope gradually as the season progresses. This will ensure that all transects are surveyed near the peak of the breeding season for the elevation zone they represent. Because the small parks are entirely near sea level, we will sample the small parks between late May and mid-June. Crew members will note detections of all bird species, but species targeted for trend analysis will include all terrestrial bird species that are considered reasonably well-sampled by point counts—passerines, near passerines, and galliformes.

Procedures for Selecting Sampling Locations; Stratification, Spatial Design

The sampling frame in the large parks consists of transects starting from points spaced every 50 m along maintained roads and trails in each park and extending perpendicularly away from the access routes.

For each large park, we started with GIS coverages of roads and trails, and then eliminated segments of roads or trails that were inappropriate for drawing starting points for sampling transects. These eliminated segments were along roads in steep areas where off-road sampling would not be possible, paralleled shorelines of large lakes or reservoirs where one-half the points would be in open water, or were along roads that were too wide and/or busy with traffic to allow for safe or meaningful sampling. We then defined potential starting points for transects every 50 m along the remaining segments of roads and trails. We used GIS data to classify the transects as low-, mid-, or high-elevation strata based on the elevation of the starting points. For NOCA and OLYM, we defined the low-elevation stratum as all potential transects with starting points less than 650 m above sea level; the mid-elevation stratum as all potential transects with starting points between and including 650 and 1,350 m above sea level; and the high-elevation stratum as all potential transects with starting points greater than 1,350 m above sea level. For MORA only, we adjusted the boundary between the low- and mid-elevation strata to 800 m, as virtually none of the park is less than 650 m above sea level, but otherwise defined the elevation strata in the same manner as for the other parks.

With assistance from Tony Olsen (U.S. Environmental Protection Agency, Western Ecology Division, Corvallis), we selected the sample of monitoring transects in each park from the candidate points, using the Generalized Random-Tessellation Stratified (GRTS) sampling method with reverse hierarchical ordering (Stevens and Olsen, 1999, 2003, 2004). We selected 24 transects in each elevation stratum in each park, except for the low-elevation stratum at MORA, where we selected only 12 transects due to the relatively small fraction of the park that lies within the stratum boundaries. GRTS sampling methods are increasingly being adopted for large-scale environmental monitoring programs, in part because they can create a spatially balanced sampling design that allows additional samples to be added or subtracted without compromising the spatial balance (Stevens and Olsen, 2003, 2004).

C. Sampling Frequency and Replication

In NOCA and OLYM, the survey will have an augmented, serially alternating panel design (table 1), wherein one panel of 12 transects in each large park will be visited once every year. An additional 60 transects will be distributed into five serially alternating panels of 12 transects. Each year, all 12 transects in one of the alternating panels will be visited in addition to the panel that is revisited annually.

Each of the six sampling panels includes four low-, four mid-, and four high-elevation transects. We assigned transects to sampling panels according to their order in the GRTS sample. For example, transects 1-4 in each elevation stratum were assigned to panel 1; transects 5-8 in each elevation stratum were assigned to panel 2, and so on until transects 21-24 in each elevation stratum were assigned to panel 6. This process produced six sampling panels each comprising a spatially balanced sample of independent sampling units. At each park, we assigned panel 1 as the annual panel, unless there were compelling reasons to assign panel 2 as the annual panel based on a better dispersion of sampling transects in panel 2.

Table 1. Proposed panel design for landbird monitoring at North Cascades and Olympic National Parks.

[Panel 1 includes 12 transects that will be sampled annually, whereas the other five panels each contain 12 transects that will be surveyed every 5 years on a rotating schedule. The panel design will be the same for MORA, except that each panel will contain 10 transects rather than 12]

Panel	Number of transects to be surveyed									
	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10
1	12	12	12	12	12	12	12	12	12	12
2	12	–	–	–	–	12	–	–	–	–
3	–	12	–	–	–	–	12	–	–	–
4	–	–	12	–	–	–	–	12	–	–
5	–	–	–	12	–	–	–	–	12	–
6	–	–	–	–	12	–	–	–	–	12

Initially, we proposed to assign transects to sampling panels as pairs of 'nearest-neighbor' transects using a systematic process to ensure that the assignment of pairs of transects to panels produced a spatially balanced sample within each panel. The pairing process helped to minimize travel costs associated with sampling by an estimated 20–25 percent. We abandoned that sampling plan in favor of the independent panel assignments described above because the pairing process could not be accommodated in our intended statistical analysis, which we describe in Appendix 4. Example of Trend Analysis for the American Robin.

The panel design will be the same at MORA, except that each panel will contain 10 transects (two low-, four mid-, and four high-elevation transects). Because fewer transects will need to be surveyed at MORA than at NOCA or OLYM, the crew members assigned to MORA, along with the two 'roving' crew members (see Section 5A and Appendix 1. Roles and Responsibilities), will spend the first 1–2 weeks of the field season each year surveying one of the two small parks.

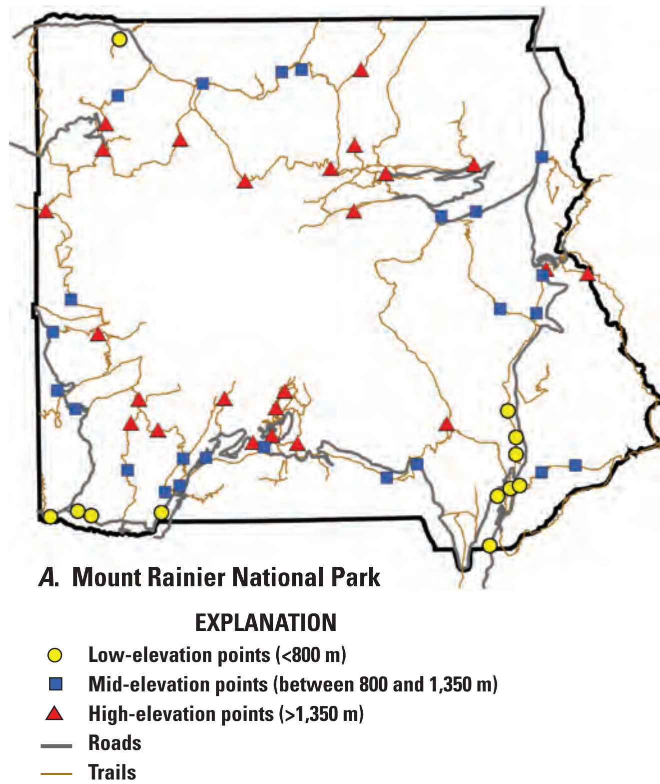
D. Recommended Number and Location of Sampling Units

The survey design described above yields 72 transects in NOCA and OLYM—each park will have 12 transects that are surveyed annually and 60 transects that are surveyed every 5 years. At MORA, where very little of the park lies in the low-elevation stratum and the survey period will begin 7 to 10 days later than in the other large parks, the survey design will yield 60 transects—10 that are surveyed annually and 50 that are surveyed every 5 years. The locations of 72 transect starting points in NOCA and OLYM and 60 transect starting points in MORA derived through GRTS sampling are shown in figure 1.

Each transect will consist of approximately 10 point count stations (as many as 12 in areas where foot travel is easier and faster, and as few as 8 in areas where it is slower and more difficult), spaced 200 m apart. Transects will 'start' at selected points along park trails, and will extend perpendicularly away from the trail to yield approximately five survey points in each direction. The first sampling points will be established 100 m from the trail 'starting point' in each direction. Experience conducting our inventory projects has shown that five off-trail points is the maximum number that a crew member can reliably survey during a morning of work in densely forested NCCN habitats. In habitats where travel is easier (such as high-elevation areas without forest cover), each of the two observers may be able to conduct as many as 10 points in a morning. In such habitats, our crews will conduct as many point counts as they can complete during the morning. The 'extra' points (beyond the sixth point in each direction) will not contribute to Park or Network trend analysis (to avoid analytical complications associated with excessively variable transect lengths), but they may nevertheless yield useful information on the status and distribution of particular species. Although such data are not as valuable as data from the points that will be used in trend analysis, they are still worth collecting, in part because the incremental cost of doing so is very low once the observers have already hiked to the transect starting point to collect the 'trend' points. Data from the 'extra' points will be included in some of the summary report tables (see SOP 16: Data Analysis and Reporting).

In the small parks, the 350-m grids will yield 54 individual point count stations at San Juan Island National Historical Park (fig. 2) and 91 point count stations at Lewis and Clark National Historical Park (fig. 3).

After the 2006 pilot season, we may determine that we have selected more sampling points than can feasibly be surveyed at LEWI given current funding and staffing constraints. If this is the case, we will discard some of the points in future years, perhaps eliminating points in one or more of the park's constituent landholdings or one or more of the park's habitats. Either way, the area of inference would be reduced somewhat.



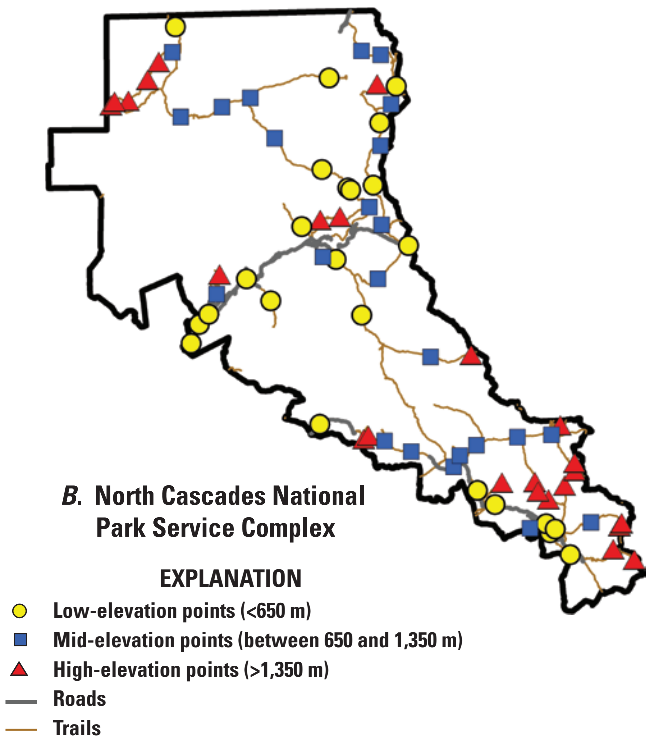


Figure 1. Location of transect starting points at Mount Rainier National Park, North Cascades National Park Service Complex, and Olympic National Park. Starting points were selected using the General Randomized Tessellation Stratified (GRTS) sampling method (Stevens and Olsen 1999, 2003, 2004).

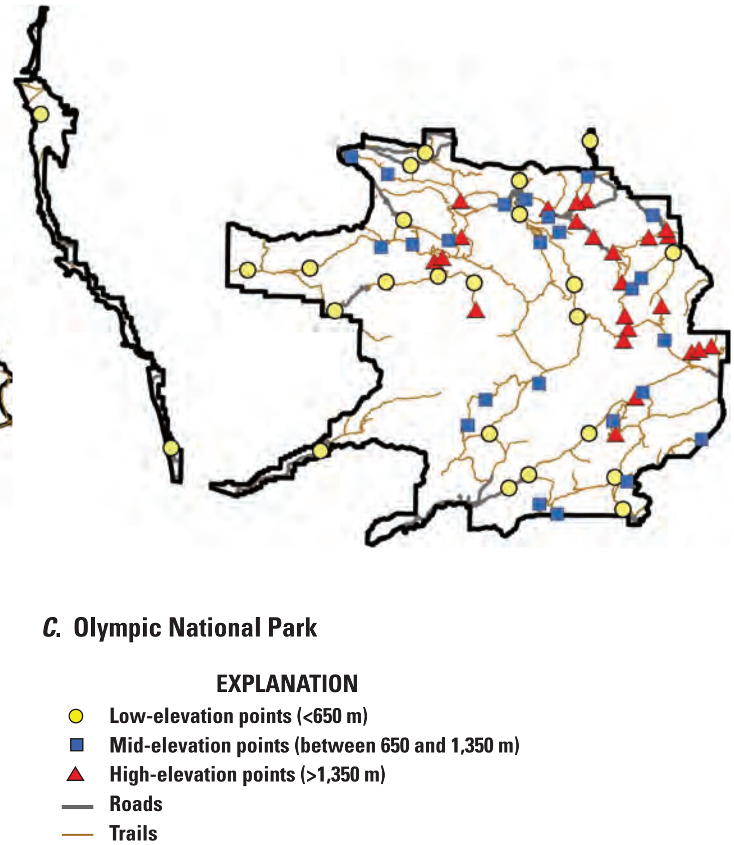
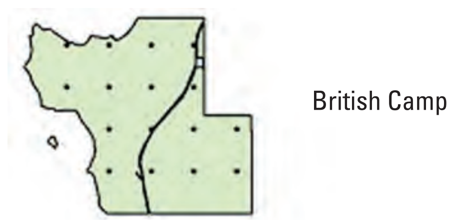


Figure 1.—Continued.



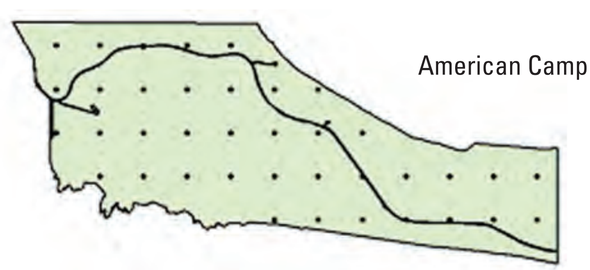


Figure 2. Location of point count survey stations at San Juan Island National Historical Park. Within each 'camp', stations are placed at the vertices of a 350-m grid with random starting point.

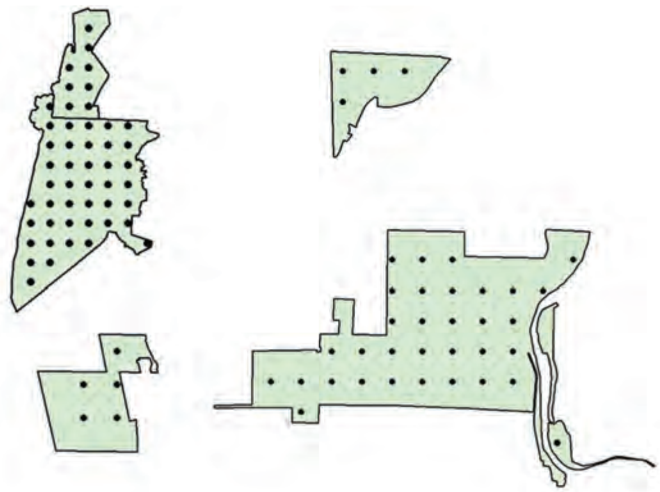


Figure 3. Location of point count survey stations at Lewis and Clark National Historical Park. Within each unit, stations are placed at the vertices of a 350-m grid with random starting point. (**Note**: Spatial scales differ within the figure).

E. Level of Change That Can Be Detected for the Amount/Type of Sampling Being Instituted

The statistical power of the stratified sampling program to detect temporal trends in landbird populations was evaluated through simulation exercises conducted by TerraStat Consulting Group (TerraStat Consulting Group, 2005). The simulation methods are described in Appendix 5: Simulation Methods. In brief, we used a profile summary approach to test the null hypothesis that the mean rate of change of 22 bird species simulated on 72 avian monitoring transects did not differ from zero (slope of log-transformed density indices). We estimated power to detect 4 percent per year exponential increases (evaluated at α=0.10) associated with sampling 72 transects following the proposed augmented serial repeat design reported in this protocol. The analysis is based on the distribution of site means for 22 avian species derived from the landbird inventory conducted in Olympic National Park in 2002–03 (Siegel and others, 2004a). Statistical power analysis requires the assumption of a single alternative hypothesis scenario. In this case, simulations were designed to estimate the probability of detecting 4 percent exponential trends, if present at all sites. The exponential trend scenario is based on the starting average density of birds—densities at sites with more birds are assumed to increase faster than densities at sites with fewer birds. The observed trends in the simulations vary based on year-to-year variability, including measurement and sampling error. Statistical power for the alternative hypothesis with multiple levels of exponential trends among sites was not tested, and is likely to be lower than the power results discussed here.

Power to detect simulated trends in 22 representative avian species is reported in table 2. After 10, 20, and 30 years of simulated trend, power to detect 4 percent per annum increase exceeded 80 percent for 2, 16, and 20 of the 22 species, respectively. These results indicate that if trends are consistent across the target populations, the proposed monitoring will be sufficient to detect 4 percent per year increases in most of species after four cycles through the sampling rotation. If trends are consistent network-wide, they should be detected earlier.

Table 2. Estimated power of serially augmented panel design (*n* = 72 transects) to detect a simulated 4 percent per annum exponential increase in 22 representative landbird species in Olympic National Park after 10, 20, and 30 years of monitoring.

[Values represent the proportion of 1,000 computer simulations in which a significant population trend was identified. Simulation methods are presented in Appendix 5: Simulation Methods. Analysis provided by TerraStat Consulting Group, 2005]

Avian species	Years of monitoring		
	10	20	30
American Pipit	0.135	0.349	0.665
American Robin	0.539	1.000	1.000
Brown Creeper	0.418	0.999	1.000
Chestnut-backed Chickadee	0.658	1.000	1.000
Dark-eyed Junco	0.574	1.000	1.000
Golden-crowned Kinglet	0.617	1.000	1.000
Gray Jay	0.301	0.979	1.000
Hammond’s Flycatcher	0.402	0.989	1.000
Hairy Woodpecker	0.307	0.942	0.994
Olive-sided Flycatcher	0.220	0.702	0.937
Pacific-slope Flycatcher	0.734	0.995	1.000
Red-breasted Nuthatch	0.495	1.000	1.000
Sooty Grouse	0.361	0.972	0.994
Steller’s Jay	0.202	0.790	0.935
Swainson’s Thrush	0.214	0.742	0.939
Townsend’s Warbler	0.368	0.953	0.986
Varied Thrush	0.814	1.000	1.000
Warbling Vireo	0.347	0.945	0.992
Western Tanager	0.192	0.785	0.999
Wilson’s Warbler	0.302	0.902	0.978
Winter Wren	0.926	1.000	1.000
Yellow Warbler	0.154	0.287	0.661

3. Field Methods

A. Permitting and Compliance

In developing the NCCN Landbird Monitoring Protocol, we designed our sampling strategy using a “minimum tool” approach to insure we are complying with National Park Service regulations and standards, including National Environmental Policy Act (NEPA) standards. Management staff at each park reviewed the protocol and sampling strategy to ensure resource protections are adequate. The Landbird Monitoring Program is excluded from further compliance with the National Environmental Policy Act according to the following Categorical Exclusion concerning resource management actions: “Nondestructive data collection, inventory (including field, aerial, and satellite surveying and mapping), study, research, and monitoring activities.”

Many of our point count transects occur in designated wilderness. We consulted wilderness committees at each park to insure that “minimum tool” standards have been addressed in our protocol. We plan periodic reviews of the Landbird Monitoring Program. As these reviews occur, all park compliance staff and wilderness committees will be consulted to ensure we maintain nondestructive methods in our program.

B. Field Season Preparations and Equipment Setup

Preparing for the field season requires getting an early start to recruit and hire a well-qualified crew. The importance of securing a well-qualified crew for this project cannot be understated. During the training period at the beginning of the season, protocols can be taught and bird identification skills can be sharpened, but it is essential that all members of the Network crew be experienced birders, very physically fit, and comfortable spending extensive time in the backcountry. Every reasonable effort should be made to entice the previous year’s observers to return, but it seems likely that at least some new observers will need to be hired every year. We recommend beginning the recruiting process in December to ensure that maximally experienced, qualified observers are available for hire. Once new observers are hired, they should be sent species lists and other materials that will enable them to be as familiar as possible with Network birds and their vocalizations prior to the start of the training session in May.

Beginning in February or March, equipment should be inventoried (including testing of breakable items such as GPS units, radios, and water filters) and any needed items should be purchased. Data forms should be printed or copied (about 50 percent on rain-proof paper), and topographic maps (1:24,000 scale) for the year’s targeted transects should be printed and assembled. Crew housing needs to be secured at each of the large parks (this process may need to begin earlier if NPS facilities are to be used), and housing, campsites, and other logistical arrangements for the training session need to be made. NPS personnel knowledgeable about backcountry conditions in each park should be consulted, to determine (to the degree possible) whether conditions such as washed out bridges, road or trail closures, or unusually heavy snowpack may present novel logistical problems.

Hiring considerations and other pre-season, logistical tasks are discussed in more detail in SOP 1: Preparing for the Field Season. Additional pre-season tasks pertaining to data management are discussed in Section 4B, Pre-Season Preparation for Information Management.

C. Sequence of Events During Field Season

We recommend beginning training between May 1 and May 7, depending on the experience level of the crew. Although many of the Neotropical migrants may not yet be singing on their territories during the first week of May, crews can begin practicing identification of the species that are present, and also can spend time learning protocols and the numerous other skills required to successfully conduct surveys (see Section 5C, Training Procedures).

Surveys will begin no earlier than May 21 at OLYM and NOCA, and about 10 days later at MORA. Upon completion of the training session, the MORA survey crew and the ‘roving’ crew will spend approximately 1 week surveying at either SAJH or LEWI before beginning work at MORA. In all three large parks, we will begin sampling at low elevations early in the season and gradually move upslope as the season progresses. All surveys will be completed by July 31. The project sampling scheme is built around an assumption that pairs of observers will work six 7-day sessions, many of which will be spent entirely in the backcountry.

D. Details of Taking Measurements

A pair of observers will work together to conduct a single, ±10-point transect each morning. The first time a transect is surveyed, observers will be given a map and coordinates that indicate a transect ‘starting point’ that lies on a trail. From this starting point, the two observers will walk 100 m along the cardinal or semi-cardinal directions that most closely approximate perpendiculars to the trail in opposite directions from one another. Each observer will conduct a point count, and then continue walking in the same direction, conducting another point count every 200 m until five point counts have been completed. Point counts will begin within 10 minutes of official local sunrise, and must be completed by 3.5 hours after official local sunrise, as bird activity tends to decrease later in the morning.

If a barrier such as a cliff or uncrossable stream is encountered, the observer will return to the last successfully surveyed point and select a new direction of travel. The new direction of travel will be determined as follows:

1. The observer assesses the directions defined by the original direction ± 45º.
2. If both appear traversable, one is randomly chosen, and then followed for the remainder of the transect (unless another barrier is encountered).
3. If one direction is traversable and the other is not, the traversable one is followed for the remainder of the transect.

If neither direction is traversable, the observer assesses the directions defined by the original direction ± 90º in the same manner as described above. In some instances—such as when a trail is immediately adjacent to a river—it may not be feasible for one or both of the observers to walk even 100 m away from the trail. In this situation, the observer will conduct the point counts directly on the trail every 200 m in a pre-determined direction. After each successive point count, the observer will reassess the feasibility of returning to the perpendicular bearing, and if it seems promising, leave the trail to conduct the remainder of the transect off-trail in the cardinal or semi-cardinal direction that best approximates a perpendicular bearing from the trail. We are confident that conducting some of our transects partially or completely on trails will not unduly bias survey results, as landbird inventory work at NOCA has shown that bird detectability during point counts appears unaffected by whether the counts are conducted on or off-trails (Siegel, Institute for Bird Populations, written commun., 2006). Additionally, visitor impacts are light enough along most trail stretches in the NCCN parks that it seems unlikely that trail proximity substantially affects avian community composition or abundance.

On the second and all subsequent visits to a transect (in future years), observers will be provided with maps, coordinates, and descriptions indicating the location of all their survey points. Unreliable GPS coverage may mean that we will not always be able to precisely relocate survey points, but we expect to reliably conduct point counts within 50 m of the intended location. This level of precision should be adequate, as it will usually place the observer in habitat very similar to the intended location and, in any case, the transect, rather than the survey point, is our primary unit of analysis.

At each point, the observer will record the starting time, score the degree of noise interference caused by such factors as flowing water or wind, record the weather conditions (see Point Count Conditions form, SOP 6: Conducting Point Counts), and then, after waiting 1 minute for any birds disturbed by the approach of the observer to resume their normal activities, begin the 5-minute point count. Birds observed in the first 3 minutes will be recorded separately from those observed in the last 2 minutes, in order to allow comparison with Breeding Bird Survey data, which are based on 3-minute counts. Observers will estimate the horizontal distance, to the nearest meter, to each bird detected. These estimations will allow detection probabilities to be calculated as a function of distance for each species, and will therefore allow estimation of absolute density. The observer also will record whether the distance estimate was based on an aural or visual detection, and whether the bird ever sang during the point count. These last two pieces of data may facilitate analysis of (a) error associated with estimating distances to unseen birds, and (b) estimation of the density of singing males rather than all birds pooled. Juvenile birds will not be recorded on the point count data form. All adult birds detected at each point will be noted on the data form, but there is a field for observers to indicate that a particular bird was already detected from a previous point. The form also will provide a separate field for tallying ‘flyovers’, birds that fly above the top of the vegetation canopy, never touch down in the observer’s field of view, and do not appear to be foraging, displaying, or behaving in any other way that might suggest a link to the habitat below them. A sample field form for conducting point counts is provided in SOP 6: Conducting Point Counts).

After completing their last point count each morning, observers will retrace their steps back to the starting point. Along the way, they will classify broad vegetation types associated with each of the five survey points. The objective of the vegetation classification is threefold: (1) to use vegetation class as a covariate in developing detectability functions, (2) determine if there are any coarse-grained changes in vegetation classes associated with the avian monitoring points, and (3) aid in point relocation in subsequent years. Such information will not be used analytically but will be examined qualitatively if there are obvious changes in vegetation or bird populations observed over the long term. Research on the associations between bird populations and structural characteristics of vegetation are beyond the scope of this monitoring program. It is NOT the objective of the avian monitoring program to understand avian community responses to gradients of vegetation structure, so we made the decision not to measure individual components of vegetation structure at any finer detail. Such measurement would be time-consuming, and would detract considerably from the primary objective of monitoring avian population trends. Detailed data on vegetation structure was collected as part of the preceding avian inventory program (Siegel and others, 2004a, 2004b; Wilkerson and others, 2005) and provide an opportunity to analyze avian community correlates to gradients in vegetation structure as a separate research exercise. Nevertheless, habitat classification is likely to facilitate post-stratification of survey data to answer future questions that may arise about bird communities or individual species in particular habitats.

At each point count station, we will classify vegetation within a 50-m radius circle centered on the station, using the vegetation classification system developed by Pacific Meridian Resources (1996). A 50-m radius circle describes an area that is large enough to be meaningful in characterizing bird habitats, but small enough to allow for rapid assessment. We will classify percent canopy cover (ocular estimates of vegetation >2 m above ground, using the same broad classification bins mapped by Pacific Meridian Resources) and record the largest size class of tree for each circle. Observers also will note any obvious changes that may have occurred since the previous visit, such as landslides or fire. Our habitat classification field form is provided in SOP 7: Classifying Vegetation. The NCCN is currently developing a new, network-wide, plant community classification system; when this becomes available, it will be adopted by the landbird monitoring program in lieu of the Pacific Meridian Resources classifications.

While classifying vegetation at each point, observers will use GPS units to collect a location data file (for detailed instructions see SOP 10: Collecting GPS Data), will collect digital photographs of the point location, and will write a brief narrative description of the point location to facilitate re-locating the point in subsequent years (see Point Establishment Form, SOP 5: Establishing, Relocating, and Describing Survey Points).

After completing their fieldwork each day, partners will review each other's data forms for missing or incorrectly recorded data, discuss any interesting or surprising bird detections, and complete a Transect Visit Log (data form provided in SOP 5: Establishing, Relocating, and Describing Survey Points). Whenever crew members detect species thought to be rare or difficult to sample in the park, they will complete "Rare Bird Report Forms", including descriptions of the birds' appearance and behavior and geographical coordinates. These reports cover not only birds detected during point counts, but also birds detected while sampling vegetation, hiking between transects, relaxing at camp in the evening, or at any other time during the field season including the pre-season training session. We provide a sample field form for 'rare bird reports' in SOP 8: Reporting Rare Bird Detections.

E. End-of-Season Procedures

At the end of the season, the Field Lead will prepare and archive a brief (generally not more than three pages) field season report that:

- Clearly enumerates which transects were completed during the season.
- Describes any logistic difficulties that arose, and explains how they were addressed.
- Clearly documents and explains any diversions from established protocols.
- Points out any interesting or potentially important observations about the parks' bird communities that may have been noted during the field season (for example, apparent changes in phenology from previous years, or notable changes in apparent abundance of particular species).
- Provides suggestions for improving the training session or field season logistics in the future.

The Field Lead also is responsible for ensuring that all equipment is properly inventoried, cleaned, and stored (see SOP 13: After the Field Season), and any gate keys or other items that have been checked out from NPS staff are returned.

Additional end-of-season tasks are discussed in Section 4L, Season Close-Out.

4. Data Handling, Analysis, and Reporting

This chapter describes the procedures for data handling, analysis, and report development. Additional details and context for this chapter are provided in the NCCN Data Management Plan (Boetsch and others, 2005), which describes the overall information management strategy for the network. The NCCN website also contains guidance documents on various information management topics (for example, report development, GIS development, GPS use).

A. Project Information Management Overview

Project information management may be best understood as an ongoing or cyclic process, as shown in figure 4. Specific yearly information management tasks for this project and their timing are described in Appendix 2: Yearly Project Task List. Readers also may refer to each respective chapter section for additional guidance and instructions.

The stages of this cycle are described in greater depth in later sections of this chapter, but can be briefly summarized as follows:

- *Preparation* – Training, logistics planning, print forms and maps
- *Data acquisition* – Field trips to acquire data
- *Data entry and processing* – Data entry and uploads into the working copy of the database, GPS data processing, etc.
- *Quality review* – Data are reviewed for quality and logical consistency
- *Metadata* – Documentation of the year's data collection and results of the quality review
- *Data certification* – Data are certified as complete for period of record

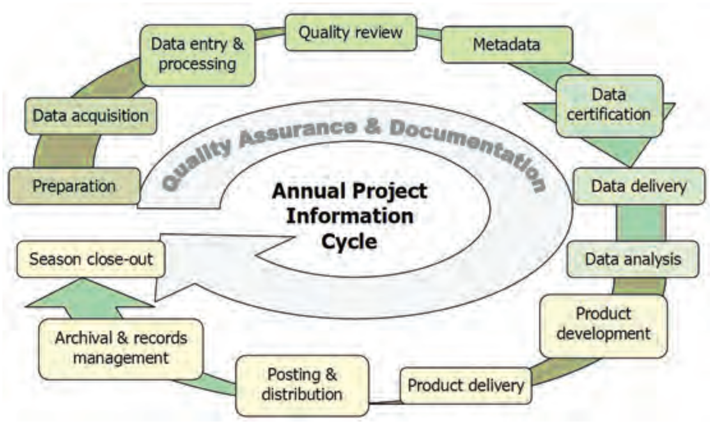


Figure 4. Idealized flow schematic of the cyclical stages of project information management, from pre-season preparation to season close-out. **Note**: Quality assurance and documentation are thematic and not limited to any particular stage.

- *Data delivery* – Certified data and metadata are delivered for archival and upload to the master project database
- *Data analysis* – Data are summarized and analyzed
- *Product development* – Reports, maps, and other products are developed
- *Product delivery* – Deliver reports and other products for posting and archiving
- *Posting and distribution* – Distribute products as planned and/or post to NPS clearinghouses
- *Archival and records management* – Review analog and digital files for retention (or destruction) according to NPS Director's Order 19. Retained files are renamed and stored as needed
- *Season close-out* – Review and document needed improvements to project procedures or infrastructure, complete administrative reports, and develop work plans for the coming season

B. Pre-Season Preparations for Information Management

Set up Project Workspace

A section of the networked file server at each host park is reserved for this project, and access permissions are established so that project staff members have access to needed files within this workspace. Prior to each season, the NPS Lead should make sure that network accounts are established for each new staff member, and that the Data Manager is notified to ensure access to the project workspace and databases. Additional details are provided in SOP 2: Workspace Setup and Project Records Management.

GPS Loading and Preparation

The GIS Specialist and Project Lead should work together to ensure that target coordinates and data dictionaries are loaded into the GPS units prior to the onset of fieldwork, and that GPS download software is available and ready for use. Additional details on GPS use and GPS data handling are provided in SOP 10: Collecting GPS Data and in NCCN GPS Guidelines (North Coast and Cascades Network-National Park Service, 2006).

Implement Working Database Copy

Prior to the field season, the Data Manager will implement a blank copy of the working database and ensure proper access on the part of the project staff. Refer to Section 4C, Overview of Database Design for additional information about the database design and implementation strategy.

C. Overview of Database Design

We maintain a customized relational database application to store and manipulate the data associated with this project. The design of this database is consistent with NPS I&M and NCCN standards (see the data dictionary and other documentation in Appendix 7: Database Documentation). The Data Manager is responsible for development and maintenance of the database, including customization of data summarization and export routines.

The database is divided into two components—one for entering, editing, and error-checking data for the current season (the "working database copy"), and another that contains the complete set of certified data for the monitoring project (the "master project database"). A functional comparison of these two components is provided in table 3.

Each of these components is based on an identical underlying data structure (tables, fields, and relationships, as documented in Appendix 7: Database Documentation). The working database is implemented in Microsoft© Access to permit greater flexibility when implementing on computers with limited or unreliable network access. The master database is implemented in Microsoft© SQL Server to take advantage of the backup and transaction logging capabilities of this enterprise database software.

Table 3. Functional comparison of the master project database and the working database copy.

Project database functions and capabilities	Working database	Master database
Software platform for back-end data	MS Access	MS SQL Server
Contains full list of sampling locations and taxa	X	X
Portable for remote data entry	X	
Forms for entering and editing current year data	X	
Quality assurance and data validation tools	X	X
Preliminary data summarization capabilities	X	
Full analysis, summarization and export tools		X
Pre-formatted report output		X
Contains certified data for all observation years		X
Limited editing capabilities, edits are logged		X
Full automated backups and transaction logging		X

Both components have an associated front-end database application ("user interface" with forms, queries, etc.) implemented in Microsoft© Access. The working database application has separate screens for data entry, data review, and quality validation tools. The master database application contains the analysis and summarization tools, including pre-formatted report output and exports to other software (for example, *Distance*).

During the field season, each project crew will be provided with its own copy of a working database into which they enter, process, and quality-check data for the current season (refer to Section 4D, Data Entry and Processing and SOP 12: Data Entry and Verification). Once data for the field season have been certified, they will be uploaded into the master database, which is then used for all reporting and analysis. This upload process is performed by the Data Manager, using a series of pre-built append queries.

D. Data Entry and Processing

After each field trip, technicians should enter data in order to keep current with data entry tasks, and to identify any errors or problems as close to the time of data collection as possible. The working database application is in the project workspace. For enhanced performance, it is recommended that users copy the front-end database onto their workstation hard drives and open it there. This front-end copy may be considered "disposable" because it does not contain any data, but rather acts as a pointer to the data that reside in the back-end working database. Whenever updates to the front-end application are made available by the Data Manager, an updated front-end database should be copied from the project workspace to the workstation hard drive.

The functional components for data entry into the working database are described in SOP 12: Data Entry and Verification. The flow of data entry generally should proceed as follows:

1. Point establishment form
2. Transect visit log
3. Point count conditions
4. Point count data
5. Habitat classification
6. Rare bird observations

Each data entry form is patterned after the structure of the field form, and has built-in quality-assurance components such as pick lists and validation rules to test for missing data or illogical combinations. Although the database permits users to view the raw data tables and other database objects, users are strongly encouraged only to use these pre-built forms as a way of ensuring the maximum level of quality assurance.

Regular Data Backups

Upon opening the working database, the user will be prompted to make a backup of the underlying data (see SOP 12: Data Entry and Verification). It is recommended that backups be done on a regular basis—perhaps every day that new data are entered—to save time in case of mistakes or database file corruption. These periodic backup files should be compressed to save drive space, and may be deleted once enough subsequent backups are made. All such backups may be deleted after the quality review and certification of the data.

Data Verification

As data are being entered, the person doing the data entry should visually review them to make sure that the data on screen match the field forms. This should be done for each record prior to moving to the next form for data entry. At regular intervals and at the end of the field season, the Field Lead should inspect the data being entered to check for completeness and perhaps identify avoidable errors. The Field Lead also may periodically run the Quality Assurance Tools that are built into the front-end working database application to check for logical inconsistencies and data outliers (this step is described in greater detail in Section 4E, Quality Review and also in SOP 14: Data Quality Review and Certification).

Field Form Handling Procedures

As the field data forms are part of the permanent record for project data, they should be handled in a way that preserves their future interpretability and information content. Refer to SOP 9: Field Form Handling Procedures for details on how to handle these forms.

Image Handling Procedures

Photographic images also should be handled and processed with care. Refer to SOP 11: Managing Photographic Images for details on how to handle and manage these files.

GPS Data Procedures

The following general procedures should be followed for GPS data (see SOP 10: Collecting GPS Data and Appendix 2: Yearly Project Task List):

1. GPS data should be downloaded by the field crew from the units at the end of each field trip and stored in the project workspace (see SOP 2: Workspace Setup and Project Records Management).
2. Raw files should be sent in a timely manner to the GIS Specialist for processing and correction.
3. The GIS Specialist will process the raw GPS data and store the processed data in the project workspace.
4. The GIS Specialist will upload corrected coordinate information into the database and create any GIS data sets.

The Field Lead should periodically review the processed GPS data to make sure that any errors or inconsistencies are identified early.

E. Quality Review

After the data have been entered and processed, they need to be reviewed by the Project Lead for quality, completeness, and logical consistency. The working database application facilitates this process by showing the results of pre-built queries that check for data integrity, data outliers and missing values, and illogical values. The user may then fix these problems and document the fixes. Not all errors and inconsistencies can be fixed, in which case a description of the resulting errors and why edits were not made is then documented and included in the metadata and certification report (see Sections 4F, Metada Procedures and 4G, Data Certification and Delivery, and SOP 14: Data Quality Review and Certification).

Data Edits after Certification

Due to the high volume of data changes and/or corrections during data entry, it is not efficient to log all changes until after data are certified and uploaded into the master database. Prior to certification, daily backups of the working database provide a crude means of restoring data to the previous day's state. After certification, all data edits in the master database are tracked in an edit log (refer to Appendix 7: Database Documentation) so that future data users will be aware of changes made after certification. In case future users need to restore data to the certified version, we also retain a separate, read-only copy of the original, certified data for each year in the NCCN Digital Library (refer to Appendix 3: Schedule for Project Deliverables).

Geospatial Data

The Project Lead and GIS Specialist may work together to review the surveyed coordinates and other geospatial data for accuracy. The purpose of this joint review is to make sure that geospatial data are complete and reasonably accurate, and also to determine which coordinates will be used for subsequent mapping and field work.

F. Metadata Procedures

Data documentation is a critical step toward ensuring that data sets are usable for their intended purposes well into the future. This involves the development of metadata, which can be defined as structured information about the content, quality, condition, and other characteristics of a given data set. Additionally, metadata provide the means to catalog and search among data sets, thus making them available to a broad range of potential data users. Metadata for all NCCN monitoring data will conform to Federal Geographic Data Committee (FGDC) guidelines and will contain all components of supporting information such that the data may be confidently manipulated, analyzed, and synthesized.

At the conclusion of the field season (according to the schedule in Appendix 2: Yearly Project Task List), the NPS Lead and Project Lead will be jointly responsible for providing a completed, up-to-date metadata interview form to the Data Manager. The Data Manager and GIS Specialist will facilitate metadata development by consulting on the use of the metadata interview form, by creating and parsing metadata records from the information in the interview form, and by posting such records to national clearinghouses. Refer to SOP 15: Metadata Development for specific instructions.

G. Data Certification and Delivery

Data certification is a benchmark in the project information management process that indicates that: (1) the data are complete for the period of record; (2) they have undergone and passed the quality assurance checks (Section 4E, Quality Review); and (3) they are appropriately documented and in a condition for archiving, posting, and distribution as appropriate. Certification is not intended to imply that the data are completely free of errors or inconsistencies that may or may not have been detected during quality assurance reviews.

To ensure that only quality data are included in reports and other project deliverables, the data certification step is an annual requirement for all tabular and spatial data. The Project Lead is the primary person responsible for completing an NCCN Project Data Certification Form, available on the NCCN website. This brief form should be submitted with the certified data according to the timeline in Appendix 2: Yearly Project Task List. Refer to SOP 14: Data Quality Review and Certification and SOP 18: Product Delivery Specifications for specific instructions.

H. Data Analysis

Annual reports will include little data analysis beyond simple tabulation and summary of the year's data, with particular emphasis on raw count results obtained from the annual panel of transects in each of the larger parks, but every 5 years, we will produce a more comprehensive report that provides a detailed analysis of data gathered to date. Refer to Appendix 3: Schedule for Project Deliverables for the specific analysis tasks and their timing, and to SOP 16: Data Analysis and Reporting for a more detailed description of analytical procedures. The analytical procedures summarized in this section will be conducted every 5 years rather than annually.

Correcting Point Count Data for Detectability

At the end of every 5-year interval, we will conduct a complete analysis of factors influencing the detectability of birds and will develop detectability models to be used in estimating density of birds from the raw counts. We will use the software program *Distance* (Thomas and others, 2005) to model relationships between detectability and distance from the observer, and then use those models to adjust detection rates for detectability, thereby producing estimates of absolute density (Buckland and others, 2001). Numerous factors may influence detectability, including species, habitat, observer, year, and perhaps other variables. Some of these factors are likely to vary over time or space, and therefore must be accounted for before density estimates can be made and trends in density can be assessed.

Because avian detection probabilities may depend on habitat structure, we will test whether separately derived detection models for each species in relatively open-canopy habitats (primarily meadow and subalpine forest) versus relatively closed-canopy habitats (primarily low- and mid-elevation forests) are preferable to using a single model incorporating data from all habitats.

Detection probability also may vary with observer. Ideally, detectability could be modeled separately for each combination of species, habitat, and observer, but in practice this is rarely possible, as at least 60–80 detections are generally necessary for reliably modeling detection functions (Buckland and others, 2001). We are unlikely to amass an adequate number of detections by each observer in both open and dense habitats for all but the most common species. Nevertheless, for some species we may be able to model observer as a covariate, rather than attempting a completely separate analysis for each observer (Buckland and others, 2001, 2004). When data are insufficient to assess variation among observers, we will pool data from multiple observers to model detectability.

For the more common species, it may be possible to model observer-specific detectability functions, at least for some observers in some habitats. When this is possible, we will do so, and use an information-theoretic approach (Akaike 1973; Burnham and Anderson, 1998) to determine whether observer-specific models are preferable to 'pooled observer' models. Unless we discover substantial temporal changes or observer effects in detectability, pooled observer models may include data from all years of the survey, as well as data collected during the avian inventory projects conducted between 2001 and 2004 (Siegel and others, 2002, 2004a, 2004b; Wilkerson and others, 2005) using a similar field methodology. For some rarer species, we may never gather enough data to even test for year or observer effects; in such cases, we may simply use the 'pooled observer' models. For all species, we will use the data at our disposal to construct the best possible detectability functions, accounting for all sources of variation in detectability, to the extent that the data permit.

Trend Detection

Park-specific trends will be assessed for each species using a profile-summary approach for the repeated measurements on transects. The profile for each transect will consist of the temporal record of bird densities computed from point count results corrected for detectability. For each species in each year, the density estimate for a transect will be calculated as simply the average of the density estimates on the constituent points of the transect. The transect profile will be summarized by the slope of the linear regression line between years and log-transformed bird densities. The transect slope estimates will be treated as replicate measurements of park-specific trends, and tested for differences from zero using a modified *t*-test approach.

The proposed trend analysis approach assumes that the slope estimates are independent random samples from a population with a common mean. The proposed analysis treats years as fixed effects, which means that the analysis reveals trends over the specific years measured and does not discriminate random year effects or causes of year effects. Although we are interested in random year effects, such as those due to weather variation in long-term data sets, examination of such patterns is beyond the scope of this protocol and will require more in depth analysis with the assistance of statisticians. Additional detail and an example of the trend analysis method, prepared by TerraStat Consulting Group, are included in Appendix 4: Example of Trend Analysis for American Robin.

After each 5-year round of sampling, the summary report will include an assessment of park-specific and Network trends in avian densities. Because a spatially dispersed set of sites is assigned to the annual panel, it will be possible to assess regional trends after the first 5 years of sampling by examining just the annual panel. After 10 years, all transects will be included. It will not be possible to estimate trends in the densities of rare species, particularly those species detected on only a few transects each sampling cycle.

Custom-designed software programs to conduct the analyses described above have been developed for this project by TerraStat Consulting Group (2005, Appendix 6: BirdTrend User's Manual).

Density Estimation and Trend Detection in Small Parks

The simpler sample designs at SAJH and LEWI, which rely not on transects but rather on systematic grids of points, will not require the profile-summary approach described above. Instead, we will use *Distance* to produce a single park-specific estimate of density and variance for each species at each of the two parks. Additionally, we will not use panel designs for the two small parks, but instead will survey all points at each park every other year (that is, we will survey all points at SAJH in year x, all points at LEWI in year x+1, all points at SAJH in year x+2, etc.). We will then use linear regression to assess trends in density estimates over time. Although the sampling designs and corresponding analytical methods differ slightly from those utilized in the large parks, they should nevertheless provide unbiased estimates, and therefore be comparable to results from the other network parks. As with analysis of data from the larger parks, density estimates and trends in the small parks will be assessed every 5 years. Because birds will be monitored on alternate years in SAJH and LEWI, there will be uneven numbers of years contained in the sample analyzed in the two parks during years 5, 15, 25, etc. During the intervening reporting years (10, 20, etc.), there will be even numbers of data points in each analysis. This unavoidable imbalance will create a slight imbalance in power to detect trends between SAJH and LEWI that will be particularly evident during the first 5-year report (2 versus 3 years in the analysis). By year 15, the imbalance in sample size (7 versus 8 years of data) should be less of an issue. Annual reports during the intervening years will simply summarize and tabulate data, without attempting to model detectability, estimate density, or evaluate trends in density.

Detailed specifications and formats for reporting program results for the small parks and the large parks are provided in SOP 16: Data Analysis and Reporting.

I. Reporting and Product Development

Report Content

We recommend that a summary report be produced annually, with a more detailed report produced every 5 years. The annual report should:

- List project personnel and their roles.
- List transects completed during the current year.
- Provide a summary history of the number of transects completed during each year of the study (enumerated by elevation and park).
- List all bird species detected in the parks during the current year.
- Indicate the number of individuals of each bird species detected during the current year in each park as a whole and on the annual panel of transects only.
- Indicate the number of transects on which each species was detected in each park as a whole and on the annual panel of transects only.
- Identify any data quality concerns and/or deviations from protocols that affect data quality and interpretability.

Detailed reporting guidelines and table structures are provided in SOP 16: Data Analysis and Reporting.

A more in-depth analysis and report should be produced every 5 years, as the full set of five panels is completed. In addition to the above, the 5-year report also should:

- Provide annual density estimates for each species during the previous 5 years.
- Provide summary and detailed trend results for each species with an adequate sample size for estimating density and assessing trend.
- Provide the detectability parameters used for estimating each species' density.
- Assess spatial patterns in the density estimates.
- Identify any possible distributional changes within the parks.
- Place network results within the larger context of bird population changes throughout the Pacific Northwest, as measured by regional efforts such as the BBS or MAPS.

- Evaluate operational aspects of the monitoring program, such as whether any transects need to be eliminated or moved due to access problems, whether the sampling period remains appropriate (the optimal sampling season could conceivably change over time in response to climate change), etc.

Standard Report Format

Annual reports and trend analysis reports will use the NPS Natural Resource Publications template, a pre-formatted Microsoft Word template document based on current NPS formatting standards. Annual reports will use the Natural Resource Report template, and trend analysis and other peer-reviewed technical reports will use the Natural Resource Technical Report template. These templates and documentation of the NPS publication standards (National Park Service, 2005) are available at: http://www.nature.nps.gov/publications/NRPM/index.cfm.

Review Products for Sensitive Information

Certain project information related to the specific locations of rare or threatened taxa may meet criteria for protection and as such should not be shared outside NPS except where a written confidentiality agreement is in place prior to sharing. Before preparing data in any format for sharing outside NPS—including presentations, reports, and publications—the Project Lead should refer to the guidance in SOP 19: Sensitive Information Procedures. Certain information that may convey specific locations of sensitive resources may need to be screened or redacted from public versions of products prior to release.

J. Product Delivery, Posting, and Distribution

Refer to Appendix 3: Schedule for Project Deliverables for the complete schedule for project deliverables and the people responsible for them. To package products for delivery, refer to SOP 18: Product Delivery Specifications. Upon delivery they will be posted to NPS websites and clearinghouses (NatureBib, NPSpecies, NPS Data Store) according to guidelines in Appendix 3: Schedule for Project Deliverables.

Holding Period for Project Data

To permit sufficient time for priority in publication, certified project data will be held upon delivery for a period not to exceed 2 years after it was originally collected. After the 2-year period has elapsed, all certified, non-sensitive data will be posted to the NPS Data Store.

Note: This hold only applies to raw data, and not to metadata, reports or other products which are posted to NPS clearinghouses immediately after being received and processed.

Special Procedures for Sensitive Information

Products that have been identified upon submission by the Project Lead and/or NPS Lead as containing sensitive information will either be revised into a form that does not disclose the locations of sensitive resources, or withheld from posting and distribution. When requests for distribution of the unedited version of products are initiated by the NPS, by another Federal agency, or by another partner organization (for example, a research scientist at a university), the unedited product (the full data set that includes protected information) may be shared only after a confidentiality agreement is established between NPS and the other organization. Refer to SOP 19: Sensitive Information Procedures for more information.

All official FOIA requests will be handled according to NPS policy. The NPS Lead will work with the Data Manager and the park FOIA representative(s) of the park(s) for which the request applies.

K. Archival and Records Management

All project files should be reviewed, cleaned up, and organized by the Project Lead and NPS Lead on a regular basis (for example, annually in January). Decisions on what to retain and what to destroy should be made following guidelines stipulated in NPS Director's Order 19, which provides a schedule indicating the amount of time that the various kinds of records should be retained. Refer to SOP 2: Workspace Setup and Project Records Management.

L. Season Close-Out

After the conclusion of the field season, the Project Lead, NPS Lead, Data Manager, and GIS Specialist should meet to discuss the recent field season, and to document any needed changes to the field sampling protocols, the working database application, or to any of the SOPs associated with the protocol. Refer to Section 3D, Details for Taking Measurements for additional close-out procedures not specifically related to project information management.

5. Personnel Requirements and Training

A. Roles and Responsibilities

Field operations for this program were designed to be staffed by an 8-person crew: seven Field Technicians and one Field Lead. In addition to collecting data alongside the other crew members, the Field Lead will be principally responsible for training and testing the crew, providing quality assurance, trouble-shooting logistical problems throughout the field season, and preparing the end-of-season field report. We anticipate the most efficient arrangement likely will be to assign a pair of observers to each large park, and then have the Field Lead and the seventh Field Technician visit all parks as needed throughout the field season. This 'roving' pair of crew members will join the MORA crew in surveying one of the small parks each year.

For the first 5 years of this project, it is anticipated that personnel at The Institute for Bird Populations will fulfill the roles of Project Lead and Data Analyst in close conjunction with the NPS Lead. The Institute for Bird Populations also will provide a Field Lead and Field Technicians. The NPS Lead will work closely with the Project Lead throughout the initial 5 years of monitoring, and may decide to assume all Project Lead responsibilities at the end of the 5-year period.

Other personnel who will provide key roles in the implementation of this program include the Data Manager, GIS Specialist, Network Coordinator, Park Biologists or Resource Specialists at each of the five parks, and the USGS Liaison. Specific responsibilities of all personnel involved with this project are detailed in Appendix 1: Project Roles and Responsibilities.

B. Qualifications

The Field Lead each year must be a highly skilled birder with experience conducting point counts with distance sampling and familiarity with Pacific Northwest birds and plant communities. Familiarity with one or more of the NCCN parks also is desirable. Ideally, the Field Lead will have supervised field crews before and/or previously served as an NCCN landbird monitoring crew member. Finally s/he must be very physically fit and prepared to spend extended periods of time in the backcountry.

Field Technicians should have prior birding experience, including substantial experience with NCCN birds or a demonstrated ability to quickly learn the songs and calls of new bird species. They also must be very physically fit and prepared to spend extended periods of time in the backcountry. Substantial backpacking experience and experience conducting point counts with distance sampling also are desirable.

More detailed descriptions of desired qualifications for the Field Lead and Field Technicians are provided in SOP 1: Preparing for the Field Season.

C. Training Procedures

A comprehensive and well-designed training program is critical to the success of this project, as it will maximize observer consistency—both within and between years. Past experience has shown us that particularly experienced or talented crew members can be adequately trained in 2 weeks or less, but we recommend allowing up to 3 weeks for the training period, to maximize the likelihood that all observers will be qualified to conduct point counts at the end of the training session, and to allow ample time for any required meetings between the crew and NPS personnel (Park Biologists, Data Manager, GIS Specialist, etc.). The details of how the training session should be conducted are addressed in SOP 3: Training Observers, but in general terms, the session should provide instruction in the following topics:

- Bird identification by sight and sound
- Estimating distance to birds
- Conducting point counts
- Plant identification and habitat classification
- Completing field forms
- Orienteering and collecting GPS data
- First aid and backcountry safety
- Discussion of optimal scheduling and access routes for sites in the current panels, including review of past years' efforts
- Data entry procedures

At the end of the training session, all observers must pass a rigorous bird identification exam, which certifies that they can competently identify by sight and sound all species they are expected to encounter during the field season.

6. Operational Requirements

A. Annual Workload and Field Schedule

Preparation for the field season must begin well in advance of the pre-season training session. Appendix 2 provides a Yearly Project Task List that identifies each task by project stage, indicates who is responsible, and establishes the timing for its execution. We recommend beginning the process of recruiting and hiring qualified crew members no later than December of the preceding year. Crew training should begin between May 1 and May 7. Point count surveys should begin no sooner than May 22. The sampling design assumes that in NOCA and OLYM, two observers will work together to survey 24 transects, and in MORA, a pair of observers will work together to sample 20 transects, plus survey one of the small parks. A fourth pair of 'roving' observers will assist with the small park survey, and then spend the remainder of the season assisting in any (or all) of the three large parks—wherever help is needed. We recommend providing observers with a 3-day break after each 7-day 'tour' conducting fieldwork. Depending on hiking distances, weather, and geographic proximity of the transects to one another, observers should be able to complete 2-4 transects per 7-day tour. Sampling will begin with the low-elevation transects in each park, and observers will gradually progress upslope throughout the season. The final transect must be completed by July 31.

Field crews will enter data into the custom-designed database throughout the field season, and should be able to complete data entry within 1 or 2 days after completing their last transect in late July. Detailed data entry instructions are provided in SOP 12: Data Entry and Verification.

We recommend that data verification and certification should be completed by the end of November, and data analysis and the preparation of the annual report should be completed by the end of April, before the next field season begins.

B. Facility and Equipment Needs

This project requires minimal special facilities and equipment. The crew will require housing in the vicinity of each large park for the duration of the season (early May–late July). Crew members will provide their own backpacking gear (excluding the equipment itemized in this section) and personal vehicles. Computer access is necessary during the training session, and throughout the season so that crew members can enter their own data. Based on four 2-person crews, the following equipment will be required:

- 8 binoculars
- 4 park radios
- 8 two-way radios
- 8 GPS units
- 8 compasses
- 8 digital cameras
- 8 bear-proof food canisters
- 4 tents
- 4 water filters
- 4 camp stoves and fuel
- 4 cook kits
- 8 clipboards, field paper, and pencils
- 8 altimeters (optional)
- 8 clinometers (optional)
- 8 digital rangefinders (optional)

C. Startup Costs and Budget Considerations

This project will incur relatively low startup costs beyond the cooperative agreement between USGS and The Institute for Bird Populations (IBP), which funded the development of this protocol narrative and accompanying Standard Operating Procedures. Additional startup costs associated with the above equipment needs are approximately $10,000 (excluding NPS radios).

While this protocol has been under development, the amount of funds forecasted to be available for the project has been reduced substantially. In response to this reduction in anticipated funding, we will begin implementation of the monitoring program with a 6-person crew, rather than an 8-person crew. Under this scenario, we will likely scale back sampling effort in each of the large parks by reducing the panel sizes from 12, 12, and 10 transects in OLYM, NOCA and MORA, respectively, to 9, 9, and 8 transects in each panel. The flexibility of the GRTS-based sampling design enables us reduce the number of transects in each panel without compromising the statistical integrity of the sampling effort. For each of the six panels, we will simply eliminate the last-selected transect in each of the three elevation strata in each park, except for the low-elevation stratum at MORA, where we are already sampling only two transects per panel. Implementation of this reduced sample design in 2007 under IBP management is expected to cost approximately $70,000. Table 4 provides a budget outline showing how funds will be allocated to the various project tasks.

Table 4. Annual budget for implementing landbird monitoring in the North Coast and Cascades Network.

[**NPS I&M** includes funding allocated to the NCCN Inventory and Monitoring Program for network data manager's time. **Abbreviations:** NPS I&M, National Park Service inventory and monitoring; CA, Cooperative Agreement; NCCN, North Coast and Cascades Network; pp, pay period]

Project tasks	CA	NPS I&M	NPS other
Administration			
Salaries (w/ benefits)			
NPS (Lead-3 pay periods, MORA & OLYM Biologists-0.7pp)			$13,513
Seasonal Preparation			
Salaries (w/ benefits)			
NPS (MORA & OLYM Biologists-0.7pp)		$2,146	$2,716
Cooperative Agreement (CA)	$3,531		
Equipment & Supplies	$1,200		
Crew Training & Certification			
Salaries (w/ benefits)			
NPS (Lead-1.5pp, Data Manager-0.2pp, Data Tech-0.2pp)		$1,033	$5,399
Cooperative Agreement (CA)	$8,842		
Data Collection			
Salaries (w/ benefits)			
NPS (Lead-0.5pp)			$1,800
Cooperative Agreement (CA)	$18,950		
Housing	$6,604		
Travel	$4,445		
Data Management			
Salaries (w/ benefits)			
NPS (Lead-1pp, Data Manager-1.8 pp, Data Tech-0.5pp)		$6,461	$3,599
Cooperative Agreement (CA)	$14,118		
Data Analysis & Reporting			
Salaries (w/ benefits)			
NPS (Lead-1pp, MORA & OLYM Biologists-0.7pp, Data Tech-0.5pp)		$1,090	$6,315
Cooperative Agreement (CA)	$12,467		
Totals	$70,157	$10,730	$33,342

Annual reports for the NCCN landbird monitoring program will tabulate and summarize raw count results, but in the interest of keeping annual costs down, will not include complex data analysis. At the end of every 5-year interval, when each of the alternating panels has been sampled and the annual panel has been sampled five times, we will conduct a comprehensive data analysis. This analysis will have two major components:

- Estimation of species-specific detectability and application of appropriate correction factors to point count data
- Trend detection

Additionally, for the 5-year reports, we will use linear regression to assess temporal trends in density estimates at the small parks, SAJH and LEWI, which will involve statistical procedures that differ from those used to assess trends in the larger parks because of the differing sample designs at those parks. Finally, the 5-year reports also will include assessments of any apparent distributional changes of species in the parks, as well as an evaluation of temporal change in density and/or distribution in the context of results from other regional and/or national monitoring programs.

These substantial additions to the annual data analysis and reporting workload will require additional funds every 5 years. We expect the cost, in 2007 dollars to be approximately $12,500, as indicated table 5.

Additionally, NPS will re-evaluate at each 5-year period whether it is most cost-effective to renew our cooperative agreement with IBP.

Table 5. Five-year data analysis budget for determining trends in North Coast and Cascades Network.

[**Abbreviations:** CA, Cooperative Agreement; NPS, National Park Service; USGS, U.S. Geological Survey; pp, pay period]

Data analysis	CA	NPS	USGS
Salaries (w/ benefits)			
NPS (Lead-2 pp, MORA & OLYM Biologists-1 pp)		$11,078	
USGS (Research Scientist-1 pp)			$4,200
Cooperative Agreement (CA)	$12,500		
Totals	$12,500	$11,078	$4,200

D. Protocol Revisions

All protocol revisions will be documented in the revision logs. Small changes to the protocol (for example, adding or modifying a variable) will be reviewed by the Project Leads and Park Biologists or Resource Management Specialists (small parks) at the affected park(s), and approved by the Network Coordinator. More drastic changes (for example, modifications to the sample design or analytical methods for trend detection) will trigger an outside review to be conducted by the NPS Pacific West Regional Office or designated review panel as directed by the NPS Inventory and Monitoring Program. Detailed instructions for making and tracking changes to the NCCN Landbird Monitoring Protocol, including its accompanying SOPs and Appendixes, are provided in SOP 21: Revising the Protocol.

References Cited

Akaike, H., 1973, Information theory as an extension of the maximum likelihood principle, *in* Petrov, B.N., and Csaki, F. (eds.), Second International Symposium on Information Theory: Akademiai Kiado, Budapest, p. 267-281.

Altman, B., 2005, Conservation priorities for landbirds of the Pacific Coast of Oregon and Washington, *in* Proceedings of the Third International Partners in Flight Symposium: General Technical Report PSW-GTR-191, Albany, California, USDA Forest Service, Pacific Southwest Research Station, p. 143-148.

Altman, B., 2000, Conservation strategy for landbirds of the east-slope of the Cascade Mountains in Oregon and Washington: Prepared for Oregon-Washington Partners in Flight, American Bird Conservancy, 121 p., available online at http://www.orwapif.org/pdf/east_slope.pdf (accessed October 3, 2006).

Altman, B., and Bart, J., 2001, Special species monitoring and assessment in Oregon and Washington: Landbird species not adequately monitored by the Breeding Bird Survey: Oregon-Washington Partners in Flight.

Andelman, S.J., and Stock, J., 1994a, Management, research, and monitoring priorities for the conservation of Neotropical migratory landbirds that breed in Oregon: Olympia, Washington, Washington Department of Natural Resources.

Andelman, S.J., and Stock, A., 1994b, Management, research, and monitoring priorities for the conservation of Neotropical migratory landbirds that breed in Washington: Olympia, Washington, Washington Department of Natural Resources.

Atkinson, S., and Sharpe, F.A., 1985, Wild plants of the San Juan Islands: Seattle, Washington, The Mountaineers.

Boetsch, J.R., Christoe, B., and Holmes, R.E., 2005, Data management plan for the North Coast and Cascades Network Inventory and Monitoring Program: USDI National Park Service: Port Angeles, Washington, 88 p., available only online at http://www1.nature.nps.gov/im/units/nccn/datamgmt.cfm (accessed January 25, 2007.)

Bolsinger, C.L., and Waddell, K.L., 1993, Area of old-growth forests in California, Oregon and Washington: USDA Forest Service Resource Bulletin PNW-RB-197.

Breidt, F.J., and Fuller, W.A., 1999, Design of supplemented panel surveys with application to the national resources inventory: Journal of Agricultural, Biological and Environmental Statistics, v. 4, p. 391-403.

Buckland, S.T., Anderson, D.R., Burnham, K.P., Laake, J.L., Borchers, D.L., and Thomas, L., 2001, Introduction to distance sampling: estimating abundance of biological populations: Oxford University Press, Oxford.

Buckland, S. T., Anderson, D.R., Burnham, K.P., Laake, J.L., Borchers, D.L., and Thomas, L. (eds.), 2004, Advanced distance sampling: estimating abundance of biological populations: Oxford University Press, Oxford.

Bunnell, F.L., Kremsater, L.L., and Wells, R.W., 1997, Likely consequences of forest management on terrestrial, forest-dwelling vertebrates in Oregon: Report M-7 of the Centre for Applied Conservation Biology, University of British Columbia.

Burnham, K.P., and Anderson, D.R., 1998, Model Selection and Inference: A practical information-theoretic approach: Springer, New York.

Coonan, T.J., Austin, G., and Dye, L. C., 2001, Landbird monitoring1995–2000 annual report, Technical Report 2001-03: Ventura, California, Channel Islands National Park.

Cordell, H.K., and Herbert, N.G., 2002, The popularity of birding is still growing: Birding, v. Feb., p. 54-61.

Cordell, H.K., Herbert, N.G., and Pandolfi, F., 1999, The growing popularity of birding in the United States: Birding, v. 3, p.168-176.

Croze, H., 1982, Monitoring within and outside protected areas, in McNeeley, J.A., and Miller, K.R. (eds.), National parks, conservation, and development: the roles of protected areas in sustaining society: Proceedings of the World Congress on National Parks: Washington, D.C., Smithsonian Institution Press, p. 628-633.

DeSante, D.F., and George, T.L., 1994, Population trends in the landbirds of western North America, *in* Jehl Jr., J.R., and Johnson, N.K. (eds.), A century of avifaunal change in western North America: Studies in Avian Biology, no. 15, p. 173-190.

Droege, S., 1990, The North American Breeding Bird Survey, *in* Sauer, J.R., and Droege, S. (eds.), Survey designs and statistical methods for the estimation of avian population trends: U.S. Fish and Wildlife Service, Biological Report, v. 90, n. 1, p. 1-4.

Fancy, S.G., 1997, A new approach for analyzing bird densities from variable circular-plot counts: Pacific Science, v. 51, p. 107-114.

Fancy, S.G., and Sauer, J.R., 2000, Recommended methods for inventorying and monitoring landbirds in the National Parks, available only online at http://science.nature.nps.gov/im/monitor/protocols/npsbird.doc (Accessed January 25, 2007.)

Furness, R.W., Greenwood, J.J.D., and Jarvis, P.J., 1993, Can birds be used to monitor the environment? *in* Furness, R.W., and Greenwood, J.J.D. (eds.), Birds as monitors of environmental change: London, England, Chapman and Hall, p. 1-41.

Gilbert, F.F., and Allwine, R., 1991, Spring bird communities in the Oregon Cascade Range, *in* Ruggiero, L.F., Aubry, K.B., Carey, A.B., and Huff, M.H. (eds.), Wildlife and vegetation of unmanaged Douglas-fir forests: USDA Forest Service, Pacific Northwest Research Station, General Technical Report PNW-GTR-285, p. 144-158.

Greenwood, J.J.D., Baillie, S.R., Crick, H.Q.P., Marchant, J.H., and Peach, W.J., 1993, Integrated population monitoring: detecting the effects of diverse changes, *in* Furness, R.W., and Greenwood, J.J.D. (eds.), Birds as monitors of environmental change: London, Chapman and Hall, p. 267-342.

Hagar, J.C., McComb, W.C., and Chambers, C.C., 1995, Effects of forest practices on wildlife, *in* Beschta, R.P., and others. (eds.), Cumulative effects of forest practices in Oregon: literature and synthesis: Corvallis, Oregon, Oregon State University.

Hansen, A.J., McComb, W.C., Vega, R., Raphael, M.G., and Hunter, M., 1995, Bird habitat relationships in natural and managed forests in the west cascades of Oregon: Ecological Applications, v. 5, p. 555-569.

Huff, M.H., Agee, J.K., and Manuwal, D.A., 1985, Post-fire succession of avifauna in the Olympic Mountains, Washington, *in* Lotan, J.E., and Brown, J.K. (eds.), Proceedings: fire's effect on wildlife habitat: USDA Forest Service General Technical Report INT-186, p. 8-15.

Hutto, R.L., and Young, J.S., 2002, Regional landbird monitoring: perspectives from the Northern Rocky Mountains: Wildlife Society Bulletin, v. 31, p. 738-750.

Jenkins, K., Beirne, K., and Seaman, D.E., 2000, Inventory and monitoring of breeding land birds in Olympic National Park—preliminary results, 1999 annual report: Port Angeles, Washington, U.S. Geological Survey, Forest and Rangeland Ecosystem Science Center, Olympic Field Station.

Lewis, M.G., and Sharpe, F.A., 1987, Birding in the San Juan Islands: Seattle, Washington, The Mountaineers.

Manley, P.N., Zielinski, W.J., Schlesinger, M.D., and Mori, S.R., 2004, Evaluation of a multiple-species approach to monitoring species at the ecoregional scale: Ecological Applications, v. 14, p. 296-310.

Manuwal, D.A., 1991, Spring bird communities in the southern Washington Cascade Range, *in* Ruggiero, L.F., Aubry, K.B., Carey, A.B., and Huff, M.H. (eds.), Wildlife and vegetation of unmanaged Douglas-fir forests: USDA Forest Service, Pacific Northwest Research Station, General Technical Report PNW-GTR-285, p. 160-174.

McDonald, T.L., 2003, Review of environmental monitoring methods: survey designs: Environmental Monitoring and Assessment, v. 85, p. 277-292.

Meslow, E.C., and Wight, H.M., 1975, Avifauna and succession in Douglas-fir forests of the Pacific Northwest, *in* Smith, D.R., ed., Proceedings of the Symposium on Management of Forest and Rangeland Habitats for Non-Game Birds: USDA Forest Service General Technical Report WO-1, p. 266-271.

National Park Service, 2005, Reporting Guidelines: USDI National Park Service website at http://www.nature.nps.gov/publications/NRPM/index.cfm (Accessed January 25, 2007.)

Nelson, J.T., and Fancy, S.G., 1999, A test of the variable circular-plot method when exact density of a bird population was known: Pacific Conservation Biology, v. 5, p. 139-143.

North Coast and Cascades Network – National Park Service, 2006, GPS Guidelines: USDI National Park Service website at http://www1.nature.nps.gov/im/units/nccn/datamgmt_guide.cfm (Accessed January 25, 2007.)

Oakley, K.L., Thomas, L.P., and Fancy, S.G., 2003, Guidelines for long-term monitoring protocols: Wildlife Society Bulletin, v. 31, p. 1000-1003.

O'Connor, R.J., 1992, Population variation in relation to migrancy status in some North American birds, *in* Hagan III, J.M., and Johnson, D.W. (eds.), Ecology and conservation of neotropical migrant landbirds: Washington D.C., Smithsonian Institution Press, p. 46-74.

Pacific Meridian Resources, 1996, Vegetation and landform database development study: final report: Pacific Meridian Resources, Portland.

Peitz, D.G., Fancy, S.G., Thomas, L.P., and Witcher, B., 2002, Bird monitoring protocol for Agate Fossil Beds National Monument, Nebraska and Tallgrass Prairie National Preserve, Kansas: Prairie Cluster Prototype Monitoring Program, National Park Service, U.S. Department of the Interior.

Peterjohn, B.G., and Sauer, J.R., 1993, North American Breeding Bird Survey annual summary, 1990-1991: Bird Populations, v. 1, p. 1-15.

Peterjohn, B.G., Sauer, J.R., and Robbins, C.S., 1995, Population trends from North American breeding bird survey, *in* Martin, T.E., and Finch, D.M. (eds.), Ecology and management of Neotropical migratory birds: New York, Oxford Press, p. 3-39.

Quinn, J.F., and van Riper III, C., 1990, Design considerations for national park inventory databases, *in* van Riper, C., and others (eds.), Examples of resource inventory and monitoring in national parks of California: Proceedings of the Third Biennial Conference on Research in California's National Parks, September 13-15, 1990, University of California, Davis, p. 5-14.

Ralph, C.J., and Scott, J.M. (eds.), 1981, Estimating numbers of terrestrial birds: Studies in Avian Biology 6, p. 630.

Reynolds, R.T., Scott, J.M., and Nussbaum, R.A., 1980, A variable circular-plot method for estimating bird numbers: Condor, v. 82, p. 309-313.

Robbins, C.S., Sauer, J.R., Greenburg, R., and Droege, S., 1989, Population declines in North American birds that migrate to the neotropics: Proceedings of the National Academy of Sciences, v. 86, p. 7658-7662.

Rosenstock, S.S., Anderson, D.R., Giesen, K.M., Leukering, T., and Carter, M.F., 2002, Landbird counting techniques: current practices and an alternative: Auk, v. 119, p. 46-53.

Saab, V.A., and Rich, T.D., 1997, Large-scale conservation assessment for Neotropical migratory land birds in the interior Columbia River basin: Portland, Oregon, General Technical Report PNW-GTR-285: USDA Forest Service, Pacific Northwest Research.

Sauer, J.R., 2000, Combining information from monitoring programs: complications associated with indices and geographic scale, *in* Bonney, R., Pashley, D.N., Cooper, R.J., and Niles, L. (eds.), Strategies for bird conservation: the Partners in Flight planning process: Ogden, Utah, USDA Forest Service, Proceedings RMRS_P_16, p. 124-126.

Sauer, J.R., and Cooper, R.J., 2000, Population and habitat assessment: monitoring bird populations over large areas, *in* Bonney, R., Pashley, D.N., Cooper, R.J., and Niles, L. (eds.), Strategies for bird conservation: the Partners in Flight planning process: Ogden, Utah, USDA Forest Service, Proceedings RMRS_P_16, p. 113-114.

Sauer, J.R., Hines, J.E., and Fallon, J., 2001, The North American breeding bird survey, results and analysis 1966-2000, Version 2001.2: Laurel, Maryland, USGS Patuxent Wildlife Research Center.

Sauvajot, R.M., Quinn, J.E., van Riper III, C., and Farmer, C., 1990, Comparative analyses of bird inventory databases from California National Parks, *in* van Riper, C., and others, (eds.), Examples of resource inventory and monitoring in National Parks of California: Proceedings of the Third Biennial Conference on Research in California's National Parks, September 13-15, 1990, University of California, Davis, p. 15-48.

Sharp, B.E., 1996, Avian population trends in the Pacific Northwest: Bird Populations v. 3, p. 26-45.

Siegel, R.B., and Kuntz II, R.C., 2000, Designing a landbird monitoring program at North Cascades National Park Service Complex: summary recommendations from a September 2000 workshop: USDI Technical Report NPS/NRNOCA/NRTR/00-04.

Siegel, R.B., and Wilkerson, R.L., 2005, Sample designs for avian monitoring alternatives in Sierra Nevada Network parks: Point Reyes Station, California, The Institute for Bird Populations.

Siegel, R.B., Wilkerson, R.L., and Hall, S., 2004a, Landbird inventory for Olympic National Park (2002-2003): Point Reyes Station, California, The Institute for Bird Populations.

Siegel, R.B., Wilkerson, R.L., Kuntz II, R.C., and J.F. McLaughlin, 2004b., Landbird inventory for North Cascades National Park Service Complex: Point Reyes Station, California, The Institute for Bird Populations.

Siegel, R.B., Wilkerson, R.L., Pedersen, H.K., and Kuntz II, R.C., 2002, Landbird inventory of San Juan Island National Historical Park: Technical Report NPS D 73 of the National Park Service.

Silsbee, G.G., and Peterson, D.L., 1991, Designing and implementing comprehensive long-term inventory and monitoring programs for National Park System lands: Denver, Colorado, Natural Resources Report NPS/NRUW/NRR-91/04.

Simons, T.R., Rabenold, K.N., Buehler, D.A., Collazo, J.A., and Fransreb, K.E., 1999, The role of indicator species: neotropical migratory song birds, *in* Peine, J.D., ed., Ecosystem Management for Sustainability, Principles and Practices Illustrated by a Regional Biosphere Reserve Cooperative: New York, Lewis Publishers, p. 187-208.

Smith, M.R., Mattocks Jr., P.W., and Cassidy, K.M., 1997, Breeding birds of Washington State, *in* Cassidy, K.M., Grue, C.E., Smith, M.R., and Dvornich, K.M. (eds.), Washington State Gap Analysis - Final Report: Seattle, Washington, Audubon Society Publications in Zoology, v. 4, no. 1.

Smith, W.P., Twedt, D.J., Cooper, R.J., Wiedenfeld, D.A., Hamel, P.B., and Ford, R.P., 1995, Sample size and allocation of effort in point count sampling of birds in bottomland hardwood forests, *in* Ralph, C.J., Sauer, J.R., and Droege, S. (eds.), Monitoring Bird Populations by Point Counts: Berkeley, California, USDA Forest Service General Technical Report, PSW-GTR-149, p. 7-17.

Stevens Jr., D.L., and Olsen, A.R., 1999, Spatially restricted surveys over time for aquatic resources: Journal of Agricultural, Biological, and Environmental Statistics, v. 4, p. 415-428.

Stevens Jr., D.L., and Olsen, A.R., 2003, Variance estimation for spatially balanced samples of environmental resources: EnvironMetrics, v. 14, p. 593-610.

Stevens Jr., D.L., and Olsen, A.R., 2004, Spatially balanced sampling of natural resources: Journal of the American Statistical Association, v. 99, p. 262-278.

TerraStat Consulting Group, 2005, Protocols for analyzing and reporting trends in avian abundance in NCCN parks–Task 2 Report: Available from USGS, Forest and Rangeland Ecosystem Science Center, Olympic Field Station, Port Angeles, Washington.

Thomas, L., Laake, J.L., Strindberg, S., Marques, F.F.C., Buckland, S.T., Borchers, D.L., Anderson, D.R., Burnham, K.P., Hedley, S.L., Pollard, J.H., Bishop, J.R.B., and Marques, T. A., 2005, Distance 5.0. Research Unit for Wildlife Population Assessment, University of St. Andrews, UK. Program Distance Home Page web site at http://www.ruwpa.st-and.ac.uk/distance/ (Accessed October 10, 2007.)

Urquhart, N.S., and Kincaid, T.M., 1999, Designs for detecting trend from repeated surveys of ecological resources: Journal of Agricultural, Biological, and Environmental Statistics, v. 4, p. 404-414.

Urquhart, N.S., Paulsen, S.G., and Larsen, D.P., 1998, Monitoring for policy-relevant regional trends over time: Ecological Applications, v. 8, p. 246-257.

Wilkerson, R.L., Siegel, R.B., and Schaberl, J., 2005, Landbird inventory for Mount Rainier National Park: first annual progress report: Point Reyes Station, California, The Institute for Bird Populations.

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Landbird Monitoring Protocol for National Parks in the North Coast and Cascades Network

Standard Operating Procedure (SOP) 1:

Preparing for the Field Season

Revision History Log:

Revision Date	Author	Changes Made	Reason for Change

This Standard Operating Procedure identifies preparatory steps that must be taken prior to the field season of the NCCN landbird monitoring program.

1. Hiring the Field Crew

A. Hiring the Field Lead

At least for the initial years of this program, The Institute for Bird Populations will provide the Field Lead and Field Technicians. The Field Lead will have an identified liaison at each park (usually the lead park wildlife biologist or resource specialist) that will be the key contact for planning and logistics. Over time, the NPS may assume control over hiring and staffing the field crew. Regardless, if the Field Lead is to be a seasonal employee, rather than year-round staff member, then the Field Lead recruiting process should begin in late November or early December of the preceding year. Qualities to seek in potential Field Leads include the following:

- Proficiency at identifying western landbirds by sight and sound.
- Bird survey experience, preferably conducting point counts with distance estimation.
- Substantial backcountry orienteering and backpacking experience.
- High level of physical fitness.
- Familiarity with one or more of the NCCN parks.
- Familiarity with NCCN plant communities.
- Leadership experience.
- Strong organizational skills.
- Ability to get along well with others in a field crew setting.
- Knowledge of (or preferably, certification in) wilderness first aid.
- Possession of a reliable vehicle.

If at all possible, priority consideration should be given to previous years' Field Leads or Field Technicians, to maximize year-to-year consistency in field operations and methods. Once selected, the Field Lead, especially if new, should review all relevant sections of the protocol and discuss any questions with the Project Lead.

B. Hiring the Field Technicians

Recruitment of the rest of the field crew should begin by late December of the preceding year. As with hiring the Field Lead, initiating the recruitment process early is critical for ensuring that well-qualified candidates are available. Although the Field Technicians do not need to have the same level of experience nor all required skills as the Field Lead, similar general qualities should be sought:

- Proficiency at identifying western landbirds by sight and sound. If a full pre-season training session is planned (see SOP 3: Training Observers) then this requirement may be relaxed slightly. Successful candidates should at least be nearly proficient at identifying NCCN landbirds by sight and sound, or be proficient at identifying landbirds of other regions by sight and sound and be able to demonstrate enthusiasm and ability to learn to identify new species.
- High level of physical fitness.
- Ability to get along well with others in a field crew setting.
- Bird survey experience, preferably conducting point counts with distance sampling. If a full training session is planned, this requirement can be eliminated. However, experience with some kind of formal data collection is still highly desirable.

- Backpacking experience and proficiency at backcountry orienteering. The orienteering requirement may be waived if orienteering will be emphasized during training.
- Familiarity with one or more of the NCCN parks (desirable but not required).
- Familiarity with NCCN plant communities (desirable but not required).
- Knowledge of (or preferably, certification in) wilderness first aid (desirable but not required).
- Possession of a reliable vehicle.
  Note: Unless NPS vehicles are available for field work, at least one-half of the crew will need to provide personal vehicles.

Although the first three of the above qualities should be considered mandatory, the others are desirable but not strictly required. As with selection of the Field Lead, priority consideration should be given to returning crew members, to maximize year-to-year consistency in field operations and methods.

Soon after being hired, Field Technicians should be sent the following:

- A written description of expectations, duties, and responsibilities, to be signed and returned.
- A list of all bird species likely to be encountered during the field season (see SOP 3: Training Observers).
- Song recordings and/or other materials that will assist Field Technicians to bolster their bird identification skills prior to the field season.
- A list of required and recommended personal equipment.

2. Organizing Supplies and Equipment

An equipment list should be compiled, and equipment organized and made ready for the field season several weeks in advance of the training session. This allows time to make needed repairs and order equipment. Table 1 provides a list of field equipment needs for each pair of crew members.

In addition to the equipment specified in table 1, crews need access to field guides to aid them in bird and plant identification. Recommended field guides and reference materials for bird surveys and associated vegetation assessments in the NCCN parks are listed below, with the most important items indicated in bold type:

Table 1. Field equipment list for each pair of crew members.

[Asterisk (*) indicates items that crew members are currently required to supply for themselves]

Number needed	Item
	Survey Equipment
2	Binoculars*
2	Celsius thermometers
2	GPS units
2	Altimeters
2	Wristwatches*
2	Clinometers
2	Clipboards
Many	Pens or pencils
4 rolls	Flagging
2	Radios
2	Compasses
Many	Aluminum tree tags
Many	Nails
2	Lightweight hammers
2	Lightweight measuring tapes for assessing dbh (in metric)
	General Backpacking Gear
1	First aid kit
1	Tent*
2	Sleeping bags*
2	Sleeping pads*
1	Stove*
2	Mess kits*
2	Bear-proof food containers
1	Water filter
2	Backpacks*
2	Daypacks or other means of carrying gear during surveys*

Atkinson, S., and Sharpe, F.A., 1985, Wild plants of the San Juan Islands: The Mountaineers, Seattle, WA.

Biek, D., 2000, Flora of Mount Rainier National Park: Oregon State University Press, Corvallis.

Buckingham, N.M., Schreiner, E.G., Kaye, T.N., Burger, J.E., and Tisch, E.L., 1995, Flora of the Olympic Peninsula: Northwest Interpretive Association, Seattle.

Lewis, M.G. and Sharpe, F.A.,1987, Birding in the San Juan Islands: The Mountaineers, Seattle.

National Geographic, 1987, Field Guide to Birds of North America, 3rd Edition: National Geographic, Washington, D.C.

Pojar, J., and MacKinnon, A. (eds.), 1994, Plants of the Pacific Northwest Coast: Lone Pine Publishing, Vancouver.

Sibley, D.A., 2003, The Sibley field guide to birds of western North America: Alfred A. Knopf, New York.

Smith, M.R., Mattocks, P.W., Jr., and Cassidy, K.M., 1997, Breeding birds of Washington State—Volume 4 *in* Cassidy, K.M., Grue, C.E., Smith, M.R., and Dvornich, K.M. (eds.), Washington State Gap Analysis—Final Report. Audubon Society Publications in Zoology No. 1, Seattle.

3. Scheduling Field Work

The Field Lead should consult with each park liaison to develop a general schedule for conducting the bird surveys prior to beginning the training. Point counts surveys should begin no sooner than May 29 at MORA and May 22 at the four other parks. Surveys should be completed by July 31 in the large parks, and by June 21 in SAJH and LEWI, which are entirely at low elevations. By sampling the Network's low-elevation sites first, then the mid-elevation sites, and finally the high-elevation sites, crews can ensure that sampling coincides with the peak of breeding activity for most species within each elevation zone. However, a limited amount of flexibility in scheduling is permissible; for example, it may be appropriate to sample the first high-elevation transect during the same backcountry trip in which the last mid-elevation transects are sampled, if this would result in saving substantial travel time, and snow cover at the site is minimal. As a general rule, survey locations should be nearly free of snow cover before they are surveyed. Unpredictable weather precludes the scheduling of sampling events to specific annual dates, as point counts cannot be conducted in the rain.

Prior to the start of the field season, transect location maps and directions for all transects in the annual panel and the appropriate alternating panel in the large parks should be printed and studied, along with field maps for the appropriate small park. The Field Lead should plan the optimal order to sample the necessary transects in each park, even though unpredictable weather may require that the plan be revised during the field season. Knowledgeable park personnel should be consulted as to whether any bridges have been washed out, or especially heavy snowpack or other factors might alter the accessibility of any transects. To maximize efficiency, we recommend that field crews work a schedule of approximately 7 days working, and then 3 days off. This will allow time for two 7-day 'tours' in each elevation stratum at each large park (except for MORA, where only one 7-day tour will be available to survey low-elevation transects).

4. Additional Miscellaneous Tasks to Complete Before Field Season

- If housing is to be provided for the field crew, housing needs to be arranged.
- Camping arrangements at SAJH or LEWI need to be made in advance, and the appropriate personnel at these parks should be consulted to schedule survey dates.
- The pre-season training session needs to be planned in detail, including preparing any teaching materials, scheduling the session to make sure all necessary topics are covered, coordinating with park personnel who may need to meet with the crew (this may include Park Biologists, Rangers, Data Managers, and/or GIS Specialists) and arranging camping or lodging for the crew throughout the training session.
- An adequate number of data forms to fulfill training needs and provide for the first 7-day tour (at least) should be printed or copied; about one-quarter should be produced on waterproof paper. Additional data forms will need to be copied or printed throughout the field season, if they are not produced in advance.

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Landbird Monitoring Protocol for National Parks in the North Coast and Cascades Network

Standard Operating Procedure (SOP) 2:

Workspace Setup and Project Records Management

Revision History Log:

Revision Date	Author	Changes Made	Reason for Change

Project Workspace Setup

A section of the networked file server at each host park is reserved for this project, and access permissions are established so that project staff members have access to needed files within this workspace. Prior to each season, the NPS Lead should make sure that network accounts are established for each new staff member, and that the Data Manager is notified to ensure access to the project workspace and databases.

The recommended file structure within this workspace is shown in figure 1. Certain folders, especially those for GPS data and images, should be retained in separate folders for each calendar year as shown in figure 1. This will make it easier to identify and move these files to the project archives at the end of each season.

Figure 1. Recommended file structure for project workspace. **Note:** Workspace folder name includes 'BDa03', the NCCN project code.

Each major subfolder is described as follows:

- Analysis – Contains working files associated with data analysis.
- Database – Contains the working database file for the season. The master database for the project is stored in the enterprise data management system (Boetsch and others, 2005).
- Documents – Contains subfolders to categorize documents as needed for various stages of project implementation.
- GPS data – Contains GPS data dictionaries, and raw and processed GPS data files.
  Note: This folder contains subfolders to arrange files by year. Each of these subfolders also contains the project code ('BDa03') to make it easier to select the correct project folder within the GPS processing software (refer to SOP 10: Collecting GPS Data).
- Images – For storing images associated with the project (refer to SOP 11: Managing Photographic Images).
  Note: This folder contains subfolders to arrange files by year.
- Spatial info – Contains files related to visualizing and interacting with GIS data.
  - GIS data – New working shapefiles and coverages specific to the project.
  - GIS layers – Pointer files to centralized GIS base themes and coverages.
  - Map documents – Map composition files (.mxd).

Naming Conventions

Folder Naming Standards

In all cases, folder names should follow these guidelines:

- No spaces or special characters in the folder name.
- Use the underbar ("_") character to separate words in folder names.
- Try to limit folder names to 20 characters or fewer.
- Dates should be formatted as YYYYMMDD.

File Naming Standards

In all cases, file names should follow these guidelines:

- No spaces or special characters in the file name.
- Use the underbar ("_") character to separate file name components.
- Try to limit file names to 30 characters or fewer, up to a maximum of 50 characters.
- Dates should be formatted as YYYYMMDD.
- Correspondence files should be named as YYYYMMDD_AuthorName_subject.ext.

Archival and Records Management

All project files should be reviewed, cleaned up, and organized by the Project Lead and NPS Lead on a regular basis (for example, annually in January). Decisions on what to retain and what to destroy should be made following guidelines stipulated in NPS Director's Order 19, which provides a schedule indicating the amount of time that the various kinds of records should be retained. Many of the files for this project may be scheduled for permanent retention, so it is important to isolate and protect them, rather than lose them in the midst of a large, disordered array of miscellaneous project files. Because this is a long-term monitoring project, good records management practices are critical for ensuring the continuity of project information. Files will be more useful to others if they are well organized, well named, and stored in a common format. In addition, files containing sensitive information must be stored in a manner that will enable quick identification. Refer to SOP 19: Sensitive Information Procedures for more information.

To help ensure safe and organized electronic file management, NCCN has implemented a system called the NCCN Digital Library, which is a hierarchical digital filing system stored on the NCCN file servers (Boetsch and others, 2005). The typical arrangement is by project, then by year to facilitate easy access. Network users have read-only access to these files, except where information sensitivity may preclude general access.

As digital products are delivered for long-term storage according to the schedule in SOP 18: Product Delivery Specifications, they will be catalogued in the NCCN project tracking database and filed within the NCCN Digital Library. Analog (non-digital) materials are to be handled according to current practices of the individual park collections.

Reference Cited

Boetsch, J.R., Christoe, B., and Holmes, R.E., 2005, Data management plan for the North Coast and Cascades Network Inventory and Monitoring Program: USDI National Park Service, Port Angeles, WA, 88 p. Available at: http://www1.nature.nps.gov/im/units/nccn/datamgmt.cfm.

Landbird Monitoring Protocol for National Parks in the North Coast and Cascades Network

Standard Operating Procedure (SOP) 3:

Training Observers

Revision History Log:

Revision Date	Author	Changes Made	Reason for Change

This Standard Operating Procedure explains the procedures and topics to cover in training observers to collect data for the NCCN landbird monitoring program.

We recommend conducting an intensive training program immediately preceding the field season. The optimal duration of this program will depend somewhat on the skill and experience level of the crew members, but our experience in training crews for the NCCN landbird inventory projects has shown that even relatively experienced and/or skilled observers can benefit from 2 full weeks of training to hone their skills and fully prepare themselves for fieldwork. Less experienced individuals may require up to 3 weeks of training to truly be prepared to collect reliable data at the beginning of the field season. Our experience further suggests that one experienced trainer can adequately train 3–5 individuals in this timeframe (depending on their skill levels), but if the crew is larger than that, then the assistance of an additional trainer, at least during part of the training session, is highly desirable.

The training session must be carefully planned and scheduled to ensure that all necessary topics are adequately covered, and that crew members receive adequate exposure to as many of the network's bird species as possible. During training for the inventory projects, we found this was best achieved by dividing the training session between time spent at OLYM and time spent at NOCA. We have found birding at MORA, which includes very little low-elevation landmass, to be rather unproductive during the first 3 weeks of May.

In this SOP, we enumerate 12 primary topics that need to be covered during the training session, and provide some guidance on effective ways of presenting them.

1. Identification of Birds by Sight and Sound

For this monitoring program to produce meaningful results, all observers must be fully competent at identifying NCCN landbirds by sight and sound (See table 1 at the end of this SOP for lists of bird species likely to be encountered at each NCCN park). Ensuring that Field Technicians are fully competent by the end of the training session is a process that must begin well before the training session. Every effort must be made to recruit and hire observers who are already proficient or nearly proficient at identifying NCCN species by sight and sound, or who are proficient at identifying birds from other regions by sight and sound and can demonstrate an enthusiasm and ability to quickly learn to identify new species (see SOP 1: Preparing for the Field Season). No matter how well-executed the training session is, most observers who do not have substantial birding experience will not be adequately prepared to conduct point counts by the end of the training session.

Soon after being hired, Field Technicians should be sent species lists and other training materials, and be urged to begin preparing themselves prior to the start of the training session. The bird field guides listed in SOP 1: Preparing for the Field Season may be helpful in this process. Throughout the training session, every day should begin with the Field Technicians birding at sunrise, either with the trainer(s) (usually the Field Lead, perhaps with assistance from the Project Lead, the NPS Lead, or another qualified person) or in small groups. Observers learn to identify new species most quickly when they actually see and hear them in the field. The crew should visit as wide a variety of habitats and locales as possible during the training session, to maximize the number of species encountered in the field.

In addition to observing and listening to birds in the field, Field Technicians should spend time throughout the training session studying field guides, listening to recordings, and using instructional software to review plumages and vocalizations and to test themselves. We have found it most useful to conduct group reviews every other evening during training. These reviews have been most effective when the trainer used an instructional CD ROM to present images and/or recordings of the species encountered that morning, as well as other species the group (a) may be having trouble distinguishing from one another or (b) may be unlikely to encounter during training (for example, high-elevation species). The trainer leads the crew in a discussion of field marks and distinguishing characteristics of vocalizations, and also quizzes the crew. During the evenings that are not occupied by group review sessions, Field Technicians should use a variety of materials (field guides, recordings from multiple sources, their own field notes) to study independently or in small groups.

About halfway through the training session, the Field Technicians should be given a practice evaluation of their bird identification skills. The practice evaluation should be structured similarly to the formal evaluation that crew members will need to pass before they are certified to conduct point counts (see below). The practice evaluation helps crew members assess their own strengths and weaknesses, and also helps the trainer(s) identify individual species or groups of species that the crew may be having particular trouble learning.

Certifying Observers to Conduct Point Counts

Before they can collect point count data for the NCCN landbird monitoring program, Field Technicians must pass a rigorous bird identification exam. We recommend that the exam involve identifying approximately 60 recorded vocalizations, including all the more common landbird species in the parks, and many of the rarer ones (although familiarity with the numerous shorebird species in table 1 is desirable, it is not strictly necessary, should not be a major focus of training, and should not be part of the exam). In addition, two or more groups of approximately 10 recordings each should be grouped together in rapid succession to produce ‘simulated point counts’, which test crew member’s ability to rapidly identify vocalizations, as is often required in the field. Field Technicians also should have to identify 30–40 photographic images of birds, generally rarer species or less obvious female plumages (computer CD ROM programs work well for this). Passing the exam should require a near-perfect score. Field Technicians who do not pass should be given feedback on which species they misidentified, and be allowed to take the full exam again after a few days or a week. The exam needs to be remade (the order, if not the identity, of the recordings and pictures needs to be changed) before the exam can be administered again.

2. Pacing

Practicing distance estimation is greatly facilitated by being able to reliably measure distance by pacing. Accurate pacing also greatly helps in finding point count stations. Field Technicians should be taught to measure distance by pacing within the first few days of training. The trainer should measure out a 50-m walking route—somewhere fairly flat where the crew can walk freely and repeatedly. Field Technicians should walk the route and count their steps multiple times, and then commit to memory their average number of paces needed to travel 50 and 10 m. Experienced observers should conduct this exercise as well, as an individual’s pacing can change slightly from year to year.

3. Estimating Distances

A. Estimating Distance to Seen Objects

The Field Lead should begin training observers by placing flagging at 10, 25, 50, 100, and 200 m from a central point and having observers estimate distances to trees, rocks, and flagging that are visible from the central point. Distances should be estimated to the nearest meter—observers must resist the tendency to round off estimates to the nearest 5 or 10 m. As proficiency increases, Field Technicians should begin estimating distances to other visible objects (including birds) that are not within the vicinity of the measured-out flags. Distances to birds should be estimated and measured as the horizontal distance only; that is, the distance to a bird in the canopy should be estimated as the distance to the location on the ground beneath the bird. After estimating a distance, Field Technicians should use pacing, measuring tapes, or laser rangefinders to determine the actual distance. Both the estimated and actual distance should be recorded in a notebook, so that Field Technicians can assess their own tendencies to overestimate or underestimate distances, and thereby improve their estimates.

This exercise should be repeated many times over a period of days in various habitats and on flat ground as well as steeper slopes. With practice, Field Technicians should be able to estimate most distances within 10–15 percent of the actual distance. Accuracy may be reduced somewhat for particularly distant birds or objects (>100 m), but this is not of great concern, as far-off detections have less effect on detectability models than do closer detections.

B. Estimating Distance to Singing Birds

When Field Technicians have become relatively proficient at estimating distances to seen birds, they should start estimating distances to singing—but unseen—birds. The importance of this skill cannot be overstated, as the greatest majority of birds detected during point counts can be heard but not seen.

Estimating distances to unseen birds is challenging because birds can sound louder or quieter depending on how far away they are, how much vegetation is present to muffle the sound, how loud they are actually singing, and the acoustic properties of the particular species' vocalizations. Nevertheless, observers can greatly improve their estimates with practice.

As with estimating distances to seen birds, measuring the actual distance to unseen birds is needed to assess the accuracy of the estimates. Measuring distances to unseen birds can be quite challenging, especially in habitats where thick undergrowth makes walking noisy or difficult. Singing birds will often retreat as the observer approaches, resulting in no measurement, or in a measurement that does not really reflect the distance to the bird when the estimate was made. A useful exercise for dealing with this problem is to have a group of observers remain at a mock point count location, while one or two others serve as 'scouts' who walk out of sight of the group and locate with certainty a singing bird. The scouts then call the group via walkie-talkie and call the group's attention to the located bird when it sings. Each member of the group independently estimates the distance to the singing bird, and the scouts then measure the actual distance from the bird back to the group. Although this exercise can be time-consuming and even feel tedious at times, it is worth the effort, and should be repeated with multiple species in a variety of habitats.

4. Conducting Point Counts

When Field Technicians can identify most species and have begun practicing distance estimation, part of each training day should be devoted to conducting simultaneous point counts. Working in groups of 2–6, Field Technicians should conduct practice point counts at the same time in the same location. At the end of each count, they should compare notes and discuss any discrepancies in the species detected and the estimated distances to them. Continue these simultaneous counts until there is consistency among observers in the species and distances recorded. While conducting these practice point counts, Field Technicians should adhere to all aspects of the field protocol (see SOP 6: Conducting Point Counts) with one possible exception: it is often more useful to shorten the duration of the practice point counts to 3 minutes rather than 5 minutes. This makes it easier for observers to remember when and where they heard specific vocalizations when they are discussing their results after the point count.

5. Identifying Plants and Collecting Habitat Data

Throughout the training session the trainer(s) need to teach the Field Technicians to identify all trees as well as the most common shrubs in the parks. Studying birds in different locations each morning should facilitate exposure to a wide variety of plant species and plant communities, but observers also will need to study plant guides and receive some instruction to be prepared to identify plants in high-elevation plant communities that will not likely be accessible during the training session.

The crew also should practice collecting habitat data, as a group, in order to standardize habitat classification, canopy cover assessment, and tree size class assessment (See SOP 7: Classifying Vegetation). Practice should occur in multiple habitats and should continue until crew-wide standardization is achieved.

6. Orienteering

During the training session, all Field Technicians must become proficient at off-trail orienteering, including the proper use of a compass, altimeter, and GPS unit, and the ability to read topographic maps. GPS signals are frequently unavailable in the NCCN parks, so observers must become proficient at determining their own location as well as traveling to a distant, unseen destination using only a compass and topographic map. These skills should be practiced until all observers are proficient.

7. Recording Data

Field Technicians must be instructed how to complete each of the data forms, and have an opportunity to practice completing them during training, so that questions can arise and be resolved before official data collection begins.

8. Conducting Transects

Once all constituent skills have been practiced, observers should conduct practice transects in small groups. Working in groups allows crew members to standardize the assessment of safe versus unsafe terrain, and test against one another their accuracy of pacing and following a compass bearing.

9. First Aid, Safety, and Emergency Procedures

Pairs of crew members will work together for up to a week at a time in remote, rugged areas of the large parks, with a substantial portion of each day spent working off-trail. It is, therefore, essential that everyone, to the extent possible, be prepared for emergency situations. Although providing full-scale training in wilderness first aid is beyond the scope of the landbird monitoring training program, we recommend at least requiring the crew to read and discuss in detail a simple wilderness first aid booklet prior to beginning data collection. Crews also should brainstorm potential responses to theoretical emergency situations, and have a clear understanding of what to do if a partner should become seriously injured or go missing.

10. Backcountry Rules and Ethics

Field Technicians should receive instruction on backcountry regulations for the large parks, including permit requirements and procedures, campsite restrictions, food storage, etc.

Note: Some of these rules differ among the parks. If possible, arrangements should be made for a backcountry ranger or other qualified NPS employee to meet with the crew to discuss these topics. Regardless, the Field Lead is responsible to ensure that all crew members understand the rules they must follow.

11. Coordination with Park Biologists

Arrangements should be made for crews to meet with Park Biologists and other personnel (for example, Data Manager, GIS Specialists) as needed. This will provide opportunities to:

- Clarify expectations and procedures for crews to notify Park Biologists of their schedule and whereabouts in the park.
- Arrange computer access, if needed.
- Arrange acquisition of gate keys, if needed.
- Clarify procedures for obtaining backcountry permits.
- Ensure that GIS data are collected to protocol.

Note: Park Biologists require at least 2–4 weeks (preferably even more) notice to arrange computer access, keys, etc., for individual crew members.

12. Computer Data Entry

During the pre-season training program, Field Technicians must receive adequate instruction on data entry procedures (see SOP 12: Date Entry and Verification), so that they can complete their data entry during the field season. If NPS computers are to be used for data entry, crew members may need security clearances or other specific authorization, which may have to be arranged well in advance of the field season.

Table 1. Bird species likely to be encountered in the North Coast and Cascades Network.

Common name	Genus	Species	Code[1]	NOCA[2]	OLYM[2]	MORA[2]	SAJH[2]	LEWI[3]
Red-throated Loon	*Gavia*	*stellata*	RTLO	NotRecorded	Possible	NotRecorded	NotRecorded	NotRecorded
Pacific Loon	*Gavia*	*pacifica*	PALO	NotRecorded	Possible	NotRecorded	IBPInventory	NotRecorded
Common Loon	*Gavia*	*immer*	COLO	IBPInventory	Possible	NotRecorded	Rare	NotRecorded
Pied-billed Grebe	*Podilymbus*	*podiceps*	PBGR	NotRecorded	Possible	NotRecorded	NotRecorded	NotRecorded
Horned Grebe	*Podiceps*	*auritus*	HOGR	NotRecorded	Possible	NotRecorded	NotRecorded	NotRecorded
Red-necked Grebe	*Podiceps*	*grisegena*	RNGR	NotRecorded	Possible	NotRecorded	NotRecorded	NotRecorded
Western Grebe	*Aechmophorus*	*occidentalis*	WEGR	Possible	Rare	NotRecorded	NotRecorded	NotRecorded
Black-footed Albatross	*Phoebastria*	*nigripes*	BFAL	NotRecorded	Possible	NotRecorded	NotRecorded	NotRecorded
Northern Fulmar	*Fulmarus*	*glacialis*	NOFU	NotRecorded	Possible	NotRecorded	NotRecorded	NotRecorded
Pink-footed Shearwater	*Puffinus*	*creatopus*	PFSH	NotRecorded	Possible	NotRecorded	NotRecorded	NotRecorded
Flesh-footed Shearwater	*Puffinus*	*carneipes*	FFSH	NotRecorded	Possible	NotRecorded	NotRecorded	NotRecorded
Sooty Shearwater	*Puffinus*	*griseus*	SOSH	NotRecorded	Possible	NotRecorded	NotRecorded	NotRecorded
Short-tailed Shearwater	*Puffinus*	*tenuirostris*	SRTS	NotRecorded	Possible	NotRecorded	NotRecorded	NotRecorded
Fork-tailed Storm-Petrel	*Oceanodroma*	*furcata*	FTSP	NotRecorded	Possible	NotRecorded	NotRecorded	NotRecorded
Leach's Storm-Petrel	*Oceanodroma*	*leucorhoa*	LESP	NotRecorded	Rare	NotRecorded	NotRecorded	NotRecorded
American White Pelican	*Pelecanus*	*erythrorhynchos*	AWPE	NotRecorded	Possible	NotRecorded	NotRecorded	NotRecorded
Brown Pelican	*Pelecanus*	*occidentalis*	BRPE	NotRecorded	Rare	NotRecorded	NotRecorded	NotRecorded
Brandt's Cormorant	*Phalacrocorax*	*penicillatus*	BRAC	NotRecorded	Possible	NotRecorded	NotRecorded	NotRecorded
Double-crested Cormorant	*Phalacrocorax*	*auritus*	DCCO	NotRecorded	Rare	NotRecorded	IBPInventory	IBPInventory
Pelagic Cormorant	*Phalacrocorax*	*pelagicus*	PECO	NotRecorded	Rare	NotRecorded	IBPInventory	NotRecorded
American Bittern	*Botaurus*	*lentiginosus*	AMBI	NotRecorded	Possible	NotRecorded	NotRecorded	NotRecorded
Great Blue Heron	*Ardea*	*herodias*	GBHE	Possible	Rare	Rare	NotRecorded	IBPInventory
Great Egret	*Ardea*	*alba*	GREG	NotRecorded	Possible	NotRecorded	NotRecorded	NotRecorded
Green Heron	*Butorides*	*virescens*	GRHE	NotRecorded	Possible	NotRecorded	NotRecorded	NotRecorded
Turkey Vulture	*Cathartes*	*aura*	TUVU	NotRecorded	Rare	Rare	Rare	Rare
Canada Goose	*Branta*	*canadensis*	CANG	Possible	Possible	IBPInventory	IBPInventory	IBPInventory
Wood Duck	*Aix*	*sponsa*	WODU	Possible	Rare	NotRecorded	NotRecorded	NotRecorded
Gadwall	*Anas*	*strepera*	GADW	NotRecorded	Possible	NotRecorded	Rare	NotRecorded
American Wigeon	*Anas*	*americana*	AMWI	Possible	Possible	NotRecorded	NotRecorded	NotRecorded
Mallard	*Anas*	*platyrhynchos*	MALL	IBPInventory	Rare	IBPInventory	Rare	IBPInventory
Blue-winged Teal	*Anas*	*discors*	BWTE	IBPInventory	Possible	NotRecorded	NotRecorded	NotRecorded
Cinnamon Teal	*Anas*	*cyanoptera*	CITE	Possible	Possible	NotRecorded	NotRecorded	NotRecorded
Northern Shoveler	*Anas*	*clypeata*	NSHO	Possible	Possible	NotRecorded	NotRecorded	NotRecorded
Green-winged Teal	*Anas*	*crecca*	GWTE	NotRecorded	Possible	NotRecorded	NotRecorded	NotRecorded
Canvasback	*Aythya*	*valisineria*	CANV	NotRecorded	Possible	NotRecorded	NotRecorded	NotRecorded
Ring-necked Duck	*Aythya*	*collaris*	RNDU	Rare	Possible	NotRecorded	NotRecorded	NotRecorded
Greater Scaup	*Aythya*	*marila*	GRSC	NotRecorded	Rare	NotRecorded	NotRecorded	NotRecorded
Lesser Scaup	*Aythya*	*affinis*	LESC	Possible	Possible	NotRecorded	NotRecorded	NotRecorded
Harlequin Duck	*Histrionicus*	*histrionicus*	HADU	Possible	Possible	Rare	NotRecorded	NotRecorded
Surf Scoter	*Melanitta*	*perspicillata*	SUSC	NotRecorded	Possible	NotRecorded	IBPInventory	NotRecorded
White-winged Scoter	*Melanitta*	*fusca*	WWSC	Possible	Rare	NotRecorded	IBPInventory	NotRecorded
Black Scoter	*Melanitta*	*nigra*	BLSC	NotRecorded	Possible	NotRecorded	NotRecorded	NotRecorded

Table 1. Bird species likely to be encountered in the North Coast and Cascades Network.—Continued

Common name	Genus	Species	Code[1]	NOCA[2]	OLYM[2]	MORA[2]	SAJH[2]	LEWI[3]
Long-tailed Duck	*Clangula*	*hyemalis*	LTDU	NotRecorded	Possible	NotRecorded	NotRecorded	NotRecorded
Bufflehead	*Bucephala*	*albeola*	BUFF	NotRecorded	Rare	NotRecorded	NotRecorded	NotRecorded
Barrow's Goldeneye	*Bucephala*	*islandica*	BAGO	IBPInventory	Rare	NotRecorded	NotRecorded	NotRecorded
Hooded Merganser	*Lophodytes*	*cucullatus*	HOME	Rare	Rare	NotRecorded	NotRecorded	NotRecorded
Common Merganser	*Mergus*	*merganser*	COME	Possible	Rare	NotRecorded	NotRecorded	NotRecorded
Red-breasted Merganser	*Mergus*	*serrator*	RBME	NotRecorded	Rare	NotRecorded	IBPInventory	NotRecorded
Ruddy Duck	*Oxyura*	*jamaicensis*	RUDU	NotRecorded	Possible	NotRecorded	NotRecorded	NotRecorded
Osprey	*Pandion*	*haliaetus*	OSPR	Possible	Rare	Rare	IBPInventory	IBPInventory
White-tailed Kite	*Elanus*	*leucurus*	WTKI	NotRecorded	Possible	NotRecorded	NotRecorded	NotRecorded
Bald Eagle	*Haliaeetus*	*leucocephalus*	BAEA	IBPInventory	Rare	NotRecorded	IBPInventory	IBPInventory
Northern Harrier	*Circus*	*cyaneus*	NOHA	NotRecorded	Possible	Rare	IBPInventory	Rare
Sharp-shinned Hawk	*Accipiter*	*striatus*	SSHA	Possible	Rare	Rare	NotRecorded	NotRecorded
Cooper's Hawk	*Accipiter*	*cooperii*	COHA	Possible	Possible	NotRecorded	Rare	NotRecorded
Northern Goshawk	*Accipiter*	*gentilis*	NOGO	IBPInventory	Possible	Rare	NotRecorded	NotRecorded
Red-tailed Hawk	*Buteo*	*jamaicensis*	RTHA	IBPInventory	Rare	Rare	IBPInventory	NotRecorded
Golden Eagle	*Aquila*	*chrysaetos*	GOEA	Possible	Possible	Rare	Rare	NotRecorded
American Kestrel	*Falco*	*sparverius*	AMKE	Possible	Rare	Rare	NotRecorded	NotRecorded
Merlin	*Falco*	*columbarius*	MERL	Possible	Possible	Rare	NotRecorded	NotRecorded
Peregrine Falcon	*Falco*	*peregrinus*	PEFA	Rare	Possible	NotRecorded	NotRecorded	NotRecorded
Ring-necked Pheasant	*Phasianus*	*colchicus*	RNEP	NotRecorded	Possible	NotRecorded	NotRecorded	NotRecorded
Ruffed Grouse	*Bonasa*	*umbellus*	RUGR	IBPInventory	IBPInventory	NotRecorded	NotRecorded	NotRecorded
White-tailed Ptarmigan	*Lagopus*	*leucura*	WTPT	Rare	NotRecorded	Rare	NotRecorded	NotRecorded
Sooty Grouse	*Dendragapus*	*fuliginosus*	SOGR	IBPInventory	IBPInventory	IBPInventory	NotRecorded	NotRecorded
Wild Turkey	*Meleagris*	*gallopavo*	WITU	NotRecorded	NotRecorded	NotRecorded	IBPInventory	NotRecorded
Mountain Quail	*Oreortyx*	*pictus*	MOUQ	NotRecorded	Possible	NotRecorded	NotRecorded	NotRecorded
California Quail	*Callipepla*	*californica*	CAQU	Possible	Rare	NotRecorded	IBPInventory	NotRecorded
Virginia Rail	*Rallus*	*limicola*	VIRA	NotRecorded	Rare	NotRecorded	NotRecorded	NotRecorded
Sora	*Porzana*	*carolina*	SORA	NotRecorded	Possible	NotRecorded	NotRecorded	NotRecorded
American Coot	*Fulica*	*americana*	AMCO	NotRecorded	Possible	NotRecorded	NotRecorded	NotRecorded
Sandhill Crane	*Grus*	*canadensis*	SACR	NotRecorded	Possible	NotRecorded	NotRecorded	NotRecorded
Snowy Plover	*Charadrius*	*alexandrinus*	SNPL	NotRecorded	Possible	NotRecorded	NotRecorded	NotRecorded
Semipalmated Plover	*Charadrius*	*semipalmatus*	SEPL	NotRecorded	Rare	NotRecorded	NotRecorded	NotRecorded
Killdeer	*Charadrius*	*vociferus*	KILL	Possible	Rare	NotRecorded	Rare	IBPInventory
Black Oystercatcher	*Haematopus*	*bachmani*	BLOY	NotRecorded	Rare	NotRecorded	IBPInventory	NotRecorded
Greater Yellowlegs	*Tringa*	*melanoleuca*	GRYE	NotRecorded	Rare	NotRecorded	NotRecorded	NotRecorded
Lesser Yellowlegs	*Tringa*	*flavipes*	LEYE	NotRecorded	Possible	NotRecorded	NotRecorded	NotRecorded
Willet	*Catoptrophorus*	*semipalmatus*	WILL	NotRecorded	Possible	NotRecorded	NotRecorded	NotRecorded
Spotted Sandpiper	*Actitis*	*macularius*	SPSA	IBPInventory	IBPInventory	Rare	Rare	IBPInventory
Whimbrel	*Numenius*	*phaeopus*	WHIM	NotRecorded	Rare	NotRecorded	NotRecorded	NotRecorded
Long-billed Curlew	*Numenius*	*americanus*	LBCU	NotRecorded	Possible	NotRecorded	NotRecorded	NotRecorded
Marbled Godwit	*Limosa*	*fedoa*	MAGO	NotRecorded	Rare	NotRecorded	NotRecorded	NotRecorded
Ruddy Turnstone	*Arenaria*	*interpres*	RUTU	NotRecorded	Possible	NotRecorded	NotRecorded	NotRecorded

Table 1. Bird species likely to be encountered in the North Coast and Cascades Network.—Continued

Common name	Genus	Species	Code[1]	NOCA[2]	OLYM[2]	MORA[2]	SAJH[2]	LEWI[3]
Black Turnstone	*Arenaria*	*melanocephala*	BLTU	NotRecorded	Possible	NotRecorded	NotRecorded	NotRecorded
Surfbird	*Aphriza*	*virgata*	SURF	NotRecorded	Possible	NotRecorded	NotRecorded	NotRecorded
Red Knot	*Calidris*	*canutus*	REKN	NotRecorded	Possible	NotRecorded	NotRecorded	NotRecorded
Sanderling	*Calidris*	*alba*	SAND	NotRecorded	Possible	NotRecorded	NotRecorded	NotRecorded
Western Sandpiper	*Calidris*	*mauri*	WESA	NotRecorded	Rare	NotRecorded	NotRecorded	NotRecorded
Least Sandpiper	*Calidris*	*minutilla*	LESA	NotRecorded	Rare	NotRecorded	NotRecorded	NotRecorded
Pectoral Sandpiper	*Calidiris*	*melanotos*	PESA	NotRecorded	Rare	NotRecorded	NotRecorded	NotRecorded
Dunlin	*Calidris*	*alpina*	DUNL	NotRecorded	Possible	NotRecorded	NotRecorded	NotRecorded
Short-billed Dowitcher	*Limnodromus*	*griseus*	SBDO	NotRecorded	Possible	NotRecorded	NotRecorded	NotRecorded
Long-billed Dowitcher	*Limnodromus*	*scolopaceus*	LBDO	NotRecorded	Possible	NotRecorded	NotRecorded	NotRecorded
Common Snipe	*Gallinago*	*gallinago*	COSN	NotRecorded	Possible	NotRecorded	NotRecorded	NotRecorded
Bonaparte's Gull	*Larus*	*philadelphia*	BOGU	Possible	Rare	NotRecorded	NotRecorded	NotRecorded
Heermann's Gull	*Larus*	*heermanni*	HEEG	NotRecorded	Possible	NotRecorded	NotRecorded	NotRecorded
Mew Gull	*Larus*	*canus*	MEGU	NotRecorded	Possible	NotRecorded	NotRecorded	NotRecorded
Ring-billed Gull	*Larus*	*delawarensis*	RBGU	Possible	Rare	NotRecorded	NotRecorded	NotRecorded
California Gull	*Larus*	*californicus*	CAGU	Possible	Possible	NotRecorded	NotRecorded	NotRecorded
Western Gull	*Larus*	*occidentalis*	WEGU	NotRecorded	Rare	NotRecorded	NotRecorded	IBPInventory
Glaucous-winged Gull	*Larus*	*glaucescens*	GWGU	Possible	Possible	NotRecorded	IBPInventory	NotRecorded
Black-legged Kittiwake	*Rissa*	*tridactyla*	BLKI	NotRecorded	Possible	NotRecorded	NotRecorded	NotRecorded
Caspian Tern	*Sterna*	*caspia*	CATE	NotRecorded	Possible	NotRecorded	NotRecorded	IBPInventory
Forster's Tern	*Sterna*	*forsteri*	FOTE	NotRecorded	Possible	NotRecorded	NotRecorded	NotRecorded
Common Murre	*Uria*	*aalge*	COMU	NotRecorded	Possible	NotRecorded	NotRecorded	NotRecorded
Pigeon Guillemot	*Cepphus*	*columba*	PIGU	NotRecorded	Rare	NotRecorded	Rare	NotRecorded
Marbled Murrelet	*Brachyramphus*	*marmoratus*	MAMU	NotRecorded	Rare	Rare	NotRecorded	NotRecorded
Ancient Murrelet	*Synthliboramphus*	*antiquus*	ANMU	NotRecorded	Possible	NotRecorded	NotRecorded	NotRecorded
Cassin's Auklet	*Ptychoramphus*	*aleuticus*	CAAU	NotRecorded	Possible	NotRecorded	NotRecorded	NotRecorded
Rhinoceros Auklet	*Cerorhinca*	*monocerata*	RHAU	NotRecorded	Possible	NotRecorded	Rare	NotRecorded
Horned Puffin	*Fratercula*	*corniculata*	HOPU	NotRecorded	Possible	NotRecorded	NotRecorded	NotRecorded
Tufted Puffin	*Fratercula*	*cirrhata*	TUPU	NotRecorded	Possible	NotRecorded	NotRecorded	NotRecorded
Rock Pigeon	*Columba*	*livia*	ROPI	NotRecorded	Possible	NotRecorded	NotRecorded	NotRecorded
Band-tailed Pigeon	*Patagioenas*	*fasciata*	BTPI	Possible	Rare	IBPInventory	IBPInventory	Rare
Mourning Dove	*Zenaida*	*macroura*	MODO	Rare	Rare	NotRecorded	NotRecorded	IBPInventory
Barn Owl	*Tyto*	*alba*	BANO	NotRecorded	Possible	NotRecorded	NotRecorded	NotRecorded
Western Screech-Owl	*Megascops*	*kennicottii*	WESO	IBPInventory	Possible	Rare	NotRecorded	NotRecorded
Great Horned Owl	*Bubo*	*virginianus*	GHOW	Possible	Possible	Rare	Rare	NotRecorded
Northern Pygmy-Owl	*Glaucidium*	*gnoma*	NOPO	IBPInventory	Rare	Rare	NotRecorded	NotRecorded
Spotted Owl	*Strix*	*occidentalis*	SPOW	Rare	Rare	NotRecorded	NotRecorded	NotRecorded
Barred Owl	*Strix*	*varia*	BADO	Possible	Rare	Rare	Rare	NotRecorded
Great Gray Owl	*Strix*	*nebulosa*	GGOW	NotRecorded	NotRecorded	NotRecorded	NotRecorded	NotRecorded
Long-eared Owl	*Asio*	*otus*	LEOW	NotRecorded	NotRecorded	NotRecorded	NotRecorded	NotRecorded
Short-eared Owl	*Asio*	*flammeus*	SEOW	NotRecorded	Possible	NotRecorded	NotRecorded	NotRecorded
Boreal Owl	*Aegolius*	*funereus*	BOOW	NotRecorded	NotRecorded	NotRecorded	NotRecorded	NotRecorded

Table 1. Bird species likely to be encountered in the North Coast and Cascades Network.—Continued

Common name	Genus	Species	Code[1]	NOCA[2]	OLYM[2]	MORA[2]	SAJH[2]	LEWI[3]
Northern Saw-whet Owl	*Aegolius*	*acadicus*	NSWO	NotRecorded	Possible	NotRecorded	NotRecorded	NotRecorded
Common Nighthawk	*Chordeiles*	*minor*	CONI	IBPInventory	Rare	Rare	Rare	NotRecorded
Black Swift	*Cypseloides*	*niger*	BLSW	IBPInventory	Possible	Rare	NotRecorded	NotRecorded
Vaux's Swift	*Chaetura*	*vauxi*	VASW	IBPInventory	IBPInventory	IBPInventory	NotRecorded	NotRecorded
Anna's Hummingbird	*Calypte*	*anna*	ANHU	IBPInventory	Possible	NotRecorded	NotRecorded	NotRecorded
Calliope Hummingbird	*Stellula*	*calliope*	CAHU	IBPInventory	NotRecorded	NotRecorded	NotRecorded	NotRecorded
Rufous Hummingbird	*Selasphorus*	*rufus*	RUHU	IBPInventory	IBPInventory	IBPInventory	IBPInventory	IBPInventory
Belted Kingfisher	*Ceryle*	*alcyon*	BEKI	IBPInventory	Rare	Rare	Rare	NotRecorded
Lewis's Woodpecker	*Melanerpes*	*lewis*	LEWO	NotRecorded	Possible	NotRecorded	NotRecorded	NotRecorded
Williamson's Sapsucker	*Sphyrapicus*	*thyroideus*	WISA	NotRecorded	NotRecorded	NotRecorded	NotRecorded	NotRecorded
Red-naped Sapsucker	*Sphyrapicus*	*nuchalis*	RNSA	IBPInventory	Rare	NotRecorded	NotRecorded	NotRecorded
Red-breasted Sapsucker	*Sphyrapicus*	*ruber*	RBSA	IBPInventory	IBPInventory	IBPInventory	NotRecorded	NotRecorded
Downy Woodpecker	*Picoides*	*pubescens*	DOWO	IBPInventory	IBPInventory	IBPInventory	Rare	NotRecorded
Hairy Woodpecker	*Picoides*	*villosus*	HAWO	IBPInventory	IBPInventory	IBPInventory	IBPInventory	IBPInventory
American Three-toed Woodpecker	*Picoides*	*dorsalis*	ATTW	Rare	NotRecorded	Rare	NotRecorded	NotRecorded
Black-backed Woodpecker	*Picoides*	*arcticus*	BBWO	NotRecorded	NotRecorded	NotRecorded	NotRecorded	NotRecorded
Northern Flicker	*Colaptes*	*auratus*	NOFL	IBPInventory	IBPInventory	IBPInventory	IBPInventory	NotRecorded
Pileated Woodpecker	*Dryocopus*	*pileatus*	PIWO	IBPInventory	IBPInventory	IBPInventory	IBPInventory	IBPInventory
Western Wood-Pewee	*Contopus*	*sordidulus*	WEWP	IBPInventory	Rare	IBPInventory	NotRecorded	NotRecorded
Willow Flycatcher	*Empidonax*	*traillii*	WIFL	IBPInventory	Rare	NotRecorded	IBPInventory	IBPInventory
Hammond's Flycatcher	*Empidonax*	*hammondii*	HAFL	IBPInventory	IBPInventory	IBPInventory	NotRecorded	NotRecorded
Dusky Flycatcher	*Empidonax*	*oberholseri*	DUFL	Possible	Possible	Rare	NotRecorded	NotRecorded
Pacific-slope Flycatcher	*Empidonax*	*difficilis*	PSFL	IBPInventory	IBPInventory	IBPInventory	IBPInventory	IBPInventory
Say's Phoebe	*Sayornis*	*saya*	SAPH	Rare	NotRecorded	NotRecorded	NotRecorded	NotRecorded
Least Flycatcher	*Empidonax*	*minimus*	LEFL	Rare	NotRecorded	NotRecorded	NotRecorded	NotRecorded
Western Kingbird	*Tyrannus*	*verticalis*	WEKI	Possible	Possible	NotRecorded	NotRecorded	NotRecorded
Cassin's Vireo	*Vireo*	*cassinii*	CAVI	IBPInventory	Rare	NotRecorded	IBPInventory	NotRecorded
Hutton's Vireo	*Vireo*	*huttoni*	HUVI	IBPInventory	IBPInventory	Rare	IBPInventory	IBPInventory
Warbling Vireo	*Vireo*	*gilvus*	WAVI	IBPInventory	IBPInventory	IBPInventory	IBPInventory	IBPInventory
Red-eyed Vireo	*Vireo*	*olivaceus*	REVI	IBPInventory	Possible	NotRecorded	NotRecorded	NotRecorded
Gray Jay	*Perisoreus*	*canadensis*	GRAJ	IBPInventory	IBPInventory	IBPInventory	NotRecorded	NotRecorded
Steller's Jay	*Cyanocitta*	*stelleri*	STJA	IBPInventory	IBPInventory	IBPInventory	NotRecorded	IBPInventory
Western Scrub-Jay	*Aphelocoma*	*californica*	WESJ	NotRecorded	Possible	NotRecorded	NotRecorded	NotRecorded
Clark's Nutcracker	*Nucifraga*	*columbiana*	CLNU	IBPInventory	Rare	IBPInventory	NotRecorded	NotRecorded
American Crow	*Corvus*	*brachyrhynchos*	AMCR	IBPInventory	IBPInventory	IBPInventory	NotRecorded	IBPInventory
Northwestern Crow	*Corvus*	*caurinus*	NOCR	NotRecorded	NotRecorded	NotRecorded	IBPInventory	NotRecorded
Common Raven	*Corvus*	*corax*	CORA	IBPInventory	Rare	IBPInventory	IBPInventory	IBPInventory
Horned Lark	*Eremophila*	*alpestris*	HOLA	NotRecorded	Rare	NotRecorded	NotRecorded	NotRecorded
Purple Martin	*Progne*	*subis*	PUMA	NotRecorded	Possible	NotRecorded	Rare	NotRecorded
Tree Swallow	*Tachycineta*	*bicolor*	TRES	Possible	Rare	IBPInventory	IBPInventory	NotRecorded
Violet-green Swallow	*Tachycineta*	*thalassina*	VGSW	IBPInventory	Rare	IBPInventory	IBPInventory	IBPInventory

Table 1. Bird species likely to be encountered in the North Coast and Cascades Network.—Continued

Common name	Genus	Species	Code[1]	NOCA[2]	OLYM[2]	MORA[2]	SAJH[2]	LEWI[3]
Northern Rough-winged Swallow	*Stelgidopteryx*	*serripennis*	NRWS	IBPInventory	Rare	NotRecorded	IBPInventory	NotRecorded
Cliff Swallow	*Petrochelidon*	*pyrrhonota*	CLSW	IBPInventory	Rare	NotRecorded	IBPInventory	IBPInventory
Barn Swallow	*Hirundo*	*rustica*	BARS	Possible	Rare	Rare	IBPInventory	IBPInventory
Black-capped Chickadee	*Poecile*	*atricapillus*	BCCH	IBPInventory	IBPInventory	NotRecorded	NotRecorded	IBPInventory
Mountain Chickadee	*Poecile*	*gambeli*	MOCH	IBPInventory	Possible	IBPInventory	NotRecorded	NotRecorded
Chestnut-backed Chickadee	*Poecile*	*rufescens*	CBCH	IBPInventory	IBPInventory	IBPInventory	IBPInventory	IBPInventory
Bushtit	*Psaltriparus*	*minimus*	BUSH	IBPInventory	Possible	Rare	IBPInventory	NotRecorded
Red-breasted Nuthatch	*Sitta*	*canadensis*	RBNU	IBPInventory	IBPInventory	IBPInventory	IBPInventory	IBPInventory
White-breasted Nuthatch	*Sitta*	*carolinensis*	WBNU	IBPInventory	NotRecorded	NotRecorded	NotRecorded	NotRecorded
Brown Creeper	*Certhia*	*americana*	BRCR	IBPInventory	IBPInventory	IBPInventory	IBPInventory	IBPInventory
Rock Wren	*Salpinctes*	*obsoletus*	ROWR	Possible	Possible	NotRecorded	NotRecorded	NotRecorded
Canyon Wren	*Catherpes*	*mexicanus*	CANW	Rare	NotRecorded	Rare	NotRecorded	NotRecorded
Bewick's Wren	*Thryomanes*	*bewickii*	BEWR	NotRecorded	Possible	NotRecorded	IBPInventory	NotRecorded
House Wren	*Troglodytes*	*aedon*	HOWR	IBPInventory	Possible	NotRecorded	IBPInventory	NotRecorded
Winter Wren	*Troglodytes*	*troglodytes*	WIWR	IBPInventory	IBPInventory	IBPInventory	IBPInventory	IBPInventory
Marsh Wren	*Cistothorus*	*palustris*	MAWR	IBPInventory	Rare	NotRecorded	IBPInventory	IBPInventory
American Dipper	*Cinclus*	*mexicanus*	AMDI	IBPInventory	IBPInventory	IBPInventory	NotRecorded	NotRecorded
Golden-crowned Kinglet	*Regulus*	*satrapa*	GCKI	IBPInventory	IBPInventory	IBPInventory	IBPInventory	IBPInventory
Ruby-crowned Kinglet	*Regulus*	*calendula*	RCKI	IBPInventory	Rare	Rare	NotRecorded	NotRecorded
Western Bluebird	*Sialia*	*mexicana*	WEBL	IBPInventory	Possible	NotRecorded	NotRecorded	NotRecorded
Mountain Bluebird	*Sialia*	*currucoides*	MOBL	Rare	Possible	Rare	NotRecorded	NotRecorded
Townsend's Solitaire	*Myadestes*	*townsendi*	TOSO	IBPInventory	IBPInventory	Rare	NotRecorded	NotRecorded
Veery	*Catharus*	*fuscescens*	VEER	IBPInventory	NotRecorded	NotRecorded	NotRecorded	NotRecorded
Swainson's Thrush	*Catharus*	*ustulatus*	SWTH	IBPInventory	IBPInventory	IBPInventory	IBPInventory	IBPInventory
Hermit Thrush	*Catharus*	*guttatus*	HETH	IBPInventory	IBPInventory	IBPInventory	NotRecorded	NotRecorded
American Robin	*Turdus*	*migratorius*	AMRO	IBPInventory	IBPInventory	IBPInventory	IBPInventory	IBPInventory
Varied Thrush	*Ixoreus*	*naevius*	VATH	IBPInventory	IBPInventory	IBPInventory	Rare	NotRecorded
Gray Catbird	*Dumetella*	*carolinensis*	GRCA	Rare	NotRecorded	NotRecorded	NotRecorded	NotRecorded
Northern Mockingbird	*Mimus*	*polyglottos*	NOMO	NotRecorded	Possible	NotRecorded	NotRecorded	NotRecorded
European Starling	*Sturnus*	*vulgaris*	EUST	IBPInventory	Rare	NotRecorded	IBPInventory	IBPInventory
American Pipit	*Anthus*	*rubescens*	AMPI	Possible	Rare	IBPInventory	NotRecorded	NotRecorded
Bohemian Waxwing	*Bombycilla*	*garrulus*	BOWA	Possible	NotRecorded	NotRecorded	NotRecorded	NotRecorded
Cedar Waxwing	*Bombycilla*	*cedrorum*	CEDW	IBPInventory	IBPInventory	IBPInventory	NotRecorded	IBPInventory
Orange-crowned Warbler	*Vermivora*	*celata*	OCWA	IBPInventory	IBPInventory	IBPInventory	IBPInventory	IBPInventory
Nashville Warbler	*Vermivora*	*ruficapilla*	NAWA	IBPInventory	NotRecorded	NotRecorded	NotRecorded	NotRecorded
Yellow Warbler	*Dendroica*	*petechia*	YWAR	IBPInventory	Rare	IBPInventory	IBPInventory	IBPInventory
Yellow-rumped Warbler	*Dendroica*	*coronata*	YRWA	Possible	Possible	IBPInventory	IBPInventory	IBPInventory
Black-throated Gray Warbler	*Dendroica*	*nigrescens*	BTYW	IBPInventory	IBPInventory	IBPInventory	IBPInventory	IBPInventory
Townsend's Warbler	*Dendroica*	*townsendi*	TOWA	IBPInventory	IBPInventory	IBPInventory	IBPInventory	IBPInventory
Townsend's x Hermit Warbler Hybrid	*Dendroica*	*townsendi x occi.*	THWH	NotRecorded	Rare	Rare	NotRecorded	IBPInventory
Hermit Warbler	*Dendroica*	*occidentalis*	HEWA	NotRecorded	Possible	Rare	NotRecorded	IBPInventory

Table 1. Bird species likely to be encountered in the North Coast and Cascades Network.—Continued

Common name	Genus	Species	Code[1]	NOCA[2]	OLYM[2]	MORA[2]	SAJH[2]	LEWI[3]
American Redstart	*Setophaga*	*ruticilla*	AMRE	Rare	NotRecorded	NotRecorded	NotRecorded	NotRecorded
MacGillivray's Warbler	*Oporornis*	*tolmiei*	MGWA	IBPInventory	IBPInventory	IBPInventory	IBPInventory	NotRecorded
Common Yellowthroat	*Geothlypis*	*trichas*	COYE	IBPInventory	Rare	Rare	IBPInventory	IBPInventory
Wilson's Warbler	*Wilsonia*	*pusilla*	WIWA	IBPInventory	IBPInventory	IBPInventory	IBPInventory	IBPInventory
Western Tanager	*Piranga*	*ludoviciana*	WETA	IBPInventory	IBPInventory	IBPInventory	IBPInventory	IBPInventory
Spotted Towhee	*Pipilo*	*maculatus*	SPTO	IBPInventory	IBPInventory	IBPInventory	IBPInventory	IBPInventory
Chipping Sparrow	*Spizella*	*passerina*	CHSP	IBPInventory	Rare	IBPInventory	IBPInventory	NotRecorded
Vesper Sparrow	*Pooecetes*	*gramineus*	VESP	Rare	Rare	NotRecorded	IBPInventory	NotRecorded
Savannah Sparrow	*Passerculus*	*sandwichensis*	SAVS	Possible	Rare	NotRecorded	IBPInventory	IBPInventory
Fox Sparrow	*Passerella*	*iliaca*	FOSP	IBPInventory	Rare	IBPInventory	NotRecorded	NotRecorded
Song Sparrow	*Melospiza*	*melodia*	SOSP	IBPInventory	IBPInventory	IBPInventory	IBPInventory	IBPInventory
Lincoln's Sparrow	*Melospiza*	*lincolnii*	LISP	Rare	Possible	Rare	NotRecorded	NotRecorded
White-crowned Sparrow	*Zonotrichia*	*leucophrys*	WCSP	IBPInventory	Rare	IBPInventory	IBPInventory	IBPInventory
Golden-crowned Sparrow	*Zonotrichia*	*atricapilla*	GCSP	NotRecorded	IBPInventory	NotRecorded	NotRecorded	NotRecorded
Dark-eyed Junco	*Junco*	*hyemalis*	DEJU	Possible	Possible	NotRecorded	IBPInventory	IBPInventory
Black-headed Grosbeak	*Pheucticus*	*melanocephalus*	BHGR	IBPInventory	IBPInventory	IBPInventory	IBPInventory	IBPInventory
Lazuli Bunting	*Passerina*	*amoena*	LAZB	IBPInventory	NotRecorded	NotRecorded	NotRecorded	NotRecorded
Red-winged Blackbird	*Agelaius*	*phoeniceus*	RWBL	Possible	Rare	Rare	IBPInventory	IBPInventory
Western Meadowlark	*Sturnella*	*neglecta*	WEME	NotRecorded	Possible	NotRecorded	NotRecorded	NotRecorded
Yellow-headed Blackbird	*Xanthocephalus*	*xanthocephalus*	YHBL	NotRecorded	Possible	NotRecorded	NotRecorded	NotRecorded
Brewer's Blackbird	*Euphagus*	*cyanocephalus*	BRBL	Possible	Possible	NotRecorded	IBPInventory	IBPInventory
Brown-headed Cowbird	*Molothrus*	*ater*	BHCO	IBPInventory	Rare	IBPInventory	IBPInventory	IBPInventory
Bullock's Oriole	*Icterus*	*bullockii*	BUOR	Rare	Possible	NotRecorded	NotRecorded	NotRecorded
Gray-crowned Rosy-Finch	*Leucosticte*	*tephrocotis*	GCRF	IBPInventory	Rare	IBPInventory	NotRecorded	NotRecorded
Pine Grosbeak	*Pinicola*	*enucleator*	PIGR	IBPInventory	Rare	Rare	NotRecorded	NotRecorded
Purple Finch	*Carpodacus*	*purpureus*	PUFI	IBPInventory	IBPInventory	NotRecorded	IBPInventory	IBPInventory
Cassin's Finch	*Carpodacus*	*cassinii*	CAFI	IBPInventory	NotRecorded	Rare	NotRecorded	NotRecorded
House Finch	*Carpodacus*	*mexicanus*	HOFI	IBPInventory	Possible	NotRecorded	IBPInventory	NotRecorded
Red Crossbill	*Loxia*	*curvirostra*	RECR	IBPInventory	IBPInventory	IBPInventory	IBPInventory	IBPInventory
White-winged Crossbill	*Loxia*	*leucoptera*	WWCR	Rare	NotRecorded	NotRecorded	NotRecorded	NotRecorded
Pine Siskin	*Carduelis*	*pinus*	PISI	IBPInventory	IBPInventory	IBPInventory	IBPInventory	IBPInventory
American Goldfinch	*Carduelis*	*tristis*	AMGO	IBPInventory	IBPInventory	Rare	IBPInventory	IBPInventory
Evening Grosbeak	*Coccothraustes*	*vespertinus*	EVGR	IBPInventory	Rare	IBPInventory	NotRecorded	NotRecorded
House Sparrow	*Passer*	*domesticus*	HOSP	NotRecorded	Possible	NotRecorded	NotRecorded	NotRecorded

[2]These four-letter codes should be used to indicate species on the point count data forms.

[2]'IBPInventory' indicates species that were documented in the indicated park during the landbird inventory. 'Rare' indicates a species that was documented in the indicated park during the landbird inventory, but nevertheless must be documented with the completion of a Rare Bird Report Form (see SOP 8: Reporting Rare Birds) whenever a rare bird is detected in the park. 'Possible' indicates a species that was not detected during the landbird inventory of the indicated park, but is nevertheless suspected to occur in the park; detection of such species should be documented with a Rare Bird Report Form. 'NotRecorded' indicates a species that was not detected during the landbird inventory at the indicated park; detection of such species should be documented with a Rare Bird Report Form.

[3]Codes are identical to those used for the other parks, but the landbird inventory at LEWI was only partially completed, so many relatively common species may appear here as 'NotRecorded'.

Landbird Monitoring Protocol for National Parks in the North Coast and Cascades Network

Standard Operating Procedure (SOP) 4:

Field Tour Preparation

Revision History Log:

Revision Date	Author	Changes Made	Reason for Change

This SOP details procedures for preparing to go on a 'field tour' (generally ± 1 week of continuous work), including determining which transects to sample, planning travel routes, arranging travel logistics, securing permits, and assembling field equipment and food.

1. Determining Which Transects to Sample

Before beginning a field tour, crews must determine which transects to sample on the tour. The Field Lead should provide a list of transects to be sampled and the elevation strata to which they belong. Transects should be sampled as seasonal phenology allows, with the low-elevation sites visited early in the season and high-elevation sites visited as the season progresses. Once a transect has been sampled, it should be marked as such on the season's transect list. The Field Lead should determine which transects should be sampled during the upcoming tour by referring to the transect list and considering elevation and accessibility. Once the set of transects to be sampled has been established, maps for each of the transects should be assembled. All survey maps should have been prepared prior to the beginning of the field season (SOP 1: Preparing for the Field Season). For transects that have been sampled in previous years, transect summary information should be compiled and taken into the field to assist in locating sample points.

2. Planning Travel Routes, Arranging Travel Logistics, and Securing Backcountry Permits

Careful consideration should be given to determining a travel route and order for sampling the transects. If one or more of the transects has been sampled in a previous year, information on accessing them should be available and referred to in determining travel routes. In planning their routes, observers should examine trail maps to determine accessibility. If current trail conditions are not already known, they should be checked at the proper ranger station to ensure that passes and necessary trails are open. If special travel methods need to be organized, such as boat transport or car rides to trailheads, those should be organized as soon as possible. Backcountry camping and travel permits, if necessary, also must be secured. Finally, the trip itinerary should be provided to the Project Lead and the appropriate Park Biologist, who must then be contacted again when the crew returns from the field.

3. Field Gear

Crew members should take care to bring all necessary clothing and equipment into the backcountry. Shared equipment likely will include: a tent, a stove, a ground tarp, a water purification filter, and cookware. Individual camping equipment should include: a sleeping bag and pad, a backpack, a day pack (or something suitable for carrying food and field equipment while conducting transects), waterproof rain pants and jacket, a flashlight, and warm clothing (wool or polypropylene).

Survey equipment (per person) should include the following:

- Compass
- Clipboard
- GPS unit
- Safety whistle
- Clinometer
- Flagging
- Aluminum flags
- Hammer and nails
- Data forms and maps
- Altimeter
- Thermometer
- Pens or pencils
- Binoculars
- Ground stakes
- Walkie-talkie
- First aid kit

4. Food

The final consideration to make before entering the backcountry on a field tour is to carry enough food to support each person for the duration of the tour. Crew members should keep in mind that they will be working long days and hiking both on- and off-trail for much of the day during each day spent in the field. Caloric requirements can be higher than usual. At the same time, space (and weight) is often at a premium, and time for preparation may be limited. Dinners typically are shared between crew members; all other food typically is taken care of on an individual basis. All food taken into the backcountry should be stored in bear-proof food containers at all times.

Landbird Monitoring Protocol for National Parks in the North Coast and Cascades Network

Standard Operating Procedure (SOP) 5:

Establishing, Relocating, and Describing Survey Points

Revision History Log:

Revision Date	Author	Changes Made	Reason for Change

This SOP explains the procedures for establishing, marking, and relocating sampling points in the three large parks (MORA, NOCA, and OLYM), including completion of the Point Establishment Form and the Transect Visit Log. Note that all data forms referred to in this SOP are at the end of the SOP. Procedures for establishing, marking, and relocating sampling points in the small parks (LEWI and SAJH) differ somewhat, and the differences are addressed in SOP 17: Special Considerations for Small Parks. **Detailed instructions for collecting location coordinates are not provided in this SOP, but instead are presented in** SOP 10: Collecting GPS Data.

1. Establishing a New Transect

A. Day Before Conducting Point Counts

A pair of observers will split up to conduct the two halves of a single transect during each morning of sampling. For each transect, observers will be given maps and coordinates indicating a transect 'origin' point that lies on a trail or road. Observers should make every effort to reach this point the afternoon before the planned survey. If camp has been established somewhere prior to reaching the transect origin, the observers may be tempted to forego visiting the site until the morning of the survey, but this should be avoided, as it is likely to lead to delays and problems the following morning if the point proves difficult to locate. Additionally, by timing the trip back from the origin point to camp, observers can determine with certainty what time they will need to set out towards the point in the morning.

The first time a transect is surveyed (the serially alternating portion of the sample design ensures that this will happen for at least the first 5 years of the project), the observers should mark the origin point and the first survey point in each direction along the transect. Instructions for installing permanent markers are provided in Section 4, Installing Permanent Markers of this SOP.

In addition to marking the origin point, observers should mark the first two off-trail points of the transect (the first point on each transect half). These usually will be the first two points of the transect, but if, for example, the first two points heading northeast need to be placed on the trail, the first northeast point would not be marked, but instead the third northeast point—the first one to be conducted off-trail—should be marked.

The first two off-trail points should be marked using the guidelines in Section 4, Installing Permanent Markers of this SOP. These points can be marked the afternoon before the point counts are conducted, or the following morning, after the point counts have been completed. Either way, observers must be sure to record all relevant information in the Permanent Marker Information section at the bottom of the Point Establishment Form for the appropriate points.

Once the origin point and the first two off-trail points have been marked, the observers can return to camp for the night. They should be sure to time the walk, so that the proper time to leave camp the next morning can be determined.

B. Day of Point Count Survey

Observers should arrive at the transect origin the next morning with plenty of time to then separate and reach their first point count stations, such that their first point counts can begin within 10 minutes of official sunrise.

Determining Direction of Travel When Establishing a New Transect

The direction of travel from the transect origin to the first point count station in each direction should be determined as follows:

a. Using a topographic map and a ruler, rotate the ruler around the origin point until the ruler intersects the trail at a distance of 200 m from the origin point. Mark this 200-m linear intersection from the origin point on both lengths of the trail. If this segment of trail is straight, then simply mark the points that are 200 m 'up trail' and 200 m 'down trail' from the origin. If the trail bends or turns, however, mark points instead that are 200 m from the origin, 'as the crow flies'.

b. Place the ruler on the map with the edge touching both of the 200-m intersections and draw a line between the two points (now known as the 'perpendicular line').

c. Place the edge of the ruler on the origin point and rotate the ruler until it forms a right angle with the newly drawn perpendicular line. Hold the ruler at this right angle and draw a line on the map along the edge of the ruler; this is the direction of travel indicator line.

d. The direction of off-trail travel is the cardinal or semi-cardinal direction (NN, NE, EE, SE, SS, SW, WW, or NW) that most closely matches the travel indicator line drawn on the map.

The direction of travel selected will determine the name of the points on each half of the transect. Each point is named with a unique 8-character string that consists of the transect number + the direction of travel from the origin point + the sequential point number along that half of the transect. For example, if an observer heads southwest from origin point 3005, the first point will be called 3005SW01, the second point will be called 3005SW02, and so on. Even if for some reason the observer must change direction somewhere along the transect, all points surveyed on that half-transect will still be named according to the original direction of travel; in this case, they will all contain 'SW'.

Note: Traveling due north from the origin point would yield points with "NN" in their names, due south would yield points with "SS", and so on.

Once the direction of off-trail travel has been determined, use pacing to measure 100 m in the indicated direction. Use vinyl flagging to mark the route, with flags spaced such that the next flag is visible from each flag. Stop at 100 m, and use a different color flag to mark the first point count station. Then conduct a point count, following the instructions in SOP 6: Conducting Point Counts.

After conducting the first point count, continue walking in the same cardinal or semi-cardinal direction followed to reach the first point count station. Fifty meters out from the point count station, leave two flags of the same color as the route-marking flags right next to each other. This double flag serves two functions. It signals the boundary of the vegetation plot when you return later to assess the vegetation at the point count station, and it also will warn that you are nearing a survey point, and prevent you from accidentally bypassing the point when you return to collect vegetation data. Then continue on to the remainder of the points, remembering to flag the route, to place a double flag 50 m beyond each point, and to mark each point with a flag that is a different color than the route-marking flags.

What to Do When an Obstacle is Encountered

In some instances, it will not be possible to travel 100 m off-trail in the indicated direction, or for that matter, in any off-trail direction, from the transect origin. This will most commonly occur where the trail crosses very steep terrain, or where it lies adjacent to an uncrossable stream. When this occurs, travel 100 m along the trail instead, in whichever direction that will lead farther away from your partner's planned route. Conduct the first point count on the trail, using pacing, the field map, and the GPS unit to ensure that the point is 100 m from the origin, as the crow flies.

Note: If there are switchbacks or the trail doubles back, then it may be necessary to walk more than 100 m to end up 100 m from the origin.

Name the point (and all subsequent points) according to the cardinal or semi-cardinal direction that most closely approximates the direction the trail follows between the origin and the point. Do not install a permanent marker at the first point count station if it lies on the trail. After conducting a point count at the point, assess again whether it is now possible to walk 200 m perpendicular to the trail. If it is, then proceed in that direction for the duration of the transect. If the path is still blocked by an obstacle, continue along the trail, placing additional points at 200-m intervals (as the crow flies) along the trail. After each point count, leave the trail and head off-trail in the manner described above if it is possible. If and when it is finally possible to conduct a point count off-trail, install a permanent marker at the point according to the procedures described in Section 4, Installing Permanent Markers of this SOP.

Observers will sometimes encounter impassable obstacles, such as cliffs or rivers, between successive off-trail points. In this situation, the direction of travel should be revised as follows:

i. If you have already left the previous point count station, you must return to it before altering your direction of travel. Then assess the directions defined by the original direction of travel ± 45º. If both appear traversable, randomly select one of them, and then follow it for the remainder of the transect (unless another barrier is encountered). If one direction is traversable and the other is not, follow the traversable one for the remainder of the transect. If neither direction is traversable, assess the directions defined by the original direction ± 90º, in the same manner as described above.

ii. Follow this new direction of travel for the duration of the transect unless another impassable barrier is encountered, in which case follow the above methods again to determine another new direction of travel. Regardless of how many times the direction of travel must be changed, all points along the half-transect will be named according to the original direction of travel, the one followed to reach the first point from the transect origin.

When establishing a new transect, both observers must be careful to ensure they do not allow their separate halves of the transect to overlap with one another. Observers should examine the topographic map and coordinate with one another in planning their intended travel routes before beginning the transect. All survey points must be placed at least 200 m from one another.

Observers should stop conducting point counts when another point count cannot be completed before 3.5 hours after sunrise.

2. Relocating an Existing Transect

A. Day Before Conducting Point Counts

As when establishing a new transect, observers should find the transect origin point the afternoon prior to conducting the point count survey. If the origin point was marked in a previous year, and can be relocated, do not complete the Permanent Marker Information section on the Point Establishment Form. If the previously installed marker cannot be relocated, a new marker must be installed, and the Permanent Marker Information section of the Point Establishment Form for the transect origin must be completed. Detailed instructions for installing permanent markers are provided in Section 4, Installing Permanent Markers of this SOP.

When visiting a transect that was marked previously, the last task before heading back to camp the afternoon prior to conducting the survey is to find the markers that were placed at the first two off-trail point count stations (first off-trail station in each direction). Using the information provided from the Point Establishment Forms that were completed when the points were marked in a previous year, follow the indicated bearing for 100 m in each direction, and find the markers indicating where the morning's first two point counts should be conducted. As with finding the marker for the transect origin, if a marker that was placed during a previous visit cannot be relocated, it is necessary to install a new permanent marker and complete the Permanent Marker Information section of the Point Establishment Form. Be sure to note in the Marker Comments section that the previously installed marker could not be relocated. Then use flagging to mark the point conspicuously, and also to indicate the route between the transect origin and the first survey point. This will save time and effort in the morning.

B. Day of Point Count Survey

As when conducting a new transect, observers should be in place to conduct their first point counts at the correct location within 10 minutes of official sunrise. After completing the first point count, the bearing and directions provided on the Point Establishment Form from a previous year should be followed to orienteer to each successive point count station along the transect. Every effort should be made to conduct point counts at all previously established point count stations before 3.5 hours after sunrise. Occasionally, this may not be possible; however, no point counts should be conducted later than 3.5 hours after sunrise, even if this means that one or more points will go un-surveyed. Conversely, sometimes an established transect will be completed well before 3.5 hours after sunrise. In this circumstance, continue in the same direction of travel, and establish and survey as many more points as can be completed before 3.5 hours after sunrise.

3. Completing Point Establishment Form

After completing the last point count for the morning, take a rest if needed. Then start retracing the route back toward the transect origin, collecting flagging along the way. When establishing new points, complete a Habitat Assessment Form (see SOP 7: Classifying Vegetation), and a Point Establishment Form for each point. When surveying points that have been surveyed previously, complete the Point Establishment Form only if the following circumstances arise:

a. In the field, if all or part of an established transect has become inaccessible due to some change (a landslide, for example) since the time the transect was last visited, it is necessary to re-route the transect.

b. You believe that you are not at the location where the previous observer conducted the point count, and for whatever reason you are unable to get to that location.

c. You wish to correct or improve upon the previous observer's description of the point or the travel features (see explanation of the Point Establishment Form, below).

When surveying points that have been surveyed previously, and none of the three conditions above applies, it is not necessary to complete a full Point Establishment Form; rather, a Point Revisit Form, which is simply an abbreviated version of the Point Establishment Form, may be completed.

Note: Each field on the Point Revisit Form should be completed according to the instructions for the corresponding field on the Point Establishment Form.

The Point Establishment Form Should be completed as follows.

Park: Enter LEWI, MORA, NOCA OLYM, or SAJH.

Transect: Enter the 4-digit transect number.

Date: Enter the date as mm/dd/yyyy

Observer: Enter the first and last name of the observer.

Point: Enter the 4-character point name. The first two characters indicate the cardinal or semi-cardinal direction traveled from the origin point to the first point (for example, NW for northwest, or NN for north). The last two characters indicate the sequential order of the point along the half-transect, starting from the origin point (for example, the first point surveyed by an observer who traveled northwest from the origin to the first point would be NW01; the second point would be NW02, even if the observer encountered a barrier and had to change directions after the first point count.) When completing a Point Establishment Form for the origin point, simply enter 'T.O.' (Transect Origin).

Point Type: Circle 'Origin' if the point is an origin point; otherwise circle 'Survey'.

Bearing to Point: Enter the compass bearing (in declinated degrees) to the point, from the previous point (or from the origin point, if completing for point 01). Leave this space blank on the Point Establishment Form for the origin point. If the trail was deliberately followed, rather than an off-trail bearing, to the present point, then write 'Trail' rather than providing a compass bearing.

Change of Direction: Enter 'Y' if it was necessary to change the direction of travel to reach this point (that is, if it was necessary to change direction after conducting the previous point count). Enter 'N' if direction was not changed, or when completing the form for the origin point or for the first point on either half-transect.

Reason: If 'Y' was entered for Change of Direction, provide here a brief explanation of why you had to change directions. Example entries include 'Steep slope' or 'Un-crossable stream'.

Coordinate Source: Circle 'Map' if coordinates could not be obtained from a GPS unit, and instead the location was estimated solely by using the field map. Circle 'GPS' if coordinates were obtained from the GPS unit.

Elevation: Enter the elevation and indicate whether the units are feet or meters.

Elevation Source: Circle the primary method used to obtain the elevation (Altimeter=altimeter and map; GPS=high-quality GPS unit and map; map=map only). Do not use elevation measurements obtained from Garmin or equivalent GPS units.

Slope at Point: Use a clinometer to estimate the slope in degrees.

Aspect at Point: Enter the aspect in degrees.

GPS Model: Enter name of the GPS unit you are using (example: "Thales Mobile Mapper").

GPS File Name: Enter the name the GPS unit assigned to the file for this survey point. Leave blank if no GPS file was produced.

Easting: UTM easting (based on NAD83) of the survey point.

Northing: UTM northing (based on NAD83) of the survey point.

GPS Error: Error in meters, as provided by the GPS unit. Leave blank if no GPS unit was used.

Datum: Enter the datum on which the coordinates are based. Field maps are based on NAD83.

Travel Feature 1: Indicate a prominent landscape feature (for example, a creek or a ridgetop) encountered along the way between the previous point and the indicated point. Include the name of the landscape feature if it is indicated on the topographic map.

Distance from previous point: The approximate distance (based on pacing) from the previous point to the indicated landscape feature.

Travel Feature 2: Indicate a second prominent landscape feature (if available) encountered along the way between the previous point and the indicated point. Include the name of the landscape feature if it is indicated on the topographic map.

Distance from previous point: The approximate distance (based on pacing) from the previous point to the indicated landscape feature.

Travel Feature 3: Indicate a third prominent landscape feature (if available) encountered along the way between the previous point and the indicated point. Include the name of the landscape feature if it is indicated on the topographic map.

Distance from previous point: The approximate distance (based on pacing) from the previous point to the indicated landscape feature.

Travel Feature 4: Indicate a fourth prominent landscape feature (if available) encountered along the way between the previous point and the indicated point. Include the name of the landscape feature if it is indicated on the topographic map.

Distance from previous point: The approximate distance (based on pacing) from the previous point to the indicated landscape feature.

Notes regarding travel between points: Provide any additional notes that might assist subsequent observers in finding their way to the correct place to conduct the point count.

Photo Frame #: Enter the frame number on the digital camera if a photograph was taken at the sample point.

Description: Enter a brief description of the contents of the photograph (or leave blank if no photograph was taken).

File name: Enter the final digital file name of the photograph after returning to the office, downloading the camera, and renaming the file(s). Leave blank if no photograph was taken.

Conspicuous Features Seen from Point

Description: Indicate up to three visible features that will help future observers confirm they are at the correct location. Visible features could include permanent geographical features (such as peaks or ridgelines) or conspicuous features closer to the point, such as boulders, bodies of water, or large, distinctive trees.

Distance (m): Indicate the distance from the survey point to the feature.

Bearing (º): Provide the declinated compass bearing *from the survey point to the feature*.

Frame #: Enter the frame number on the digital camera if a photograph was taken of the feature. Write the final digital file name in the margin upon returning to the office, downloading the camera, and renaming the file(s).

Description of Point: Provide any additional notes that might assist subsequent observers in confirming that they are in the right location.

Permanent Marker Information: See Section 4, Installing Permanent Markers of this SOP.

4. Installing Permanent Markers

Follow the instructions below when installing a permanent marker at an origin point or the first off-trail point count station on either half of the transect. No other point count stations should receive permanent markers.

If there are trees within 20 m of the point, use an aluminum tag to mark the nearest tree, or another nearby tree if for some reason a nearby tree is more prominent than the nearest tree. Use a nail to inscribe the tag with the following information:

- [4-character park code] + “I&M” (example: NOCA I&M)
- “Bird Mon.”
- Transect number + “T.O.” (for transect origin; for example, 4035T.O.) or transect number + direction of travel + point number (for point count stations; for example, 4035SS01)
- Today’s date (mm/dd/yyyy)

Then use a permanent marker pen to write the same information again on the other side of the tag. Nail the tag to the back side of the tree you selected, being sure to fold the tag so it juts out perpendicularly from the trunk, leaving both the inscribed label and the permanent marker label visible.

If there are no trees within 20 m of the origin point, use a plastic ground stake to mark the point. Use permanent marker pen to write the information indicated above for aluminum tags on the stake, and then hammer the stake part-way into the ground, within a few meters of the edge of the trail. Make sure that the marker will not be visible to the casual hiker.

For origin points and for the first off-trail point counts on each half-transect only, regardless of which type of marker is used or even if for some reason no marker is used, complete the section called “Permanent Marker Information” at the bottom of the appropriate Point Establishment Form. The fields in this section of the form should be completed as follows:

Marker Number: Enter the transect number + “T.O.” (transect origin) or transect number + the point name (for example, 4035SS01). If for some reason you did not mark a point that did not already have a marker, write “None” in this field, and provide explanation at the bottom of the form, after “Marker Comments.”

Install Date: Today’s date in the mm/dd/yyyy format.

Removal Date: Leave blank unless removing a pre-installed marker, in which case enter the current date.

Marker Type: Indicate 'aluminum tag' or 'ground stake'.

Marker Substrate: If an aluminum tree tag was used, indicate the scientific name of the tree species to which the tag was nailed. If a ground stake was used, simply write 'ground'.

Height Above Ground: For tree tags indicate the approximate height above ground, in centimeters. For ground stakes, indicate the approximate height to which the stake protrudes from the ground, in centimeters.

Offset Dist: Indicate the distance between the actual survey point and the marker, in meters.

Offset Bearing: Indicate the declinated compass bearing from the point to the marker.

Marker Comments: Provide any additional information that might help someone find the marker in the future, including a brief description of how to find the marker from the sampling point.

5. Completing Transect Visit Log

When both partners have finished collecting habitat and location data at all of their points, they should meet at the transect origin point, where they can work together to complete the Transect Visit Log, as follows.

Park: Enter LEWI, MORA, NOCA OLYM, or SAJH.

Transect: Enter the 4-digit transect number.

Date: Enter the date as mm/dd/yyyy.

Observer1: Enter the first and last name of one of the observers.

Observer2: Enter the first and last name of the other observer.

Use the large table to summarize the data collected for each point on the transect; each point should receive its own line of data in the table. If more space is needed, attach a second sheet.

Transect Arm Code: For each point, indicate the 2-character direction code used to name the points along the half-transect ('SW', 'SS', etc.).

Point: Enter the 2-digit point code ('01' for the first point, '02' for the second point, etc.).

Intended Location: Enter 'N' if you have any reason to believe you were not in the intended location for this point count. This might occur if you were unable to find the marker for a previously marked point, or if a new landslide prevented you from following the route taken the last time the transect was surveyed. Enter 'Y' if you believe you conducted the point count in the place where it was conducted previously (for previously established transects), or if you determined the location by correctly following the protocol (for new transects).

Comment: If you answered 'N' to the previous question, provide a brief explanation here.

Site Data: Enter Y or N to indicate whether new site data was collected for the Point Establishment Form.

Coordinates: Enter Y if new coordinates were collected for the survey point, even if they differ little or not at all from previous coordinates collected. Enter 'N' if for some reason no coordinates were collected.

Travel Feature Desc.: Enter Y or N to indicate whether new travel feature descriptions were collected for the Point Establishment Form.

Photo Doc.: Enter Y or N to indicate whether new digital images were collected.

Point Marking: Enter Y or N to indicate whether a new marker was installed.

Comments: Provide any additional information needed to explain the entries in the previous fields.

Below the table more general information is requested about the transect as a whole.

General Comments: Indicate anything else that seems important to note about the transect, including the general level of difficulty presented by the terrain. It also would be helpful to future crews to indicate where you camped the night before, and the amount of time needed to travel from the campsite to the transect origin.

Describe any logistic problems encountered: Provide detail about any problems experienced in reaching, finding, or marking the transect or any of the points, or about any other logistic problems encountered.

Other interesting wildlife observations and/or plant phenology observations: Describe any interesting wildlife observations (birds as well as other animals) and indicate anything notable about plant phenology—have deciduous shrubs fully leafed out yet? Are many forbs blooming?

Nest Observations: Incidental nest observations may provide important information about breeding phenology. If any active nests were observed while visiting this transect (though not necessarily at a survey point) please indicate the species (4-letter code), and indicate the nesting stage by circling one of the choices provided.

The fields in the box at the lower right corner of the form are intended for office use, and should not be completed in the field.

After completing the last of the data forms, partners should trade data sheets. Review each other's sheets for missing or incorrectly recorded data, make any needed corrections, and discuss any interesting or surprising bird detections.

NCCN Landbirds—Point Establishment Form

Park:_________ **Transect:**______________ **Date:**_____/_____/_____ **Observer:**______________________________

Point:____________ **Point Type** (circle one): **Origin** **Survey** **Visit Type** (circle one): First Visit Return Visit

Bearing to Point:__________º **Change of Direction** (Y/N):_____ **Reason:**___________________________________

Coordinate Source (circle one): Map GPS

Elevation (circle units):__________ **m** **ft**

Elevation Source (circle one): **Altimeter** **GPS** **Map**

Slope at Point:________ º

Aspect at Point:_______ º

GPS Model:__________________________ **GPS File Name:** __________________________

Easting: __ __ __ __ __ __ **Northing:** __ __ __ __ __ __ __ **GPS Error** (m):________ **Datum**:__________

Travel Feature 1:____ **Distance from previous point:** _________ (m)

Travel Feature 2:____ **Distance from previous point:** _________ (m)

Travel Feature 3:____ **Distance from previous point:** _________ (m)

Travel Feature 4:____ **Distance from previous point:** _________ (m)

Notes regarding travel between points: ____

____

____

Photo Frame #: ______ **Description:** ____ **File name:** _________________

Conspicuous features seen from point:

Description: ____ **Distance** (m):______ **Bearing:**_____ º **Frame #:**______

Description: ____ **Distance** (m):______ **Bearing:**_____ º **Frame #:**______

Description: ____ **Distance** (m):______ **Bearing:**_____ º **Frame #:**______

Description of Point:

____

____

____

Permanent Marker Information

Marker Number:____________________________ **Install Date:**_______________ **Removal Date:**_______________

Marker Type:________________________________ **Marker Substrate**:____

Marker Location Information: Height Above Ground:________(cm) Offset Dist:________(m) Offset Bearing: _______º

Marker Comments:

____

____

NCCN Landbirds— Point Revisit Form

Park:_________ **Transect:**______________ **Date:**______/______/______ **Observer:**______________________________

Point:____________ **Point Type** (circle one): **Origin** **Survey** **Visit Type** (Circle One): First Visit Return Visit

Coordinate Source (circle one): **Map** **GPS** **GPS Model:** ___________________ **GPS file name:** _________________

Easting: __ __ __ __ __ __ **Northing:** __ __ __ __ __ __ __ **GPS Error** (m):________ **Datum**:__________

Point:____________ **Point Type** (circle one): **Origin** **Survey** **Visit Type** (Circle One): First Visit Return Visit

Coordinate Source (circle one): **Map** **GPS** **GPS Model:** ___________________ **GPS file name:** _________________

Easting: __ __ __ __ __ __ **Northing:** __ __ __ __ __ __ __ **GPS Error** (m):________ **Datum**:__________

Point:____________ **Point Type** (circle one): **Origin** **Survey** **Visit Type** (Circle One): First Visit Return Visit

Coordinate Source (circle one): **Map** **GPS** **GPS Model:** ___________________ **GPS file name:** _________________

Easting: __ __ __ __ __ __ **Northing:** __ __ __ __ __ __ __ **GPS Error** (m):________ **Datum**:__________

Point:____________ **Point Type** (circle one): **Origin** **Survey** **Visit Type** (Circle One): First Visit Return Visit

Coordinate Source (circle one): **Map** **GPS** **GPS Model:** ___________________ **GPS file name:** _________________

Easting: __ __ __ __ __ __ **Northing:** __ __ __ __ __ __ __ **GPS Error** (m):________ **Datum**:__________

Point:____________ **Point Type** (circle one): **Origin** **Survey** **Visit Type** (Circle One): First Visit Return Visit

Coordinate Source (circle one): **Map** **GPS** **GPS Model:** ___________________ **GPS file name:** _________________

Easting: __ __ __ __ __ __ **Northing:** __ __ __ __ __ __ __ **GPS Error** (m):________ **Datum**:__________

NCCN Landbird Monitoring Protocol May 8, 2007 page_______ of_______

NCCN Landbirds—Transect Visit Log

Park:_________ **Transect:**______________ **Date:**______/______/______ **Observer1:** ________________________________ **Observer2:**______________________________

Transect Arm Code	**Point**	**Intended Location** (Y/N)	**Comment** (if previous = N)	**Updated Data** (Y/N) **Site Data** (slope, aspect, etc.)	**Coordinates**	**Travel Feature Desc.**	**Photo Doc.**	**Point Marking**	**Comments**

General Comments:____

Describe any logistic problems encountered:____

Other interesting wildlife observations and/or plant phenology observations: ____

If you observed any active nests today, please indicate phenology below:

Species:_____________________ Nesting Stage (circle one): Unknown Building Eggs Nestlings Recent Fledglings

Species:_____________________ Nesting Stage (circle one): Unknown Building Eggs Nestlings Recent Fledglings

Species:_____________________ Nesting Stage (circle one): Unknown Building Eggs Nestlings Recent Fledglings

*Entered by:*____________________ *date:*__________

*Updated by:*____________________ *date:*__________

*Reviewed by:*___________________ *date:*__________

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Landbird Monitoring Protocol for National Parks in the North Coast and Cascades Network

Standard Operating Procedure (SOP) 6:

Conducting Point Counts

Revision History Log:

Revision Date	Author	Changes Made	Reason for Change

This SOP gives step-by-step instructions for surveying birds with unlimited-radius, 5-minute point counts with distance sampling, including completion of the Point Count Conditions Form and Point Count Form, which are provided at the end of the SOP. Procedures for locating point count stations are described in SOP 5: Establishing, Relocating, and Describing Survey Points.

This survey utilizes 5-minute, unlimited-radius point counts with distance sampling. Recording the distance to each bird detected allows estimation of detection probability, an essential analytical component of this study. Partitioning the data into birds detected during the first 3 minutes and the last 2 minutes of the point count facilitates comparison with results from the continent-wide Breeding Bird Survey (BBS), which utilizes 3-minute point counts.

1. Completing Point Count Conditions Form

Before beginning the transect, complete the top section of the Point Count Conditions Form, as follows:

Park: Enter LEWI, MORA, NOCA OLYM, or SAJH.

Transect: Enter the 4-digit transect number.

Date: Enter the date as mm/dd/yyyy

Observer: Enter the first and last name of the observer.

Upon arriving at each sample point, immediately mark the site with a vinyl flag differing in color from the flags used for marking the travel route. The next step is to complete a line of data in the table on the Point Count Conditions Form, as follows.

Point: Enter the 4-character point name. The first two characters indicate the semi-cardinal direction traveled from the origination point to the first point (for example, NW for northwest, or NN for north). The last two characters indicate the sequential order of the point along the half-transect (for example, the first point surveyed by a particular observer would be 01; the second point would be 02, etc.).

Noise (1-5): Record the noise interference during the point count using the following codes:

Noise code	Explanation
1	No noise.
2	Slight noise, but probably not missing birds.
3	Moderate noise, might be missing some high-pitched songs/calls of distant birds.
4	Substantial noise, detection radius probably is substantially reduced.
5	Loud noise, probably detecting only the closest/loudest birds.

Temperature (^{o}C): Record the temperature at the start of the count in Celsius.

Precip (1-3): Record the rain conditions during the point count using the following codes:

Wind code (Beaufort Scale)	Explanation
0	Calm; smoke rises vertically (<2 km/h)
1	Light air; smoke drifts (2-5 km/h)
2	Light breeze; wind felt on face, leaves rustle (6-12 km/h)
3	Gentle breeze; leaves and twigs in constant motion (13-19 km/h)
4	Moderate breeze; small branches move; raises loose paper; dust rises (20-29 km/h)
5	Fresh breeze; small trees sway (30-39 km/h)
6	Strong breeze; large branches moving, wind whistling (40-50 km/h)
Wind stronger than this precludes point counts.	

Wind (0-6): Record the wind conditions during the point count using the following codes:

Rain code	Explanation
1	No rain
2	Mist or fog
3	Light drizzle
Rain stronger than this precludes point counts.	

Clouds (%): Record percent cloud cover within the portion of the sky that is visible to you. This should be a number between 0 (no clouds) and 100 (complete overcast). If there are patches of clouds in different areas of the sky, try to image gathering all of them together into one part of the sky and recording what percent of cloud cover that would represent. On hazy mornings, it sometimes can be difficult to decide whether cloud cover is 100% or 0%—in such instances record 100%.

Point Comment: If any additional information is needed to explain your entries for the preceding fields, provide it here.

Transect Comments: Space is provided here for any more general observations about weather or other conditions present during the transect.

2. Completing Point Count Form

After all data on the Point Count Conditions form have been collected, prepare to conduct the point count. Make yourself comfortable by taking off your backpack and situating binoculars so that they are in a comfortable and accessible position around your neck. Place the point count data form on the top of your clipboard and complete the top portion of the form as follows:

Park: Enter LEWI, MORA, NOCA, OLYM, or SAJH.

Transect: Enter the 4-digit transect number.

Date: Enter the date as mm/dd/yyyy.

Observer: Enter the first and last name of the observer.

When you are ready, set your stop watch and begin the count. During the 5-minute point count, record data as follows:

Point: Enter the 4-character point name. The first two characters indicate the semi-cardinal direction traveled from the origination point to the first point (for example, NW for northwest, or NN for north). The last two characters indicate the order of the point along the half-transect, starting from the origination point (for example, the first point surveyed by a particular observer would be 01; the second point would be 02, etc.). For each point, you must write the point name on the first row of data (describing the first bird detection) only. This space may be left blank for subsequent detections at the same point.

Start Time: Record the 4-digit time of day the point count began (ex. 0620). For each point, you must write the start time on the first row of data (describing the first bird detection) only. This space may be left blank for subsequent detections at the same point.

Species: Enter the 4-letter bird species code (refer to table 1 in SOP 3: Training Observers for a complete list of 4-letter species codes). Juvenile birds should not be recorded on the data form. It can be difficult to determine the age of birds during point counts but in general, you should count a bird unless you are confident it is a juvenile. Juvenile birds are defined as birds that hatched during the current breeding season. Clues to look for that may indicate a young bird include: the presence of family groups of birds, birds wearing juvenal plumage, weak-flying birds, and begging from or being fed by parents. Be familiar with the typical signs of young birds; species-specific plumage varies but in general, look for downy, fluffy plumage that often looks quite different from that of an adult of the same species, a fleshy gape (often bright in color and contrasting with the bill color), and heavy body molt (plumage will look unusually messy with new body feathers growing in and replacing downy pre-juvenal feathers). Once birds have dispersed from the immediate breeding area, it can become much more difficult to identify a young bird. The seasonal timing of this survey should ensure that juvenile birds are encountered rarely, except at high elevations, where upslope migrating birds that hatched at lower elevations may appear before the local young have fledged.

In rare instances, observers may not be able to identify particular birds to species. The following 4-letter codes for incompletely identified birds are acceptable, but should be used judiciously.

Species code	Explanation
UNAH	Unidentified *Accipiter* Hawk
UNBI	Unidentified Bird
UCFI	Unidentified *Carpodacus* Finch
UNDU	Unidentified Duck
UEFL	Unidentified *Empidonax* Flycatcher
UNFL	Unidentified Flycatcher
UNGU	Unidentified Gull
UNHA	Unidentified Hawk
UNHU	Unidentified Hummingbird
UNOW	Unidentified Owl
UPCH	Unidentified *Poecile* Chickadee
UNSA	Unidentified Sapsucker
UNSP	Unidentified Sparrow
USWA	Unidentified Swallow
USWI	Unidentified Swift
UNTH	Unidentified Thrush
UNWA	Unidentified Warbler
UNWO	Unidentified Woodpecker
UNWR	Unidentified Wren

Distance: Record the horizontal distance in meters to a bird when it was first detected. If the bird moves closer to you later during the count, do not change the distance estimation. Record distances for all birds except individuals or groups classified as ‘flyovers’ (see definition of ‘Flyover’).

Seen First (Y/N): ‘Y’ indicates the distance to the bird was estimated after visually locating the bird. ‘N’ indicates the distance to the bird was estimated without first seeing the bird.

Ever Sang (Y/N): ‘Y’ indicates the bird sang at least once during the 5-minute point count. ‘N’ indicates the bird did not sing during the 5-minute point count. Here we provide guidelines for differentiating songs from calls. Most songbirds have a typical song that generally is not confused with typical call notes. An example is the Black-headed Grosbeak, whose song can be described as a high, drunken, rolling warble and whose call is a high, sharp *pik* note. Groups of birds that we will often encounter in the field that have less well-defined songs and calls include hawks and falcons, grouse and quail, owls, woodpeckers, flycatchers, jays and crows, and chickadees (particularly CBCH). The general rule to follow for distinguishing between songs and calls for all species is to defer to vocalization descriptions in The Sibley Field Guide to Birds of Western North America (Sibley, 2003), with a few clarifications, described as follows:

Hawks and falcons: Never sing. Regard all vocalizations as calls.

Grouse and quail: Low hoot of SOGR and drumming of RUGR classified as song, all other vocalizations classified as calls. *Quark* of MOUQ and *Chi ca go* of CAQU classed as songs, all other vocalizations are calls.

Owls: Songs are defined as the typical series of hoots a male defending territory would give. This does not include any of the female and juvenile calls. The NOPO’s ‘submarine sonar’ vocalizations and FLOW’s *poop* are included as songs.

Woodpeckers: Songs are limited to rattles for most species. Calls are defined as all contact calls, drumming and any other vocalizations. For NOFL and PIWO the similar sounding *wuk wuk wuk wuk wuk* vocalizations are classified as songs; all other vocalizations are calls.

Flycatchers: Well-defined by Sibley. Typical two and three note vocalizations from *empidonax* flycatchers are classified as songs.

Jays and crows: Never sing. Regard all vocalizations as calls.

Chickadees: Song includes MOCH’s *cheeseburger*, and BCCH’s *fee bee fee beeyee*. All other vocalizations for these two species should be classified as calls. CBCH is more ambiguous, and may not have a structured song at all—regard all vocalizations as calls.

Time Interval: Circle ‘3’ if the bird was first detected in the first 3 minutes of the point count, and ‘2’ if the bird was first detected during the last 2 minutes of the point count.

Prev. Obs.: Enter ‘Y’ to indicate that the same individual bird was recorded on more than one point count. The ‘Y’ should be associated with the count on which the species was at a greater distance from the observer. Otherwise, this field should be left blank.

Flyover: ‘Y’ indicates the detection was a ‘flyover’—a bird or birds that flew over the top of the vegetation canopy, never touched down in the observer’s field of view, and did not appear to be foraging, displaying, or behaving in any other way that might suggest a link to the habitat below. The space should simply be left blank when the detection is not a flyover.

Group Size: A blank field indicates a single individual, whereas a numerical entry indicates the number of birds in a flock. Landbird species for which group size entries may be greater than one are limited to swallows, Cedar Waxwing, Red or White-winged Crossbill, Evening Grosbeak, Pine Siskin, Gray-crowned Rosy-Finch, and late-season, high-elevation aggregations of Golden-crowned Kinglet and Dark-eyed Junco. Even for these species, only record birds together as a flock if they are clearly behaving as a flock. Multiple birds singing in the same general area, or chasing each other do not qualify as a flock. For all other landbirds, even if you see multiple individuals moving together or interacting, provide a separate line of data for each individual.

Note: Clusters of individuals of species that do not normally flock may be post-fledging family groups, in which case the juveniles should not be counted. At LEWI, SAJH, and the coastal strip at OLYM, shorebirds of numerous species may be recorded as flocks.

Comments: Use this field only for essential comments about a particular bird detection, such as noting any uncertainty about species identification.

3. Miscellaneous Things to Keep in Mind While Conducting Point Counts

- Approach each point as quietly as possible. If you need to repack your things or add or remove clothing, try to postpone doing so until after the point count.
- Be sure to periodically rotate your body so that you do not spend the entire point count facing the same direction; you must do your best to track birds around you in all directions.
- Try to keep track of individual birds, so that if they move you will not mistake them for additional individuals.
- Do not forget to record the common species—they're easy to tune out as you are concentrating on detecting and identifying rarer species.
- When estimating distances to birds, do not round to the nearest 5 or 10 m; make your best estimate to the nearest meter.

Reference Cited

Sibley, D.A., 2003, The Sibley field guide to birds of western North America: Alfred A. Knopf, New York, 471 p.

NCCN Landbirds--Point Count Conditions Form

Park:_________ Transect:______________ Date:______/______/______ Observer:____________________

Point	Noise (1-5)[1]	Temp. (C)	Wind (0-6)[2]	Rain (1-4)[3]	Clouds (%)	Point Comment

Transect Comments: ____

____

____

____

____

____

[1]Noise Code	Explanation
1	No noise.
2	Slight noise, but probably not missing birds.
3	Moderate noise, might be missing some high-pitched songs/calls of distant birds.
4	Substantial noise, detection radius is probably substantially reduced.
5	Loud noise, probably detecting only the closest/loudest birds.

[2]Wind Code (Beaufort Scale)	Explanation
0	Calm; smoke rises vertically (<2 km/h)
1	Light air; smoke drifts (2-5 km/h)
2	Light breeze; wind felt on face, leaves rustle (6-12 km/h)
3	Gentle breeze; leaves and twigs in constant motion (13-19 km/h)
4	Moderate breeze; small branches move; raises loose paper; dust rises (20-29 km/h)
5	Fresh breeze; small trees sway (30-39 km/h)
6	Strong breeze; large branches moving, wind whistling (40-50 km/h)
Wind stronger than this precludes point counts.	

[3]Rain Code	Explanation
1	No rain.
2	Mist or fog.
3	Light drizzle.
Rain stronger than this precludes point counts.	

NCCN Landbirds--Point Count Form

Park:_________ Transect:______________ Date:______/______/______ Observer:_________________________________

Point	Start Time (hh:mm)	Species code (4 char)	Dist. (m)	Seen First (Y/N)	Ever Sang (Y/N)	Time Interval[1]	Prev. Obs.[2] (Y/__)	Flyover[2] (Y/__)	Group Size	Comments
						3 2				
						3 2				
						3 2				
						3 2				
						3 2				
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						3 2				

[1]Time Interval: 3=first detected during first 3 minutes of point count; 2=first detected during last 2 minutes. [2]Mark Y (for yes) when positive, if negative leave blank.

Landbird Monitoring Protocol for National Parks in the North Coast and Cascades Network

Standard Operating Procedure (SOP) 7:

Classifying Vegetation

Revision History Log:

Revision Date	Author	Changes Made	Reason for Change

This SOP gives step-by-step instructions for classifying vegetation at each of the point count locations.

The objective of habitat classification at each of the point count stations is to: (1) use vegetation class as a covariate in developing detectability functions, (2) determine if there are any coarse-grained changes in vegetation classes associated with the avian monitoring points, and (3) aid in point relocation in subsequent years. We have selected two measures of vegetation structure (ocular estimation of canopy cover and largest size class) because these two data are used to classify vegetation in the Park's current land cover classification scheme and provide addition information (Pacific Meridian Resources, 1996). Vegetation is to be classified at each location where a point count is conducted, but is not required for transect origin points. Vegetation will be classified within a 50-m radius circle centered at the point count. All vegetation within the 50-m radius circle should be considered when classifying the habitat. The Habitat Classification Form is provided at the end of this SOP.

Use the following methods when completing the Habitat Classification Form:

Park: Enter LEWI, MORA, NOCA OLYM, or SAJH.

Transect: Enter the 4-digit transect number.

Date: Enter the date as mm/dd/yyyy.

Observer: Enter the first and last name of the observer.

Point: Enter the 4-character point name. The first two characters indicate the semi-cardinal direction traveled from the origination point to the first point (for example, NW for northwest, or NN for north). The last two characters indicate the order of the point along the half-transect, starting from the origination point (for example, the first point surveyed by a particular observer would be 01; the second point would be 02, etc.).

Hab1 and Hab2: Space is provided to enter habitat data for up to two habitats at each point. Habitat designations follow the habitat classification developed by Pacific Meridian Resources (PMR; Pacific Meridian Resources 1996), with a few additions developed primarily for use at LEWI and SAJH. If there is only one PMR habitat present, complete the fields for Hab1 only. If two PMR habitats are present, determine which one occupies a greater proportion of the vegetation plot, and enter data for it after Hab1. Enter data for the other habitat after Hab2.

PMR Habitat Code: Enter the 4-letter PMR code for each primary habitat and secondary habitat (if present) on the plot. See table 1 at the end of this SOP for a complete list of PMR habitat codes. In multi-storied habitats, classify the habitat according to the tallest vegetation layer.

PMR Habitat Name: Enter the full PMR name for each primary habitat and secondary habitat (if present) on the plot. See table 1 for a complete list of PMR habitat names.

Canopy Cover (%): Place an 'X' in the field that contains the estimated percent canopy cover of overstory vegetation (>2 m in height) for the PMR habitat type under consideration. Percent canopy cover ranges on the data form include: 11-40, 41-70, and 71-100. If the estimated canopy cover is less than 11 percent leave all canopy cover fields blank.

Tree Size Class (cm): Place an ‘X’ in the field that contains the largest tree size class (dbh in cm) for the PMR habitat under consideration. Tree size class ranges include: <23 cm, 23-53 cm, 54-81 cm, 81-122 cm, and >122 cm.

Notes: Provide any comments or notes needed to elaborate on the classification of the habitat within 50 m of the survey point.

Reference Cited

Pacific Meridian Resources, 1996, Vegetation and landform database development study: final report: Pacific Meridian Resources, Portland, Oregon.

Table 1. “PMR” habitats in each of the North Coast and Cascade Network parks.

[Most habitat categories come from Pacific Meridian Resources (1996), but a few were developed as part of separate habitat classification efforts LEWI and SAJH]

PMR habitat name	PMR habitat code	NOCA	OLYM	MORA	SAJH	LEWI
Alaska Yellow-cedar	ALYC	Yes	Yes	Yes	No	No
Beach	BEAH	No	No	No	Yes	Yes
Big Leaf Maple	BIGM	Yes	Yes	No	No	No
Black Cottonwood	BLCO	Yes	No	No	No	No
Conifer-Deciduous Mix	CODM	Yes	Yes	Yes	Yes	Yes
Developed	DEVO	No	No	No	Yes	Yes
Mixed Douglas-fir/Western Hemlock	DFWH	No	No	Yes	No	No
Douglas-fir	DOFI	Yes	Yes	Yes	Yes	Yes
Dune Grass	DUGR	No	No	No	No	Yes
Engelmann Spruce	ENGS	Yes	No	Yes	No	No
Grand Fir	GRAF	No	No	Yes	No	No
Grassland	GRAS	No	No	No	Yes	No
Hardwood Mix	HAMI	Yes	Yes	No	No	No
Heather	HEAT	Yes	Yes	Yes	No	No
Lodgepole Pine	LOPI	Yes	Yes	No	No	No
Meadow	MEAD	Yes	Yes	Yes	No	Yes
Mixed Conifer	MICO	Yes	Yes	Yes	Yes	Yes
Mountain Hemlock	MOHE	Yes	Yes	Yes	No	No
Noble Fir	NOBF	No	No	Yes	No	No
Pacific Silver Fir	PASF	Yes	Yes	Yes	No	No
Pasture	PAST	No	No	No	No	Yes
Palustrine Wetland	PAWE	No	No	No	No	Yes
Ponderosa Pine	POPI	Yes	No	No	No	No
Quaking Aspen	QUAS	Yes	No	No	No	No
Red Alder	REAL	Yes	Yes	Yes	Yes	Yes
Riverine Wetland	RIWE	No	No	No	No	Yes
Rock/Sparsely Vegetated	ROSV	Yes	Yes	Yes	No	No
Sand Dune	SADU	No	No	No	Yes	Yes
Shore Pine	SHPI	No	No	No	No	Yes
Shrub	SHRU	Yes	Yes	Yes	Yes	Yes
Sitka Spruce	SISP	No	Yes	No	No	No
Snow	SNOW	Yes	Yes	Yes	No	No
Subalpine Fir	SUBF	Yes	Yes	Yes	No	No
Subalpine Larch	SULA	Yes	No	No	No	No
Water	WATE	Yes	Yes	Yes	Yes	Yes
Western Hemlock	WEHE	Yes	Yes	Yes	No	Yes
Western Redcedar	WERC	Yes	Yes	Yes	No	No
Western Redcedar/Western Hemlock	WRCH	No	Yes	No	No	No
Willow/Shrub Wetland	WSWE	No	No	No	No	Yes

NCCN Landbirds--Habitat Classification Form

Park:______ Transect:______ Date:____/____/____ Observer:______

Point		PMR Habitat		Canopy Cover (%)			Tree Size Class (cm)					Notes
		Code	Name	11-40	41-70	71-100	<23	23-53	53-81	81-122	>122	
	Hab1											
	Hab2											
	Hab1											
	Hab2											
	Hab1											
	Hab2											
	Hab1											
	Hab2											
	Hab1											
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	Hab2											
	Hab1											
	Hab2											

Landbird Monitoring Protocol for National Parks in the North Coast and Cascades Network

Standard Operating Procedure (SOP) 8:

Reporting Rare Bird Detections

Revision History Log:

Revision Date	Author	Changes Made	Reason for Change

This SOP gives step-by-step instructions for reporting rare or incidental bird detections using the Rare Bird Report Form, which is provided at the end of this SOP.

All species having a code of anything other than 'IBPInventory' on the NCCN Bird Species List (table 1 in SOP 3: Training Observers) require a Rare Bird Report Form to be completed upon detection. Observers should familiarize themselves with this list before the start of the field season.

Note: Some of the species requiring Rare Bird Report Forms are not truly rare within the parks; they are just rarely detected with morning point counts (for example, owls). 'Rare' birds require report forms if they are detected in an NCCN park anytime during the field season, including during point counts, during the pre-season training session, and during days off.

Complete the fields on the Rare Bird Report Form as follows:

Park: Enter LEWI, MORA, NOCA, OLYM, or SAJH.

Date: Date of the observation in mm/dd/yyyy format.

Time: Time of the observation in 24-hour format.

Observer1: First and last name of the person who collected the most detailed notes on the bird detection.

Observer2: First and last name of secondary observer; if none, leave blank.

Species Name: Full common name of the detected species.

Species Code: Four-letter species code.

Quantity: Enter the number of individuals of the species detected.

Location Name: Record the colloquial name of the observation location here. If there is no colloquial name, leave this space blank.

Coordinate Source: Circle 'Map' if coordinates could not be obtained from a GPS unit, and instead the location was estimated solely by using the field map. Circle 'GPS' if coordinates were obtained from the GPS unit.

GPS Model: Enter name of the GPS unit you are using (for example: "Thales Mobile Mapper").

GPS File Name: Enter the name of the GPS unit assigned to the file for this survey point. Leave blank if no GPS file was produced.

Easting: UTM easting (based on NAD83) of the survey point.

Northing: UTM northing (based on NAD83) of the survey point.

GPS Error: Error in meters, as provided by the GPS unit. Leave blank if no GPS unit was used.

Datum: Enter the datum on which the coordinates are based. Field maps are based on NAD83.

Transect and Point: Record the transect and point number if the bird was detected during a point count; otherwise, leave blank.

Nesting Stage: If a nest was observed in conjunction with this detection, indicate the nesting stage. If no nest was observed, do not mark any of the choices.

Description: Use this space to thoroughly document the rare bird sighting. Include diagnostic field marks and/or vocalizations that would separate the species from similar sounding or appearing species. For truly rare species, the documentation should be thorough enough to convince reviewers that the observation is authentic. Record the sex of the individual (if possible) as well as any nest sightings or activity indicative of nesting.

NCCN Landbirds-- Rare Bird Report Form

Park:__________ **Date**____/____/____ **Time:**________ **Observer 1:**____________________ **Observer 2:**______________________

Species Name:___________________ **Species Code:**__ __ __ __ **Quantity:**______ **Location Name:**_______________________

Coordinate Source (circle one): **Map GPS** **GPS Model:** ______________________ **GPS File Name:** _____________________

Easting:__ __ __ __ __ __ **Northing:**__ __ __ __ __ __ __ **GPS Error** (m):_______ **Datum:**_________

Transect and Point (if detected during point count):______________ **Nesting Stage** (check one): ___Unkn. ___Building ___ Eggs ___Nestlings ___Recent Fledglings

Description (include fieldmarks and/or vocalization description, and indicate sex and any nest sightings or behavior indicative of nesting):

____

____

____

____

Park:__________ **Date**____/____/____ **Time:**________ **Observer 1:**____________________ **Observer 2:**______________________

Species Name:___________________ **Species Code:**__ __ __ __ **Quantity:**______ **Location Name:**_______________________

Coordinate Source (circle one): **Map GPS** **GPS Model:** ______________________ **GPS File Name:** _____________________

Easting:__ __ __ __ __ __ **Northing:**__ __ __ __ __ __ __ **GPS Error** (m):_______ **Datum:**_________

Transect and Point (if detected during point count):______________ **Nesting Stage** (check one): ___Unkn. ___Building ___ Eggs ___Nestlings ___Recent Fledglings

Description (include fieldmarks and/or vocalization description, and indicate sex and any nest sightings or behavior indicative of nesting):

____

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____

Park:__________ **Date**____/____/____ **Time:**________ **Observer 1:**____________________ **Observer 2:**______________________

Species Name:___________________ **Species Code:**__ __ __ __ **Quantity:**______ **Location Name:**_______________________

Coordinate Source (circle one): **Map GPS** **GPS Model:** ______________________ **GPS File Name:** _____________________

Easting:__ __ __ __ __ __ **Northing:**__ __ __ __ __ __ __ **GPS Error** (m):_______ **Datum:**_________

Transect and Point (if detected during point count):______________ **Nesting Stage** (check one): ___Unkn. ___Building ___ Eggs ___Nestlings ___Recent Fledglings

Description (include fieldmarks and/or vocalization description, and indicate sex and any nest sightings or behavior indicative of nesting):

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Landbird Monitoring Protocol for National Parks in the North Coast and Cascades Network

Standard Operating Procedure (SOP) 9:

Field Form Handling Procedures

Revision History Log:

Revision Date	Author	Changes Made	Reason for Change

Field Form Handling Procedures

As field data forms are part of the permanent record for project data, they should be handled in a way that preserves their future interpretability and information content. If changes to data on the forms need to be made subsequent to data collection, the original values should not be erased or otherwise rendered illegible. Instead, changes should be made as follows:

- Draw a horizontal line through the original value, and write the new value adjacent to the original value with the date and initials of the person making the change.
- All corrections should be accompanied by a written explanation in the appropriate notes section on the field form. These notes also should be dated and initialed.
- If possible, edits and revisions should be made in a different color ink to make it easier for subsequent viewers to be able to retrace the edit history.
- Edits should be made on the original field forms and on any photocopied forms.

These procedures should be followed throughout data entry and data revision. On a 5-year basis, data sheets are to be scanned as PDF documents and archived (see protocol narrative Section 4K, Archival and Records Management, and SOP 18: Product Delivery Specifications). The PDF files may then serve as a convenient digital reference of the original if needed.

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Landbird Monitoring Protocol for National Parks in the North Coast and Cascades Network

Standard Operating Procedure (SOP) 10:

Collecting GPS Data

Revision History Log:

Revision Date	Author	Changes Made	Reason for Change

This SOP provides step-by-step instructions for collecting position information using Thales MobileMapper GPS receivers, as well as downloading that information in preparation for sending it to the GIS Specialist. The material in this SOP is excerpted from the document NCCN Global Positioning System Data Acquisition and Processing, 2006 (http://www1.nature.nps.gov/im/units/nccn/datamgmt_guide.cfm**), which also provides information on processing GIS data once the data have been downloaded and given to the GIS Specialist.**

1. General Practices for GPS Data Collection

Regardless of GPS receiver type, certain data collection standards must be followed. Most of the quality control measures below can be established by the user and should be followed whenever possible to produce the most accurate data possible.

- Satellite availability and satellite geometry (PDOP):
  GPS users can increase mapping accuracy by using planning charts and targeting their data collection to the times of day when satellite availability and geometry are best. However, such timing does not always work in the field.
- Length of time GPS data file is open:
  Positional accuracy will be better the longer a file is open and the more GPS positions are collected and averaged.
- Mulitpath error, or signal interference:
  Although mostly beyond a user's control, some adjustments can be made to minimize multipath error. These include positioning the GPS in the most unobstructed view of the sky as possible, using offsets from better satellite reception areas to the target location, and using an external antenna.
- Signal to Noise Ratio (SNR):
  This is out of a user's control, although adjusting for less multipath also will create a better SNR.

GPS file names should be recorded on hardcopy datasheets or in field computers. GPS field coordinates (coordinates shown on a GPS receiver while a GPS is receiving satellite signals) and datum also should be recorded on hardcopy datasheets. In the event a GPS file is lost or corrupted, the coordinates recorded in the field from the GPS unit display window will become the best measure of location. Be aware that these coordinates cannot be differentially corrected and are in the coordinate system and datum that were chosen for the unit's display.

2. Thales MobileMapper Operating Instructions

Contact NCCN GIS staff to have MobileMapper Office software installed and to have MobileMapper GPS receivers initialized. The User Manual (.pdf) available under the Help section of MobileMapper Office is a useful reference.

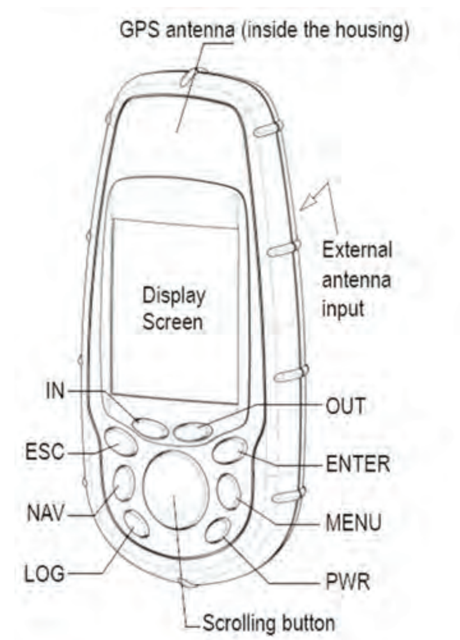
Battery Options

MobileMapper GPS receivers use two AA batteries. These will last approximately 8 hours with the backlight on and 14-16 hours with the backlight off.

External Antenna

MobileMapper GPS units have internal antenna at the top of the unit. External antennas are not necessary in the field, but can be used especially in areas with satellite signal obstructions. External antennas are required for mapping from aircraft or road vehicle. With the unit facing you, the antenna jack is on the upper right side underneath a small black rubber flap.

Hold the unit vertically so that the internal antenna is oriented correctly.



Projection and Datum

GPS units receive coordinate data from satellites in latitude and longitude in the WGS-84 datum, but can display coordinate in various projections and datums. NCCN GPS units should be set up to display coordinate information in UTM zone 10, NAD83.

Configuration Settings

Configuration settings in MobileMapper receivers consist of setting map display scales, selected navigation screens, coordinate display, selected background maps, and power options. Contact NCCN GIS Specialists for assistance with setting receiver configurations.

Receiver Operation and Data Collection

Power On and Off

Push PWR button to power on. Push ENTER when the disclaimer/warning screen appears or the unit will automatically shut off. To turn off the receiver, push PWR twice. Most NCCN MobileMapper units have been configured to prevent accidental shut off by forcing users to push the PWR button twice.

Backlight

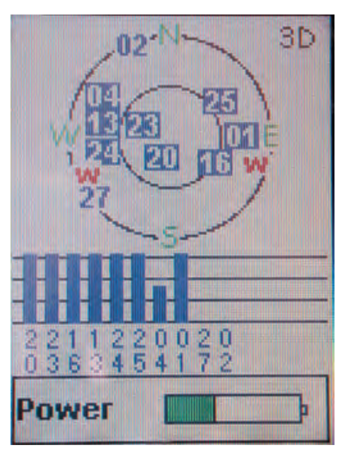
The backlight can be adjusted by using the PWR button. Push the PWR button for more than 2 seconds and then release it to change the backlight from high to low. Push the PWR button again for more than 2 seconds and then release it to change the backlight from low to off. Push the PWR button again for more than 2 seconds and then release it to turn the backlight on again.

Receiver Screens

The NAV button scrolls through navigation screens. Many navigation screens have been turned off (such as the road view) during the configuration/intialization process. The screens that will be used most are the satellite chart, the background map, the position screen, and the heading and bearing screen.

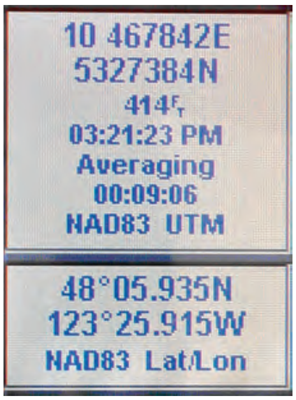
The ESC key steps back through previous screens.

Look for the Satellite Status screen. This shows the status of the battery power, how many satellites are being tracked (the solid bars in the graph), and whether the GPS is calculating positions in 2D or 3D mode (upper right corner). If there are four or more satellites being tracked and the 3D indicator appears then data recording can proceed.



Check Signal Reception and Current Location

Push the NAV button until the Position screen appears. This also will show the status of the strength of the satellite signals. The line that reads "Averaging" will indicate, whether the GPS is "Search – 1st sat", "Search – 2nd sat" … or Averaging. Averaging will only show up if the GPS is getting a good signal and is stationary. If the GPS is averaging, it also will show the duration at which the unit has been receiving satellite data at that point on the next line (for example, 9 minutes and 6 seconds).



Open a File

When you are ready to collect a data file,

1. Push the LOG button
2. Highlight Create New Job and push ENTER

3. Use the scroll arrows to get to Clear (bottom of the keyboard)

Change file name from "Job1" to, for example, "M060710"

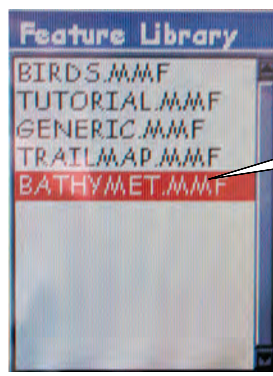
4. Push ENTER
5. Use the scroll arrows and ENTER button to type in a job file name job files should be named the following standard way:

   Xyymmdd
   Where:
   X = GPS unit letter (see the back of the GPS unit; MORA = M, NOCA = N, OLYM = O, backup unit = P)
   Yy = last two digits of the year (05)
   Mm = month (use two digits!)
   Dd = day (use two digits!)
6. Scroll to OK when finished typing in the job file name
7. Push ENTER

   Note: There is an 8 character limit in file names.

After naming the job file,

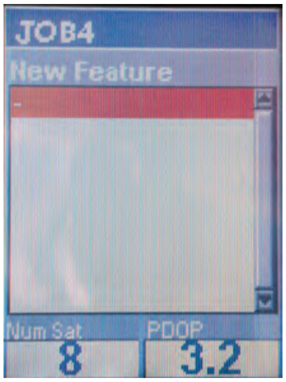
8. Select a feature library (called a data dictionary in Trimble's realm)
9. Select XXXX.mmf where XXXX is the specific feature library
10. Push Enter and the Job Mode screen will appear
11. Select Post-processing!
12. Push ENTER
    The New Feature screen will appear



Select the data dictionary created for a specific project

13. Select the feature for which data will be collected

14. Push ENTER



Note: if the default data dictionary is being used, then the screen will display choices "Point, Line, Area, Grid."

Note: Positions will not begin to collect in a file until the GPS unit begins receiving three or four satellite signals.

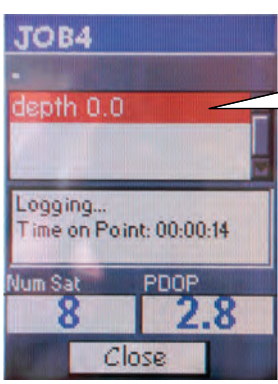
Note: Hold the unit vertically so that the antenna is oriented correctly.

Once the GPS unit receives sufficient satellite signals,

15. Push ENTER

The screen will change from showing feature type information (for example, New Feature/XXXXPlot) to a screen for feature data collection that shows: data dictionary attributes that need data entry, logging time, number of satellites, and PDOP.

Note: The MobileMapper does not show the number of points collected in a file like Trimble files do. Try to watch the elapsed time window and keep an eye on the PDOP. Try to collect at least 3 minutes of PDOP =<8.0 (make your best guess).



Example of an attribute called "depth" that needs a value entered

Data Entry Using a Data Dictionary

If a data dictionary is being used,

1. Scroll to the proper feature and then push ENTER
2. Use the scroll keys and Enter button to type in attribute data
3. Push ENTER when finished entering attribute data
4. Select OK when finished

Close the Feature

1. Scroll to CLOSE when finished logging the feature
2. Push ENTER

   This returns to the New Feature screen.

   Note: This closes the feature, not the file.
3. Write the GPS file name on a hardcopy datasheet

Open Another Feature in the Same File

When the feature is closed, the New Feature screen will appear. From here, a new feature (for example, a new plot) can be opened.

1. Scroll to the feature you wish to map
2. Push ENTER
3. Enter attribute data (see Data Entry using a Data Dictionary)
4. Close the feature (see Close the Feature)
5. Write the GPS file name on a hardcopy datasheet

Close a File

To close out of the entire job file,

1. Push MENU
2. Scroll to Close Job
3. Push ENTER

Open File Again to Collect New Feature

To open a job file again,
1. Push the LOG button
2. Select Open Existing Job
3. Push ENTER
4. Select the job file name
5. Push ENTER
6. Push LOG to get to the New Feature/Plot screen and wait for satellite signals
7. Push ENTER and log another plot location feature
8. Write the GPS file name on a hardcopy datasheet

To Close Out of the Entire Job File

1. Push MENU
2. Scroll to Close Job
3. Push ENTER

Note: You also can re-open a job from pushing the MENU button and selecting Open Job.

Note: There is no set rule for how many jobs to create and how many features (plot locations) to log per job. Differential correction and export can be done on only one job at a time. Fewer jobs will facilitate data post-processing and GIS layer creation. Let's try doing one job file per day and see how that goes.

Note: Turning off the unit will close an open job file (unlike the Trimble units, the file will not stay open).

Note: If batteries die during a job file, replace batteries, open a new job file, and begin data collection again.

Entering Offsets into a GPS File

From within the data file being collected,
1. Press MENU
2. Scroll to Offset
3. Press ENTER
4. Scroll to "Bearing"
5. Press ENTER
6. Obtain a compass bearing from your position to the target location
7. Use the arrow keys to enter the bearing value
8. Press ENTER when finished entering the bearing value
9. Use the down arrow key to move to the "Horz. Distance" field
10. Push ENTER
11. Use the arrow keys to enter a horizontal distance (meters)
12. Press ENTER when finished entering the horizontal distance value
13. Use the down arrow key to move to the "Vert. Distance" field
14. Push ENTER
15. Use the arrow keys to enter a vertical distance (meters) (zero if current position and target position are on a flat plane)
16. Press ENTER when finished entering the vertical distance value
17. Press ESC to return to the data logging screen

Note: Map screen will show the feature offset from your current position.

Current Position Information

Use the position screen to see current coordinates and obtain a running average of your current position. The position screen will show the duration and average UTMs during that duration. Relatively small movement (like shoulder width distance) will reset the duration clock and create a new running coordinate average. This screen shows a primary (at the top) and secondary (at the bottom) coordinate system (these displays are set during the configuration process). NCCN units have UTM zone 10, NAD 1983 as the primary coordinate screen. The "10" preceding the easting at the top is the UTM zone.

Background Maps

Background maps are useful reference for fieldwork. For example, a background map can show target points where field crews will place plots, roads, trails, and park boundaries. Background maps will display at scales set during map creation in MobileMapper Office and at a level set in the GPS unit configuration.

MobileMapper GPS receivers can display vector data (points, lines, polygons) in a background map. One attribute can be displayed for each vector feature in the background map. Shapefiles are imported in MobileMapper Office and saved as a map file (.mmp). Background maps are transferred to the receiver. Contact NCCN GIS staff for background map creation, imports, and proper configuration settings.

To view a background map in the GPS receiver, use the IN and OUT buttons to zoom in and out. Use the scroll arrows to move around the map and to set a center point for zooming in and out. A black triangle will show your present position (the triangle is really big and it is unclear if the triangle can be made smaller). Zooming out beyond a certain scale will show a more general map. Zooming in to the scale set during map creation in MobileMapper Office will show more detail.

Note: The black cursor on the background map will not zoom in beyond 10 m on the display.

Navigation to a Target Location

Use map, compass, and the background map to navigate as close as possible to a target location. Switch to the Position screen, using the NAV button, to read current position coordinates and check them against the target coordinates. Use the position screen and a coordinate averaging to fine-tune your location.

The GOTO option in the receiver is useful to create a bearing and heading from a current position to a target location.

1. Push the NAV button until the background map displays
2. If the GPS is receiving a minimum of four satellites, a black arrow cursor will display your current location
3. Use the arrow scroll keys to move the center of the cross-shaped selection cursor to the location to which you want to travel from your present location
4. When the cursor is over the feature, the feature’s name will display at the bottom of the screen
5. Press ENTER
   This returns you to the Select Item screen
6. Select the feature you want to go to
7. Push ENTER
   This will display the Detail Info screen
8. Scroll to the GOTO option in the lower right corner
9. Highlight GOTO
10. Press ENTER
    The background map will now show a line between your current position (the black triangle cursor) and the target location
11. Press NAV until the navigation screen you wish to use displays (the screen that shows distance, bearing, and heading is a useful one)

Note: Setting the target location depends on the scale the background map is on when GOTO is selected. If the cursor appears to be on top of the target at a background map scale of 750 m, the cursor location can be 20-30 m away from the target when zoomed to a scale of 10 m.

Note: Remember these screens will give straight line distances! The display will not account for topography such as cliffs, rivers, etc. This GOTO option probably is best used after using map, compass, and altimeter to navigate close to a target point or polygon. Then use GOTO and the position display screen (where coordinate averages display) to refine your location and get as close as possible to the target location.

Note: The GOTO screen and background map will not zoom into a scale finer that 10 m. At this point, use the position screen to make finer adjustments in navigation. The position screen will show a running average of a current position and will show the duration and average UTMs during that duration. Relatively small movement (like shoulder width distance) will reset the duration clock and create a new running coordinate average.

3. Transferring GPS Receiver Data to a Computer

Processing differentially correctable GPS rover files requires a computer, a data transfer cable, and GPS software. GPS receivers typically come with manufacturer-specific software and data transfer cables. Each software package operates differently, but the basic process is the same.

It is extremely important that whenever field crews return from the field, GPS files are transferred from GPS receivers to computers or network folders that are routinely backed-up. Files should be transferred to an appropriately named folder (such as “Raw” or “Backup”).

Files can be selected one by one for differential correction with base station files. Base stations and associated files necessary to correct rover GPS files can be selected via the GPS software interface with the internet or through ftp sites if provided by the base station of interest.

Contact NCCN GIS staff to help set-up GPS software projects for GPS data processing and the default settings in the software.

Note: Files collected on the MobileMapper GPS are termed “jobs” and files saved via MobileMapper Office are named “jobs” (both have .mmj extensions).

MobileMapper Office Project Set-Up

1. Open MobileMapper Office program from the computer and create a job file
    - a. Click on the File menu
    - b. Select New
    - c. Click on the File menu again
    - d. Select Save As
    - e. Navigate to a computer or network directory in which a PC job file will be stored
    - f. Name the file
    - g. Push Save
2. Set the coordinate system
    - a. Click on the Options menu
    - b. Select Coordinate System
    - c. Click the dropdown arrow in the Spatial Reference System window
    - d. Select UTM/WGS84/UTM zone 10N
        - i. If no coordinate system has been selected yet, click <new> from the dropdown list
        - ii. Select “SELECT a PRE-DEFINED system”
        - iii. Click the Next button
        - iv. Scroll down to UTM in the left pane of the Coordinate System Wizard – Select window and double click
        - v. Double click on WGS 84
        - vi. Select UTM/WGS 84/UTM zone 10N from the right pane in the Coordinate System Wizard – Select window
        - vii. Click on the Finish button
        - viii. Click on the browse button to the right of the dropdown list
        - ix. Click on the Datum tab
        - x. Select NAD83 from the Datum Name: pick-list
        - xi. Click OK
        - xii. Make sure the new option is selected in the Select Coordinate System window
    - e. Click OK

      Note: MobileMapper Office does not display the pick-list as NAD83; it displays as UTM/WGS 84/ UTM zone 10N
3. Set the units
    - a. Click on the Options menu
    - b. Select Units
    - c. Select m, km/hectare

Open this job file each time GPS job files are downloaded from the GPS unit to the PC desktop.

Data Transfer Between GPS and MobileMapper Office

1. Connect the GPS to the computer using the serial cable
2. Turn on the GPS unit
3. Launch MobileMapper Office if it is not already open
4. In MobileMapper Office, click on the File menu
5. Select Download from GPS
6. Click on the File menu within the MobileMapper Transfer window
7. Select Connect
8. Select GPS Device via Cable

   This will bring up a list of all files in the GPS unit on the left side pane.
9. Use the dropdown box in the right side pane to navigate to the directory to which GPS files will be copied and stored (e. g. “Raw” or “Unprocessed” folder)
10. Copy files from the left pane to the right pane by
    - a. Highlighting the job(s) name (use Shift or Ctrl keys to highlight multiple files),
    - b. Right clicking,
    - c. And selecting Copy to

      This will automatically begin the file(s) transfer from the GPS unit to the directory in the right pane.

    Note: Use the Copy option, not the Move option. It appears to be safer to copy, not move. The Move option takes the files out of the GPS unit and into the directory shown in the right pane. NCCN has experienced transfer errors that corrupt GPS receiver job files using the Move option.

    Note: Highlight and copy only the GPS receiver job files. There is no need to copy background map and feature library files.
11. Close the data transfer window

    This will return to the main MobileMapper Office job window.

Delete Files from GPS Receiver

Delete GPS files from GPS receivers only after files have been transferred to computers and backed-up.

Delete Files from MobileMapper Receiver

With the GPS receiver turned on,

1. Push MENU
2. Scroll to Delete Files
3. Push ENTER
4. Scroll to the file to be deleted
5. Push ENTER
6. Scroll to Yes to confirm deletion
7. Push ENTER

   Note: Files must be deleted one at a time. There is no option for deleting all files at once from the receiver.

Delete Files from MobileMapper Receiver Using MobileMapper Office

With MobileMapper Office open and the GPS receiver connected to the computer,

1. Click on the File menu
2. Select Download from GPS
3. Click on the File menu within the MobileMapper Transfer window
4. Select Connect
5. Select GPS Device via Cable

   This will bring up a list of all files in the GPS unit on the left side pane.
6. Highlight the job(s) name (use Shift or Ctrl keys to highlight multiple files) that will be deleted
7. Right click
8. Select Delete

   This will delete the selected job files from the GPS receiver.

Landbird Monitoring Protocol for National Parks in the North Coast and Cascades Network

Standard Operating Procedure (SOP) 11:

Managing Photographic Images

Revision History Log:

Revision Date	Author	Changes Made	Reason for Change

Overview

This document covers photographic images collected by project staff or volunteers during the course of conducting project-related activities. Images that are acquired by other means—for example, downloaded from a website or those taken by a cooperating researcher—are not project records and should be handled separately.

Care should be taken to distinguish data photographs from incidental or opportunistic photographs taken by project staff. Data photographs are those taken for at least one of the following reasons:

- To document a particular feature or perspective for the purpose of site relocation
- To capture site habitat characteristics and possibly to indicate gross structural changes over time
- To document a species detection that also is recorded in the data

Data photographs are linked to specific records within the database, and are stored in a manner that permits the preservation of those database links. Other photographs—for example, of field crew members at work, or photographs showing the morphology or behavior of certain bird species—also may be retained but are not necessarily linked with database records.

Effectively managing hundreds of photographic images requires a consistent method for downloading, naming, editing and documenting. The general process for managing data photographs proceeds as follows:

1. File Structure Setup – Set up the file organization for images prior to acquisition
2. Image Acquisition
3. Download and Process
   a. Download the files from the camera
   b. Rename the image files according to convention
   c. Copy and store the original, unedited versions
   d. Review and edit or delete the photographs
   e. Move into appropriate folders for storage
4. Establish Database Links
5. Deliver Image Files for Final Storage

A. File Structure Setup

Prior to data collection for any given year, project staff will need to set up a new folder under the Images folder in the project workspace as follows:

[Year]			The appropriate year – 2007, 2008, etc.
	[Park code]		Arrange files by park – OLYM, NOCA, etc.
	_Processing		Processing workspace
	Data		Data images
		[Site_code]	Arranged by transect, for images taken at transects
		[Date]	Arranged by date, for images not taken at transects
	Miscellaneous	[Site_code]	Non-data images taken by project staff
		[Date]	Arranged by transect, for images taken at transects
	Originals	[Site_code]	Renamed but otherwise unedited image file copies
		[Date]	Arranged by date, for images not taken at transects
	Non-NPS		Images acquired from other sources

This folder structure permits data images to be stored and managed separately from non-record and miscellaneous images collected during the course of the project. This structure also provides separate space for image processing and storage of originals.

Note: For additional information about the project workspace, refer to SOP 2: Workspace Setup and Project Records Management.

Folder Naming Standards

In all cases, folder names should follow these guidelines:

- No spaces or special characters in the folder name
- Use the underbar (“_”) character to separate words in folder names
- Try to limit folder names to 20 characters or fewer
- Dates within folder names should be formatted as YYYYMMDD (for better sorting)
- Transect names typically are a 4-character string (for example, 3140)

B. Image Acquisition

Capture images at an appropriate resolution that balances space limitations with the intended use of the images. Although photographs taken to facilitate future navigation to the site do not need to be stored at the same resolution as those that may be used to indicate gross environmental change at the site, it may be more efficient to capture all images at the same resolution initially. A recommended minimum raw resolution is 1600 × 1200 pixels (approximately 2 megapixels).

C. Downloading and Processing Procedures

1. Download the raw, unedited images from the camera into the appropriate “_Processing” folder.
2. Rename the images according to convention (refer to the section, “Image File Naming Standards”). If image file names were noted on the field data forms, be sure to update these to reflect the new image file name prior to data entry. See SOP 9: Field Form Handling Procedures.
3. Process images as follows:
   - Copy the images to the ‘Originals’ folder and set the contents as read-only by right clicking in Windows Explorer and checking the appropriate box. These originals are the image backup to be referred to in case of unintended file alteration or deletion.
   - Delete any poor quality photographs, repeats, or otherwise unnecessary photographs. Low quality photographs might be retained if the subject is highly unique, or the photograph is an irreplaceable data photograph.
   - Rotate the image to make the horizon level.
   - Photographs of people should have ‘red eye’ glare removed.
   - Photographs should be cropped to remove edge areas that grossly distract from the subject.
4. When finished, move the image files that are to be retained and possibly linked in the database to the appropriate folder – data images under the Data folder, other images under the Miscellaneous folder. Photographs of interest to a greater audience should be copied to the park Digital Image Library. To minimize the chance for accidental deletion or overwriting of needed files, no stray files should remain in the processing folder between downloads.

5. Depending on the size of the files and storage limitations, contents of the Originals folder may be deleted if all desired files are accounted for after processing.

Large groups of photographs acquired under sub-optimal exposure or lighting can be batch processed to enhance contrast or brightness. Batch processing also can be used to resize groups of photographs for use on the web. Batch processing may be done in ThumbsPlus, Extensis Portfolio, or a similar image software package.

Image File Naming Standards

In all cases, image names should follow these guidelines:

- No spaces or special characters in the file name
- Use the underbar ("_") character to separate file name components
- Try to limit file names to 30 characters or fewer, up to a maximum of 50 characters
- Park code and year should either be included in the file name or conclusive by the directory structure

The image file name should consist of the following parts:

1. Date of data capture (formatted as YYYYMMDD)
2. Transect number (if recorded at a transect)
3. Optional: a brief descriptive word or phrase
4. Optional: a sequential number if multiple images were captured
5. Optional: time (formatted as HHMM)

Examples:

- 20070621_3130_lg_tree_001.jpg
  (a feature at transect 3130 taken on June 21, 2007)
- 20070621_3130_NE01_marker.jpg
  (documents the marker at point 3130.NE01)
- 20070518_training_004.jpg
  (4th photograph taken during training on May 18, 2007)

In cases where there are small quantities of photographs, it is practical to individually rename these files. However, for larger numbers, it may be useful to rename files in batches. This may be done in ThumbsPlus, Extensis Portfolio, or a similar image software package. A somewhat less sophisticated alternative is to batch rename files in Windows Explorer, by first selecting the files to be renamed and then selecting File > Rename. The edits made to one file will be made to all others, although with the unpleasant side effect of often adding spaces and special characters (for example, parentheses) that will then need to be removed manually.

Renaming photographs may be most efficient as a two part event—first step performed as a batch process that inserts the date and transect number at the beginning of the photograph name, and a second step in which a descriptive component is manually added to each file name.

D. Establish Database Links

During data entry and processing, the database application will provide the functionality required to establish a link between each database record and the appropriate image file(s). To establish the link, the database prompts the user to indicate the root project workspace directory path, the specific image folder within the project workspace, and the specific file name. This way, the entire workspace may be later moved to a different directory (for example, the NCCN Digital Library) and the links will still be valid after changing only the root path. Refer to SOP 12: Data Entry and Verification for additional details on establishing these links.

Note: Files must keep the same name and relative organization once these database links have been established. Users should not rename or reorganize the directory structure for linked image files without first consulting with the Data Manager.

E. Deliver Image Files for Final Storage

Note: For additional information about delivery specifications, refer to SOP 18: Product Delivery Specifications.

At the end of the season, and once the year's data are certified, data images for the year may be delivered along with the working copy of the database to the Data Manager on a CD or DVD. To do this, simply copy the folder for the appropriate year(s) and all associated subfolders and images onto the disk. These files will be loaded into the project section of the NCCN Digital Library, and the database links to data images will be updated accordingly.

Prior to delivery, make sure that all processing folders are empty. Upon delivery, the delivered folders should be made read-only to prevent unintended changes.

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Landbird Monitoring Protocol for National Parks in the North Coast and Cascades Network

Standard Operating Procedure (SOP) 12:

Data Entry and Verification

Revision History Log:

Revision Date	Author	Changes Made	Reason for Change

Overview Guidelines for Data Entry and Verification

This document describes the general procedures for entry and verification of field data in the working project database. For related guidance and a clarification of the distinction between the working database and the master database, refer to protocol Section 4C, Overview of Database Design, and Section 4D, Data Entry and Processing. The following are general guidelines:

1. Data should be entered as soon after data collection as possible so that field crews remain current with data entry tasks, and identify any errors or problems as close to the time of data collection as possible.
2. The working database application is in the project workspace. For enhanced performance, users should copy the front-end database onto their workstation hard drives and open it there. This front-end copy may be considered “disposable” because it does not contain any data, but rather acts as an interface with data residing in the back-end working database.
3. Each data entry form is patterned after the layout of the field form, and has built-in quality-assurance components such as pick lists and validation rules to test for missing data or illogical combinations. Although the database permits users to view the raw data tables and other database objects, users are strongly encouraged only to use the pre-built forms as a way of ensuring the maximum level of quality assurance.
4. As data are being entered, the person entering the data should visually review each data form to make sure that the data on screen match the field forms. This should be done for each record prior to moving to the next form for data entry.
5. At regular intervals and at the end of the field season, the Field Lead should inspect the data that have been entered to check for completeness and perhaps identify avoidable errors. The Field Lead also may periodically run the Quality Assurance Tools that are built into the front-end working database application to check for logical inconsistencies and data outliers (this step is described in greater detail in Section 4E, Quality Review and also in SOP 14: Data Quality Review and Certification).

Database Instructions

Getting Started

The first action to be taken is to make sure the data entry workspace is set up properly on a networked drive. If you are unclear about where this should be, contact either the local Park Wildlife Biologist or Data Manager.

- Store the back-end database file on the server so that others can enter data into the same back end file. The back-end file has “_be_” as part of its name. Upon saving this back-end file, the user may want to append the local park code to distinguish it from other back-end files associated with other crews (for example, Landbirds_BDa03_be_2007_OLYM.mdb).

- The crew's copy of the front-end database also may be stored in the same folder.
- Create a folder if it does not already exist in the same network folder named "backups" or "backup copies" for storing daily backups of the back-end database file.

Prior to Using the Database:

- Open the front-end database. The first thing the front-end application will do is prompt you to update the links to the back-end database file. This update will only need to be done once for each new release of the front-end database.

Important Reminders for Daily Database Use

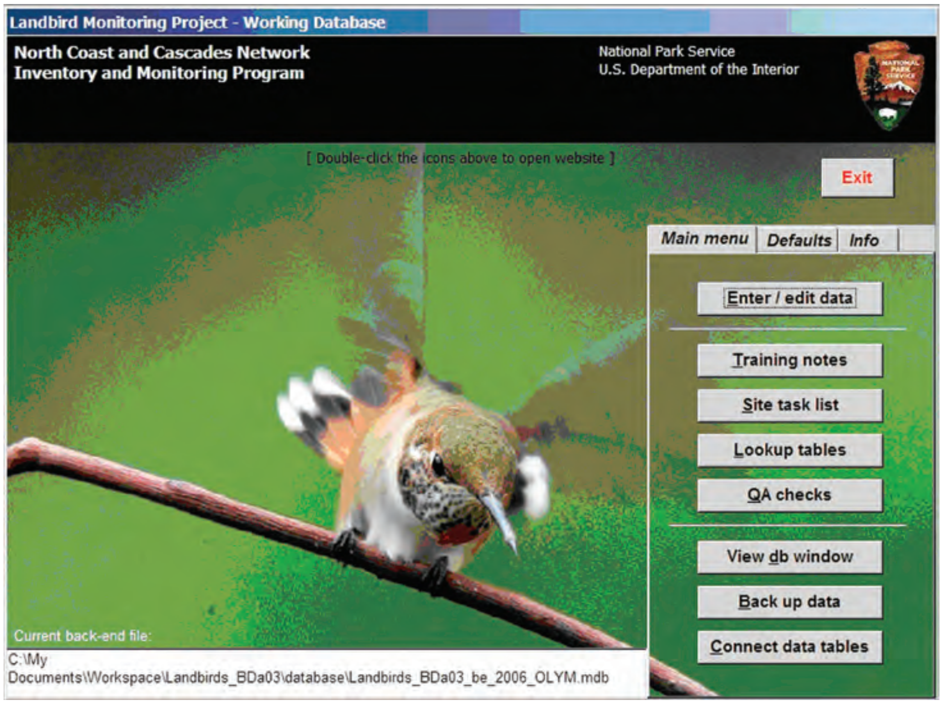
- A new copy of the front-end database will need to be copied to your workstation every day. Do not open and use the front-end database on the network as this 'bloats' the database file and makes it run more slowly.
- Backups should be made consistently at some point every day that data entry occurs. Normally, the front-end application will automatically prompt you to make a backup either upon initially opening or upon exiting the application. Backups also can be made on demand by clicking on the "Backup data" button on the main menu and storing the backup file in the "backups" folder.
- To save drive space and network resources, backup files should be compacted by right-clicking on the backup file in Windows Explorer and selecting the option: "Add to Zip file." Old files may be deleted at the discretion of the Field Lead.
- New versions of the front-end application may be released as needed through the course of the field season. If this happens, there should be no need to move or alter the back-end file. Instead, the front-end file may be deleted and replaced with the new version, which will be named in a manner reflecting the update (for example, ForestVeg_2007_v2.mdb).
- If the front-end database gets large or if performance slows, compact it periodically by selecting Tools > Database Utilities > Compact and Repair Database.

Database Components

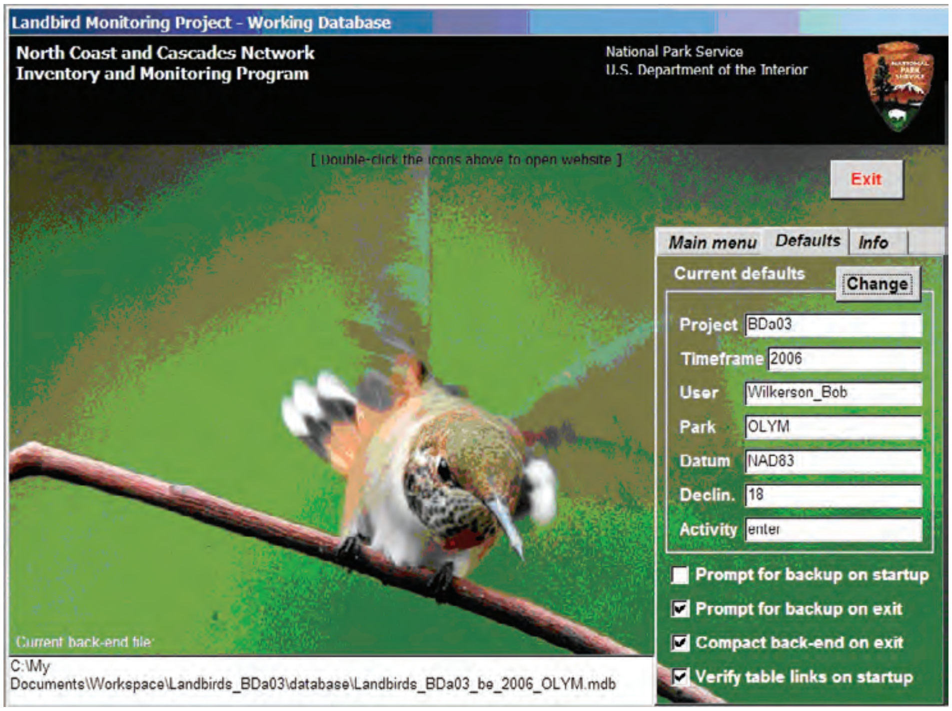
The working front-end application has the following functional components, which are accessed from the main application switchboard form that opens automatically when the application starts:

- Enter / edit data – Opens a form to confirm default settings (for example, park, coordinate datum) prior to continuing to the project-specific data entry screens.
- Training notes – Opens a form for entering information about individual pre-season and refresher training sessions.
- Site task list – Keeps track of unfinished tasks associated with sample locations (for example, forgotten equipment, unfinished data collection) that one field crew can use to communicate with a future field crew.
- Lookup tables – Opens a tool for managing the lookup values for the project data set (for example, species list, list of project personnel, etc.).
- QA checks – Opens the data validation tool, which shows the results of pre-built queries that check for data integrity, missing data, and illogical values, and allows the user to fix these problems and document the fixes. See SOP 14: Data Quality Review and Certification.
- View db window – Allows the user to view database objects (tables, queries, and forms).
- Back up data – Creates a date-stamped copy of the back-end database file.
- Connect data tables – Verifies the connection to the back-end working database file, and provides the option to redirect or update that connection.

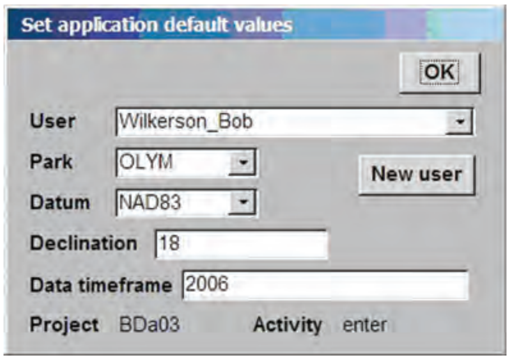
Here is a view of the main menu / switchboard form.



The second tab shows the current default settings.



To set defaults, click on the 'Change' button. This will open up a new window where the user can enter the park, datum, and user name. This window also appears each time the user selects the path for data entry or review to ensure that the correct user and park are indicated.


Set application default values

OK

User Wilkerson_Bob

Park: OLYM

New user

Datum: NAD83

Declination: 18

Data timeframe: 2006

Project: BDa03 Activity: enter

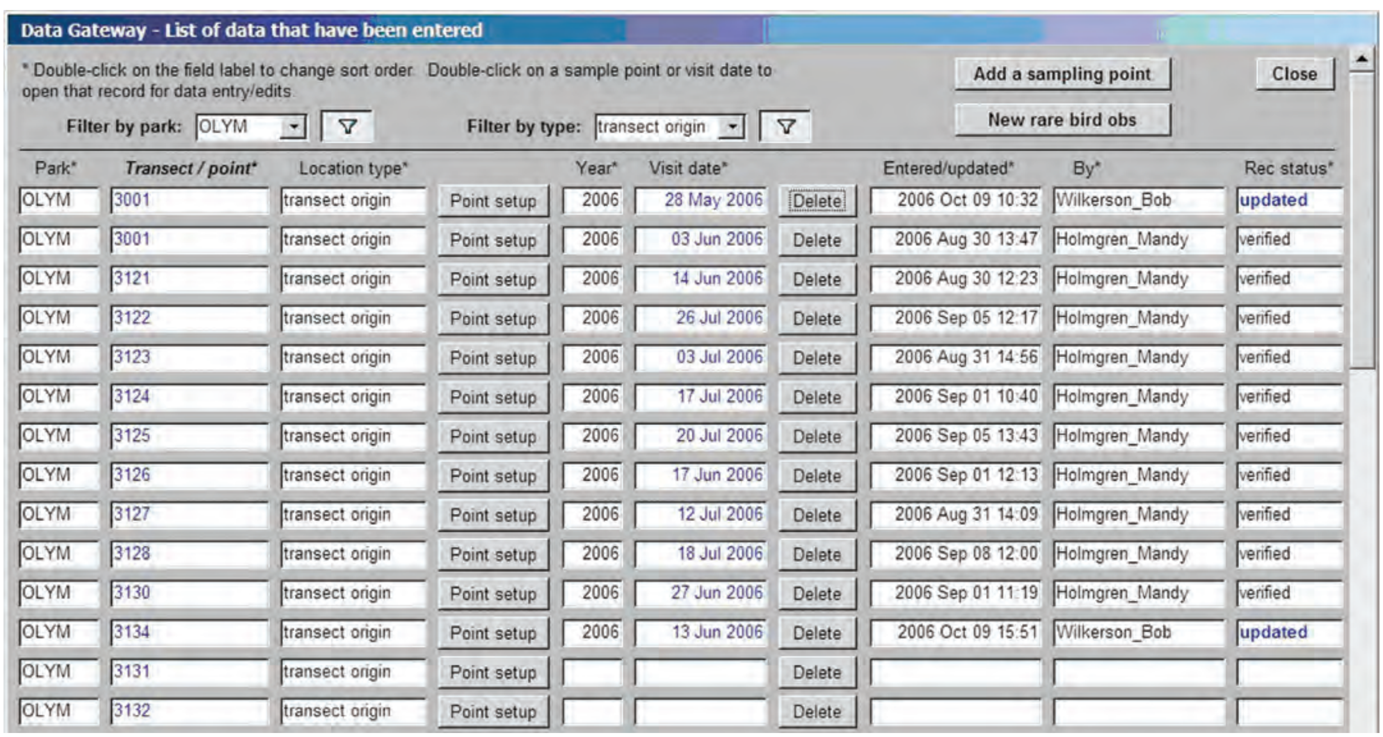
Entering Data

Enter (and verify) transect data in the following order:

1. Point Establishment form—accessed by clicking on the "Point setup" button in the Data Gateway Form.
2. Transect Visit Log and Point Count Conditions Form (and the Point Revisit Form if applicable)—all of which can be entered in the unified form called "Data Entry Form."
3. Habitat data—accessed by clicking on the "Habitat data" button in the Data Entry Form at any point after entering transect visit log data.
4. Point count data—accessed by clicking on the "Point count data" button in the Data Entry Form at any point after entering transect visit log data.

When you select the "Enter / edit data" button, you will have a chance to change the default user name, park and declination. Make sure this information is correct each time you enter data.

Next, you will see the Data Gateway Form, which is where you will see a list of transects, sample points, and incidental (rare bird observations) sample locations that are already present in the back-end database. This list is automatically filtered by the selected park (upper left corner), and to show only transect origins. Filters can be changed at any time, and records can be sorted by double-clicking on the field label above each column.


Data Gateway - List of data that have been entered

* Double-click on the field label to change sort order. Double-click on a sample point or visit date to open that record for data entry/edits

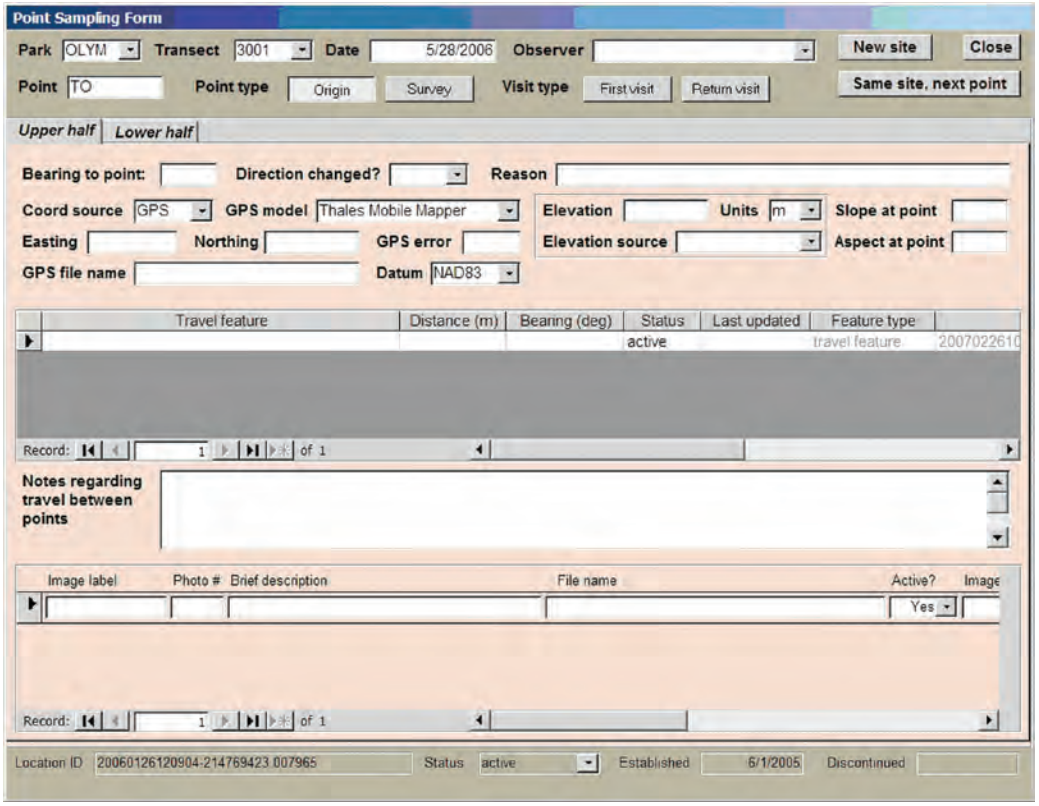
Add a sampling point | Close

New rare bird obs

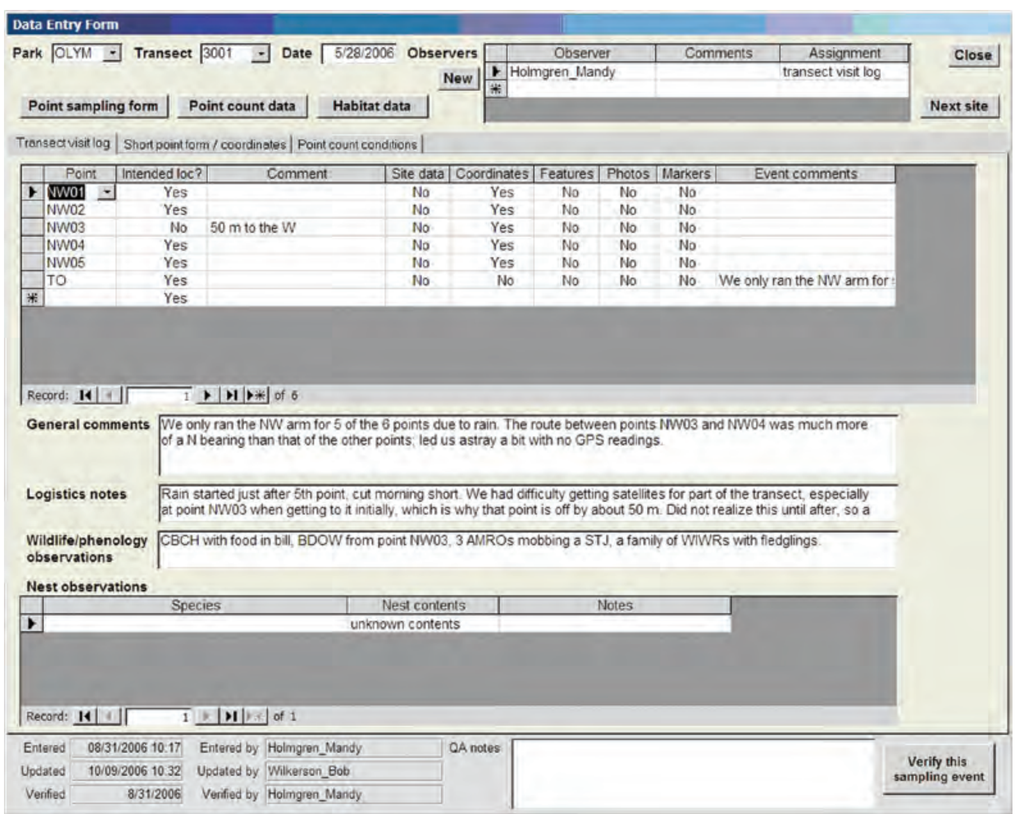
Filter by park: OLYM | Filter by type: transect origin

Park*	Transect / point*	Location type*		Year*	Visit date*		Entered/updated*	By*	Rec status*
OLYM	3001	transect origin	Point setup	2006	28 May 2006	Delete	2006 Oct 09 10:32	Wilkerson_Bob	updated
OLYM	3001	transect origin	Point setup	2006	03 Jun 2006	Delete	2006 Aug 30 13:47	Holmgren_Mandy	verified
OLYM	3121	transect origin	Point setup	2006	14 Jun 2006	Delete	2006 Aug 30 12:23	Holmgren_Mandy	verified
OLYM	3122	transect origin	Point setup	2006	26 Jul 2006	Delete	2006 Sep 05 12:17	Holmgren_Mandy	verified
OLYM	3123	transect origin	Point setup	2006	03 Jul 2006	Delete	2006 Aug 31 14:56	Holmgren_Mandy	verified
OLYM	3124	transect origin	Point setup	2006	17 Jul 2006	Delete	2006 Sep 01 10:40	Holmgren_Mandy	verified
OLYM	3125	transect origin	Point setup	2006	20 Jul 2006	Delete	2006 Sep 05 13:43	Holmgren_Mandy	verified
OLYM	3126	transect origin	Point setup	2006	17 Jun 2006	Delete	2006 Sep 01 12:13	Holmgren_Mandy	verified
OLYM	3127	transect origin	Point setup	2006	12 Jul 2006	Delete	2006 Aug 31 14:09	Holmgren_Mandy	verified
OLYM	3128	transect origin	Point setup	2006	18 Jul 2006	Delete	2006 Sep 08 12:00	Holmgren_Mandy	verified
OLYM	3130	transect origin	Point setup	2006	27 Jun 2006	Delete	2006 Sep 01 11:19	Holmgren_Mandy	verified
OLYM	3134	transect origin	Point setup	2006	13 Jun 2006	Delete	2006 Oct 09 15:51	Wilkerson_Bob	updated
OLYM	3131	transect origin	Point setup			Delete			
OLYM	3132	transect origin	Point setup			Delete			

Clicking on the "Add a sampling point" button (upper right corner) will open the Point Establishment Form to a blank record. To open an existing record for edits or to complete data entry, click on the "Point setup" button associated with the desired record.

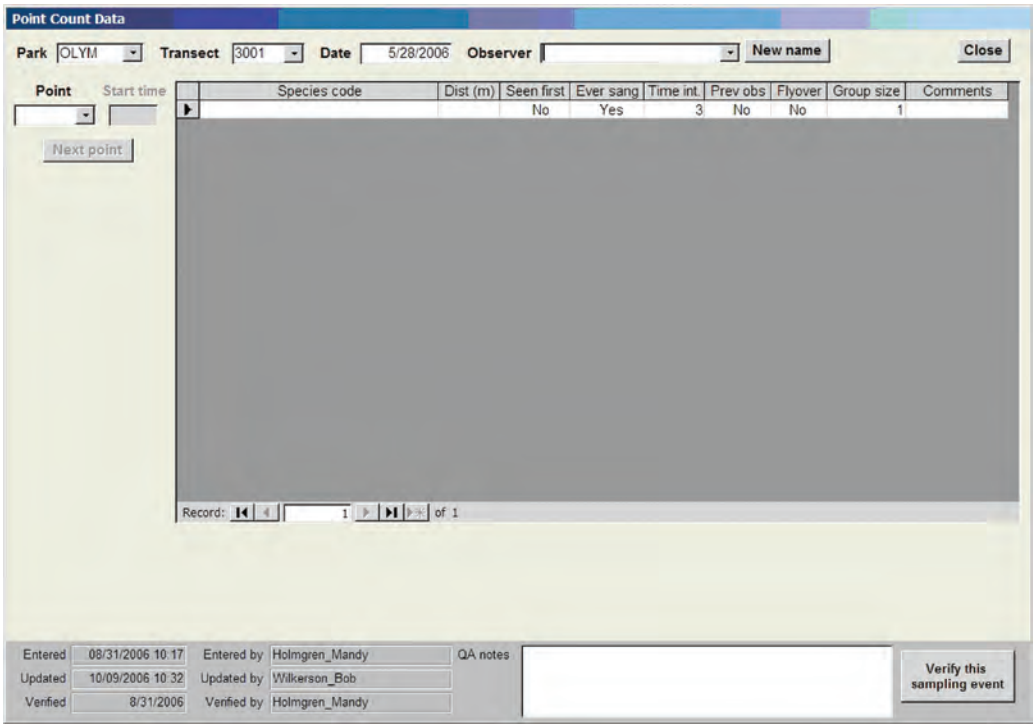


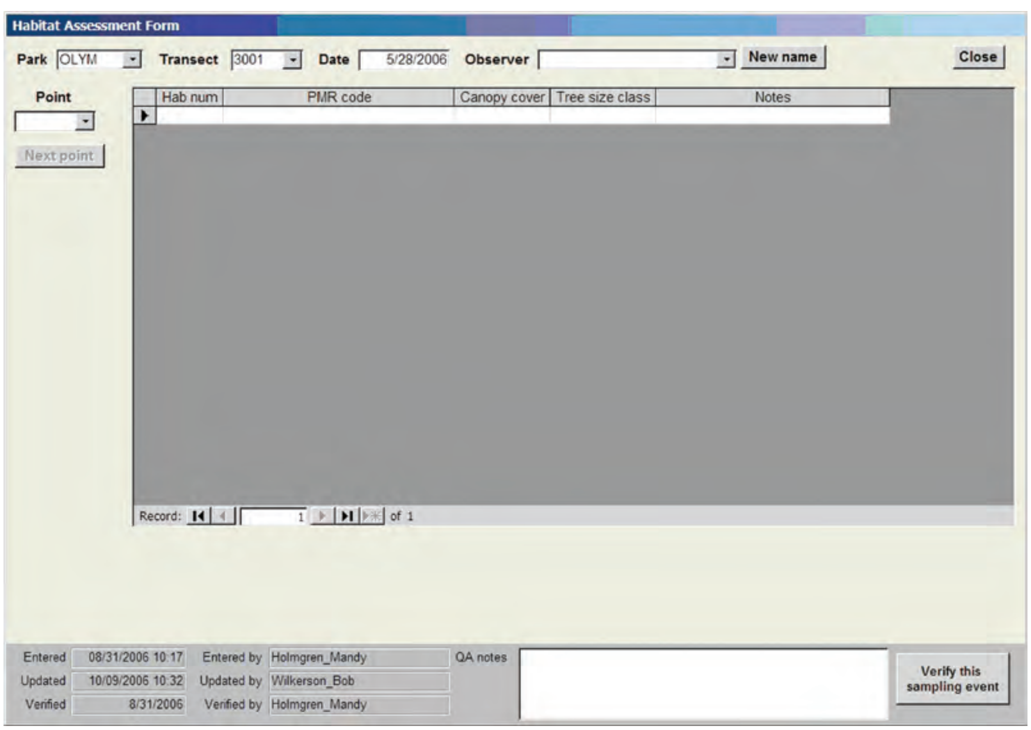
In the Data Gateway Form, double-click on the appropriate “Transect / point” cell, or on the “Visit date” cell to open the main data entry form. This form has multiple tabs for entering the Transect Visit Log, the Plot Revisit Form, and the Point Count Conditions Form. The main entry data form also has links for entering data from Point Count and Habitat Assessment Forms associated with the transect visit.



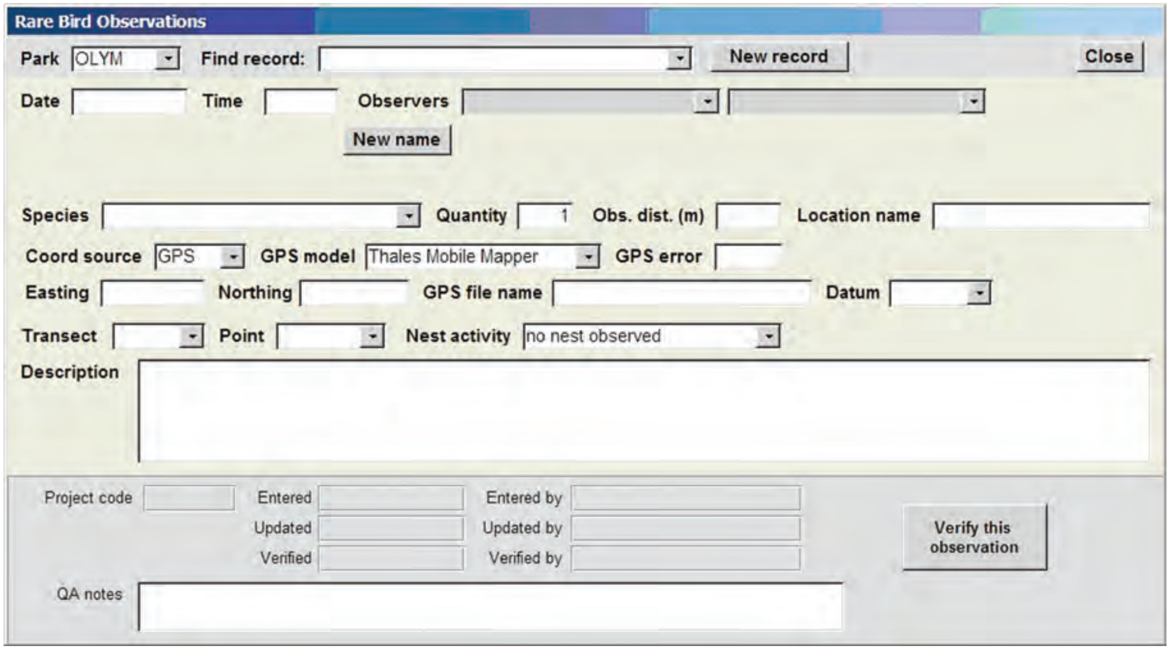
Upon finishing data entry for each plot, the database entries should be compared against the original field forms. Most of the data entry screens—in particular the Data Entry Form, the Point Count Form, and the Rare Bird Observation Form—have fields for storing miscellaneous comments about each sampling event, quality assurance information about the event, and information on who created the sampling event record, who last updated it, etc. When all data for the sampling event have been entered, click on the button that says “Verify this sampling event” to indicate that the event record is complete and accurately reflects the field forms.

The following forms for point count data and habitat assessment can be accessed from the Data Entry Form using either the “Point count data” or “Habitat data” buttons at the top of the form.



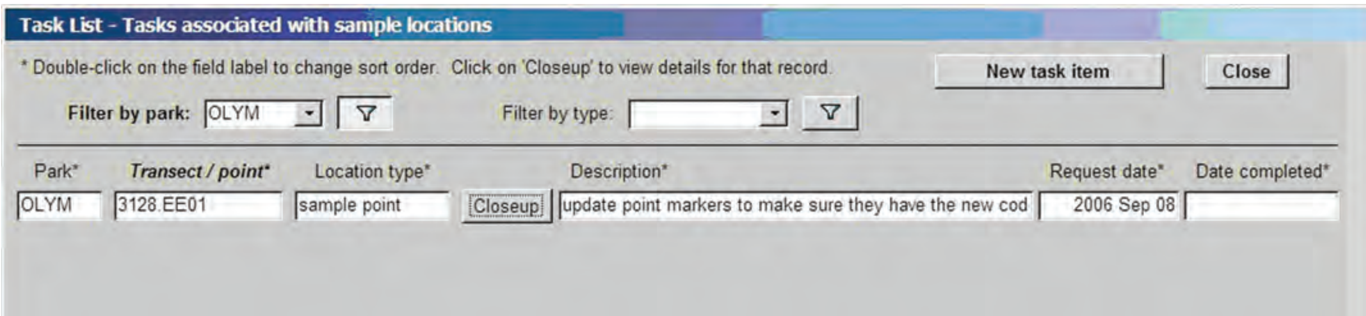


Rare bird observations also can be accessed from the Data Gateway Form, either by changing the filter and opening by selecting the appropriate “Visit date” cell, or by adding a new record using the “New rare bird obs” button. Relevant records also may be accessed directly for verification by double-clicking on the appropriate row of the “Rec status” column in the Data Gateway Form.

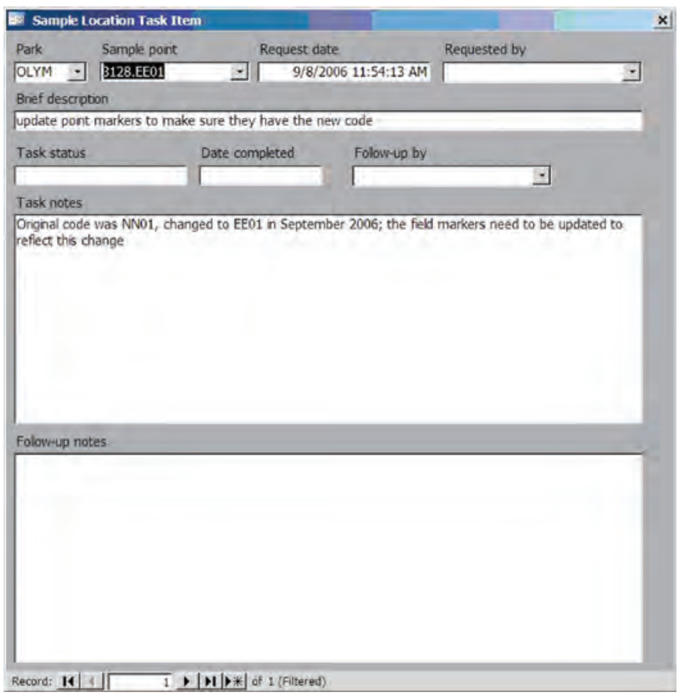


Task List and Training Notes

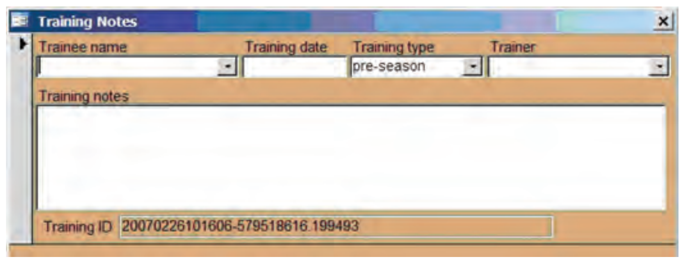
The task list browser functions in much the same way as the Data Gateway Form, and can be sorted or filtered by park or location type. Click on the “Closeup” button to view or edit information for that record.



Close-up view for entering/editing location task items:

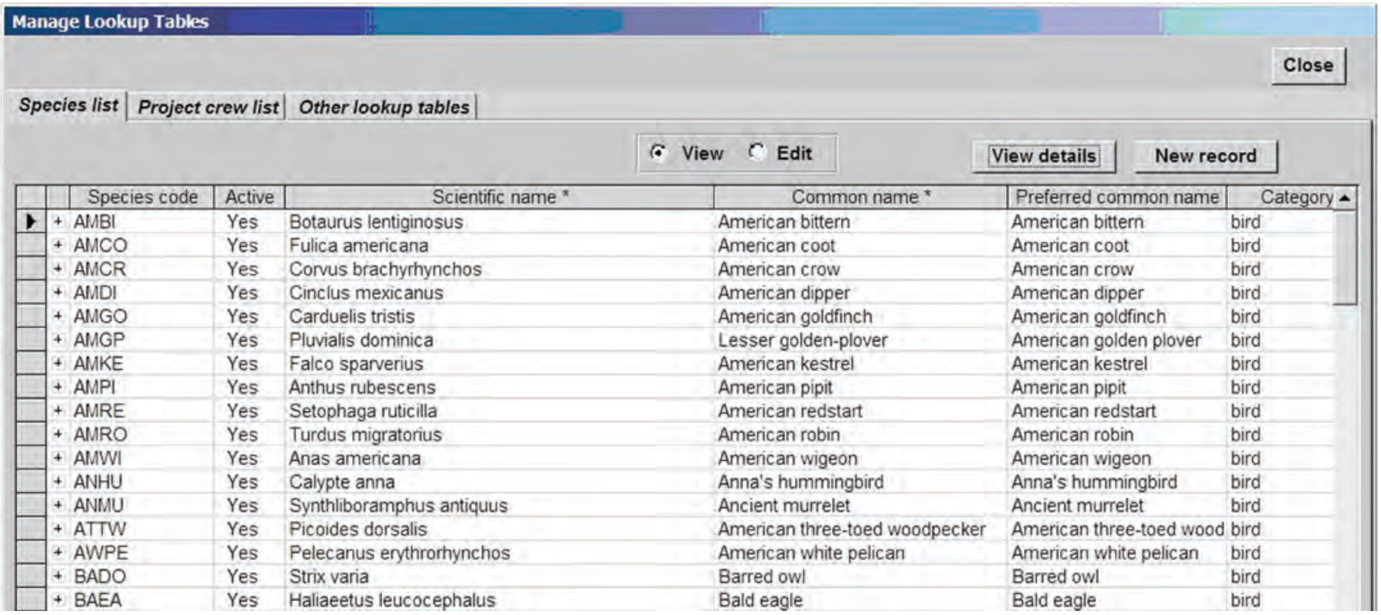


Training notes form:

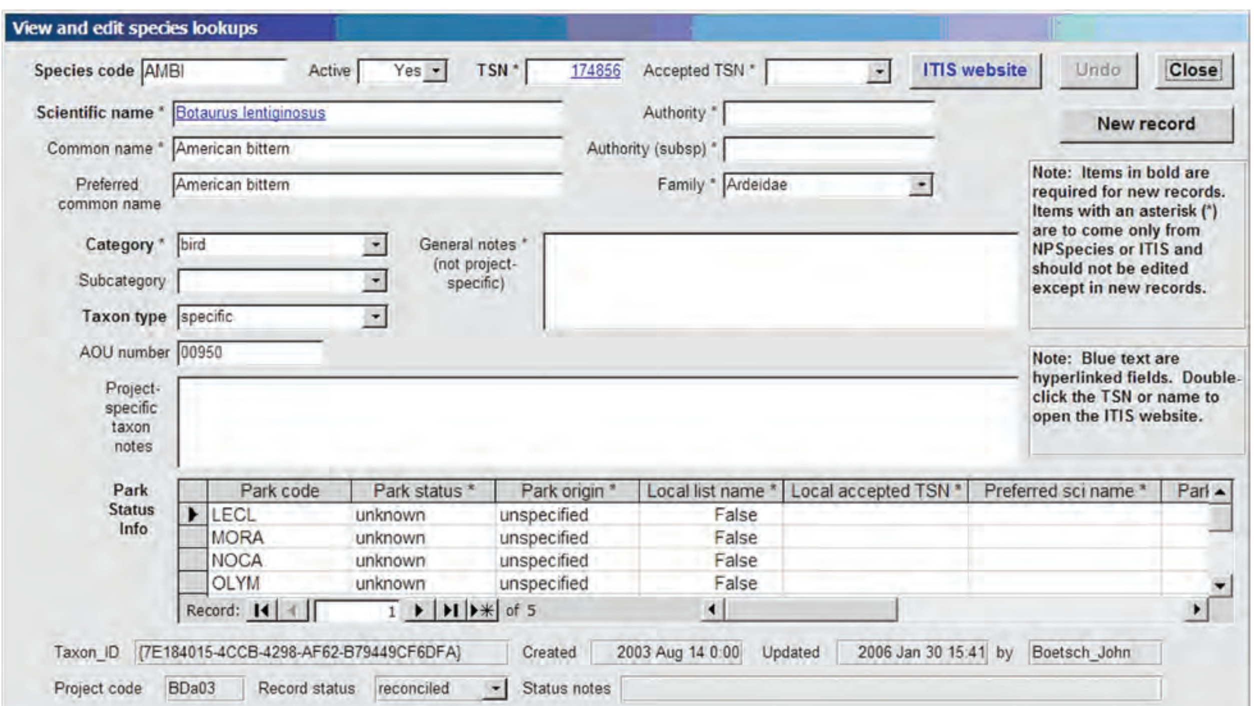


Manage Lookups

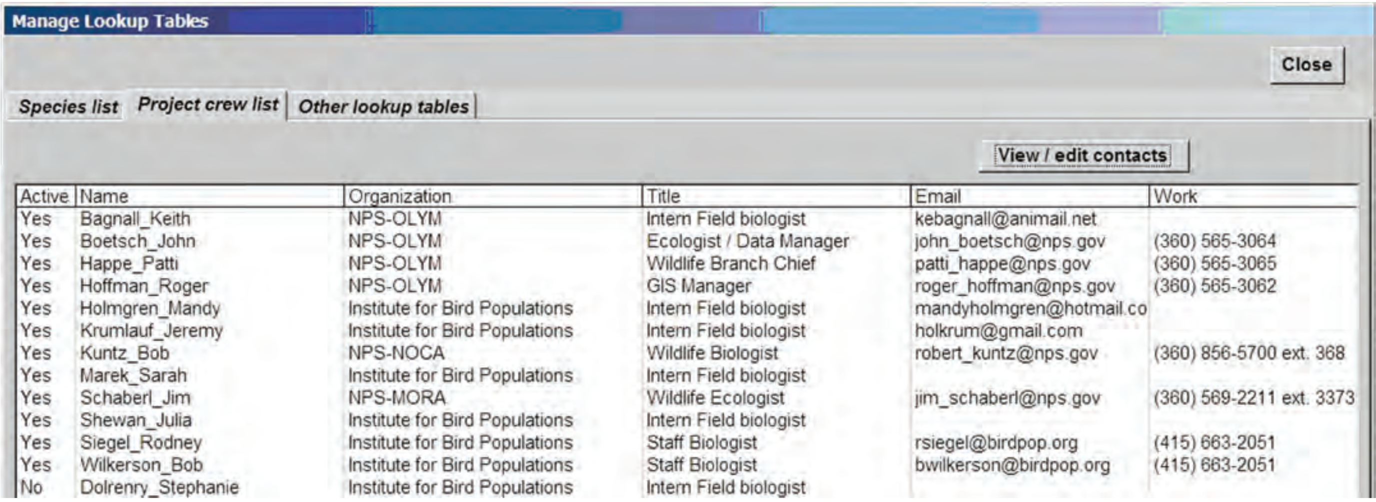
From the main menu, click on ‘Lookup tables’ to open the lookup tool. This tool has 3 tabs—one for the project species list, another for the project crew list, and a third for viewing the contents of all other lookup tables. The first tab is the project species list. Minor edits may be made by putting the form into Edit mode. By selecting a record and clicking on “View details”, or by double-clicking on any record selector (the gray box to the left of each record), the species popup form will open. To add a new record click on ‘New record’.



The species popup form can be used for adding or editing species records. Required fields are shown in **bold**, and items with an asterisk (*) next to the name are not to be edited except by the Data Manager (these come from either ITIS or the NPSpecies application). The Integrated Taxonomic Information System (ITIS) website may be accessed by clicking on the button labeled ‘ITIS website’, or by clicking on either the Taxonomic Serial Number (TSN) or scientific name if either of these fields is already populated. All new records—except for unknown taxa or temporary names—should have TSN entered if it exists on the ITIS website.

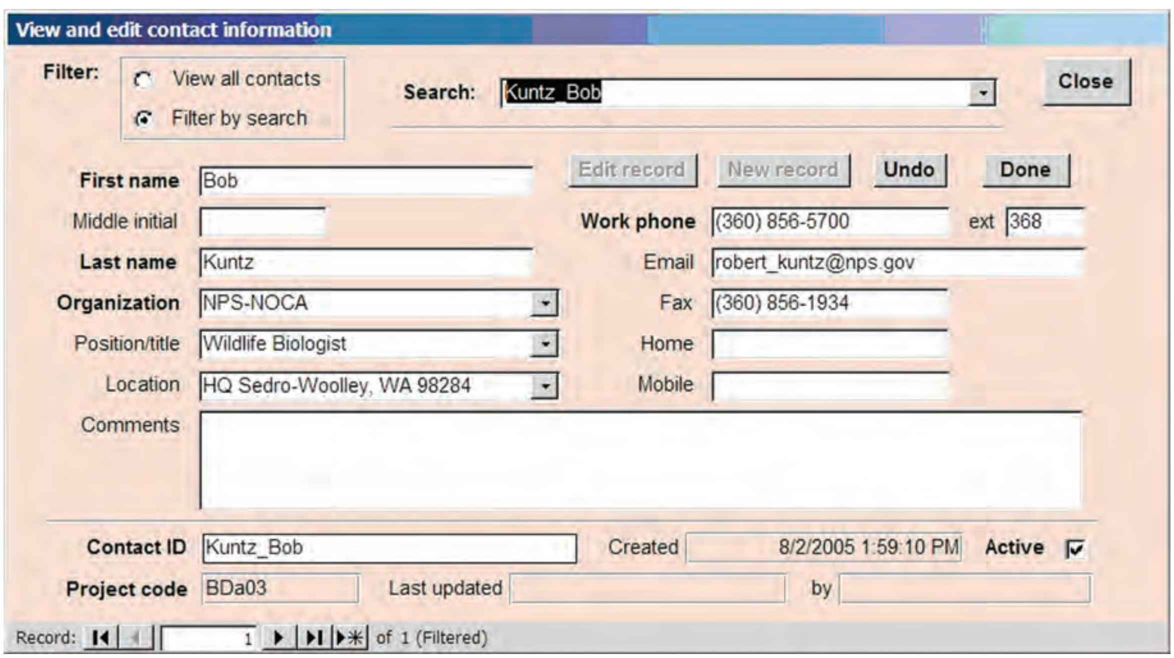


The second tab of the lookups module is a list of contacts for the project.



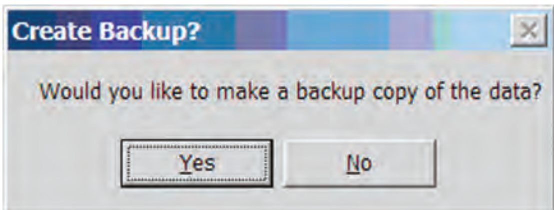
Active	Name	Organization	Title	Email	Work
Yes	Bagnall_Keith	NPS-OLYM	Intern Field biologist	kebagnall@animail.net	
Yes	Boetsch_John	NPS-OLYM	Ecologist / Data Manager	john_boetsch@nps.gov	(360) 565-3064
Yes	Happe_Patti	NPS-OLYM	Wildlife Branch Chief	patti_happe@nps.gov	(360) 565-3065
Yes	Hoffman_Roger	NPS-OLYM	GIS Manager	roger_hoffman@nps.gov	(360) 565-3062
Yes	Holmgren_Mandy	Institute for Bird Populations	Intern Field biologist	mandyholmgren@hotmail.co	
Yes	Krumlauf_Jeremy	Institute for Bird Populations	Intern Field biologist	holkrum@gmail.com	
Yes	Kuntz_Bob	NPS-NOCA	Wildlife Biologist	robert_kuntz@nps.gov	(360) 856-5700 ext. 368
Yes	Marek_Sarah	Institute for Bird Populations	Intern Field biologist		
Yes	Schaberl_Jim	NPS-MORA	Wildlife Ecologist	jim_schaberl@nps.gov	(360) 569-2211 ext. 3373
Yes	Shewan_Julia	Institute for Bird Populations	Intern Field biologist		
Yes	Siegel_Rodney	Institute for Bird Populations	Staff Biologist	rsiegel@birdpop.org	(415) 663-2051
Yes	Wilkerson_Bob	Institute for Bird Populations	Staff Biologist	bwilkerson@birdpop.org	(415) 663-2051
No	Dolrenry_Stephanie	Institute for Bird Populations	Intern Field biologist		

By selecting a contact record and clicking on the “View / edit” button, or by double-clicking on a contact record, the following popup is opened in edit mode. Once edits are accepted with the “Done” button, the user may either page through the records using the record navigator at the bottom of the form, or may search for a particular name in the dropdown pick list.

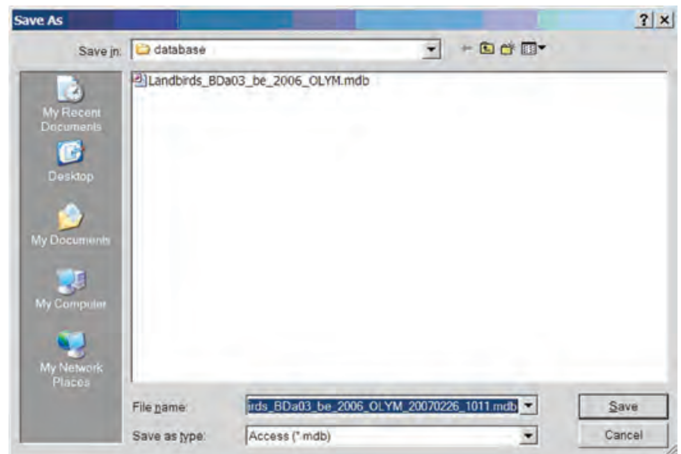


Database Backups

Data backups must be made on a regular basis—perhaps every day that new data are entered —to save time in case of mistakes or database file corruption. Depending on application defaults, you will be prompted upon opening or closing the application as to whether or not you want to make a backup. If you choose not to make a backup at this time, you may make one at any point by clicking on the “Backup data” button on the main menu.

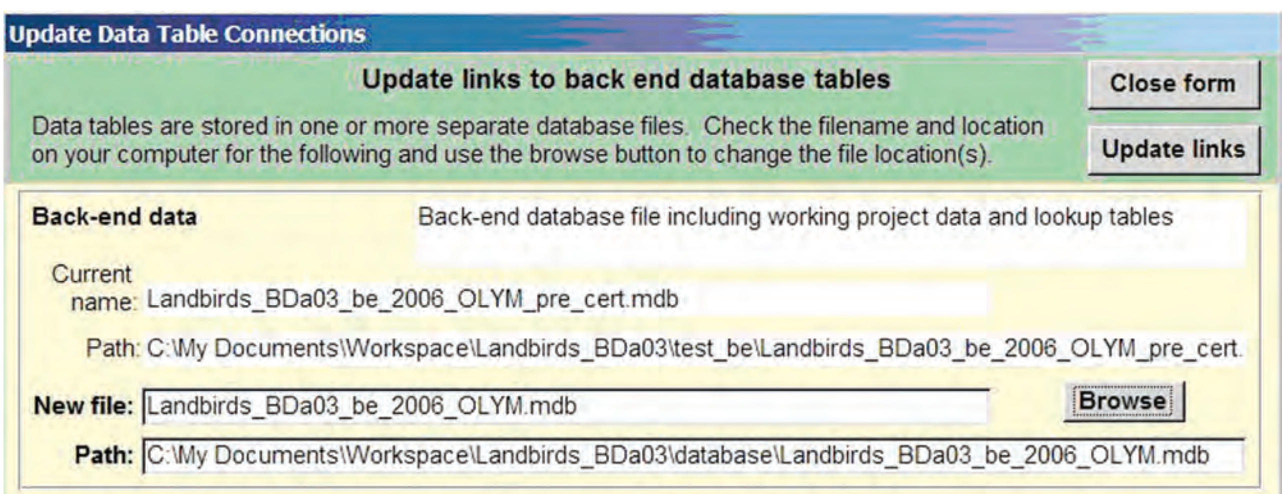


If you respond ‘Yes’ to the backup prompt, a window will open to allow you to indicate where to save the file. The default path is the same as the back-end database file, and the default name is that for the back-end file with a date stamp appended to the end. Backups are to be made in a subfolder created exclusively for backups in order to clearly separate the working back-end database file from the backups. These periodic backup files should be compressed to save drive space, and may be deleted once enough subsequent backups are made. All such backups should be deleted after the data have passed the quality review and have been certified.



Link Back-End Data File

When first installing the front-end application, the user will need to establish the table links to the back-end database. Users also may need to refresh the links if the back-end file path changes or if a user wants to connect to a different back-end data file. Table links can be updated using the Data Table Connections tool, available by clicking on the ‘Connect data tables’ button on the main menu. Browse to the desired back-end file and then click on ‘Update links’ to refresh the connection.



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Landbird Monitoring Protocol for National Parks in the North Coast and Cascades Network

Standard Operating Procedure (SOP) 13:

After the Field Season

Revision History Log:

Revision Date	Author	Changes Made	Reason for Change

This Standard Operating Procedure identifies steps that must be completed before NCCN landbird monitoring field crews complete the field season.

1. Clean, Inventory, and Store Field Gear

Each field team at each park is responsible for cleaning and properly storing all field gear checked out to them at the beginning of the field season.

- First aid kits should be inventoried, so that all used supplies can be replenished. First aid supplies should be checked to insure items with expiration dates will still be usable during the following field season. Items that are or will be out of date should be noted so that they can be replaced at the beginning of the next field season.
- Wash all bear-resistant food canisters and dry thoroughly.
- Clean all water pump filters and store in sealed plastic container.
- After all field gear is cleaned and assembled, use the equipment checkout sheet posted at each park on the LTEM equipment cabinet to inventory items as they are replaced for storage.
- Record needed repairs or replacement parts on the equipment checkout sheet in the appropriate column AND on a label affixed to the damaged equipment. Do NOT return any unlabeled equipment needing repair to the equipment cabinet.
- Report missing or faulty equipment or equipment needing repair to the Project Lead so that equipment can be repaired or replaced before the following field season.

2. Data Management

- Ensure that all data are properly entered into the computer database.
- Ensure that all GPS data have been delivered to the GIS Specialist for processing.

3. Close-Out

- Return keys, radios, or any other park property.

4. Field Season Reporting

The Field Lead should prepare a brief report to the Project Lead (generally not more than three pages) that includes the following:

- Clear enumeration of which transects were completed during the season.
- Description of any logistic difficulties that arose, and explanation of how they were addressed.
- Clear documentation and explanation of any diversions from established protocols.
- Discussion of any interesting or potentially important observations about the parks' bird communities that may have been noted during the field season (for example, apparent changes in phenology from previous years, or notable changes in apparent abundance of particular species).
- Suggestions for improving the training session or field season logistics in the future.

Landbird Monitoring Protocol for National Parks in the North Coast and Cascades Network

Standard Operating Procedure (SOP) 14:

Data Quality Review and Certification

Revision History Log:

Revision Date	Author	Changes Made	Reason for Change

Overview

This document describes the procedures for validation and certification of data in the working project database. Refer also to protocol narrative Section 4C, Overview of Database Design; Section 4E, Quality Review; and Section 4G, Data Certification and Delivery for related guidance and a clarification of the distinction between the working database and the master database.

After the season's field data have been entered and processed, they need to be reviewed and certified by the Project Lead for quality, completenes, and logical consistency. Data validation is the process of checking data for completeness, structural integrity, and logical consistency. The working database application facilitates this process by showing the results of pre-built queries that check for data integrity, data outliers and missing values, and illogical values. The user may then fix these problems and document the fixes.

Once the data have been through the validation process and metadata have been developed for them, they are to be certified by completing the NCCN Project Data Certification Form, available on the NCCN website. The completed form, certified data and updated metadata may then be delivered to the NPS Lead and the Data Manager according to the timeline in Appendix 2: Yearly Project Task List.

Data Quality Review

The following table shows the automated validation checks that are performed on the data prior to certification. These queries are designed to return records that need to be fixed, so ideally—once all data checks have been run and any errors have been fixed—none of the queries will return records. However, not all errors and inconsistencies can be fixed, in which case a description of the resulting errors and why edits were not made is then documented and included in the metadata and certification report.

The queries are named and numbered hierarchically so that high-order data—for example from tables on the parent side of a parent-child relationship such as sample locations —should be fixed before low-order data (for example, individual species observations). The rationale for this is that one change in a high-order table affects many downstream records, and so proceeding in this fashion is the most efficient way to isolate and treat errors.

In addition to these automated checks, the person performing the quality review should remain vigilant for errors or omissions that may not be caught by the automated queries. Another task that cannot be automated is the process of ensuring that all data for the current season are entered into the database. This will often involve manual comparisons between field forms or other lists of the sites visited and the results of queries showing the sites for which data exist. The Data Manager also is available as needed to help construct new database queries or modify existing ones as needed.

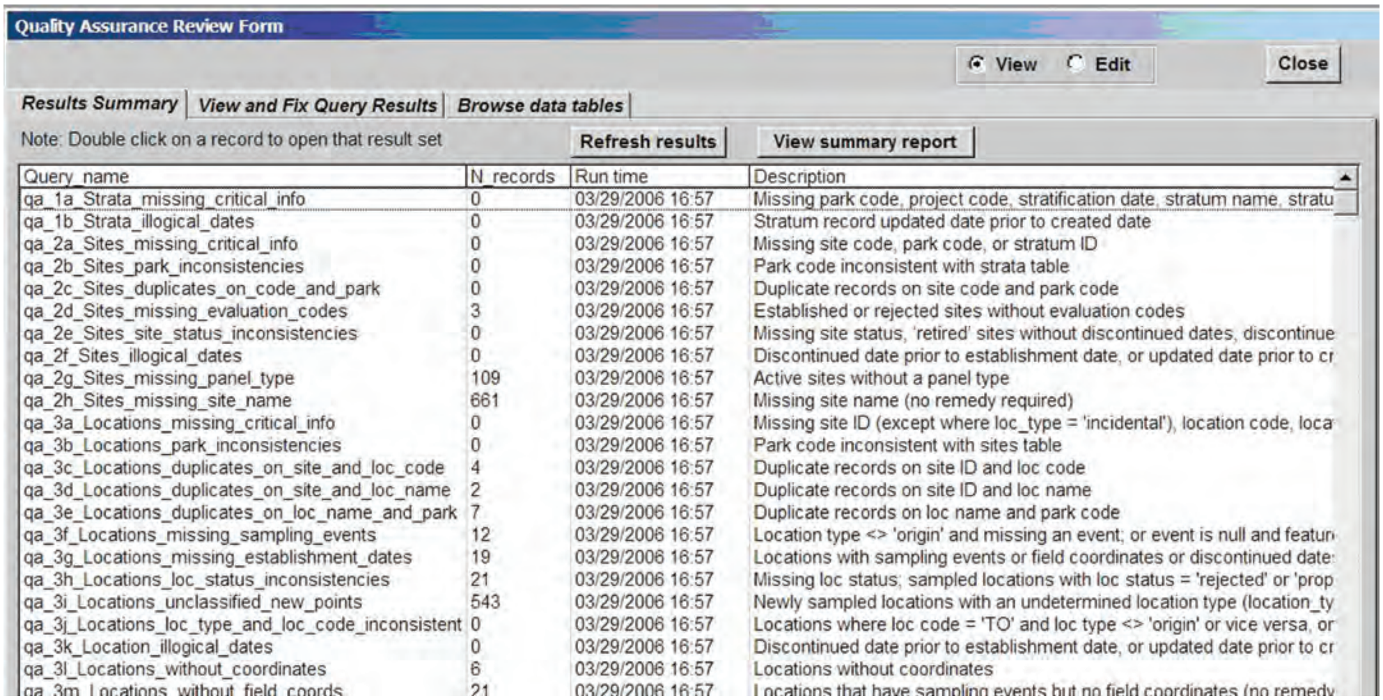
Query_name	Returns records meeting the following criteria
qa_1a_Strata_missing_critical_info	Missing park code, project code, stratification date, stratum name, stratum definition
qa_1b_Strata_illogical_dates	Stratum record updated date prior to created date
qa_2a_Sites_missing_critical_info	Missing site code, park code, or stratum ID
qa_2b_Sites_park_inconsistencies	Park code inconsistent with strata table
qa_2c_Sites_duplicates_on_code_and_park	Duplicate records on site code and park code
qa_2d_Sites_missing_evaluation_codes	Established or rejected sites without evaluation codes
qa_2e_Sites_site_status_inconsistencies	Missing site status, ‘retired’ sites without discontinued dates, discontinued dates on status other than ‘retired’, or discontinued dates without establishment dates
qa_2f_Sites_illogical_dates	Discontinued date prior to establishment date, or updated date prior to created date
qa_2g_Sites_missing_panel_type	Active sites without a panel type
qa_2h_Sites_missing_site_name	Missing site name (no remedy required)
qa_3a_Locations_missing_critical_info	Missing site ID (except where loc_type = ‘incidental’), location code, location type, or park code
qa_3b_Locations_park_inconsistencies	Park code inconsistent with sites table
qa_3c_Locations_duplicates_on_site_and_loc_code	Duplicate records on site ID and location code
qa_3d_Locations_duplicates_on_site_and_loc_name	Duplicate records on site ID and location name
qa_3e_Locations_duplicates_on_loc_name_and_park	Duplicate records on location name and park code
qa_3f_Locations_missing_sampling_events	Location type <> ‘origin’ and missing an event; or event is null and features, markers or images were entered
qa_3g_Locations_missing_establishment_dates	Locations with sampling events or field coordinates or discontinued dates, but without with location establishment dates
qa_3h_Locations_loc_status_inconsistencies	Missing loc status; sampled locations with location status = ‘rejected’ or ‘proposed’; locations with establishment dates or field coordinates and loc_status = ‘proposed’; ‘retired’ locations without discontinued dates; discontinued dates on status other than ‘retired’
qa_3i_Locations_unclassified_new_points	Newly sampled locations with an undetermined location type (location_type = ‘new’)
qa_3j_Locations_loc_type_and_loc_code_inconsistent	Locations where loc code = ‘TO’ and loc type <> ‘origin’ or vice versa, or where loc code = ‘rare’ and loc type <> ‘incidental’ or vice versa
qa_3k_Location_illogical_dates	Discontinued date prior to establishment date, or updated date prior to created date
qa_3l_Locations_without_coordinates	Locations without coordinates
qa_3m_Locations_without_field_coords	Locations that have sampling events but no field coordinates (no remedy required)
qa_3n_Locations_with_more_than_one_coord	Locations with more than one coordinate record - verify that these are intended
qa_3o_Locations_missing_travel_info	Sampled locations missing azimuth to point, travel notes, or reason for azimuth direction changes where direction changed = ‘yes’
qa_3p_Locations_missing_env_values	Missing elevation, slope or aspect values
qa_3q_Locations_elev_source_inconsistencies	Sampled locations where elevation source = ‘GIS theme’
qa_3r_Locations_missing_elev_metadata	Missing elevation units or elevation source where elevations are present
qa_3s_Locations_elev_unit_inconsistencies	Elevation units = ‘m’ but elevation source = ‘GIS theme’; units = ‘m’ but elevation values greater than 4,419
qa_3t_Locations_without_markers	Locations that have sampling events but no markers
qa_3u_Locations_no_best_coord_assigned	For GIS Specialist - locations without best coordinates
qa_4a_Coordinates_missing_critical_values	Records missing location ID or coord creation date
qa_4b_Coordinates_incomplete_field_UTMs	A portion of the field coordinate pair is missing, or the field datum is missing
qa_4c_Coordinates_missing_field_UTMs	Field UTMs are missing, but where there is either a coordinate collection date, a coordinate label, a field error, field offsets, field sources, GPS file or model type, or a source map scale filled in
qa_4d_Coordinates_missing_field_coord_date	Field coordinates without a coordinate collection date
qa_4e_Coordinates_inconsistent_field_source_info	Field coordinate source = ‘map’, however, there is a GPS file name, a field horizontal error, or GPS model filled in to suggest that the source is GPS

Query_name	Returns records meeting the following criteria
qa_4f_Coordinates_final_UTM_inconsistencies	Final UTM coordinates are incomplete; or they are present and the coordinate type or datum is missing; or coordinate type or an estimated error value is present and the coordinates are missing
qa_4g_Coordinates_public_UTM_inconsistencies	Public UTM coordinates are incomplete; or they are present and the public coordinate type is missing; or public coordinate type or public coordinate scale is present and the public coordinates are missing
qa_4h_Coordinates_illogical_dates	Coordinates with updated dates before creation dates
qa_4i_Coordinates_target_coord_inconsistencies	Target UTM coordinates are incomplete; or they are present and the target datum is missing
qa_4j_Coordinates_without_final_or_public_coords	For GIS specialist - records missing final UTMs and/or public coordinates
qa_5a_Sample_period_errors	Missing start or end dates; start date/time after end date/time; or updated dates prior to created dates
qa_6a_Events_missing_critical_info	Missing location ID, project code, or start date
qa_6b_Events_duplicates_on_location	Duplicate records on location ID - also shows how many records exist in related tables
qa_6c_Events_missing_start_times	Start times missing where location type is missing or <> ‘origin’
qa_6d_Events_without_observers	Events without associated observers
qa_6e_Events_without_point_count_data	Events without associated point count data where location type <> ‘incidental’
qa_6f_Events_without_habitat_data	Events without associated habitat data where location type <> ‘incidental’
qa_6g_Events_missing_obs_records	Events at incidental sampling locations without associated rare bird or nesting observations
qa_6h_Events_inconsistent_coord_info	Events at locations where coordinates_updated = True but missing associated coordinate records, or having associated coordinates where coordinates _updated = False, or where coord_date is different from the date of the event
qa_6i_Events_inconsistent_feature_info	Events at locations where features_updated = True but missing associated feature records, or having associated features where features_updated = False
qa_6j_Events_inconsistent_marker_info	Events at locations where markers_updated = True but missing associated marker records, or having associated markers where markers_updated = False, or where marker_installed is different from the date of the event
qa_6k_Events_inconsistent_image_info	Events at locations where photos_taken = True but missing associated image records, or having associated images where photos_taken = False, or where image_date is different from the date of the event
qa_6l_Events_missing_conditions	Point count events with missing environmental conditions - noise level, wind_cond, precip_cond, cloud_cover, temperature
qa_6m_Events_illogical_dates	Events with start date/times occurring after end date/times; or records that have update or verified dates prior to the record creation date
qa_7a_Observers_missing_critical_info	Missing event ID or contact ID
qa_7b_Observers_missing_role	Observer role is missing (no remedy required)
qa_7c_Markers_missing_critical_info	Missing marker code, location ID, marker type, marker status, or marker updated values
qa_7d_Markers_missing_measurements	Missing marker height, substrate, or having only partial offset information (distance without azimuth or vice versa)
qa_7e_Markers_status_inconsistencies	Marker status = ‘removed’ but no removal date, or with a removal date and status <> ‘removed’
qa_7f_Markers_illogical_dates	Marker updated or marker removed date before marker installed date
qa_7i_Features_missing_measurements	Missing distance or azimuth values
qa_7j_Features_missing_critical_info	Location ID, feature type, or feature status is missing
qa_8a_Habitat_missing_critical_info	Missing event ID or habitat number
qa_8b_Habitat_missing_values	Missing PMR code, canopy cover, or tree size class
qa_8c_Nesting_obs_missing_values	Missing event ID, taxon ID, or nest activity
qa_8d_Point_counts_missing_critical_info	Missing event ID, taxon ID, time interval, or group size
qa_8e_Point_counts_missing_values	Missing observation distance, seen first, ever sang, previously observed, or flyover
qa_8f_Rare_bird_obs_missing_critical_info	Missing event ID or taxon ID
qa_8g_Rare_bird_obs_missing_values	Missing observation distance, group size, or nest activity

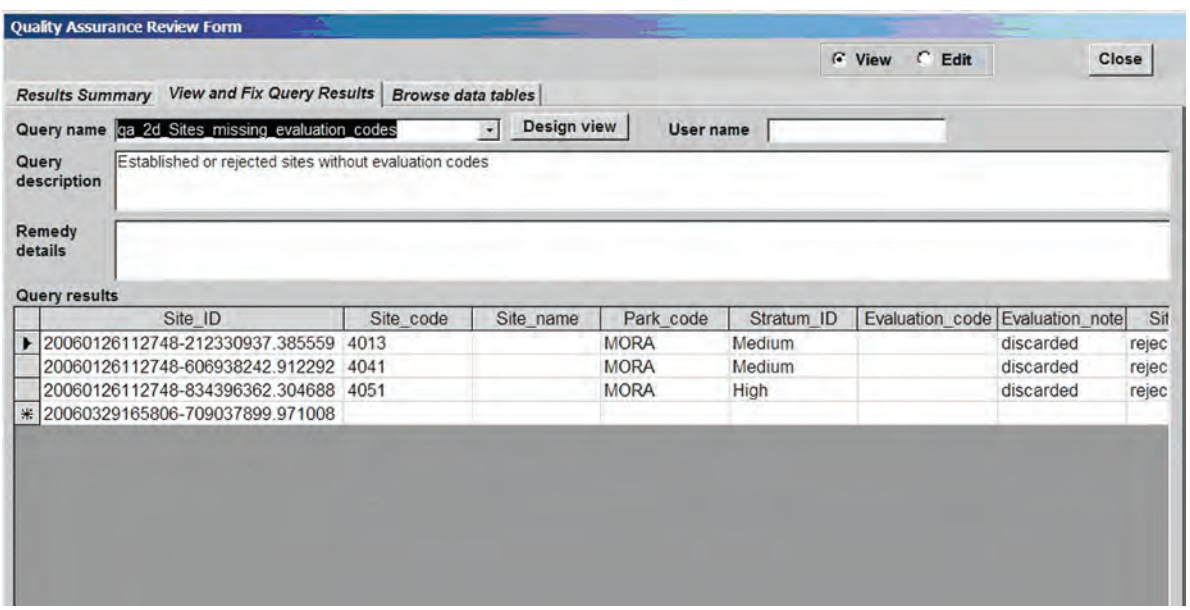
Using Database Quality Review Tools

Open the working copy of the database application and click on “QA Checks”. This will open the quality assurance review form. Upon opening, the quality assurance review form automatically runs the validation queries and stores the results in a table built into the front-end database (tbl_QA_Results). Each time the queries results are refreshed, or the quality assurance review form is re-opened, the number of records returned and the run times are rewritten so that the most recent result set is always available; any remedy description and the user name for the person making the edits is retained between runs of the queries. These results form the basis of documentation in the certification report output as shown below.

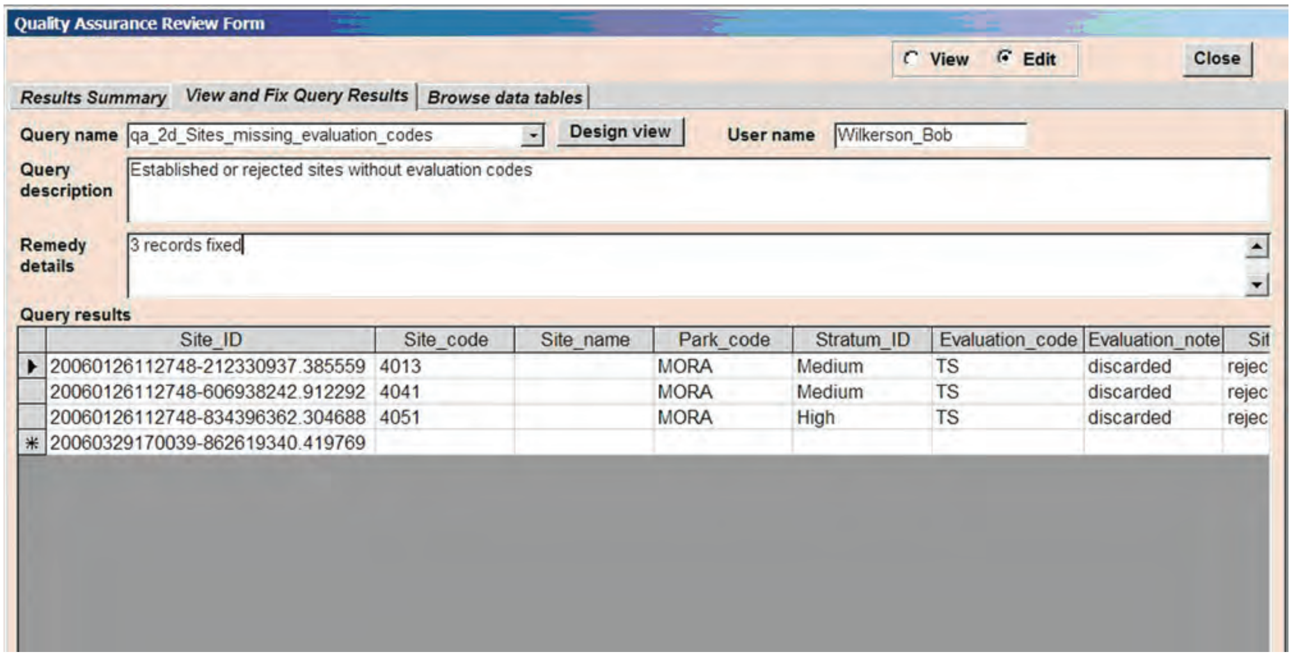
The first page of the quality review form has a results summary showing each query sorted by name, the number of records returned by the query, the most recent run time, and the description. There also is a button for refreshing the results, which may need to be done periodically as changes in one part of the data structure may change the number of records returned by other queries.



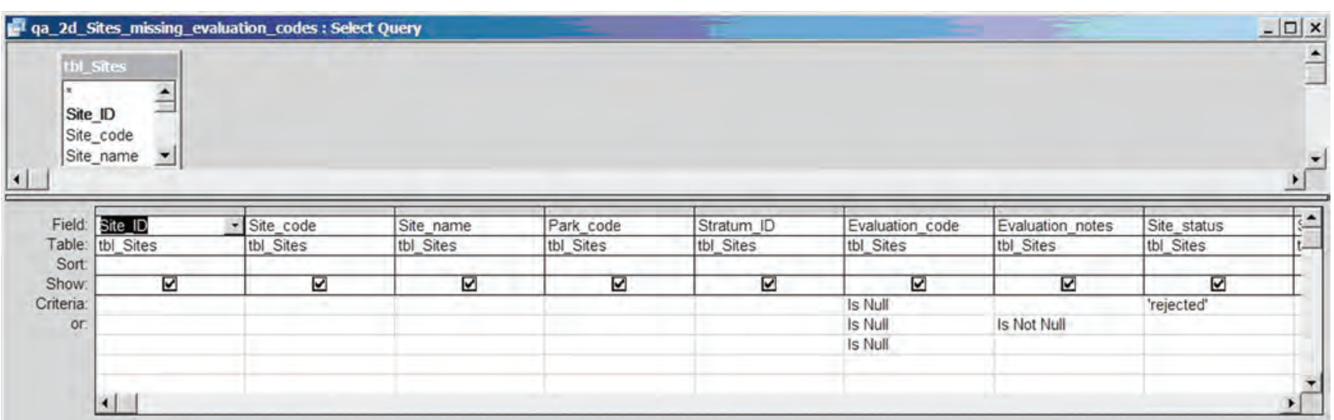
Upon double-clicking a particular query name, the second page will open up to show the results from that query.



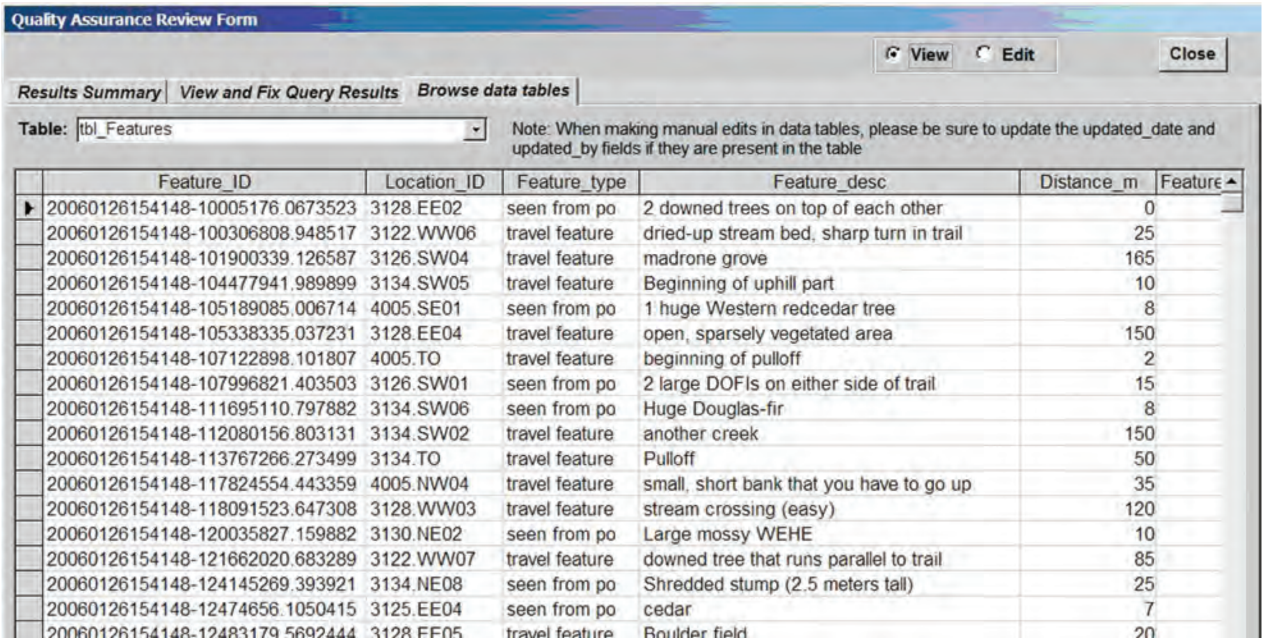
A switch in the upper-right corner allows the user to put the form in either view mode (default) or edit mode. Upon changing to edit mode, the form changes color to provide a visual reminder that edits are possible. At this point, the query results may be modified and the remedy details may be entered in the appropriate place. If certain records in a query result set are not to be fixed for whatever reason, this also is the place to document that. The user name is automatically filled in (if it was blank) once the user types in the remedy details.



A button labeled "Design view" also on this page opens the currently selected query in the design interface in Microsoft© Access. In this manner, the user can verify that the query is in fact filtering records appropriately. **Note:** Any desired changes to query structure or names should be discussed with the Data Manager prior to making these changes.



Certain queries, due to their structural complexity, cannot be edited directly. Other queries may not contain all fields the user may want to see in order to make the best decision about whether and how to edit a given record. In such cases, the user may opt to view and/or edit data directly in the data tables. To facilitate this process, the "Browse Data Tables" page on the form can be used to open the table directly for viewing and editing as needed.


Quality Assurance Review Form

View | Edit | Close

Results Summary | View and Fix Query Results | Browse data tables

Table: tbl_Features

Note: When making manual edits in data tables, please be sure to update the updated_date and updated_by fields if they are present in the the table

Feature_ID	Location_ID	Feature_type	Feature_desc	Distance_m	Feature
20060126154148-10005176.0673523	3128.EE02	seen from po	2 downed trees on top of each other	0	
20060126154148-100306808.948517	3122.WW06	travel feature	dried-up stream bed, sharp turn in trail	25	
20060126154148-101900339.126587	3126.SW04	travel feature	madrone grove	165	
20060126154148-104477941.989899	3134.SW05	travel feature	Beginning of uphill part	10	
20060126154148-105189085.006714	4005.SE01	seen from po	1 huge Western redcedar tree	8	
20060126154148-105338335.037231	3128.EE04	travel feature	open, sparsely vegetated area	150	
20060126154148-107122898.101807	4005.TO	travel feature	beginning of pulloff	2	
20060126154148-107996821.403503	3126.SW01	seen from po	2 large DOFIs on either side of trail	15	
20060126154148-111695110.797882	3134.SW06	seen from po	Huge Douglas-fir	8	
20060126154148-112080156.803131	3134.SW02	travel feature	another creek	150	
20060126154148-113767266.273499	3134.TO	travel feature	Pulloff	50	
20060126154148-117824554.443359	4005.NW04	travel feature	small, short bank that you have to go up	35	
20060126154148-118091523.647308	3128.WW03	travel feature	stream crossing (easy)	120	
20060126154148-120035827.159882	3130.NE02	seen from po	Large mossy WEHE	10	
20060126154148-121662020.683289	3122.WW07	travel feature	downed tree that runs parallel to trail	85	
20060126154148-124145269.393921	3134.NE08	seen from po	Shredded stump (2.5 meters tall)	25	
20060126154148-12474656.1050415	3125.EE04	seen from po	cedar	7	
20060126154148-12483179.5692444	3128.EE05	travel feature	Boulder field	20	

Important: As with all edits performed during the quality review, these types of direct edits in the data tables should be made with extreme care as the validation checks that are built into the front-end data entry forms are not present in the tables themselves. It is possible, therefore, to make edits to the tables that may result in a loss of data integrity and quality. While the automated queries are intended to check for these, it is not possible to check for every possible error combination.

Note: Whenever making quality review edits – whether through a query or directly in a table – the user should remember to update the Updated_date and Updated_by fields to the current date and the current user name.

Generating Output for the Certification Report

The first page of the quality review form has a button labeled "View summary report". This button opens the formatted information for each query, the last run time, the number of records returned at last run time, a description and any remedy details that were typed in by the user. This report can be exported from the database and included as an attachment to the certification report by either clicking on File > Export on the Access menu, or by right clicking on the report object and selecting Export. Select 'Rich Text Format (*.rtf)' to retain formatting to facilitate importing it into the certification report in Microsoft© Word.

tbl_QA_Results

Quality Assurance and Data Validation Results **Run time** 03/29/2006 17:02 **QA by**

Query name	Records	Query description	Remedy details
qa_1a_Strata_missing_critical_info	0	Missing park code, project code, stratification date, stratum name, stratum definition	
qa_1b_Strata_illogical_dates	0	Stratum record updated date prior to created date	
qa_2a_Sites_missing_critical_info	0	Missing site code, park code, or stratum ID	
qa_2b_Sites_park_inconsistencies	0	Park code inconsistent with strata table	
qa_2c_Sites_duplicates_on_code_and_park	0	Duplicate records on site code and park code	
qa_2e_Sites_site_status_inconsistencies	0	Missing site status, 'retired' sites without discontinued dates, discontinued dates on status other than 'retired', or discontinued dates without establishment dates	
qa_2f_Sites_illogical_dates	0	Discontinued date prior to establishment date, or updated date prior to created date	
qa_2g_Sites_missing_panel_type	109	Active sites without a panel type	
qa_2h_Sites_missing_site_name	661	Missing site name (no remedy required)	
qa_3a_Locations_missing_critical_info	0	Missing site ID (except where loc_type = 'incidental'), location code, location type, or park code	
qa_3b_Locations_park_inconsistencies	0	Park code inconsistent with sites table	
qa_3c_Locations_duplicates_on_site_and_lo	4	Duplicate records on site ID and loc code	
qa_3d_Locations_duplicates_on_site_and_lo	2	Duplicate records on site ID and loc name	
qa_3e_Locations_duplicates_on_loc_name_	7	Duplicate records on loc name and park code	
qa_3f_Locations_missing_sampling_events	12	Location type <> 'origin' and missing an event; or event is null and features, markers or images were entered	
qa_3g_Locations_missing_establishment_da	19	Locations with sampling events or field coordinates or discontinued dates, but without with location establishment dates	
qa_3h_Locations_loc_status_inconsistencies	21	Missing loc status; sampled locations with loc status = 'rejected' or 'proposed'; locs with establishement dates or field coords and loc_status = 'proposed'; 'retired' locs without discontinued dates; discontinued dates on status other than 'retired'	
qa_3i_Locations_unclassified_new_points	543	Newly sampled locations with an undetermined location type (location_type = 'new')	
qa_3j_Locations_loc_type_and_loc_code_in	0	Locations where loc code = 'TO' and loc type <> 'origin' or vice versa, or where loc code = 'rare' and loc type <> 'incidental' or vice versa	
qa_3k_Location_illogical_dates	0	Discontinued date prior to establishment date, or updated date prior to created date	

Wednesday, March 29, 2006 Page 1 of 4

Page: 1

Completing Data Certification

Data certification is a benchmark in the project information management process that indicates that: (1) the data are complete for the period of record; (2) they have undergone and passed the quality assurance checks; and (3) that they are appropriately documented and in a condition for archiving, posting and distribution as appropriate. Certification is not intended to imply that the data are completely free of errors or inconsistencies which may or may not have been detected during quality assurance reviews.

To ensure that only quality data are included in reports and other project deliverables, the data certification step is an annual requirement for all tabular and spatial data. The Project Lead is primarily responsible for completing a NCCN Project Data Certification Form, available on the NCCN website. This brief form and the certified data should be submitted according to the timeline in Appendix 2: Yearly Project Task List. Refer to SOP 18: Product Delivery Specifications for delivery instructions.

Landbird Monitoring Protocol for National Parks in the North Coast and Cascades Network

Standard Operating Procedure (SOP) 15:

Metadata Development

Revision History Log:

Revision Date	Author	Changes Made	Reason for Change

Data documentation is a critical step toward ensuring that data sets are usable for their intended purposes well into the future. This involves the development of metadata, which can be defined as structured information about the content, quality, condition, and other characteristics of a given data set. Additionally, metadata provide the means to catalog and search among data sets, thus making them available to a broad range of potential data users. Metadata for all NCCN monitoring data will conform to Federal Geographic Data Committee (FGDC) guidelines and will contain all components of supporting information such that the data may be confidently manipulated, analyzed, and synthesized.

Updated metadata are a required deliverable that should accompany each season's certified data. For long-term projects such as this one, metadata creation is most time consuming the first time it is developed—after which most information remains static from one year to the next. Metadata records in subsequent years then only need to be updated to reflect changes in contact information and taxonomic conventions, to include recent publications, to update data disposition and quality descriptions, and to describe any changes in collection methods, analysis approaches, or quality assurance for the project.

Specific procedures for creating, parsing, and posting the metadata record are provided in NCCN Metadata Development Guidelines (North Coast and Cascades Network – National Park Service, 2006). General procedures are as follows:

1. After the annual data quality review has been performed and the data are ready for certification, the Project Lead (or a designee) updates the Metadata Interview Form.
   a. The Metadata Interview Form greatly facilitates metadata creation by structuring the required information into a logical arrangement of 15 primary questions; many with additional sub-questions.
   b. The first year, a new copy of the NCCN Metadata Interview Form should be downloaded. Otherwise the form from the previous year can be used as a starting point, in which case the Track Changes tool in Microsoft© Word should be activated in order to make edits obvious to the person who will be updating the XML record.
   c. Complete the Metadata Interview Form and maintain it in the project workspace. Much of the interview form can be filled out by cutting and pasting material from other documents (for example, reports, protocol narrative sections, and SOPs).
   d. The Data Manager can help answer questions about the Metadata Interview Form.
2. Deliver the completed interview form to the Data Manager according to SOP 18: Product Delivery Specifications.
3. The Data Manager (or GIS Specialist for spatial data) will then extract the information from the interview form and use it to create and update an FGDC- and NPS-compliant metadata record in XML format. Specific guidance for creating the XML record is contained in NCCN Metadata Development Guidelines (North Coast and Cascades Network—National Park Service, 2006).

4. The Data Manager will post the record and certified data to the NPS Data Store, and maintain a local copy of the XML file for subsequent updates. The NPS Data Store has help files to guide the upload process.
5. The Project Lead should update the metadata interview content as changes to the protocol are made, and each year as additional data are accumulated.

Identifying Sensitive Information

Part of metadata development includes determining whether or not the data include any sensitive information, which is partly defined as the specific locations of rare, threatened, or endangered species. Prior to completing the Metadata Interview Form, the NPS Lead and Project Lead should work together to identify any sensitive information in the data after first consulting SOP 19: Sensitive Information Procedures. Their findings may be documented and communicated to the Data Manager through the Metadata Interview Form.

Reference Cited

North Coast and Cascades Network – National Park Service, 2006, Metadata Development Guidelines: USDI National Park Service. Available at: http://www1.nature.nps.gov/im/units/nccn/datamgmt_guide.cfm

Landbird Monitoring Protocol for National Parks in the North Coast and Cascades Network

Standard Operating Procedure (SOP) 16:

Data Analysis and Reporting

Revision History Log:

Revision Date	Author	Changes Made	Reason for Change

This Standard Operating Procedure describes methods for analyzing data associated with the NCCN landbird monitoring program, and provides guidelines and templates for the annual and 5-year reports. Items 2-4 apply only to data analysis in conjunction with the 5-year reports.

1. Querying Data from the Database

Our custom-designed Microsoft© Access database includes features that allow the analyst to query the database to produce most of the data summary tables that should be included in the annual report, and allow for an easy transition between the database and the properly formatted summary tables described below. However, detectability modeling, point-specific density estimation, and temporal trend assessment require exporting data to other software applications for manipulation and analysis. Guidelines for performing these operations are provided in sections 2-4 of this SOP.

2. Computing and Selecting Detectability Parameters

At the end of every 5-year interval, we will conduct a complete analysis of factors influencing the detectability of birds and will develop detectability models to be used in estimating density of birds from raw counts. The data analyst should use the most recently available version of the free software program *Distance* (Thomas and others, 2005), available at http://www.ruwpa.st-and.ac.uk/distance/, to model detectability and estimate density of NCCN landbirds. This SOP provides some guidelines for analyzing the NCCN landbird data in *Distance*, but explaining in detail how to use the software or providing a primer on analytical techniques associated with distance sampling is beyond the scope of this SOP. *Distance* includes a user-friendly interface and a user's manual that explains how to use the software. The user's manual assumes that the user is already familiar with distance sampling concepts and statistics. Data analysts seeking help with the analytical aspects of distance sampling should consult Buckland and others (2001) and Buckland and others (2004) for a discussion of more advanced topics.

Numerous factors may influence detectability, including species, habitat, observer, year, and perhaps other variables. Some of these factors are likely to vary over time or space, and therefore must be accounted for before density can be estimated and trends in density can be assessed.

Data analysis should identify and correct for any substantial sources of variation in detectability, to the extent that sample sizes allow. For common species, the analyst will model detection probabilities based on species detections amassed during the 5-year analysis period. For rarer species, it may be necessary to derive detection models using more extensive data sets that contain all NCCN landbird inventory and monitoring data gathered to date. As of spring 2006, this amounts to more than 33,000 bird detections with distance estimates. By having all data at his or her disposal, the analyst retains the flexibility to test the effects of variables such as habitat, year, and observer on detection probability where sample sizes allow, and develop the best possible detectability functions for rarer species.

To import the inventory and monitoring data into *Distance* for detectability modeling, first create a text file that contains all detection records for all species of interest (if desired, records for additional species may be left in the file, as they will do no harm). At a minimum, the file should contain fields indicating the habitat group (open- or closed-canopy), survey point, species (4-letter codes will be easiest to use) and detection distance. Other fields may be added if the analyst is interested in exploring additional possible covariates of detectability. The records in the text file must be sorted in the correct order: habitat group (and/or grouping defined by other variables that may affect detectability, such as observer or year), survey point, and species.

Follow the general instructions provided in the *Distance* User's Manual to create a project and import the data. Although step-by-step instructions are beyond the scope of this SOP, the suggestions below should help in successfully navigating through portions of the user interface that may be confusing.

- In the New Project Setup Wizard, at Step 3: Survey Methods, choose 'Point transect' as the Type of Survey.
- At Step 5, it is not necessary to select any multiplier options if the project will be used only for modeling detectability (that is, if it will not be used for calculating density estimates, which may be treated as a separate step from detectability estimation).
- In Import Data Wizard, at Step 5: Data File Structure, select the habitat group field as the Region, the point identifier field as the Point Transect (note that in Distance terminology, each of the sampling points is a "Point Transect"), and the detection distance and species as Observation fields.

Once the data have been successfully imported, use the Analysis tab to construct and test detectability models. For each species with adequate data, specify the model definitions three ways: once with the data filter set to include only detections at points in relatively closed-canopy habitats (table 1), once with the data filter set to include only detection at relatively open-canopy habitats (table 1), and once with all detections of the species included. Then use criteria including AIC, model fit statistics, and biological 'reasonableness' of the models to determine whether a better model was fit by separating or combining the two groups of habitats. The same general approach may be used to assess other potential sources of variation in detectability, including observer and year. Other sources may be important as well; there is no substitute for thorough data exploration.

Alternately, the multiple covariates distance sampling (MCDS) engine in the *Distance* software may be used to model potential sources of variation in detectability as covariates of the scale parameter of the key function. Using this method, the covariates are assumed to influence the scale of the detection function, but not its shape; that is, the covariates affect the rate at which detectability decreases with distance, but not the overall shape of the detection curve.

Table 1. Recommended grouping of North Coast and Cascades Network habitats for detectability modeling.

[Most habitat categories come from Pacific Meridian Resources (1996), but a few were developed as part of separate classification efforts LEWI and SAJH]

Vegetation Type	Code	Grouping
Alaska Yellow-cedar	ALYC	Dense
Beach	BEAH	Sparse
Big Leaf Maple	BIGM	Dense
Black Cottonwood	BLCO	Dense
Conifer-Deciduous Mix	CODM	Dense
Developed	DEVO	Sparse
Mixed Douglas-fir/Western Hemlock	DFWH	Dense
Douglas-fir	DOFI	Dense
Dune Grass	DUGR	Sparse
Engelmann Spruce	ENGS	Dense
Grand Fir	GRAF	Dense
Grassland	GRAS	Sparse
Hardwood Mix	HAMI	Dense
Heather	HEAT	Sparse
Lodgepole Pine	LOPI	Dense
Meadow	MEAD	Sparse
Mixed Conifer	MICO	Dense
Mountain Hemlock	MOHE	Dense
Noble Fir	NOBF	Dense
Pacific Silver Fir	PASF	Dense
Pasture	PAST	Sparse
Ponderosa Pine	POPI	Dense
Quaking Aspen	QUAS	Dense
Red Alder	REAL	Dense
Rock/Sparsely Vegetated	ROSV	Sparse
Sand Dune	SADU	Sparse
Shore Pine	SHPI	Dense
Shrub	SHRU	Dense
Sitka Spruce	SISP	Dense
Snow	SNOW	Sparse
Subalpine Fir	SUBF	Sparse
Subalpine Larch	SULA	Sparse
Water	WATE	Sparse
Western Hemlock	WEHE	Dense
Western Redcedar	WERC	Dense
Western Redcedar/Western Hemlock	WRCH	Dense
Willow/Shrub Wetland	WSWE	Dense

Once the analyst is satisfied that the best possible models of detectability for each species have been developed, he or she should record the essential parameters of the selected model(s) for each species—truncation point (w), detection probability estimate (P), standard error of the detection probability estimate (se of P), and degrees of freedom of the detection probability estimate (df of P). All these values should be reported in the 5-year report.

3. Estimating Density

Once the detectability model parameters have been derived, they should be used to estimate density of each species at each point, for all years under consideration.

To estimate point-specific densities for a particular year in *Distance*, begin by querying the NCCN landbird monitoring database to create a text file containing all point count detections for the year of interest. At a minimum, the text file will need to contain fields indicating the park (NOCA, MORA, etc.), the habitat group (open-canopy or closed-canopy), the survey point, the species (4-letter codes will be most convenient), and the estimated distance from the observer. If other variables such as observer or year also have affected detectability, they need be included as well.

A few things to keep in mind when creating the text file:

- Detections classified in the database as 'flyovers' should be omitted from the text file.
- There must be at least one record for every point that was surveyed in the year of interest. For points where no birds were detected, there should be a single record with species = 'None'. Failure to account for points with no detections will cause an upward bias in the results.
- *Distance* will not perform the calculations correctly if the records are not sorted properly. For the density estimations, the records must be sorted by point, such that all records for each species at each point are grouped together in the database.

Import the text file into *Distance*. At Step 5 of the New Project Setup Wizard be sure to check the box indicating "Add Multipliers for: Other". When running the calculations for each species and each set of habitats, use the Data tab to enter the appropriate multiplier (detection probability) estimate, standard error, and degrees of freedom values from the modeling efforts in Section 2 above. Use the Data Filter to specify not only the species, but also the truncation point, which should be the distance that was used in generating the models (see section 2, above). Remember to change the multiplier and truncation values each time analysis is conducted on a new species. If two separate models (one for closed-canopy points and one for open-canopy points) are to be used for a given species, also use the Data Filter to specify the set of habitats for which the program should produce density estimates.

When defining models, select the uniform key function with no series expansions—this way the program will simply use the parameter values you have specified, without constructing new models. Specifying Sample under "Level of Resolution of Estimates" in the Model Definition Properties box will instruct the program to return a density estimate of the species indicated in the Data Filter at each survey point.

4. Assessing Temporal Trends in Density Estimates

Temporal trends in density estimates of bird species should be assessed using the custom-made software program *BirdTrend*, developed by TerraStat Consulting Group for use with the free software package R. In addition to assessing temporal trends, *BirdTrend* also calculates park- and year-specific density estimates for each species. Detailed instructions for importing and analyzing data are provided in Appendix 6: User's Manual for *BirdTrend* of this protocol.

Note: *Distance* output tables will have to be reformatted according to the specifications in the *BirdTrend* User's Manual before they can be imported into *BirdTrend*.

5. Reporting Annual and 5-Year Results

Several standard summary tables should be included in the annual report. The recommended structures for standard tables and figures to include in the annual report are presented in the following pages, in some cases with fabricated data included for illustrative purposes.

A. Observers Who Conducted Point Counts in the Current Year

Table 1 of the annual report should provide the names and roles of all observers who conducted point counts during the current year. A sample table is provided below.

Observer	Role
Stephanie Dolrenry	Technician
Mandy Holmgren	Technician
Eric Mickelson	Technician
Lauren Mork	Technician
Rodney Siegel	Project Lead
Katie Stassen	Technician
Bob Wilkerson	Field Lead

B. Transects That Were Completed in the Current Year

Table 2 of the annual report should list each transect that was supposed to have been sampled during the current year, and the number of points along each transect that was actually sampled. An abbreviated version of the table is provided below.

Park	Panel	Elevation	Transect	Number of points completed
MORA	Ann1	Low	4001	14
MORA	Ann1	Medium	4015	10
MORA	Alt2	High	4017	10
NOCA	Ann1	Low	1017	10
NOCA	Ann1	Low	1020	10
NOCA	Alt2	Medium	1032	8
OLYM	Ann1	Low	3100	10
OLYM	Ann1	High	3450	0

C. Summary History of Transects Completed Up Through the Current Year

Table 3 of the annual report should indicate how many transects were surveyed in each elevation zone of each park during the current year and in all previous years. A sample table is provided below.

Park	Elevation class	Number of transects completed							
		2007	2008	2009	2010	2011	2012	2013	2014
MORA	Low	2	2	2	2	2	2	2	2
MORA	Medium	4	4	4	4	4	3	4	4
MORA	High	4	4	3	4	4	3	4	4
MORA	ALL	10	10	9	10	10	8	10	10
NOCA	Low	4	4	4	4	4	4	4	4
NOCA	Medium	4	4	4	4	4	4	4	4
NOCA	High	4	4	3	4	4	4	4	4
NOCA	ALL	12	12	11	12	12	12	12	12
OLYM	Low	4	4	4	4	4	4	4	4
OLYM	Medium	4	4	4	4	4	4	4	4
OLYM	High	4	4	4	4	4	2	4	4
OLYM	ALL	12	12	12	12	12	10	12	12
ALL	Low	10	10	10	10	10	10	10	10
ALL	Medium	12	12	12	12	12	11	12	12
ALL	High	12	12	11	12	12	9	12	12
ALL	ALL	34	34	31	34	34	30	34	34

D. All Species Recorded in the Large Parks During the Field Season

Table 4 in the annual report should list all species detected during point counts, and/or recorded on 'rare bird' detection forms in the large parks during the current year. In the abbreviated sample table below, asterisks (*) indicate species that were recorded only on 'rare bird' detection forms. The actual table will likely contain 70–100 records.

Common name	Latin name
Pileated Woodpecker	*Dryocopus pileatus*
Olive-sided Flycatcher	*Contopus borealis*
Western Wood-Pewee	*Contopus sordidulus*
Willow Flycatcher*	*Empidonax trailii*
Hammond's Flycatcher	*Empidonax hammondii*
Pacific-slope Flycatcher	*Empidonax difficilis*

E. Number of Individuals of Each Species Detected During Point Counts in the Large Parks and the Number of Transects on Which Each Species Was Detected

Table 5 in the annual report should indicate the number of individuals of each species detected during point counts in the large parks and the number of transects on which each species was detected. An abbreviated sample table is provided below. The actual table will likely have 70 or more records. Totals include all point counts, not just the point counts that contribute to park-specific and network density estimates.

The annual report also should include one or more tables and/or bar graphs indicating the numbers of each species detected on the annual panel of transects only.

Species	Number of transects with detections				Number of individuals detected			
	MORA	NOCA	OLYM	ALL	MORA	NOCA	OLYM	ALL
Bald Eagle	0	1	0	1	0	1	0	1
Chestnut-backed Chickadee	8	10	9	27	18	20	16	54
Wilson's Warbler	1	2	1	4	2	4	1	7
Dark-eyed Junco	6	7	7	20	9	11	13	33

F. Transect Survey History at the Large Parks Through the Current Year

Appendix 1 of the annual report should provide a detailed survey history of each transect surveyed to date. An abbreviated sample table is provided below. The actual table should include a record for each transect that has ever been surveyed.

Park	Panel membership	Elevation class	Transect	Number of points completed					
				2007	2008	2009	2010	2011	2012
MORA	Ann1	Low	4001	10	10	8	9	10	10
MORA	Ann1	Medium	4015	10	10	10	10	10	10
MORA	Alt2	High	4017	10	0	0	0	0	10
MORA	Alt3	High	4018	0	8	0	0	0	0
NOCA	Ann1	Low	1017	10	10	9	10	10	10
NOCA	Ann1	Low	1020	10	10	10	0	10	10
NOCA	Alt2	Medium	1032	10	0	0	0	0	10
NOCA	Alt3	High	1045	0	12	0	0	0	0
OLYM	Ann1	Low	3100	10	10	10	10	10	10
OLYM	Ann1	High	3150	0	10	10	10	10	10

G. Reporting Results for Small Parks

For whichever small park was surveyed in the year of interest, the report should:

- List any points that were not surveyed, and explain why they were missed.
- Provide the number of individuals detected and the number of points with detections for each species detected during point counts in the small park that was surveyed in the current year. A sample table structure is provided below.

Species[1]	Number of points with detections	Number of individuals detected
Winter Wren	36	45
Golden-crowned Kinglet	8	12
Dark-eyed Junco	41	53

[1]Includes all species detected during point counts in the specified small park and year.

H. Maps to Include in the Annual Reports

The annual report should include maps indicating the general location of each transect that was surveyed in each large park during the current year. In the sample map provided below, squares indicate low-elevation transects, triangles indicate mid-elevation transects, and octagons indicate high-elevation transects.

I. Other Components of Annual Reports

In addition to the tables and figures described above, annual reports should include:

- A brief Narrative section describing any logistical problems that were encountered, and providing suggestions for preventing or coping with similar problems in the future.
- A Methods section detailing data-collection procedures and analytical techniques; this may change little from year to year, but should still be included as part of each year's report. The section should highlight any changes from previous methods.
- A Results section that describes the content of the tables and figures.
- Graphs showing trends in the raw counts of at least the most common species detected on the annual panel. These graphical presentations of trends in raw data will not be analyzed quantitatively because they represent interim data that has not accounted for annual differences in avian detectability (to be analyzed at the end of each 5-year interval).
- A brief Discussion section that highlights and interprets any notable findings, such as detections of unexpected species, factors such as unusual weather patterns that might have affected results, or unexpectedly large changes in raw detection counts obtained from the annual panel.
- An Acknowledgements section thanking individuals who contributed to the field season or the report.

Standard Report Format

Annual reports and trend analysis reports will use the NPS Natural Resource Publications template, a pre-formatted Microsoft© Word template document based on current NPS formatting standards. Annual reports will use the Natural Resource Report template, and trend analysis and other peer-reviewed technical reports will use the Natural Resource Technical Report template. These templates and documentation of the NPS publication standards are available at: http://www.nature.nps.gov/publications/NRPM/index.cfm.

In addition to the material recommended for the annual reports, the 5-year reports also should include the following tables.

J. Estimated Annual Density of Each Species in Each Large Park and in All Three Parks Combined

The 5-year reports should provide the estimated density (bird/ha) of each species at each large park (and at all three parks combined) during each year, leading up to and including the present year.

Note: *BirdTrendAnnualDensity* module of *BirdTrend* can perform these calculations, taking into account the appropriate weighting of each transect.

Park	Year	Mean density (birds/ha)	Mean density SE	Park	Year	Mean density (birds/ha)	Mean density SE
MORA	2007	0.10	0.006	OLYM	2007	0.10	0.006
MORA	2008	0.11	0.005	OLYM	2008	0.11	0.005
MORA	2009	0.11	0.004	OLYM	2009	0.11	0.004
MORA	2010	0.12	0.006	OLYM	2010	0.12	0.006
MORA	2011	0.10	0.005	OLYM	2011	0.10	0.005
NOCA	2007	0.10	0.006	Combined	2007	0.10	0.006
NOCA	2008	0.11	0.005	Combined	2008	0.11	0.005
NOCA	2009	0.11	0.004	Combined	2009	0.11	0.004
NOCA	2010	0.12	0.006	Combined	2010	0.12	0.006
NOCA	2011	0.10	0.005	Combined	2011	0.10	0.005

K. Summary Trend Results for Species With Adequate Data for Density Estimation and Trend Assessment

The 5-year report should summarize trend results from *BirdTrend* for species with adequate data for density estimation and trend assessment. An abbreviated sample table is provided below.

Note: *BirdTrend* produces this summary table.

Species	Years	Park	Number of non-zero transects	Mean of slope	Variance of slope	*df*	*t*-stat	2-tailed *p*-value
AMRO	2007–16	OLYM	72	0.022	0.00035	38.26	1.1976	0.238
		NOCA	72	0.018	0.000157	45.54	1.4181	0.163
		MORA	60	0.043	0.000808	20.99	1.522	0.142
		Combined	204	0.030	0.000133	146.83	2.3328	0.021
WIWA	2007–16	OLYM	72	0.098	0.00038	47.62	5.0157	0
		NOCA	72	0.088	0.000317	50.77	4.9443	0
		MORA	60	0.082	0.000475	17.35	3.7676	0.001
		Combined	204	0.090	0.000128	150.7	7.9335	0

L. Detectability Parameters Used for Calculating Density Estimates

The 5-year report should discuss results of detectability modeling and should provide the detectability parameters used for calculating density estimates. The table structure may change somewhat if analysts decide to use covariates other than habitat (such as observer, year, etc.).

Note: These are fabricated values; the actual table will include many more species.

Species	Density adjustment parameters obtained through detectability modeling									
	Relatively closed-canopy habitats					Relatively open-canopy habitats				
	Number of detections	Sample width (m)	Detection probability			Number of detections	Sample width (m)	Detection probability		
			P	SE	*df*			*P*	SE	*df*
Western Wood-Pewee	64	90	0.707	0.323	220	62	94	0.780	0.090	70
Hammond’s Flycatcher	120	72	0.665	0.240	150	67	79	0.680	0.069	95
Pacific-slope Flycatcher	350	72	0.600	0.268	94	70	79	0.654	0.069	100
Ch.-backed Chickadee	805	85	0.504	0.066	400	805	85	0.504	0.066	400

M. Detailed Species-Specific Trend Results

The 5-year report should provide a table with detailed trend results for each species for which density estimates have been calculated. A sample table is provided below.

Note: This table is produced by *BirdTrend*.

Years: 2007–16	Variance group	Species: AMRO	Elevation class	Number of non–zero sites	Mean slope	Variance of slope	Variance of mean slope	*df*	*t*–stat	2–tailed *p*–value
Park		Panel(s)								
OLYM	1	Ann1	Low	4	0.0337	0.000715	–	–	–	–
	2	Ann1	Mid	4	–0.0341	0.000612	–	–	–	–
	3	Ann1	High	4	0.0091	0.001378	–	–	–	–
	4	Alt2,Alt3,Alt4,Alt5,Alt6	Low	20	0.0302	0.030507	–	–	–	–
	5	Alt2,Alt3,Alt4,Alt5,Alt6	Mid	20	0.0276	0.01932	–	–	–	–
	6	Alt2,Alt3,Alt4,Alt5,Alt6	High	20	0.0084	0.015879	–	–	–	–
				–	–	–	–	–	–	–
	Combined panels		Low	24	0.0308	–	0.001064	–	–	–
			Mid	24	0.0173	–	0.000675	–	–	–
			High	24	0.0086	–	0.000561	–	–	–
				–	–	–	–	–	–	–
	Grand mean		All	72	0.0224	–	0.00035	38.26	1.1976	0.2384
				–	–	–	–	–	–	–
NOCA	1	Ann1	Low	4	0.0302	0.000486	–	–	–	–
	2	Ann1	Mid	4	0.0029	0.003128	–	–	–	–
	3	Ann1	High	4	4.00E–04	0.000745	–	–	–	–
	4	Alt2,Alt3,Alt4,Alt5,Alt6	Low	20	0.0467	0.010676	–	–	–	–
	5	Alt2,Alt3,Alt4,Alt5,Alt6	Mid	20	–0.0039	0.013248	–	–	–	–
	6	Alt2,Alt3,Alt4,Alt5,Alt6	High	20	0.0216	0.007386	–	–	–	–
				–	–	–	–	–	–	–
	Combined panels		Low	24	0.044	–	0.000374	–	–	–
			Mid	24	–0.0028	–	0.000482	–	–	–
			High	24	0.0181	–	0.000262	–	–	–
				–	–	–	–	–	–	–
	Grand mean		All	72	0.0178	–	0.000157	45.54	1.4181	0.163
				–	–	–	–	–	–	–
MORA	1	Ann1	Low	2	0.0058	4.60E–05	–	–	–	–
	2	Ann1	Mid	4	0.0206	0.000669	–	–	–	–
	3	Ann1	High	4	–0.0098	0.002933	–	–	–	–
	4	Alt2,Alt3,Alt4,Alt5,Alt6	Low	10	–0.0514	0.048625	–	–	–	–
	5	Alt2,Alt3,Alt4,Alt5,Alt6	Mid	20	0.1521	0.049226	–	–	–	–
	6	Alt2,Alt3,Alt4,Alt5,Alt6	High	20	–0.0066	0.015099	–	–	–	–
				–	–	–	–	–	–	–
	Combined panels		Low	12	–0.0419	–	0.003377	–	–	–
			Mid	24	0.1302	–	0.001714	–	–	–
			High	24	–0.0071	–	0.000545	–	–	–
				–	–	–	–	–	–	–
	Grand mean		All	60	0.0433	–	0.000808	20.99	1.522	0.1429
Combined			204	0.0269	–	0.000133	146.83	2.3328	0.021	

N. Density Reporting and Trend Assessment for the Smaller Parks

For each of the small parks, the 5-year report should provide annual density estimates for each species with adequate data for density estimation. The 5-year report also should present simple linear regression analysis of parkwide density over time (See SOP 17: Special Considerations for the Small Parks for more detailed instructions).

6. Additional Components of the 5-year Report

In addition to the extra analyses and tables described above, the 5-year report also should assess spatial patterns in the density estimates, identify any possible distributional changes within the parks, and perhaps try to place network results within the larger context of bird population changes throughout the Pacific Northwest, as measured by regional efforts such as the BBS or MAPS. The report also should evaluate operational aspects of the monitoring program, such as whether any transects need to be eliminated or moved due to access problems, whether the sampling period remains appropriate (the optimal sampling season could conceivably change over time in response to climate change), etc.

References Cited

Buckland, S.T., Anderson, D.R., Burnham, K.P., Laake, J.L., Borchers, D.L., and Thomas, L., 2001, Introduction to distance sampling: estimating abundance of biological populations: Oxford University Press, Oxford.

Buckland, S. T., Anderson, D.R., Burnham, K.P., Laake, J.L., Borchers, D.L., and Thomas, L. (eds.), 2004, Advanced distance sampling: estimating abundance of biological populations: Oxford University Press, Oxford.

Pacific Meridian Resources, 1996, Vegetation and landform database development study: final report: Pacific Meridian Resources, Portland.

Thomas, L., Laake, J.L., Strindberg, S., Marques, F.F.C., Buckland, S.T., Borchers, D.L., Anderson, D.R., Burnham, K.P., Hedley, S.L., Pollard, J.H., Bishop, J.R.B., and Marques, T. A., 2005, Distance 5.0. Research Unit for Wildlife Population Assessment, University of St. Andrews, UK. Program Distance Home Page web site at http://www.ruwpa.st-and.ac.uk/distance/ (Accessed October 10, 2007.)

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Landbird Monitoring Protocol for National Parks in the North Coast and Cascades Network

Standard Operating Procedure (SOP) 17:

Special Considerations for Small Parks

Revision History Log:

Revision Date	Author	Changes Made	Reason for Change

In addition to monitoring landbird populations in the large wilderness units of the NCCN, this program also monitors landbirds in two of the small units—San Juan Island National Historical Park (SAJH) and Lewis and Clark National Historical Park (LEWI). Working in these small, 'front-country' parks differs in many respects from working in the large parks, but we have nevertheless tried to integrate them into the larger regional effort. This protocol describes the ways in which data collection, data analysis, and reporting differ from the methods described for the large parks.

1. Before the Field Season

The project lead should coordinate with Resource Management Specialists at whichever small park is to be surveyed in the current year to make sure that local personnel are aware of the monitoring efforts and the likely survey dates. Campsites or other accommodations for the field crews also need to be arranged. Resource Management Specialists should be contacted at least 1 month prior to the survey.

2. Data Collection

SAJH and LEWI are to be surveyed by the NCCN landbird monitoring crew biennially in alternating years. At this writing, we expect that SAJH will be surveyed in odd years and LEWI will be surveyed in even years. If additional funding and/or personnel time become available, either or both of the parks may be surveyed during their 'off' years, but not at the expense of conducting surveys during the regularly scheduled years.

The sampling design at SAJH and LEWI differs substantially from that of the large parks. Rather than arraying points along transects that start from randomly selected points along the trails, we have overlaid the two small parks (including both American Camp and British Camp at SAJH, and Fort Clatsop, Sunset Beach, Cape Disappointment, and Dismal Nitch at LEWI) with a systematic grid of points, 350 m apart. This grid-based approach yields 53 survey points at SAJH and 91 survey points at LEWI.

Due to the relatively small number of points and frequently sunny weather during the survey period, the survey at SAJH should be completed easily by a 2-person crew working for a 7-day work tour, even including travel time to and from the island, and a day for familiarization with the area. If at all possible, SAJH should be surveyed during the first work tour after training is completed—this coincides approximately with the last week in May. If for some reason SAJH cannot be surveyed during this work tour, it may be delayed slightly, but should be completed no later than June 21. Delaying the survey any longer may bias the results, as many bird species sing less frequently as the summer progresses.

At LEWI, where the sampling points are more numerous and rain during the breeding season is much more frequent, completing all intended survey points will be more difficult. After the completion of our 2006 pilot season at LEWI, we will revisit the sampling design, and possibly reduce the area of inference and the sampling frame by discarding the survey points in one or more units, or one or more habitats. Even after such a reduction, surveying the remaining points at LEWI may still require a 2-person crew at least 7 days of sampling, not including travel to and from the large parks, or any days for familiarization with the area. Additionally, any days lost because of rain will further extend the time required to complete the survey. Given the usual weather patterns at LEWI in late May and early June, the survey could therefore easily take 2 weeks or more for a 2-person crew to complete, or 1 week for a 4-person crew to complete. The crew should therefore begin monitoring the weather forecast for the LEWI area towards the end of training; if the forecast looks promising, then two or more crew members should be sent to LEWI during the first work tour after training is completed. If, however, substantial rain is forecasted, the crew may choose to postpone their visit to LEWI until the second, or perhaps even third work tour, although every effort should be made to complete the survey by June 21. Even employing this strategy, it may not be possible for the NCCN landbird crew to complete the full survey grid at LEWI, given the likely funding and staffing constraints faced by the NCCN landbird monitoring program. If this proves to be the case, personnel at LEWI may wish to find locally based volunteers or staff to survey a portion of the points. Alternately, it may prove necessary to eliminate a subset of the survey points, perhaps the points representing one or more distinct park units, or one or more habitats. In this case, the area of inference will of course need to be scaled back accordingly.

Data collection at SAJH and LEWI will follow the same methods described elsewhere in this protocol, except for differences stemming from the fact that the points are arrayed in a systematic grid, rather than along discrete transects.

Points in the grids do not need to be surveyed in the same order in successive years, provided that all points are surveyed within the dates specified above. Surveyors should group points opportunistically to facilitate surveying as many points as possible per morning.

Point counts at SAJH and LEWI are not grouped into discrete 10-point transects as they are in the large parks; rather, for the purpose of data management, we are considering the survey points within each contiguous landholding to be a single transect. For data collection at LEWI or SAJH, use the following transect codes anywhere on the data sheets where it is necessary to indicate the transect:

Lewis and Clark National Historical Park
Cape Disappointment — CADI
Dismal Nitch — DINI
Fort Clatsop — FOCL
Sunset Beach — SUBE

San Juan Island National Historical Park
American Camp — AMCA
British Camp — BRCA

At both SAJH and LEWI, individual points are sequentially numbered 001, 002, 003, etc. These numbers should be used wherever the data forms require the point to be indicated.

When conducting surveys in the small parks, complete the Point Establishment Form according to the instructions provided in SOP 5: Establishing, Relocating, and Describing Survey Points, except for the following fields:

Point Type: All points should be recorded as 'Survey' points.

Bearing to Point: Leave blank.

Change of Direction: Leave blank.

Reason: Leave blank.

Notes regarding travel between points: Be sure to indicate which point or other landmark you are approaching the survey point from.

Permanent Marker Information: Leave all associated fields blank.

Survey points at SAJH and LEWI should *not* be marked with permanent markers.

At the end of each day's work at the small parks, each observer should complete a Transect Visit Log. The data form should be completed according to the instructions in SOP 5: Establishing, Relocating, and Describing Survey Points, with the following exceptions:

Observer2: Leave blank.

Transect Arm Code: Leave blank.

Both SAJH and LEWI include some habitats and, potentially, bird species that survey crews may not have encountered during training in the large parks. The Field Lead should ensure that surveyors are prepared to identify correctly any such habitats or bird species when they are encountered.

3. Data Analysis and Reporting

Data analysis for SAJH and LEWI will not make use of the *BirdTrend* software that was developed to accommodate the more complicated sample design at the large parks. Rather, data analysis should use the best available detectability estimation parameters (at least for the initial years of the project, these will need to be obtained from pooling detections from all NCCN parks, as described in SOP 16: Data Analysis and Reporting) to estimate a biennial park-wide density for each species detected in each park. Simple linear regression should then be used to test for temporal trends in the biennial estimates for each species.

Linear regression may be performed using numerous widely available statistical software packages, as well as spreadsheet applications. Instructions for performing linear regression analysis in Microsoft© Excel are provided below.

- Import annual density estimates (calculated in *Distance*) into an Excel spreadsheet, such that the years are in one column, and the density estimates are in another column.

- Click Tools > Data Analysis.
- In the window titled Data Analysis, select Regression and click OK. A new window titled Regression should appear. This window has many options. Below is a brief explanation of each.
- Highlight the density estimates and put into Input Y Range.
- Highlight the years and put into Input X Range.
- Click Labels, if the variable names were included under the Input Range.
- Constant is zero should NOT be checked.
- Click Confidence Level, if you want to change the level of confidence when creating intervals for the regression parameters.
- Select one of the following Output options:
    - Click Output Range if you want the test results to be placed on the current sheet. Next, simply input the cell where you want the output to be placed.
    - Click New Worksheet Ply if you want the test results to be placed on a new sheet. Next, type the name of the new sheet where you want the output to be placed.
- Click Residuals to output the residual values. The residual value is simply the difference between the observed value and the fitted value.
- Click Standardized Residuals to output the standardized residual values. Standardized residual values, unlike residual values, are invariant to the scale of measurement. Standardized residuals can be used to check for outliers in the data. If the standardized residual value is greater than 3 or less than -3, the observation is a potential outlier.
- Click Residual Plots to return the residual scatterplot. The scatterplot allows a visual check of the regression assumptions. If the scatterplot has any significant pattern, the regression assumptions are being violated.
- Click Line Fit Plots to return a scatterplot of the data with the predicted values added to the plot.
    - Normal Probability Plots are used to check the normality assumption of the error term (or residuals). Click Normal Probability Plots to output the normal probability plot.
    - Click OK. The test results and outputted scatterplots will be placed onto your spreadsheet.

Suggested table formats for reporting results from the small parks are provided in SOP 16: Data Analysis and Reporting.

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Landbird Monitoring Protocol for National Parks in the North Coast and Cascades Network

Standard Operating Procedure (SOP) 18:

Product Delivery Specifications

Revision History Log:

Revision Date	Author	Changes Made	Reason for Change

Overview

This document provides details on the process of submitting completed data sets, reports, and other project deliverables. Prior to submitting digital products, files should be named according to the naming conventions appropriate to each product type (see below for general naming conventions).

All digital file submissions that are sent by email should be accompanied by a product submission form, which briefly captures the following information about the products:

- Submission date.
- Name of the person submitting the product(s).
- Name and file format of each product.
- Indication of whether or not each product contains sensitive information (see SOP 19: Sensitive Information Procedures for more detail).

This form can be downloaded from the NCCN website or obtained from the Data Manager. People who submit digital files directly to the NCCN Digital Library will be prompted for the same information, and so a submission form is not required.

Upon notification and/or receipt of the completed products, the Data Manager or GIS Specialist will check them into the NCCN project tracking application.

Product Delivery Schedule and Specifications

Deliverable product	Primary responsibility	Target date	Instructions
Field season report	Project Lead	September 15 of the same year	Upload digital file in MS Word format to the NCCN Digital Library[1] submissions folder.
Raw GPS data files	Field Crew Lead	September 15 of the same year	Zip and send all digital files to the GIS Specialist.
Processed GPS data files	GIS Specialist	September 15 of the same year	Zip and upload raw and processed files to the NCCN Digital Library[1].
Digital photographs	Project Lead	November 30 of the same year	Organize, name, and maintain photographic images in the project workspace according to SOP #11: Managing Photographic Images.
Certified working database	Project Lead	November 30 of the same year	Refer to the following section on delivering certified data and related materials.
Certified geospatial data	Project Lead with GIS Specialist		
Data certification report	Project Lead		
Metadata interview form	Project Lead and NPS Lead		
Full metadata (parsed XML)	Data Manager and GIS Specialist	March 15 of the following year	Upload the parsed XML record to the NPS Data Store[2], and store in the NCCN Digital Library[1].
Annual I&M report	Project Lead and NPS Lead	April 30 of the following year	Refer to the following section on reports and publications.
5-year analysis report	Project Lead, NPS Lead, Data Analyst	Every 5 years by April 30	
Other publications	NPS Lead, Project Lead, Data Analyst	As completed	
Field data forms	NPS Lead and Project Lead	Every 5 years by April 30	Scan original, marked-up field forms as PDF files and upload these to the NCCN Digital Library[1] submissions folder. Originals go to the Park Curator for archival.
Other records	NPS Lead and Project Lead	Review for retention every January	Organize and send analog files to Park Curator for archival. Digital files that are slated for permanent retention should be uploaded to the NCCN Digital Library. Retain or dispose of records following NPS Director's Order #19[3].

[1]The NCCN Digital Library is a hierarchical digital filing system stored on the NCCN file servers (Boetsch and others, 2005). Network users have read-only access to these files, except where information sensitivity may preclude general access.

[2]NPS Data Store is a clearinghouse for natural resource data and metadata (http://science.nature.nps.gov/nrdata). Only non-sensitive information is posted to NPS Data Store. Refer to SOP 19: Sensitive Information Procedures for details.

[3]NPS Director's Order 19 provides a schedule indicating the amount of time that the various kinds of records should be retained. Available at: http://data2.itc.nps.gov/npspolicy/DOrders.cfm

Specific Instructions for Delivering Certified Data and Related Materials

Data certification is a benchmark in the project information management process that indicates that: (1) data are complete for the period of record; (2) data have undergone and passed the quality assurance checks; and (3) data are appropriately documented and in a condition for archiving, posting, and distribution as appropriate. To ensure that only quality data are included in reports and other project deliverables, the data certification step is an annual requirement for all tabular and spatial data. For more information, refer to SOP 14: Data Quality Review and Certification.

The following deliverables should be delivered as a package:

- Certified working database — Database in Microsoft© Access format containing data for the current season that has been through the quality assurance checks documented in SOP 14: Data Quality Review and Certification.
- Certified geospatial data — GIS themes in ESRI coverage or shapefile format. Refer to NCCN GIS Development Guidelines (North Coast and Cascades Network, 2006) and NCCN GIS Product Specifications (North Coast and Cascades Network, 2005a) for more information.
- Data certification report — A brief questionnaire in Microsoft© Word that describes the certified data product(s) being submitted. A template form is available on the NCCN website at: http://www1.nature.nps.gov/im/units/nccn/datamgmt_guide.cfm.
- Metadata interview form — The Metadata Interview Form is an Microsoft© Word questionnaire that greatly facilitates metadata creation. It is available on the NCCN website at: http://www1.nature.nps.gov/im/units/nccn/datamgmt_guide.cfm. For more details, refer to SOP 15: Metadata Development.

After the quality review is completed, the Project Lead should package the certification materials for delivery as follows:

1. Open the certified back-end database file and compact it (in Microsoft© Access, Tools > Database Utilities > Compact and Repair Database). This will make the file size much smaller. Back-end files typically are indicated with the letters "_be" in the name (for example, Landbirds_BDa03_be_2007.mdb).
2. Rename the certified back-end file with the project code ("BDa03"), the year or span of years for the data being certified, and the word "certified". For example: BDa03_2007_certified.mdb.
3. Create a compressed file (using WinZip® or similar software) and add the back-end database file to that file.

   Note: The front-end application does not contain project data and as such should not be included in the delivery file.
4. Add the completed Metadata Interview and Data Certification Forms to the compressed file. Both files should be named in a manner consistent with the naming conventions described elsewhere in this document.
5. Add any geospatial data files that are not already in the possession of the GIS Specialist. Geospatial data files should be developed and named according to NCCN GIS Naming Conventions (North Coast and Cascades Network, 2005b).
6. Upload the compressed file containing all certification materials to the new submissions folder of the NCCN Digital Library. If the Project Lead does not have intranet access to the NCCN Digital Library, then certification materials should be delivered as follows:

   a. If the compressed file is under 5 mb in size, it may be delivered directly to the NPS Lead and Data Manager by email.

   b. If the compressed file is larger than 5 mb, it should be copied to a CD or DVD and delivered in this manner. Under no circumstances should products containing sensitive information be posted to an FTP site or other unsecured web portal (refer to SOP 19: Sensitive Information Procedures for more information).
7. Notify the Data Manager and NPS Lead by email that the certification materials have been uploaded or otherwise sent.

Upon receiving the certification materials, the Data Manager will:

1. Review them for completeness and work with the Project Lead if there are any questions.
2. Notify the GIS Specialist if any geospatial data are submitted. The GIS Specialist will then review the data, and update any project GIS data sets and metadata accordingly.
3. Check in the delivered products using the NCCN project tracking application.
4. Store the certified products together in the NCCN Digital Library.
5. Upload the certified data to the master project database.
6. Notify the Project Lead that the year's data have been successfully uploaded and processed. The Project Lead may then proceed with data summarization, analysis, and reporting.

7. Develop, parse, and post the XML metadata record to the NPS Data Store.
8. After a holding period of 2 years, the Data Manager will upload the certified data to the NPS Data Store. This holding period is to protect professional authorship priority and to provide sufficient time to catch any undetected quality assurance problems. See SOP 20: Product Posting and Distribution.

Specific Instructions for Reports and Publications

Annual reports and trend analysis reports will use the NPS Natural Resource Publications template, a pre-formatted Microsoft Word template document based on current NPS formatting standards. Annual reports will use the Natural Resource Report template, and trend analysis and other peer-reviewed technical reports will use the Natural Resource Technical Report template. Instructions for acquiring a series number and other information about NPS publication standards are at: http://www.nature.nps.gov/publications/NRPM/index.cfm. In general, the procedures for reports and publications are as follows:

1. The document should be formatted using the NPS Natural Resource Publications template. Formatting according to NPS standards is easiest when using the template from the very beginning, as opposed to reformatting an existing document.
2. The document should be peer reviewed at the appropriate level. For example, I&M Annual Reports should be reviewed by other members of the appropriate project work group. The Network Coordinator also will review all annual reports for completeness and compliance with I&M standards and expectations.
3. Upon completing the peer review, acquire a publication series number from the NPS Technical Information Center or the appropriate local or regional key official (currently the Regional I&M Coordinator).
4. Upload the file in PDF and Microsoft© Word formats to the NCCN Digital Library submissions folder.
5. Send a printout to each Park Curator.
6. The Data Manager or a designee will create a bibliographic record and upload the PDF document to NatureBib according to document sensitivity.

Naming Conventions

In all cases, file names should follow these guidelines:

- No spaces or special characters in the file name.
- Use the underbar ("_") character to separate file name components.
- Try to limit file names to 30 characters or fewer, up to a maximum of 50 characters.
- Dates should be formatted as YYYYMMDD.
- Correspondence files should be named as YYYYMMDD_AuthorName_subject.ext.
- As appropriate, include the project code (for example, "BDa03"), network code ("NCCN") or park code, and year in the file name.

Examples:

- NCCN_BDa03_2007_Annual_report.pdf
- NCCN_BDa03_2007_Field_season_report.doc
- NCCN_BDa03_2007_Certification_report.doc

References Cited

Boetsch, J.R., Christoe, B., and Holmes, R.E., 2005, Data management plan for the North Coast and Cascades Network Inventory and Monitoring Program: USDI National Park Service, Port Angeles, WA, 88 p. Available at: http://www1.nature.nps.gov/im/units/nccn/datamgmt.cfm

North Coast and Cascades Network – National Park Service, 2005a, GIS Product Specifications: USDI National Park Service. Available at: http://www1.nature.nps.gov/im/units/nccn/datamgmt_guide.cfm

North Coast and Cascades Network – National Park Service, 2005b, GIS Naming Conventions: USDI National Park Service. Available at: http://www1.nature.nps.gov/im/units/nccn/datamgmt_guide.cfm

North Coast and Cascades Network – National Park Service, 2006, GIS Development Guidelines: USDI National Park Service. Available at: http://www1.nature.nps.gov/im/units/nccn/datamgmt_guide.cfm

Landbird Monitoring Protocol for National Parks in the North Coast and Cascades Network

Standard Operating Procedure (SOP) 19:

Sensitive Information Procedures

Revision History Log:

Revision Date	Author	Changes Made	Reason for Change

Overview

Although it is the general NPS policy to share information widely, the NPS also realizes that providing information about the location of park resources may sometimes place those resources at risk of harm, theft, or destruction. This can occur, for example, with regard to caves, archeological sites, tribal information, and rare plant and animal species. Therefore, information will be withheld when the NPS foresees that disclosure would be harmful to an interest protected by an exemption under the Freedom of Information Act (FOIA). The National Parks Omnibus Management Act, Section 207, 16 U.S.C. 5937, is interpreted to prohibit the release of information regarding the "nature or specific location" of certain cultural and natural resources in the national park system. Additional details and information about the legal basis for this policy are in the NPS Management Policies (National Park Service 2006), and in Director's Order #66.

These guidelines apply to all NCCN staff, cooperators, contractors, and other partners who are likely to obtain or have access to information about protected NPS resources. The NPS Lead has primary responsibility for ensuring adequate protection of sensitive information related to this project.

The following are highlights of our strategy for protecting this information:

- *Protected resources*, in the context of the NCCN Inventory and Monitoring Program, include species that have State- or Federally-listed status, and other species deemed rare or sensitive by local park taxa experts.
- *Sensitive information* is defined as information about protected resources that may reveal the "nature or specific location" of protected resources. Such information must not be shared outside the National Park Service, unless a signed confidentiality agreement is in place.
- In general, if information is withheld from one requesting party, it must be withheld from anyone else who requests it, and if information is provided to one requesting party without a confidentiality agreement, it must be provided to anyone else who requests it.
- To share information as broadly as legally possible, and to provide a consistent, tractable approach for handling sensitive information, the following shall apply if a project is likely to collect and store sensitive information:
  - Random coordinate offsets of up to 2 km for data collection locations, and
  - Removal of data fields from the released copy that are likely to contain sensitive information.

What Kinds of Information Can and Can Not Be Shared?

Do not share: Project staff and cooperators should not share any information outside NPS that reveals details about the "nature or specific location" of protected resources, unless a confidentiality agreement is in place. Specifically, the following information should be omitted from shared copies of all data, presentations, reports, or other published forms of information.

- Exact coordinates—Instead, public coordinates are to be generated that include a random offset azimuth and distance. These offset coordinates can be shared freely.
- Other descriptive location data—Examples may include travel descriptions, location descriptions, or other fields that contain information that may reveal the specific location of the protected resource(s).
- Protected resource observations at disclosed locations—If specific location information has already been made publicly available, the occurrence of protected resources at that location cannot be shared outside NPS without a confidentiality agreement. For example, if the exact coordinates for a monitoring station location are posted to a website or put into a publication, then at a later point in time a spotted owl nest is observed at that monitoring station, that nest cannot be mentioned or referred to in any report, presentation, data set, or publication that will be shared outside NPS.

Do share: All other information about the protected resource(s) may be freely shared, so long as the information does not reveal details about the "nature or specific location" of the protected resource(s) that are not already readily available to the general public in some form (for example, other published material). Species tallies and other types of data presentations that do not disclose the precise locations of protected resources may be shared, unless by indicating the presence of the species the specific location also is revealed (i.e., in the case of a small park).

Details for Specific Products

Whenever products such as databases and reports are being generated, handled and stored, they should be created explicitly for one of the following purposes:

1. *Public or general-use* — Intended for general distribution, sharing with cooperators, or posting to public websites. They may be derived from products that contain sensitive information so long as the sensitive information is either removed or otherwise rendered in a manner consistent with other guidance in this document.
2. *Internal NPS use* — These are products that contain sensitive information and should be stored and distributed only in a manner that ensures their continued protection. These products should clearly indicate that they are solely for internal NPS use by containing the phrase: "Internal NPS Use Only – Not For Release." These products can only be shared within NPS or in cases where a confidentiality agreement is in place. They do not need to be revised in a way that conceals the location of protected resources.

Data Sets

To create a copy of a data set that will be posted or shared outside NPS:

1. Make sure the public offset coordinates have been populated for each sample or observation location in tbl_Locations.
2. Remove tbl_Coordinates and tbl_GPS_Info.
3. Delete the following database objects to ensure consistent omission of fields that may contain specific, identifying information about locations of protected resources:
   a. tbl_Sites.Site_notes
   b. tbl_Locations.Travel_notes
   c. tbl_Locations.Elevation, Elev_units, Elev_source
   d. tbl_Locations.Location_desc
   e. tbl_Locations.Location_notes
   f. tbl_Features
   g. tbl_Markers

The local, master copy of the database contains the exact coordinates and all data fields. The Data Manager and/or GIS Specialist can provide technical assistance as needed to apply coordinate offsets or otherwise edit data products for sensitive information.

Maps and Other GIS Output

General use maps and other geographic representations of observation data that will be released or shared outside NPS should be rendered using offset coordinates, and should only be rendered at a scale that does not reveal their exact position (for example, 1:100,000 maximum scale).

If a large-scale, close-up map is to be created using exact coordinates (for example, for field crew navigation, etc.), the map should be clearly marked with the following phrase: "Internal NPS Use Only — Not For Release."

The Data Manager and/or GIS Specialist can provide technical assistance as needed to apply coordinate offsets or otherwise edit data products for sensitive information.

Presentations and Reports

Public or general-use reports and presentations should adhere to the following guidelines:

1. Do not list exact coordinates or specific location information in any text, figure, table, or graphic in the report or presentation. If a list of coordinates is necessary, use only offset coordinates and clearly indicate that coordinates have been purposely offset to protect the resource(s) as required by law and NPS policy.
2. Use only general use maps as specified in the section on maps and other GIS output.

If a report is intended for internal use only, these restrictions do not apply. However, each page of the report should be clearly marked with the following phrase: “Internal NPS Use Only — Not For Release.”

Voucher Specimens

Specimens of protected taxa should only be collected as allowed by law. Labels for specimens should be clearly labeled as containing sensitive information by containing the following phrase: “Internal NPS Use Only — Not For Release.” These specimens should be stored separately from other specimens to prevent unintended access by visitors. As with any sensitive information, a confidentiality agreement should be in place prior to sending these specimens to another non-NPS cooperator or collection.

Procedures for Coordinate Offsets

1. Process GPS data, upload into the database, and finalize coordinate data records. Update tbl_Coordinates.Is_best as appropriate, especially where there is more than one set of coordinates per sample location.
2. Set the minimum and maximum offset distances (project-specific, typically up to 2 km).
3. Apply a random offset and random azimuth to each unique set of coordinates.
4. Coordinates may then be either rounded or truncated so the UTM values end in zeros to give a visual cue that the values are not actual coordinates.
5. Do not apply independent offsets to clustered or otherwise linked sample locations (for example, multiple sample points along a transect). Instead, either apply a single offset to the cluster so they all remain clustered after the offset is applied, or apply an offset to only one of the points in the cluster (for example, the transect origin) and store the result in the public coordinates for each point in that cluster.
6. These “public” coordinates are then the only ones to be shared outside NPS — including all published maps, reports, publications, presentations, and distribution copies of the data set — in the absence of a confidentiality agreement.

The following components can be used to create individual offsets rounded to the nearest 100 m in Microsoft© Excel:

- Angle = rand() * 359
- Distance = ((Max_offset – Min_offset) * rand() + Min_offset)
- Public_UTME = Round(UTME_final + (Distance * cos(radians(Angle – 90))), -2)
- Public_UTMN = Round(UTMN_final + (Distance * sin(radians(Angle + 90))), -2)

Project-Specific Steps for Updating the Public Coordinates

The following steps are specific to the landbird monitoring project:

1. Offset large park incidental observation coordinates. Criteria: Park_code <> ‘LEWI’ And <> ‘SAJH’, Is_best = True, and Location_type = ‘incidental’.
2. Set public coordinates for small park incidental observations to the centroid of the unit or park. Criteria: Park_code = ‘LEWI’ Or ‘SAJH’, Is_best = True, and Location_type = ‘incidental’.
3. Offset transect origins. Criteria: Park_code <> ‘LEWI’ And <> ‘SAJH’, Is_best = True, and Location_type = ‘origin’.
4. Apply the site/transect offsets to non-origin points. Criteria: Park_code <> ‘LEWI’ And <> ‘SAJH’, Is_best = True, and Location_type <> ‘origin’ And <> ‘incidental’.
5. Set public coordinates for small park grid points to the centroid of the unit or park. Criteria: Park_code = ‘LEWI’ or ‘SAJH’.

Sharing Sensitive Information

Note: Refer to SOP 20: Product Posting and Distribution for a more complete description of how to post and distribute products, and to keep a log of data requests.

No sensitive information (information about the specific nature or location of protected resources) may be posted to the NPS Data Store or another publicly accessible website, or otherwise shared or distributed outside NPS without a confidentiality agreement between NPS and the agency, organization, or person(s) with whom the sensitive information is to be shared. Only products that are intended for public/general use may be posted to public websites and clearinghouses—these may not contain sensitive information.

Responding to Data Requests

If requests for distribution of products containing sensitive information are initiated by the NPS, by another Federal agency, or by another partner organization (for example, a research scientist at a university), the unedited product (the full data set that includes sensitive information) may only be shared after a confidentiality agreement is established between NPS and the agency, organization, or person(s) with whom the sensitive information is to be shared. All data requests will be tracked according to procedures in SOP 20: Product Posting and Distribution.

Once a confidentiality agreement is in place, products containing sensitive information may be shared following these guidelines:

- Always clearly indicate in accompanying correspondence that the products contain sensitive information, and specify which products contain sensitive information.
- Indicate in all correspondence that products containing sensitive information should be stored and maintained separately from non-sensitive information, and protected from accidental release or re-distribution.
- Indicate that NPS retains all distribution rights; copies of the data should not be redistributed by anyone but NPS.
- Include the following standard disclaimer in a text file with all digital media upon distribution: "The following files contain protected information. This information was provided by the National Park Service under a confidentiality agreement. It is not to be published, handled, re-distributed, or used in a manner inconsistent with that agreement." The text file also should specify the file(s) containing sensitive information.
- If the products are being sent on physical media (for example, CD or DVD), the media should be marked in such a way that clearly indicates that media contains sensitive information provided by the National Park Service.

Confidentiality Agreements

Confidentiality agreements may be created between NPS and another organization or individual to ensure that protected information is not inadvertently released. When contracts or other agreements with a non-federal partner do not include a specific provision to prevent the release of protected information, the written document must include the following standard Confidentiality Agreement:

> **Confidentiality Agreement** — I agree to keep confidential any protected information that I may develop or otherwise acquire as part of my work with the National Park Service. I understand that with regard to protected information, I am an agent of the National Park Service and must not release that information. I also understand that by law I may not share protected information with anyone through any means except as specifically authorized by the National Park Service. I understand that protected information concerns the nature and specific location of endangered, threatened, rare, commercially valuable, mineral, paleontological, or cultural patrimony resources such as threatened or endangered species, rare features, archeological sites, museum collections, caves, fossil sites, gemstones, and sacred ceremonial sites. Lastly, I understand that protected information must not be inadvertently disclosed through any means including websites, maps, scientific articles, presentation, and speeches.

Note: Certain States, including the State of Washington, have Sunshine laws that do not have exemptions for sensitive information. NPS should not create confidentiality agreements or share sensitive information with these States without first seeking the advice of an NPS solicitor.

Freedom of Information (FOIA) Requests

All official FOIA requests will be handled according to NPS policy. The NPS Lead will work with the Data Manager and the park FOIA representative(s) of the park(s) for which the request applies.

Reference Cited

National Park Service, 2006, Management policies: Accessed February 6, 2007, http://www.nps.gov/policy/mp/policies.htm.

Landbird Monitoring Protocol for National Parks in the North Coast and Cascades Network

Standard Operating Procedure (SOP) 20:

Product Posting and Distribution

Revision History Log:

Revision Date	Author	Changes Made	Reason for Change

This document provides details on the process of posting and otherwise distributing finalized data, reports, and other project deliverables. For a complete list of project deliverables, refer to SOP 18: Product Delivery Specifications.

Product Posting

Once digital products have been delivered and processed, the following steps will be taken by the Data Manager to make them generally available:

1. Full metadata records will be posted to the NPS Data Store, which is the NPS clearinghouse for natural resource data and metadata that is available to the public at: http://science.nature.nps.gov/nrdata. Refer to the website for upload instructions.
2. A record for reports and other publications will be created in NatureBib, which is the NPS bibliographic database (http://www.nature.nps.gov/nrbib/index.htm). The digital report file in PDF format will then be uploaded and linked to the NatureBib record. Refer to the NatureBib website for record creation and upload instructions.
3. Species observations will be extracted from the database and entered into NPSpecies, which is the NPS database and application for maintaining park-specific species lists and observation data (http://science.nature.nps.gov/im/apps/npspp/index.htm).

These three applications serve as the primary mechanisms for sharing reports, data, and other project deliverables with other agencies, organizations, and the general public.

Holding Period for Project Data

To protect professional authorship priority and to provide sufficient time to complete quality assurance measures, there is a 2-year holding period before posting or otherwise distributing finalized data. This means that certified data sets are first posted to publicly accessible websites (for example, the NPS Data Store) approximately 24 months after they are collected (for example, data collected in June 2006 becomes generally available through the NPS Data Store in June 2008). In certain circumstances, and at the discretion of the NPS Lead and Park Biologists, data may be shared before a full 2 years have elapsed.

Note: This hold only applies to raw data; all metadata, reports, or other products are to be posted to NPS clearinghouses in a timely manner as they are received and processed.

Responding to Data Requests

Occasionally, a park or project staff member may be contacted directly regarding a specific data request from another agency, organization, scientist, or from a member of the general public. The following points should be considered when responding to data requests:

- NPS is the originator and steward of the data, and the NPS Inventory and Monitoring Program should be acknowledged in any professional publication using the data.

- NPS retains distribution rights; copies of the data should not be redistributed by anyone but NPS.
- Data that project staff members and cooperators collect using public funds are public records and as such can not be considered personal or professional intellectual property.
- No sensitive information (information about the specific nature or location of protected resources) may be posted to the NPS Data Store or another publicly accessible website, or otherwise shared or distributed outside NPS without a confidentiality agreement between NPS and the agency, organization, or person(s) with whom the sensitive information is to be shared. Refer to the section in this document about sensitive information and also to SOP 19: Sensitive Information Procedures.
- For quality assurance, only certified, finalized versions of data sets should be shared with others.

The NPS Lead will handle all data requests as follows:

1. Discuss the request with other Park Biologists as necessary to make those with a need to know aware of the request and, if necessary, to work together on a response.
2. Notify the Data Manager of the request if s/he is needed to facilitate fulfilling the request in some manner.
3. Respond to the request in an official email or memo.
4. In the response, refer the requestor to the NPS Data Store (http://science.nature.nps.gov/nrdata), so they may download the necessary data and/or metadata. If the request can not be fulfilled in that manner—either because the data products have not been posted yet, or because the requested data include sensitive information—work with the Data Manager to discuss options for fulfilling the request directly (for example, burning data to CD or DVD). Ordinarily, only certified data sets should be shared outside NPS.
5. If the request is for a document, it is recommended that documents be converted to PDF format prior to distributing it.
6. If the request is for data that may reveal the location of protected resources, refer to the section in this document about sensitive information and also to SOP 19: Sensitive Information Procedures.
7. After responding, provide the following information to the Data Manager, who will maintain a log of all requests in the NCCN Project Tracking database:
   - Name and affiliation of requestor
   - Request date
   - Nature of request
   - Responder
   - Response date
   - Nature of response
   - List of specific data sets and products sent (if any)

All official FOIA requests will be handled according to NPS policy. The NPS Lead will work with the Data Manager and the park FOIA representative(s) of the park(s) for which the request applies.

Special Procedures for Sensitive Information

Products that have been identified upon delivery by the Project Lead and/or NPS Lead as containing sensitive information will normally be revised into a form that does not disclose the locations of protected resources—most often by removing specific coordinates and only providing coordinates that include a random offset to indicate the general locality of the occurrence. If this kind of measure is not a sufficient safeguard given the nature of the product or the protected resource in question, the product(s) will be withheld from posting and distribution.

If requests for distribution of the unedited version of products are initiated by the NPS, by another Federal agency, or by another partner organization (for example, a research scientist at a university), the unedited product (for example, the full data set that includes sensitive information) may only be shared after a confidentiality agreement is established between NPS and the agency, organization, or person(s) with whom the sensitive information is to be shared. Refer to SOP 19: Sensitive Information Procedures for more information.

Landbird Monitoring Protocol for National Parks in the North Coast and Cascades Network

Standard Operating Procedure (SOP) 21:

Revising the Protocol

Revision History Log:

Revision Date	Author	Changes Made	Reason for Change

Overview

This document explains how to make and track changes to the NCCN Landbird Monitoring Protocol, including its accompanying SOPs. Project staff should refer to this SOP whenever edits are necessary, and should be familiar with the protocol versioning system in order to identify and use the most current versions of the protocol documents. Required revisions should be made in a timely manner to minimize disruptions to project planning and operations.

This protocol attempts to incorporate the best and most cost-effective methods for monitoring and information management. As new technologies, methods, and equipment become available, this protocol will be updated as appropriate, by balancing current best practices against the continuity of protocol information. All changes will be made in a timely manner with the appropriate level of review.

All edits require review for clarity and technical soundness. Small changes to existing documents—for example, formatting, simple clarification of existing content, small changes in the task schedule or project budget, or general updates to information management handling SOPs—may be reviewed in-house by project cooperators and NCCN staff. However, changes to data collection or analysis techniques, sampling design, or response design will trigger an outside review to be coordinated by the Pacific West Regional Office.

Procedures

1. Discuss proposed changes with other project staff prior to making modifications. Consult with the Data Manager prior to making changes because certain types of changes may jeopardize data set integrity unless they are planned and executed with data set integrity in mind. Because certain changes may require altering the database structure or functionality, advance notice of changes is important to minimize disruptions to project operations. Consensus should be reached on who will be making the changes and in what timeframe.
2. Make the agreed-upon changes in the current, primary version of the appropriate protocol document (for example, not the most recent versioned copy—see below). Note that the protocol is split into separate documents for each appendix and SOP.

   Note: A change in one document also may necessitate other changes elsewhere in the protocol. For example, a change in the narrative may require changes to several SOPs; similarly renumbering an SOP may mean changing document references in several other documents. The project task list and other appendixes also may need to be updated to reflect changes in timing or responsibilities for the various project tasks.

3. Document all edits in the Revision History Log embedded in the protocol narrative and each SOP. Log changes only in the document being edited (for example, if there is a change to an SOP, log those changes only in that document). Record the date of the changes (the date on which all changes were finalized), author of the revision, describe the change and cite the paragraph(s) and page(s) where changes are made, and briefly indicate the reason for making the changes.
4. Circulate the changed document for internal review among project staff and cooperators.
5. Upon ratification and finalizing changes:

   a. Ensure that the version date (last saved date field code in the document header) and file name (field code in the document footer) are updated properly throughout the document.

   b. Make a copy of each changed file to the protocol archive folder (a subfolder under the Protocol folder in the project workspace).

   c. The copied files should be renamed by appending the revision date in YYYYMMDD format. In this manner, the revision date becomes the version number, and this copy becomes the ‘versioned’ copy to be archived and distributed.

   d. The current, primary version of the document for example, not the versioned document just copied and renamed) does not have a date stamp associated with it.

   e. To avoid unplanned edits to the document, reset the document to read-only by right-clicking on the document in Windows Explorer and checking the appropriate box in the Properties popup.

   f. Inform the Data Manager so the new version number(s) can be incorporated into the project metadata.

6. As appropriate, create PDF files of the versioned documents to post to the internet and share with others. These PDF files should have the same name and be made from the versioned copy of the file.
7. Post the versioned copies of revised documents to the NCCN Digital Library and forward copies to all individuals who had been using a previous version of the affected document.

Example of Document Revision

SOP_2_Records_Mgmt.doc is revised on October 31, 2008, and circulated for review.

Changes are accepted by the group and changes are finalized on November 6, 2008.

The revised SOP is:

a. Copied into the Archive folder.

b. That versioned copy is renamed as SOP_2_Records_Mgmt_20081106.doc.

c. Both the current, primary version and the versioned copy are set to read-only.

d. A PDF of the document is created from the versioned copy and named SOP_2_Records_Mgmt_20081106.pdf.

e. Both the PDF and the versioned document are uploaded to the NCCN Digital Library.

f. The PDF is sent to any cooperators.

Appendix 1. Roles and Responsibilities

Role	Responsibilities	Name / Position
NPS Lead	• Project oversight and administration • Track project objectives, budget, requirements, and progress toward project objectives • Facilitate communications between NPS and cooperator(s) • Coordinate and ratify changes to protocol • Assist in training field crews • Assist in performing data summaries and analysis, assist interpretation and report preparation • Review annual reports and other project deliverables for completeness and compliance with Inventory and Monitoring Program specifications • Maintain and archive project records	Bob Kuntz, Wildlife Biologist, NOCA
Project Lead	• Project operations and implementation • Certify each season's data for quality and completeness • Complete reports, metadata, and other products according to schedule	Rodney Siegel, Research Scientist, IBP and Bob Wilkerson, Biologist, IBP
Data Analyst	• Perform data summaries and analysis, assist interpretation and report preparation	
Field Lead	• Train and ensure safety of field crew • Plan and execute field visits • Acquire and maintain field equipment • Oversee data collection and entry; verify accurate data transcription into database • Complete a field season report	IBP Field Biologist
Technicians	• Collect, record, enter, and verify data	IBP Technicians
Data Manager	• Consultant on data management activities • Facilitate check-in, review and posting of data, metadata, reports, and other products to national databases and clearinghouses according to schedule • Maintain and update database application • Provide database training as needed	John Boetsch, Data Manager, OLYM[1]
GIS Specialist	• Consultant on spatial data collection, GPS use, and spatial analysis techniques • Facilitate spatial data development and map output generation • Work with Project Lead and Data Analyst to analyze spatial data and develop metadata for spatial data products • Primary steward of GIS data and products	Roger Hoffman, GIS Specialist, OLYM[1]
Network Coordinator	• Review annual reports for completeness and compliance with I&M standards and expectations	NCCN Network Coordinator
Park Biologists	• Facilitate logistics planning and coordination • Ensure project compliance with park requirements • Review reports, data and other project deliverables	Park Wildlife Biologists and Resource Managers
Park Curator	• Receive and catalogue voucher specimens • Receive and archive copies of annual reports, analysis reports, and other publications • Facilitate archival of other project records (for example, original field forms, etc.)	Park Curators and Collections Managers at OLYM, NOCA and MORA
USGS Liaison	• Consultant on technical issues related to project sampling design, statistical analyses, or other issues related to changes in protocol and SOPs	Kurt Jenkins, Biologist, USGS-FRESC

[1] These individuals act as coordinators and primary points of contact for this project. Their responsibility is to facilitate communication among network and park data managers and geographic information specialists and to coordinate the work that may be shared to enhance the efficiency of operations.

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Appendix 2. Yearly Project Task List

This table identifies each task by project stage, indicates who is responsible, and establishes the timing for its execution. Protocol sections and SOPs are referred to as appropriate.

Project stage	Task description	Responsibility	Timing
Preparation (*Sections 3A, 3B, and 4B; SOPs 1, 2, and 3*)	Initiate announcements for seasonal technician positions, begin hiring	Project Lead	November–January
	Notify Data Manager and GIS Specialist of needs for the coming season (field maps, GPS support, training)	Project Lead	By December 1
	Meet (or conference call) to recap past field season, discuss the upcoming field season, and document any needed changes to field sampling protocols or the working database	Project Lead, NPS Lead, Park Biologists, and Data Manager, GIS Specialist	January
	Ensure all project compliance needs are completed for the coming season	Park Biologists	January–February
	Provide names of field crew to Park Biologists	Project Lead	Mid-February
	Plan schedule and logistics, including ordering any needed equipment and supplies (SOP 1)	Project Lead, NPS Lead, and Park Biologists	By March 1
	Inform GIS Specialist and Data Manager of specific needs for upcoming field season	Project Lead	By March 31
	Generate field navigation reports, roster of sample points and coordinates from the database (SOP 1)	Project Lead	By March 31
	Prepare and print field maps (SOP 1)	Project Lead	By April 15
	Update and load data dictionary, background maps, and target coordinates into GPS units (SOP 1)	GIS Specialist	By April 15
	Ensure that project workspace is ready for use and GPS download software is loaded at each park (SOP 2)	NPS Lead, Data Manager and GIS Specialist	By April 30
	Implement working database copy	Data Manager	By May 1
	Initiate computer access and key requests (may need park-specific dates)	Park Biologists	May
	Provide field crew email addresses and user logins to Data Manager	Park Biologists	May
	Provide database/GPS training as needed	Data Manager and GIS Specialist	May
	Train field crew in bird identification, distance estimation, sampling protocols, and safety (SOP 3)	Field Lead	May
	Examination and certification of field observer qualifications, enter training results into database (SOP 3)	Field Lead	May
Data Acquisition (*Section 3C; SOPs 4, 5, 6, 7, 8, 9, and 10*)	Notify Park Biologist and Project Lead of tour itinerary	Technicians	Before each tour
	Collect field observations and position data during field trips	Technicians	May-July
	Review data forms after each day	Technicians	Daily
	Check in with Park Biologist	Technicians	After each tour
	De-brief crew on operations, field methods, gear needs	Field Lead	After each tour

Project stage	Task description	Responsibility	Timing
Data Entry and Processing (*Sections 4C and 4D; SOPs 10, 11, and 12*)	Download GPS data and email files to GIS Specialist for correction (SOP 10)	Technicians	After each tour
	Download and process digital images (SOP 11)	Technicians	After each tour
	Enter data into working copy of the database (SOP 12)	Technicians	After each tour
	Verification of accurate transcription as data are entered	Technicians	After each tour
	Correct GPS data and send screen capture to Field Lead and Project Lead for review	GIS Specialist	After each tour
	Periodic review of GPS location data and database entries for completeness and accuracy	Field Lead	Bi-weekly
	Merge, correct, and export GPS data. Upload processed and verified coordinates to database	GIS Specialist	August
Product Development (*Section 4I*)	Complete field season report (SOP 13)	Field Lead	July–August
Product Delivery (*Section 4J*)	Send field season report to NPS Lead, Park Biologists, Data Manager, and GIS Specialist (SOP 18)	Project Lead	By September 30
Quality Review (*Section 4E; SOP 14*)	Quality review and data validation using database tools (SOP 14)	Project Lead	August–October
	Prepare coordinate summaries and/or GIS layers and data sets as needed for spatial data review	GIS Specialist	By September 15
	Joint quality review of GIS data, determine best coordinates for subsequent mapping and field work	Project Lead and GIS Specialist	September–October
Metadata (*Section 4F; SOPs 15 and 19*)	Identify any sensitive information contained in the data set (SOP 19)	Project Lead and NPS Lead	August–October
	Update project metadata records (SOP 15)	Project Lead and NPS Lead	August–October
Data Certification and Delivery (*Section 4G; SOPs 14, 18, 19, 20*)	Certify the season's data and complete the certification report (SOP 14)	Project Lead	November
	Deliver certification report, certified data, digital photographs, and updated metadata to Data Manager (SOP 18)	NPS Lead	By November 30
	Upload certified data into master project database, store data files in NCCN Digital Library[1] (SOP 20)	Data Manager	December–January
	Notify Project Lead of uploaded data ready for analysis and reporting	Data Manager	By January 15
	Update project GIS data sets, layers and associated metadata records	GIS Specialist	December–January
	Finalize and parse metadata records, store in NCCN Digital Library[1] (SOP 15)	Data Manager and GIS Specialist	By March 15
Data Analysis (*Section 4H; SOP 16*) **Note**: The tasks in this section occur every 5 years.	Export *Distance* input file from database	Data Analyst	February–March
	Import into *Distance* to model detectability functions and estimate density by species and detection class	Data Analyst	February–March
	Export and reformat *Distance* output for import into database and *BirdTrend* analytical tool	Data Analyst	February–March
	Assign variance groups to transects	Data Analyst	February–March
	Iterative revision of variance groups as needed to provide sufficient data for each variance group	Data Analyst	February–March
	Export park-specific trends and density estimates for each species, import into database	Data Analyst	February–March

Project stage	Task description	Responsibility	Timing
Reporting & Product Development (*Section 4I; SOPs 16 and 19*)	Export automated summary queries and reports from database	Data Analyst	February–March
	Produce park-wide and transect-specific map output for archives	GIS Specialist	January–March
	Generate report-quality map output for reports	GIS Specialist	February–March
	Acquire the proper report template from the NPS website, create annual report	Data Analyst and Project Lead	February–April
	Screen all reports and data products for sensitive information (SOP 19)	Project Lead and NPS Lead	February–April
	Prepare draft report and distribute to Park Biologists for preliminary review	Project Lead and NPS Lead	By April 1
Product Delivery (*Section 4J; SOP 18*)	Submit draft I&M report to Network Coordinator for review	NPS Lead	By April 30
	Review report for formatting and completeness, notify Project Lead of approval or need for changes	Network Coordinator	May
	Upload completed report to NCCN Digital Library 1 submissions folder, notify Data Manager (SOP 18)	NPS Lead	Upon approval
	Deliver other products according to the delivery schedule and instructions (SOP 18)	Project Lead and NPS Lead	Upon completion
	Product check-in	Data Manager	Upon receipt
Posting & Distribution (*Section 4J; SOP 20*)	Submit metadata to NPS Data Store[2]	Data Manager	By March 15
	Create NatureBib[3] record, post reports to NPS clearinghouse	Data Manager	Upon receipt
	Update NPSpecies[4] records according to data observations	Data Manager	December–March
	Submit certified data and GIS data sets to NPS Data Store[2]	Data Manager	June (after 2-year hold)
Archival & Records Management (*Section 4K; SOPs 2 and 20*)	Store finished products in NCCN Digital Library[1]	Data Manager	Upon receipt
	Review, clean up and store and/or dispose of project files according to NPS Director's Order #19[5]	NPS Lead and Project Lead	January
Season Close-out (*Sections 3D and 4L*)	Inventory equipment and supplies	Field Lead	By August 7
	Conference call to discuss recent field season (close out); discuss who needs to do what to get data ready for analysis	Project Lead, NPS Lead, Park Biologists, Data Manager, and GIS specialist	By October 15
	Discuss and document needed changes to analysis and reporting procedures	Project Lead, NPS Lead, Park Biologists, and Data Manager	By April 30

[1] NPS Data Store is a clearinghouse for natural resource data and metadata (http://science.nature.nps.gov/nrdata). Only non-sensitive information is posted to NPS Data Store. For details refer to SOP 19: Sensitive Information Procedures.

[2] NatureBib is the NPS bibliographic database (http://www.nature.nps.gov/nrbib/index.htm). This application has the capability of storing and providing public access to image data (for example, PDF files) associated with each record.

[3] NPSpecies is the NPS database and application for maintaining park-specific species lists and observation data (http://science.nature.nps.gov/im/apps/npspp/index.htm).

[4] The NCCN Digital Library is a hierarchical digital filing system stored on the NCCN file servers (Boetsch, J.R., Christoe, B., and Holmes, R.E., 2005, Data management plan for the North Coast and Cascades Network Inventory and Monitoring Program: USDI National Park Service: Port Angeles, Washington, 88 p. available only online at http://www1.nature.nps.gov/im/units/nccn/datamgmt.cfm, accessed January 25, 2007). Network users have read-only access to these files, except where information sensitivity may preclude general access.

[5] NPS Director's Order 19 provides a schedule indicating the amount of time that the various kinds of records should be retained. Available at: http://data2.itc.nps.gov/npspolicy/DOrders.cfm.

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Appendix 3. Schedule for Project Deliverables

Deliverable Product	Primary Responsibility	Target Date	Destination(s)
Field season report	Field Lead	September 15 of the same year	NCCN Digital Library[1]
Raw GPS data files	Field Lead	September 15 of the same year	NCCN Digital Library[1]
Processed GPS data files	GIS Specialist	September 15 of the same year	NCCN Digital Library[1]
Digital photographs	Project Lead	November 30 of the same year	NCCN Digital Library[1]
Certified working database	Project Lead	Delivered by November 30 of the same year, not posted to public sites until June of the second year	Master project database and GIS data sets, copy to NCCN Digital Library[1], and NPS Data Store[2]
Certified geospatial data	Project Lead with GIS Specialist		
Data certification report	Project Lead	November 30 of the same year	NCCN Digital Library[1]
Metadata interview form	Project Lead and NPS Lead	November 30 of the same year	NCCN Digital Library[1]
Full metadata (parsed XML)	Data Manager and GIS Specialist	March 15 of the following year	NPS Data Store[2], NCCN Digital Library[1]
Annual I&M report	Project Lead	April 30 of the following year	NatureBib[3], NCCN Digital Library[1], printout to local park collections
Field data forms	NPS Lead and Project Lead	Every 5 years by April 30	Scanned PDF files in NCCN Digital Library[1], physical copies moved to park collections
5-year analysis report	Data Analyst	Every 5 years by April 30	NatureBib[3], NCCN Digital Library[1], printout to local park collections
Other publications	NPS Lead, Project Lead, Data Analyst	As completed	NatureBib[3], NCCN Digital Library[1], printout to local park collections
Other records	NPS Lead and Project Lead	Review for retention every January	Retain according to NPS Director's Order #19[4]

[1] The NCCN Digital Library is a hierarchical digital filing system stored on the NCCN file servers (Boetsch, J.R., Christoe, B., and Holmes, R.E., 2005, Data management plan for the North Coast and Cascades Network Inventory and Monitoring Program: USDI National Park Service: Port Angeles, Washington, 88 p., available only online at http://www1.nature.nps.gov/im/units/nccn/datamgmt.cfm, accessed January 25, 2007). Network users have read-only access to these files, except where information sensitivity may preclude general access.

[2] NPS Data Store is a clearinghouse for natural resource data and metadata (http://science.nature.nps.gov/nrdata). Only non-sensitive information is posted to NPS Data Store. For details, refer to SOP 19: Sensitive Information Procedures.

[3] NatureBib is the NPS bibliographic database (http://www.nature.nps.gov/nrbib/index.htm). This application has the capability of storing and providing public access to image data (for example, PDF files) associated with each record.

[4] NPS Director's Order 19 provides a schedule indicating the amount of time that the various kinds of records should be retained. Available at: http://www.nps.gov/refdesk/DOrders/DOrder19.html.

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Appendix 4. Example of Trend Analysis for the American Robin (Provided by A. Shelly and T. Cardoso, TerraStat Consulting Group, Seattle)

This section provides a simulated example of a complete trend analysis for one species (AMRO) for the augmented, serially alternating panel design. The example is based on current planned methods which may be subject to minor modifications in the next phase of method development.

Planned Analysis Methods

We hypothesize an equal average slope on the exponential scale. For each transect, the density will be natural log-transformed after adding 1 to account for zeros. The sample mean slope is tested for differences from zero based on the sample variance of the site-specific slope estimates. Because the samples are stratified by elevation, with potentially different slope variances within strata, the sample variance formula and associated degrees of freedom was carefully derived.

The mean of a stratified random sample is pooled based on the relative size of the strata:

$$\bar{\bar{y}} = \frac{1}{N}\sum_{i=1}^{L} N_i \bar{y}_i, \quad (1)$$

where

N is the total number of available population units,

L is the number of strata,

N_i is the number of population units in strata i, and

$\bar{y}_i$ is the sample mean in strata i. For our case, y is the estimated slope parameter, and $L = 3$ for three elevation strata.

The variance of the stratified mean is:

$$Var(\bar{\bar{y}}) = \frac{1}{N^2}\sum_{i=1}^{L} N_i^2 Var(\bar{y}_i) \cdot \quad (2)$$

The mean slope within a strata ($\bar{y}_i$) is:

$$\bar{y}_i = \frac{\sum_{j=1}^{s}\sum_{k=1}^{m_{ij}} y_{ijk}}{n_i}, \quad (3)$$

where

s is the number of panels,

m_{ij} is the number of sites from strata i in panel j,

n_i is the number of samples in strata i.

Assuming independence among slope estimates, the variance of the mean slope within each strata is estimated as follows:

$$Var(\bar{y}_i) = \frac{N_i - n_i}{N_i} \cdot \frac{1}{n_i^2}\sum_{j=1}^{s}\sum_{k=1}^{m_{ij}} Var(y_{ijk}), \quad (4),$$

where $\frac{N_i - n_i}{N_i}$ is the finite population factor, which is likely to be close to one in our case.

The slope estimates in the annual revisit panel are likely to have lower variance than the slope estimates from the rotating panel, so we allow these variances to vary, and estimate the variance as follows:

$$Var(\bar{y}_i) = \frac{N_i - n_i}{N_i} \cdot \frac{1}{n_i^2}\sum_{j=1}^{s} m_{ij} s_{ij}^2, \quad (5)$$

where

s_{ij}^2 is the sample variance of slopes for panel j in elevation strata i.

For the general case where all rotating panels can all be assumed to have the same variance, the variance formula becomes:

$$Var(\bar{y}_i) = \frac{N_i - n_i}{N_i} \cdot \frac{1}{n_i^2}\left[m_{iA} s_{iA}^2 + (n_i - m_{iA}) s_{iR}^2 \right], \quad (7)$$

where

m_{iA} is the number of sites in the annual panel in elevation strata i,

s_{iA}^2 is the sample variance of all slopes in the annual panels for strata i,

s_{iR}^2 is the sample variance of all slopes in rotating panels for strata i.

For a given species, if there are less than two non-zero sites in either the annual or rotating panels (or both), but at least two sites total, the annual and rotating panel sites will be combined to calculate one variance. If there is only one variance calculated, the formula reduces to:

$$Var(\bar{y}_i) = \frac{N_i - n_i}{N_i} \cdot \frac{s_i^2}{n_i}. \quad (8),$$

The general case for rotating panels shown above will only be used if the number of years sampled for each site in the set of rotating panels is the same. If years are missing for some sites, or if trend is being analyzed in a year that is not a multiple of five, variances should be estimated separately for the sets of sites that have different numbers of revisits, where possible. This might not be possible, for example, if most sites have 3 years of data, and only one site is missing 1 year of data. In this case, equal variance will be assumed for all rotating sites. A similar rule should be applied to the annual panel: variances will be assumed equal unless there are sites with more than sporadic missing years. As a simple example, if there are three bad weather years, and one-half of the sites are missed in these 3 years, this group of sites may technically be considered another panel, and variance may be estimated separately for this panel.

Trends will be tested by comparing the grand mean divided by the standard error of the mean to the t-distribution with the appropriate degrees of freedom (two-tailed test, $\alpha = 0.10$). Using the general case where all rotating panels are assumed to have equal variance, the degrees of freedom will be estimated using Satterthwaite's formula (1941) as follows:

$$\frac{\left[\sum_{i=1}^{L}(a_{iA}s_{iA}^2 + a_{iR}s_{iR}^2)\right]^2}{\sum_{i=1}^{L}\left(\frac{(a_{iA}s_{iA}^2)^2}{m_{iA}} + \frac{(a_{iR}s_{iR}^2)^2}{(n_i - m_{iA})}\right)}, \quad (9)$$

where

$$a_{iA} = \frac{(N_i - n_i)m_{iA}}{Nn_i^2} \text{ and } a_{iR} = \frac{(N_i - n_i)(n_i - m_{iA})}{Nn_i^2}. \quad (10)$$

Plots of the cumulative distributions of slopes also will be made to graphically compare different species, elevation strata, or regions of the park.

Example Trend Analysis

This example is simulated based on a positive 4% exponential trend across 30 years. Figures 1–3 display the example AMRO data (log-transformed densities) by site for each panel, with the estimated linear regression lines as dotted lines. Table 1 displays the results of the analysis of trend for the AMRO example. For this example, the average trend is not significant after 10 years, but is significant after 20 years.

In addition to the overall regional trend test, it may be of interest to look at the trend slopes by elevation or by habitat. Figure 4 displays two plots of the cumulative distributions of estimated slopes (CDF plot), the top by elevation strata, and the bottom by habitat. The median slopes are the same, and the distributions of slopes are not widely different. This is as expected, because identical trends were added for the different categories. With real data, these plots might be more interesting.

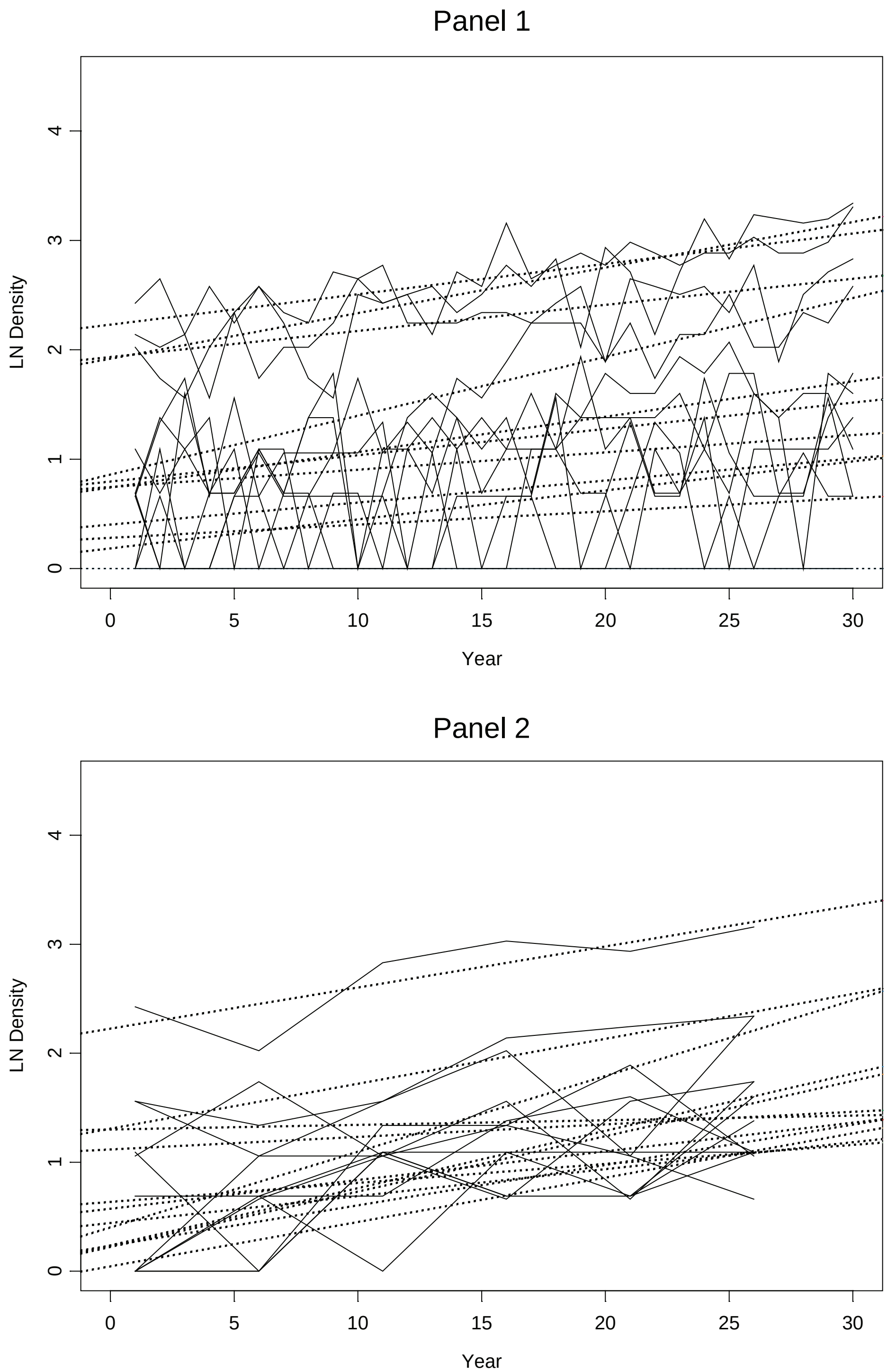
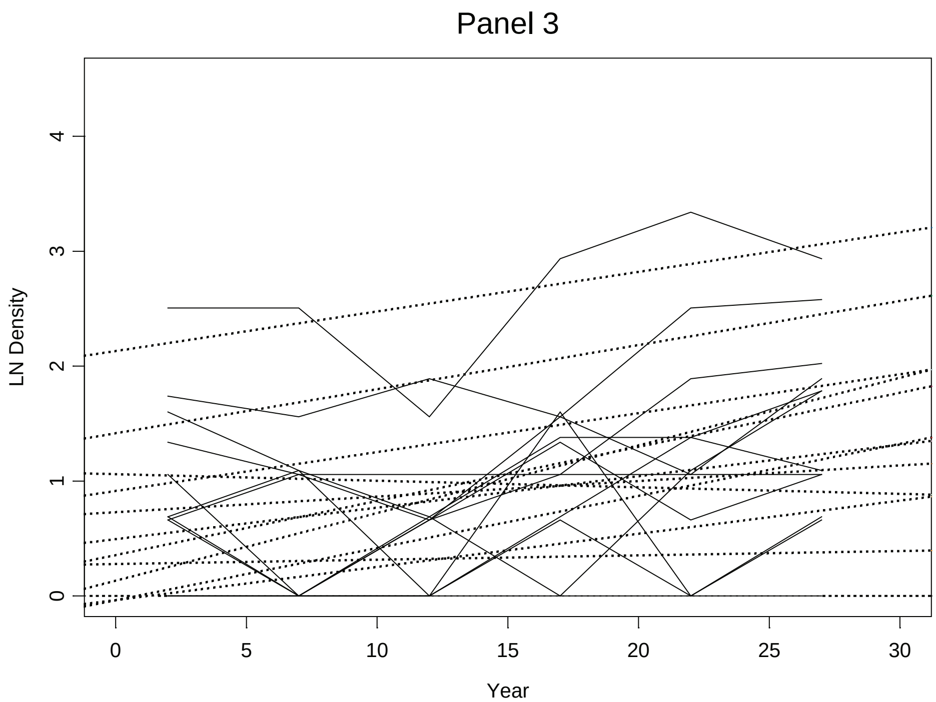


Figure 1. Example of AMRO data (log-transformed densities) for panels 1 (annual panel) and 2 (rotating panel). Solid lines connect the data; dotted lines are estimated linear trends.



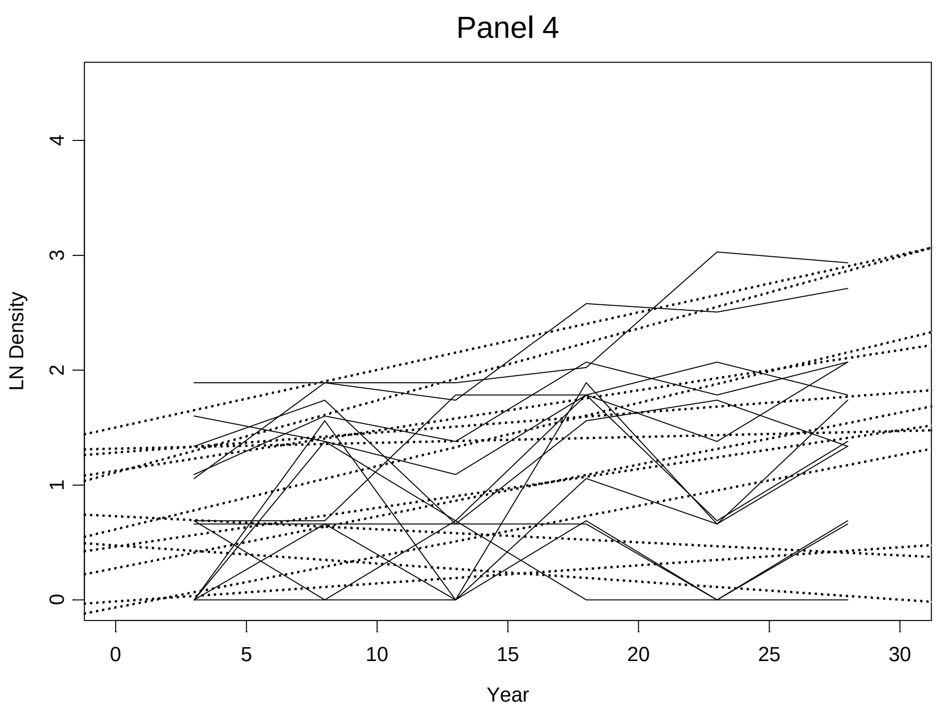


Figure 2. Example of AMRO data (log-transformed densities) for rotating panels 3 and 4. Solid lines connect the data; dotted lines are estimated linear trends.

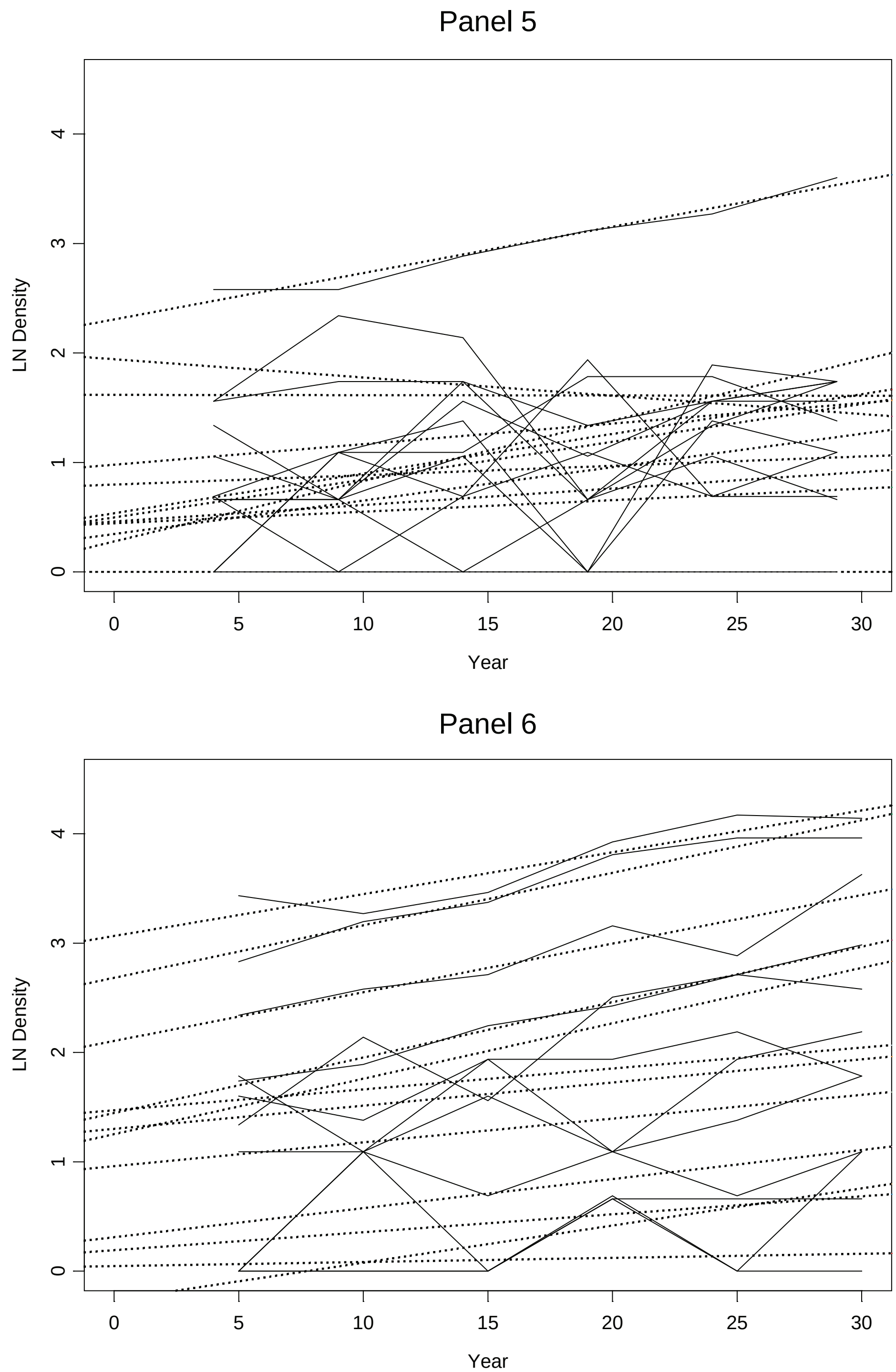
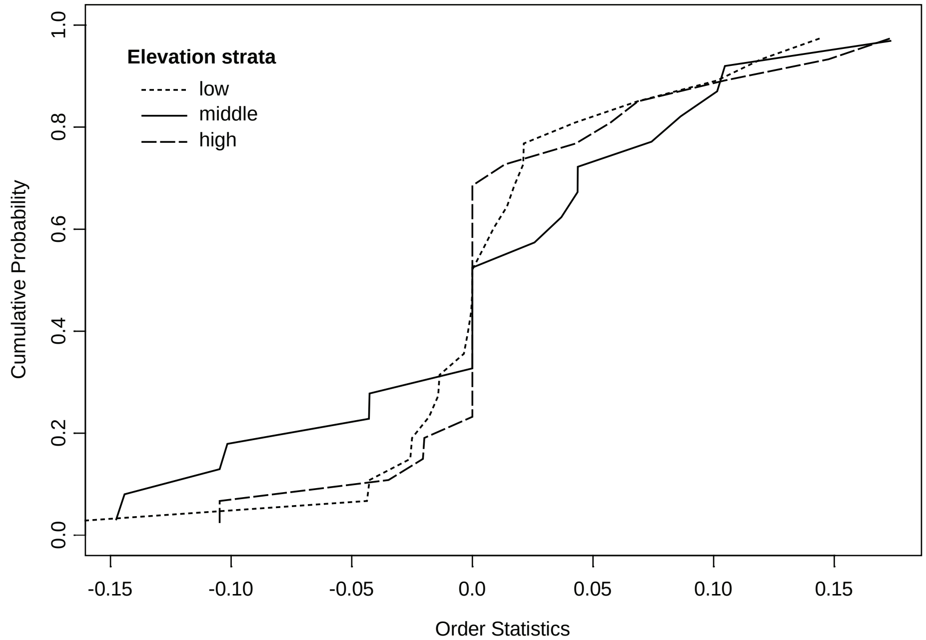


Figure 3. Example of AMRO data (log-transformed densities) for rotating panels 5 and 6. Solid lines connect the data; dotted lines are estimated linear trends.

	Panel	Elevation class	Number of non-zero sites	Mean slope	Variance of slope	Variance of mean slope	Degrees of freedom	*t* statistic	One-tailed *p*-value
10 Years	Annual Panel	Low	4	0.00992	0.0000957				
		Mid	2	0.0556	0.000697				
		High	4	-0.0154	0.000418				
	Rotating Panels	Low	20	0.00829	0.00452				
		Mid	18	-0.000258	0.00769				
		High	20	0.0193	0.00459				
	Combined Annual and Rotating Panels	Low	24	0.00856		0.000157			
		Mid	20	0.00533		0.000349			
		High	24	0.0135		0.000161			
	Grand Mean	All	68	0.00842		0.0000800	46.9	0.942	0.175
20 Years	Annual Panel	Low	4	0.0133	0.0000968				
		Mid	2	0.00268	0.0000574				
		High	4	0.0145	0.0000339				
	Rotating Panels	Low	20	0.0145	0.000326				
		Mid	18	0.0146	0.000770				
		High	20	0.0266	0.000427				
	Combined Annual and Rotating Panels	Low	24	0.0143		0.0000119			
		Mid	20	0.0134		0.0000348			
		High	24	0.0246		0.0000150			
	Grand Mean	All	68	0.0159		0.0000070	44.8	5.99	0.0000002
30 Years	Annual Panel	Low	4	0.0120	0.0000421				
		Mid	2	0.0104	0.0000121				
		High	4	0.0132	0.0000149				
	Rotating Panels	Low	20	0.0144	0.0000733				
		Mid	18	0.0140	0.0000974				
		High	20	0.0158	0.000298				
	Combined Annual and Rotating Panels	Low	24	0.0140		0.0000028			
		Mid	20	0.0136		0.0000044			
		High	24	0.0154		0.0000104			
	Grand Mean	All	68	0.0141		0.0000015	60.2	11.5	0



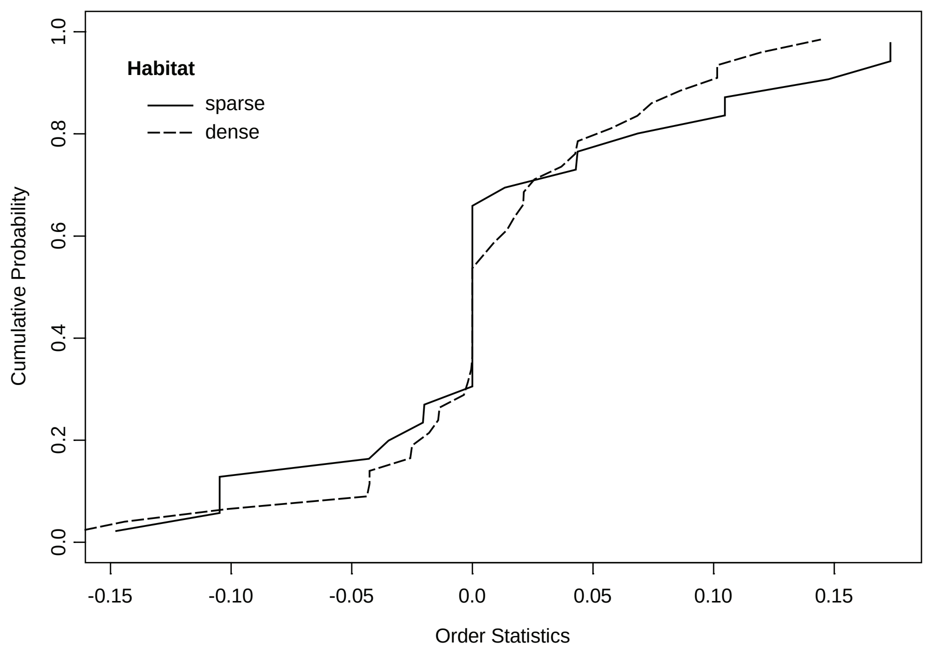


Figure 4. Empirical Cumulative Distribution plots of estimated slopes for simulated AMRO example.

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Appendix 5. Simulation Methods Used to Estimate Power to Detect Trends in 22 Representative Avian Species in Olympic National Park Based Upon the Proposed Augmented, Serially Alternating Panel Design (*n* = 72 Transects)

Parameter estimates are based on Distance sampling of 22 avian species collected across 82 transects in Olympic National Park in 2002–03 by The Institute for Bird Populations (Siegel and others, 2004). Detailed methods are available in a report from TerraStat Consulting Group (TerraStat Consulting Group, 2005). Protocols for analyzing and reporting trends in avian abundance in NCCN parks-Task 2 Report. Unpublished Report available from USGS, 600 E. Park Avenue, Port Angeles, WA 98362). An abbreviated description of simulation methods follows:

1. Selected 96 site means for each species, 32 for each elevation strata, from the appropriate zero-modified lognormal distribution.
2. Constructed the 30-year series of means for each site by adding 4% exponential trend (positive or negative) to the initial site mean generated above, as follows:

   $$X_t = X_1 \times (1 + d)t\text{-}1,$$

   for $t = 2, 3, \ldots, 30$. A set with 0% trend also was included in order to check Type I error.
3. Randomly assigned the sites to panels for the current sampling scenario (12 annual, 12 rotating, equal numbers from three elevation strata in each panel).
4. Generated a single random count for each sampled year from the Poisson distribution with the given annual mean for each species at each site.
5. For each transect, multiplied the annual counts by the appropriate habitat-specific constant to estimate density (birds/hectare).
6. Transformed each series of densities by adding one, then taking the natural logarithm.
7. Estimated the linear regression slope for each series, for the appropriate number of years, and with only the appropriate samples for each panel (rotating panels have four out of five annual samples left out of the slope calculation). Sites for which all observations (30 years) were zero were removed from the analysis.
8. Estimated the pooled mean and variance of the slope estimates among panels, including consideration for unequal slopes among annual and rotating panels.
9. Generated the *t*-test *p*-value, testing if the mean of the *N* slope estimates is significantly different from zero. Note that the degrees of freedom for the *t*-test are determined by the Satterthwaite formula.
10. Repeated steps 3–9 for two additional sampling scenarios.
11. Repeated steps 1–10 for 1,000 simulations.
12. Estimated the statistical power as the percent of the 1,000 trials with two-tailed *p*-values less than 0.10.

References Cited

Siegel, R.B., Wilkerson, R.L. and Hall, S., 2004, Landbird inventory for Olympic National Park (2002–2003): The Institute for Bird Populations, Point Reyes Station, CA.

TerraStat Consulting Group, 2005, Protocols for analyzing and reporting trends in avian abundance in NCCN parks–Task 2 Report: Available from USGS, Forest and Rangeland Ecosystem Science Center, Olympic Field Station, Port Angeles, Washington.

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Appendix 6. BirdTrend 1.1 User's Manual

Appendix 6.
BirdTrend 1.1 User's Manual
Prepared by TerraStat Consulting Group
29 March 2006

Introduction

BirdTrend 1.1 is a software application that has been developed specifically for the analysis of trends in avian densities in three large NCCN parks. The program is design-specific, and is not intended for analysis of trends for other applications. The program is run in *R* version 2.2.1, a free statistical analysis software package available online. For more information on *R*, see the website: http://www.r-project.org/. This user's manual describes how to download and create data directories in *R*, how to prepare the input file, how to run the *BirdTrend* program, and how to interpret the output of *BirdTrend*. Note that Version 1.1 is an incremental update that incorporates some new functionality not included in the original Version 1.0 program suite.

BirdTrend 1.1 provides:

- Summary of input data files by species and park
- Annual density estimates
  - Output includes average densities and corresponding standard errors for each species, by park and combined parks.
- Complete statistical trend analysis
  - Output includes average trend and variance estimates for elevation strata, park, and combined parks.
- Cumulative Distribution plots displaying trend slope distributions by park and/or elevation stratum.

Downloading R and preparing data directories

(Instructions as of 3/06, minor changes may occur)
To download *R*, go to the website: http://www.r-project.org/, and find the closest *CRAN mirror* website from which to obtain the software, by clicking on the icon below the "Getting Started:" heading. Click on the selected mirror on the mirror index page. Click on the appropriate version of *R* – *BirdTrend* has been set up for the Windows version, but it should run on other versions as well. Click on the "base" directory, then on *R-2.2.1-win32.exe* to download the executable file, which will install *R* onto your computer. The default download for *R* should save a shortcut on your desktop.

If you want to save your data in different project directories, you can copy the shortcut on your desktop, rename it, and change the properties so that the program (when started from this shortcut) starts in the appropriate project directory. When exiting *R*, you will be prompted to save the workspace image – this will save any functions or objects that have been created during the current session so that they are accessible for the next session.

R Basics

R is an object-oriented command line program with simple functional format. It operates as a base package containing commonly used functionality, and contributed packages containing more complex statistical functionality for specific purposes. The packages can be downloaded separately from the same website as the base package. Various help manuals for *R* are available online (or as pdf documents if specified as part of your installation). The links are found on the help menu in *R*.

"Object-oriented" means that data are stored as objects and sent to functions. The output of functions is typically stored as a new object. For example, type:

```
> foo = 1+2
```

at the prompt in the command window. You have just assigned the result of 1+2 to an object named "foo". Type:

```
> foo
```

and the contents of foo ("3") are printed on the screen.

Many functions are included in the base *R* package, and they can also be created by the user. Functions are called by typing the name of the function, then supplying the appropriate input arguments within a set of parenthesis. For example, vectors of data are created using the function *c*, as follows:

```
> foo2 = c(1,2,3,4,5)
> foo2
```

Other useful R tips:

- The escape key deletes the text written after the current prompt.
- The up arrow key copies the previous command to the current prompt (multiple up arrows scroll through the existing commands).
- If enter is hit before a function is completed with a close-parenthesis, a plus sign appears on the next line, and the user can complete the command (*escape* voids the whole command).
- Directory locations must be specified with double backslashes, such as "C:\\birds\\birdfile"
- It is possible to run commands as a batch in *R* by opening a script file (*file*, *new script*) and typing your commands in the script editor. To run all commands in the script, use *edit*, *run all*; To run selected lines, use *edit*, *run line or selection*, or use the icon on the displayed toolbar.

BirdTrend 1.1 consists of three main functions, *PreBirdTrend*, *BirdTrendAnnualDensity*, and *BirdTrend*. The user opens *R*, makes the functions resident in the current working directory, and runs the functions on data stored as comma delimited ASCII files. Some messages will be printed on the *R* command screen, but the main output from the programs are text files which are created in directories specified by the user. Details on the process are described below with examples.

Input files

The required input file is a comma delimited ASCII file (extension *.csv*) containing data from all sampled transects in each sampled year. Zero densities must be included if transects were sampled and no birds of the given species were observed. If no data are present for a given subplot or transect for a given year, the program assumes that the subplot or transect were not sampled. Both programs can be run with multiple species, but due to the size of the input files and the potential size of the output files, we recommend running one species at a time.

The table in the file should have a header row, and consist of the following columns, with one species density observation per line. Note that the columns MUST be in the following order, although the column headers do not need to precisely match these headers:

Park
OLYM, NOCA, or MORA

Year
Sampling year: Numeric field

Panel
Unique alphanumeric identifier (Ann1, Alt1, Alt2, Alt3, etc…). ***NOTE: rotating panels must be identified with "Alt" as the first alphanumeric characters in the panel ID.***

Elevation
Elevation Group: 1 (for low elevation), 2 (for mid elevation), or 3 (for high elevation)

Transect ID
Unique alphanumeric identifier

Subplot ID
Unique alphanumeric identifier

Species
4-digit species code

Estimated Subplot Density
Numeric field

Variance Group ID
Unique alphanumeric identifier (see explanation below)

Defining the Variance Group

Within each elevation stratum, transects with equal or nearly equal numbers of sampled years are assumed to have similar trend slope variance. If all transects are sampled in each planned year, and the species is observed at least once on each transect, then the annual panel would be one variance group, and rotating panels with equal numbers of samples (i.e., in years 10, 15, 20,….) would comprise a second variance group. In years that are not a multiple of five there would be two variance groups for rotating panels. Similar groups in different elevation strata would comprise additional variance groups. For example, in this ideal case, when rotating panels have the same number of years and there are no missing transects, there will be 6 variance groups total, 2 for each elevation stratum.

When entire transects are missing (either there are no non-zero densities or the transect could not be sampled in any of the planned years) for some species, the sample size within some of the ideal variance groups outlined above may be too small (i.e., less than two) for variance estimation. In this case, the variance groups within the elevation stratum must be combined. In some cases, only one variance estimate for the elevation stratum may be possible.

Further, if there is only one transect for a particular elevation stratum, variance can only be estimated for the elevation stratum if the single transect is added to the most appropriate variance group in a different elevation stratum. This combination should be made with care – for each species, the transect should be placed in the most appropriate variance group. For example, if the transect is a high elevation transect, it should be added to a middle elevation variance group. If it is a middle elevation transect, the appropriate variance group may differ for different species.

Note that variance groups should not contain more than one elevation stratum unless one of the elevation strata contains only one transect. For rare species having few observations, one variance group may be defined for the species. This will cause BirdTrend to process estimates by combining across elevations.

Missing years (i.e., transect was not visited in planned year) may or may not require adjustment to the variance groups, depending upon scale. For example, after 10 years of sampling, if some transects in the annual panel have one or two missing years, one variance estimate for the annual panel is appropriate. However, after 15 years of sampling, if some of the rotating panels have only two years, and others have three years of observations, two estimates for rotating panel variance would be most appropriate.

Example Input File

An example input file, *testcasefull.csv* is provided with the software. The first page of the example input file is displayed in Table A6.1.

Running the pre-processor, *PreBirdTrend*

In order for *BirdTrend* to run properly and to provide correct results, the data have to meet certain basic requirements. Other elements of the data may meet the basic requirements but not be ideal for statistical analysis. The pre-processor *PreBirdTrend* was designed to screen the input for these details. *PreBirdTrend* evaluates and provides summary information for each species and park in the input file, including warnings for improper variance groups or other problematic data. *PreBirdTrend* must be run prior to running *BirdTrend*.

Two user-named files are output by *PreBirdTrend*. The first file is a report providing summary tables of the input data, as well as:

- *Errors* in the file that will prevent *BirdTrend* from running,
- *Warnings* on elements of the input file that are not ideal, and
- *Notes* which are merely informational.

Note that this file may be quite large if many species in multiple parks are included. The file is a tab-delimited ASCII file which can easily be opened by MSExcel for viewing.

The second output file from *PreBirdTrend* is the input file for *BirdTrend and BirdTrendAnnualDensity*. This file will only be created if there are no errors identified in the input. If there are errors, the original input file will have to be revised by the user, and *PreBirdTrend* rerun. Note that *BirdTrend* and *BirdTrendAnnualDensity* will not run on an input file that has not been created by *PreBirdTrend*.

The first time *PreBirdTrend* is used in a particular working directory, you must type:

> source(“*dirloc*\\PreBirdTrendV1.1.R”)

at the command line prompt, and hit enter. The “*dirloc*” is the exact directory location where the *PreBirdTrend* software file is stored. This command makes the program resident in the working directory.

NOTE: In *R*, directory locations must be specified with double backslashes.

For example:

> source(“C:\\Birds\\PreBirdTrendV1.1.R”)

Then type:

> PreBirdTrendV1.1(infile = *infile.csv*, report.out = *report.txt*, outfile = *outfile.csv*)

and hit enter. The “*infile.csv*” is the name and exact directory location of the comma delimited ASCII input file, “*report.txt*” is the name and exact directory location for the detailed report output file that is generated by the pre-processor, and “*outfile.csv*” is the name and exact directory location of the new input file that is generated during pre-processing if no errors are found.

Note: The report.out file must have an extension of .txt and the outfile must have an extension of .csv. Also, the program will not overwrite existing files, so if output files exist with the requested names, an error will result.

For example:

> PreBirdTrendV1.1("c:\\myfiles\\birdfiles\\testcasefull.csv", "c:\\myfiles\\birdfiles\\output\\testsum.txt", "c:\\myfiles\\birdfiles\\testcaseclean.csv")

Notice that the argument names are not required, as long as the inputs are in the proper order. If errors are noted in the output file, a message will appear on the screen alerting the user. In this case, the input file must be revised to correct the errors, and *PreBirdTrend* must be rerun with the corrected data. If the input file had no errors, the new input file generated by the preprocessor, *outfile*, can be used as the input into *BirdTrend*. If warnings or notes are displayed in the output file, you may wish to modify the input file according to the recommendations, then re-run *PreBirdTrend* prior to running *BirdTrend*.

Table A6.2 shows the first page of sample report output from *PreBirdTrend* for the supplied input file *testcasefull.csv*. Each report file specifies the input file and contains a date/time stamp. A table showing the subplot count by variance group, transect, panel, elevation, and year is generated for each species by park. The "by species" processing is necessary since the trend analysis is conducted by species; this will help identify records missing from a database query. The example data set does not contain errors, warnings, or notes, but these would be displayed throughout the file if they were generated. Table A6.3 contains a list of the possible errors, warnings, and notes that can result from a call to *PreBirdTrend*.

<u>Running *BirdTrendAnnualDensity*</u>

The first time *BirdTrendAnnualDensity* is run in a particular working directory, you must type:

> source("*dirloc*\\BirdTrendAnnualDensityV1.1.R")

at the command line prompt, and hit enter. The "*dirloc*" is the exact directory location where the *BirdTrend* computer files are stored. This command makes the program resident in the working directory.

Then type:

>BirdTrendAnnualDensityV1.1(infile = *INFILE.csv*, outfile = *OUTFILE.txt*, outfile2 = *OUTFILE2.txt)*

at the command line prompt, and hit enter. The "*INFILE.csv*" is the name and exact directory location of the clean input file that has been produced by *PreBirdTrend*. The "*OUTFILE.txt*" and "*OUTFILE2.txt*" are the requested names for the annual density results files, including the exact directory location where they should be stored by the program. "*OUTFILE.txt*" will contain the density estimates table. "*OUTFILE2.txt*" will contain any notes generated by the program.

Note that these files should have .txt extensions to simplify output formatting. Also, the program is designed to append outputs to existing files in order to generate a single table for all species. So, if either of the specified output files does not exist the program will generate a warning. If you want appended output, then change the output file names and rerun *BirdTrendAnnualDensity*.

Table A6.4 shows the sample table output from *BirdTrendAnnualDensity* for the supplied input file *testcasefull.csv*. Table A6.5 contains a list of the possible errors, warnings, and notes that can result from a call to *BirdTrendAnnualDensity*.

<u>Running *BirdTrend*</u>

The first time *BirdTrend* is run in a particular working directory, you must type:

> source("*dirloc*\\BirdTrendV1.1.R")

at the command line prompt, and hit enter. The "*dirloc*" is the exact directory location where the *BirdTrend* computer files are stored. This command makes the program resident in the working directory.

Then type:

> BirdTrendV1.1(infile = *INFILE.csv*, outfile = *OUTFILE.txt*, slopes.out = *SLOPEFILE.txt*,
  summary.out = *SUMMARYFILE*.txt, combine.parks = F, plot.cdf = "None",
  plot.outdir=*DIRECTORY*)

at the command line prompt, and hit enter. The "*INFILE.csv*" is the name and exact directory location of the clean input file that has been produced by *PreBirdTrend*. The "*OUTFILE.txt*", "*SLOPEFILE.txt*", and "*SUMMARYFILE*.txt" are the requested names for the trend results files, including the exact directory location where they should be stored by the program.

Note that these files should have .txt extensions to simplify output formatting. Also, the program will not overwrite or append to"*OUTFILE.txt*" and "*SLOPEFILE.txt*"; if either of the output files exist with the requested names, an error will result. "*SUMMARYFILE*.txt" allows appended output in order to generate a summary table that contains information for all species. So, if the specified summary file does not exist the program will generate a warning. If you want appended output, then change the output file name and rerun *BirdTrend*.

The *combine.parks* and *plot.cdf* arguments do not need to be included in the function call because they have default assignments. Only include them if you want to modify the selections. If not specified, the *combine.parks* argument will default to "F", which means that a trend result for combined parks will not be generated. Change this argument to "T" if you want combined results; these results will be provided if sufficient data are included in the input file. The *plot.cdf* argument will default to "None", which means that no cumulative distribution plots (CDF) plots will be produced. If you want to produce CDF plots for each species there are three choices:

- "Park", which produces CDF plots by park across all elevations,
- "Elev", which produces CDF plots by elevation across all parks, and
- "Both", which produces CDF plots by elevation within parks.

The *plot.cdf* argument options may be entered individually or in any combination of the three possibilities. For example, if you want CDF plots for both by park and by elevation, the call to *BirdTrend* would include *plot.cdf*=c("Park","Elev"). Note that *c*, an R function for combine, must be used if more than one option is specified. The last argument, *plot.outdir*, provides a directory location for the CDF plots. Note that two final backslashes must be part of the directory location.

****

Caution: Some things to know about the CDF plots:

If the directory for *plot.outdir* does not exist, the program will terminate with an error produced by R indicating that the program was unable to produce the metafile. If this happens, check your *plot.outdir* argument for typos or make sure that the directory you specified does exist.

The CDF plot files are given fixed names within the program. The first time the program encounters a CDF plot file that already exists, a new file name will be generated. On subsequent runs, however, *BirdTrend* will overwrite CDF plot files that have been placed in the same directory unless the user has renamed the .wmf files!! Either rename .wmf files from previous runs, or specify a new *plot.cdf* directory for each run of *BirdTrend*.

If CDF plots are created, they will appear on the screen in a R graphics window. Only the final plot will remain visible when the program has completed running.

****

Example call to *BirdTrend*:

```
> BirdTrendV1.1(infile="C:\\myfiles\\birdfiles\\testcaseclean.csv",
  outfile="C:\\myfiles\\birdfiles\\testresfull.txt",
  slopes.out="C:\\myfiles\\birdfiles\\testslopefull.txt",
  summary.out="C:\\myfiles\\birdfiles\\testsummaryfull.txt"
  plot.cdf=c("Park","Elev"),
  plot.outdir="C:\\myfiles\\birdfiles\\")
```

Most of the errors that can result from a call to *BirdTrend* have to do with the function arguments. Table A6.6 contains a complete list of the possible errors, warnings, and notes that can result from a call to *BirdTrend*.

The main output file ("*OUTFILE.txt*") from *BirdTrend* is a tab-delimited ASCII file. For the best viewing of this file, open it using the file/open command in MSExcel, specifying that the file is tab-delimited. Table A6.7 displays an example of the unformatted output for one species with three parks. Limited formatting by the user should provide report-ready tables. Header information provides the input file name, a date/time stamp, and the sampled years represented in the input file. Output by species and park follows. Within each park, the number of non-zero transects is reported along with mean slopes and variance estimates for each variance group. Mean slope and variance estimates for elevation strata are also given. The results of the trend test for mean slope across all panels and elevations are provided, including the observed t-statistic, degrees of freedom, and the two-tailed *p*-value. If requested and appropriate, a trend test combined across parks is also included.

The slope output file ("*SLOPEFILE.txt*") is also a tab-delimited ASCII file, and should be opened in the same way. Table A6.8 displays the first page of the slope file output for *testcasefull.csv*. The file contains the slope estimate for each transect in the input file, by species. Elevation, variance group, panel, and park are also included as columns.

The summary output file ("*SUMMARYFILE.txt*") is also a tab-delimited ASCII file, and should be opened in the same way. Table A6.9 displays the first page of the summary file output for *testcasefull.csv*. The file contains a one line summary of the trend test per species/park combination, as well as a combined test if it was calculated.

If requested, cumulative distribution plots are also output by *BirdTrend*. These are encapsulated metafiles, which can be input (as pictures) into a MSWord document. An example CDF plot is shown in Figure A6.1. This CDF plot, for example, shows that the medians (cumulative probability = 0.50) are identical at zero for the three parks, but there are a wider range of slopes at OLYM.

Table A6.1. Example Input File (testcasefull.csv).

Park	Year	Panel	Elev	Tran	SubPlot	Species	Density	VarGroup
OLYM	2002	Ann1	1	1	1	AMRO	0.9376	1
OLYM	2002	Ann1	1	1	2	AMRO	0.9376	1
OLYM	2002	Ann1	1	1	3	AMRO	0.9376	1
OLYM	2002	Ann1	1	1	4	AMRO	0.9376	1
OLYM	2002	Ann1	1	1	5	AMRO	0.9376	1
OLYM	2002	Ann1	1	1	6	AMRO	0.9376	1
OLYM	2002	Ann1	1	1	7	AMRO	0.9376	1
OLYM	2002	Ann1	1	1	8	AMRO	0.9376	1
OLYM	2002	Ann1	1	1	9	AMRO	0.9376	1
OLYM	2002	Ann1	1	1	10	AMRO	0.9376	1
OLYM	2002	Ann1	1	1	1	WIWA	0	1
OLYM	2002	Ann1	1	1	2	WIWA	0	1
OLYM	2002	Ann1	1	1	3	WIWA	0	1
OLYM	2002	Ann1	1	1	4	WIWA	0	1
OLYM	2002	Ann1	1	1	5	WIWA	0	1
OLYM	2002	Ann1	1	1	6	WIWA	0	1
OLYM	2002	Ann1	1	1	7	WIWA	0	1
OLYM	2002	Ann1	1	1	8	WIWA	0	1
OLYM	2002	Ann1	1	1	9	WIWA	0	1
OLYM	2002	Ann1	1	1	10	WIWA	0	1
OLYM	2003	Ann1	1	1	1	AMRO	0	1
OLYM	2003	Ann1	1	1	2	AMRO	0	1
OLYM	2003	Ann1	1	1	3	AMRO	0	1
OLYM	2003	Ann1	1	1	4	AMRO	0	1
OLYM	2003	Ann1	1	1	5	AMRO	0	1
OLYM	2003	Ann1	1	1	6	AMRO	0	1
OLYM	2003	Ann1	1	1	7	AMRO	0	1
OLYM	2003	Ann1	1	1	8	AMRO	0	1
OLYM	2003	Ann1	1	1	9	AMRO	0	1
OLYM	2003	Ann1	1	1	10	AMRO	0	1
OLYM	2003	Ann1	1	1	1	WIWA	1.3068	1
OLYM	2003	Ann1	1	1	2	WIWA	1.3068	1
OLYM	2003	Ann1	1	1	3	WIWA	1.3068	1
OLYM	2003	Ann1	1	1	4	WIWA	1.3068	1
OLYM	2003	Ann1	1	1	5	WIWA	1.3068	1
OLYM	2003	Ann1	1	1	6	WIWA	1.3068	1
OLYM	2003	Ann1	1	1	7	WIWA	1.3068	1
OLYM	2003	Ann1	1	1	8	WIWA	1.3068	1
OLYM	2003	Ann1	1	1	9	WIWA	1.3068	1
OLYM	2003	Ann1	1	1	10	WIWA	1.3068	1

Table A6.2. Sample report file output from *PreBirdTrend*.

INPUT to preprocessor: C:\myfiles\birdfiles\testcasefull.csv
Wed Mar 29 07:16:29 2006

SPECIES: AMRO

TRANSECT/SUBPLOT SUMMARY for Park: OLYM
NOTE: Counts in table under year headers are numbers of subplots

Tran	VarGp	Panel	Elev	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
1	1	Ann1	1	10	10	10	10	10	10	10	10	10	10
2	1	Ann1	1	10	10	10	10	10	10	10	10	10	10
3	1	Ann1	1	10	10	10	10	10	10	10	10	10	10
4	1	Ann1	1	10	10	10	10	10	10	10	10	10	10
5	2	Ann1	2	10	10	10	10	10	10	10	10	10	10
6	2	Ann1	2	10	10	10	10	10	10	10	10	10	10
7	2	Ann1	2	10	10	10	10	10	10	10	10	10	10
8	2	Ann1	2	10	10	10	10	10	10	10	10	10	10
9	3	Ann1	3	10	10	10	10	10	10	10	10	10	10
10	3	Ann1	3	10	10	10	10	10	10	10	10	10	10
11	3	Ann1	3	10	10	10	10	10	10	10	10	10	10
12	3	Ann1	3	10	10	10	10	10	10	10	10	10	10
13	4	Alt1	1	10	0	0	0	0	10	0	0	0	0
14	4	Alt1	1	10	0	0	0	0	10	0	0	0	0
15	4	Alt1	1	10	0	0	0	0	10	0	0	0	0
16	4	Alt1	1	10	0	0	0	0	10	0	0	0	0
17	5	Alt1	2	10	0	0	0	0	10	0	0	0	0
18	5	Alt1	2	10	0	0	0	0	10	0	0	0	0

Table A6.3. List of errors, warnings, and notes that can be generated by *PreBirdTrend*.

	Message	Written To	Interpretation
Errors			
***ERROR:	Missing *infile* argument. Specify an input file name and rerun preprocessor.	R Window	Missing input file name.
***ERROR:	Missing *report.out* argument. Specify report file name and rerun preprocessor.	R Window	Missing output report file name.
***ERROR:	Missing *outfile* argument. Specify output file name and rerun preprocessor.	R Window	Missing clean output file name.
***ERROR:	Specified input file does not exist. Check file name and rerun preprocessor.	R Window	Input file does not exist.
***ERROR:	Specified report output file already exists. Specify a new file name and rerun preprocessor.	R Window	Output report file already exists. Must specify a new file name.
***ERROR:	Specified CLEAN output file already exists. Specify a new file name and rerun preprocessor.	R Window	Clean output file already exists. Must specify a new file name.
***ERROR:	Columns are out of order. Fix column ordering and rerun preprocessor.	R Window	Columns in the input file are out of order. Check the User's Guide for required order, adjust input and rerun the preprocessor.
***ERRORS found!	Check report.out for ERRORS, Warnings, Notes and summaries. File *infile* must be modified and rerun through *PreBirdTrend*.	R Window	Specified input file did not pass preprocessor checks. Check *outfile* for details, make necessary changes to the input file and rerun the preprocessor.
***ERROR:	Columns are out of order. Fix column ordering and rerun preprocessor.	R and Outfile	Input file has columns out of required order.
***ERROR:	Input for *ParkID* only has two consecutive years of data. Too soon to test for trend.	Outfile	Trend testing not possible for specified input file.
***ERROR:	Variance group *VarGroup* has only one transect.	Outfile	A variance group must have more than one non-zero transect.

Table A6.3 (continued).

	Message	Written To	Interpretation
Warnings			
***Warning:	Years for *ParkID* not contiguous. Input file may have one or more years of missing data.	Outfile	While years need not be contiguous due to having rotating panels, this may indicate that data is missing from the input file.
***Warning:	Transect *TransectID* has more than one variance group specified for the transect.	Outfile	Generally a given transect will only be assigned to one variance group. More than one variance group may be needed, however, in cases were data are missing from one or more years---variance groups may be used as a means to split transects into more than one transect for variance calculations.
***Warning:	Transect *TransectID* has an unequal number of subplots among years. Varying numbers of subplots within a transect may cause increased variance in trend analysis.	Outfile	At least one year of data for the current transect has a different number of subplots than for other years.
***Warning:	Transect *TransectID* has < 6 subplots for at least one year. Few subplots may indicate a poor sample.	Outfile	All transects should have a minimum of six sample subplots per year.
***Warning:	Transect *TransectID* has > 12 subplots for at least one year. Too many subplots..	Outfile	All transects should have a maximum of twelve sample subplots per year.
***Warning:	Transect *TransectID* has < 6 subplots for all years. Few subplots may indicate a poor sample.	Outfile	All transects should have a minimum of six sample subplots per year.
***Warning:	Transect *TransectID* has > 12 subplots for all years. Too many subplots.	Outfile	All transects should have a minimum of twelve sample subplots per year.
***Warning:	Transect *TransectID* has an unequal number of subplots (difference > 3) among years. Varying numbers of subplots within a transect may cause increased variance in trend analysis.	Outfile	All transects should have a no more than a difference of three subplots sampled across years.
***Warning:	Transect *TransectID* has only one year of data. Transect will not be included in trend analysis.	Outfile	Transects with only one year of data cannot be included in the trend analysis.
***Warning:	Input contains data from only *#Elevations* elevation(s). If requested, trend across parks will not be calculated because comparison is invalid with missing elevation strata.	Outfile	Combined trend across parks can only be calculated if each park has sample data from each of the three elevations.

Table A6.3 (continued).

	Message	Written To	Interpretation
***Warning:	Input for Park *ParkID* contains data from only *#Elevations* elevation(s). Park-wide trend will be calculated, but this estimate is biased because one or more elevation strata have not been sampled.	Outfile	Park-wide trend is biased if samples from one or more elevations are missing.
***Warning:	Variance group *VarGroup* has multiple elevation strata with each elevation having more than one transect.	Outfile	If possible, elevation strata should be in different variance groups if they contain more than one non-zero transect.
Notes			
***Note:	Variance group *VarGroup* has multiple elevation strata. Elevation strata have been combined since at least one of the elevations has only one sampled transect.	Outfile	Ideally each variance group will only contain data from one elevation strata. If, however, an elevation has only one sampled non-zero transect, the elevation group may be combined with another elevation via the variance group identifier.
***Note:	Variance group *VarGroup* has multiple rotating panels with varying number of sampled years. Recommend splitting variance group if possible.	Outfile	If an individual variance group contains transects from more than one rotating panel, each panel will ideally contain the same number of sampled years. If, for example, two panels each have two years of data and two panels each have three years of data, we recommend splitting the rotating panels into two different variance groups---one for the two and three year sampled transects, respectively.
***Note:	At least one transect in Variance group *VarGroup* has a different number of sampled years than other transects in the group. Recommend splitting variance group if possible.	Outfile	If an individual variance group contains transects with highly varying numbers of sampled years, we recommend splitting the transects into different variance groups if possible.

Table A6.4. Sample summary table output from *BirdTrendAnnualDensity*.

ANNUAL DENSITY REPORT--2002

Species	Park	Mean Density	SE
AMRO	OLYM	0.220	0.066
AMRO	NOCA	0.280	0.063
AMRO	MORA	0.080	0.040
AMRO	Combined	0.20	0.039
WIWA	OLYM	0.260	0.145
WIWA	NOCA	0.030	0.028
WIWA	MORA	0.020	0.015
WIWA	Combined	0.150	0.076

Table A6.5. List of errors, warnings, and notes that can be generated by *BirdTrendAnnualDensity*.

	Message	Written To	Interpretation
Errors			
***ERROR:	Missing *infile* argument. Specify an input file name and rerun *BirdTrendAnnualDensity*.	R Window	Missing input file name.
***ERROR:	Missing *outfile* argument. Specify file name for density estimates and rerun *BirdTrendAnnualDensity*.	R Window	Missing output table file name.
***ERROR:	Missing *outfile2* argument. Specify second output file name and rerun *BirdTrendAnnualDensity*.	R Window	Missing second output file name, used to report program messages.
***ERROR:	Specified input file does not exist. Check file name and rerun *BirdTrendAnnualDensity*.	R Window	Input file does not exist.
***ERROR:	Specified report output file already exists. Specify a new file name and rerun *BirdTrendAnnualDensity*.	R Window	Output report file already exists. Must specify a new file name.
***ERROR:	Input data file did not pass preprocessor checks. Please run input through preprocessor or, modify the input and rerun the preprocessor.	R Window	Specified input file is missing the necessary flag that indicates a CLEAN pass through *PreBirdTrend*. Run input through the preprocessor or make necessary changes from the first pass and rerun through the preprocessor.
***ERROR:	Data set contains records for more than one year. This program generates an annual summary only. Modify the input file to contain only 1 years worth of data and rerun *BirdTrendAnnualDensity*.	R Window	Program only runs on one year's worth of data.
Warnings			
***Warning:	Specified *outfile* file does not exist, which means that output will be written to a new file. Check the file name and rerun *BirdTrendAnnualDensity* if you want to specify a different density output file.	R Window	Specify an existing file name to append densities for multiple species in one table.
Notes			
***Note:	Combined density estimate was not generated for *Species* because fewer than three elevations were sampled for at least one park.	Outfile2	Combined estimates are only generated when a species is sampled at all elevations at all parks.

Table A6.6. List of errors, warnings, and notes that can be generated by *BirdTrend*.

	Message	Written To	Interpretation
Errors			
***ERROR:	Missing *infile* argument. Specify an input file name and rerun *BirdTrend*.	R Window	Missing input file name.
***ERROR:	Missing *outfile* argument. Specify output file name and rerun *BirdTrend*.	R Window	Missing trend analysis output file name.
***ERROR:	Missing *slopes.out* argument. Specify slope file name and rerun *BirdTrend*.	R Window	Missing slope output file name.
***ERROR:	Missing *summary.out* argument. Specify summary file name and rerun *BirdTrend*.	R Window	Missing summary output file name.
***ERROR:	Missing *plot.outdir* argument. Specify an output directory for the requested cdf plots and rerun *BirdTrend*.	R Window	CDF plots were selected, but output directory for metafiles is missing.
***ERROR:	Specified input file does not exist. Check file name and rerun *BirdTrend*.	R Window	Input file does not exist.
***ERROR:	Specified output file already exists. Specify a new file name and rerun *BirdTrend*.	R Window	Output file for trend analysis already exists. Must specify a new file name.
***ERROR:	Specified slope file already exists. Specify a new file name and rerun *BirdTrend*	R Window	Slope file for trend analysis already exists. Must specify a new file name.
***ERROR:	Input data file did not pass preprocessor checks. Please run input through preprocessor or, modify the input and rerun the preprocessor.	R Window	Specified input file is missing the necessary flag that indicates a CLEAN pass through *PreBirdTrend*. Run input through the preprocessor or make necessary changes from the first pass and rerun through the preprocessor.
Warnings			
***Warning:	Invalid input for *plot.cdf* argument. Valid choices are None, or any combination of Parks, Elev, or Both. Some cdf plots may not have been generated.	R Window	Check *plot.cdf* argument in call to *BirdTrend*. Valid choices are “None”, “Parks”, “Elev”, and “Both”.
***Warning:	Specified *summary.out* file does not exist, which means that output will be written to a new file. Check the file name and rerun *BirdTrend* if you want to specify a different summary output file.		Specify an existing file name to append summaries for multiple species in one table.

Table A6.6 (continued). List of errors, warnings, and notes that can be generated by *BirdTrend*.

	Message	Written To	Interpretation
Notes			
***Note:	*outplot* renamed to *outplot2*.	R Window	A cdf plot file named *outplot* already exists so current metafile was written to a file named *outplot2*.
***Note:	Combined trend test across parks was not conducted because at least one elevation was not sampled for at least one park.	Outfile	The *combine.parks* flag was set to *T* in the call the *BirdTrend*, however, at least one elevation was not sampled for at least one park so a combined trend across parks was not calculated.

Table A6.7. Example of report output by *BirdTrend*.

INPUT: C:\myfiles\birdfiles\testcaseclean.csv

Wed Mar 29 07:17:27 2006

YEARS: 2002-2011

SPECIES: AMRO

Park	Variance Group	Panel(s)	Elevation Class	# Non-Zero Sites	Mean Slope	Variance of Slope	Variance of Mean Slope	df	t-stat	2-tailed p-value
OLYM	1	Ann1	Low	4	0.0337	0.000715	-	-	-	-
	2	Ann1	Mid	4	-0.0341	0.000612	-	-	-	-
	3	Ann1	High	4	0.0091	0.001378	-	-	-	-
	4	Alt1,Alt2,Alt3,Alt4,Alt5	Low	20	0.0302	0.030507	-	-	-	-
	5	Alt1,Alt2,Alt3,Alt4,Alt5	Mid	20	0.0276	0.01932	-	-	-	-
	6	Alt1,Alt2,Alt3,Alt4,Alt5	High	20	0.0084	0.015879	-	-	-	-
				-	-	-	-	-	-	-
	Combined Panels		Low	24	0.0308	-	0.001064	-	-	-
			Mid	24	0.0173	-	0.000675	-	-	-
			High	24	0.0086	-	0.000561	-	-	-
				-	-	-	-	-	-	-
	Grand Mean		All	72	0.0224	-	0.00035	38.26	1.1976	0.2384
				-	-	-	-	-	-	-
NOCA	1	Ann1	Low	4	0.0302	0.000486	-	-	-	-
	2	Ann1	Mid	4	0.0029	0.003128	-	-	-	-
	3	Ann1	High	4	4.00E-04	0.000745	-	-	-	-
	4	Alt1,Alt2,Alt3,Alt4,Alt5	Low	20	0.0467	0.010676	-	-	-	-
	5	Alt1,Alt2,Alt3,Alt4,Alt5	Mid	20	-0.0039	0.013248	-	-	-	-
	6	Alt1,Alt2,Alt3,Alt4,Alt5	High	20	0.0216	0.007386	-	-	-	-
				-	-	-	-	-	-	-
	Combined Panels		Low	24	0.044	-	0.000374	-	-	-
			Mid	24	-0.0028	-	0.000482	-	-	-
			High	24	0.0181	-	0.000262	-	-	-
				-	-	-	-	-	-	-
	Grand Mean		All	72	0.0178	-	0.000157	45.54	1.4181	0.163
				-	-	-	-	-	-	-
MORA	1	Ann1	Low	2	0.0058	4.60E-05	-	-	-	-
	2	Ann1	Mid	4	0.0206	0.000669	-	-	-	-
	3	Ann1	High	4	-0.0098	0.002933	-	-	-	-
	4	Alt1,Alt2,Alt3,Alt4,Alt5	Low	10	-0.0514	0.048625	-	-	-	-
	5	Alt1,Alt2,Alt3,Alt4,Alt5	Mid	20	0.1521	0.049226	-	-	-	-
	6	Alt1,Alt2,Alt3,Alt4,Alt5	High	20	-0.0066	0.015099	-	-	-	-
				-	-	-	-	-	-	-
	Combined Panels		Low	12	-0.0419	-	0.003377	-	-	-
			Mid	24	0.1302	-	0.001714	-	-	-
			High	24	-0.0071	-	0.000545	-	-	-
				-	-	-	-	-	-	-
	Grand Mean		All	60	0.0433	-	0.000808	20.99	1.522	0.1429
	Combined			204	0.0269	-	0.000133	146.83	2.3328	0.021

Table A6.8. Example slope output file generated by *BirdTrend*.

Species	Slope	Elevation	Var Group	Panel	Transect	Park
AMRO	0.036267	1	1	Ann1	1	OLYM
AMRO	0.008422	1	1	Ann1	2	OLYM
AMRO	0.069981	1	1	Ann1	3	OLYM
AMRO	0.020156	1	1	Ann1	4	OLYM
AMRO	-0.06886	2	2	Ann1	5	OLYM
AMRO	-0.03235	2	2	Ann1	6	OLYM
AMRO	-0.02403	2	2	Ann1	7	OLYM
AMRO	-0.01125	2	2	Ann1	8	OLYM
AMRO	0.005102	3	3	Ann1	9	OLYM
AMRO	0.033696	3	3	Ann1	10	OLYM
AMRO	0.039519	3	3	Ann1	11	OLYM
AMRO	-0.04176	3	3	Ann1	12	OLYM
AMRO	0	1	4	Alt1	13	OLYM
AMRO	-0.01374	1	4	Alt1	14	OLYM
AMRO	-0.13538	1	4	Alt1	15	OLYM
AMRO	-0.10042	1	4	Alt1	16	OLYM
AMRO	-0.06264	1	4	Alt2	25	OLYM
AMRO	0.245898	1	4	Alt2	26	OLYM
AMRO	0.267673	1	4	Alt2	27	OLYM
AMRO	0.036317	1	4	Alt2	28	OLYM
AMRO	0.029225	1	4	Alt3	37	OLYM
AMRO	0.167195	1	4	Alt3	38	OLYM
AMRO	0.030672	1	4	Alt3	39	OLYM
AMRO	0.070769	1	4	Alt3	40	OLYM
AMRO	-0.0443	1	4	Alt4	49	OLYM
AMRO	0.078934	1	4	Alt4	50	OLYM
AMRO	0.205072	1	4	Alt4	51	OLYM
AMRO	0.093013	1	4	Alt4	52	OLYM
AMRO	-0.44441	1	4	Alt5	61	OLYM
AMRO	-0.23345	1	4	Alt5	62	OLYM
AMRO	0.224456	1	4	Alt5	63	OLYM
AMRO	0.189479	1	4	Alt5	64	OLYM
AMRO	0.049528	2	5	Alt1	17	OLYM
AMRO	0.021232	2	5	Alt1	18	OLYM
AMRO	0.080761	2	5	Alt1	19	OLYM

Table A6.9. Example summary output file generated by *BirdTrend*.

BIRDTREND SUMMARY OUTPUT

Species	Years	Park	No. Non-zero Transects	Mean of Slope	Variance of Slope	df	t-stat	2-tailed p-value
AMRO	2002-2011	OLYM	72	0.022	0.00035	38.26	1.1976	0.2384
	2002-2011	NOCA	72	0.018	0.000157	45.54	1.4181	0.163
	2002-2011	MORA	60	0.043	0.000808	20.99	1.522	0.1429
	2002-2011	Combined	204	0.03	0.000133	146.83	2.3328	0.021
WIWA	2002-2011	OLYM	72	0.098	0.00038	47.62	5.0157	0
	2002-2011	NOCA	72	0.088	0.000317	50.77	4.9443	0
	2002-2011	MORA	60	0.082	0.000475	17.35	3.7676	0.0015
	2002-2011	Combined	204	0.09	0.000128	150.7	7.9335	0

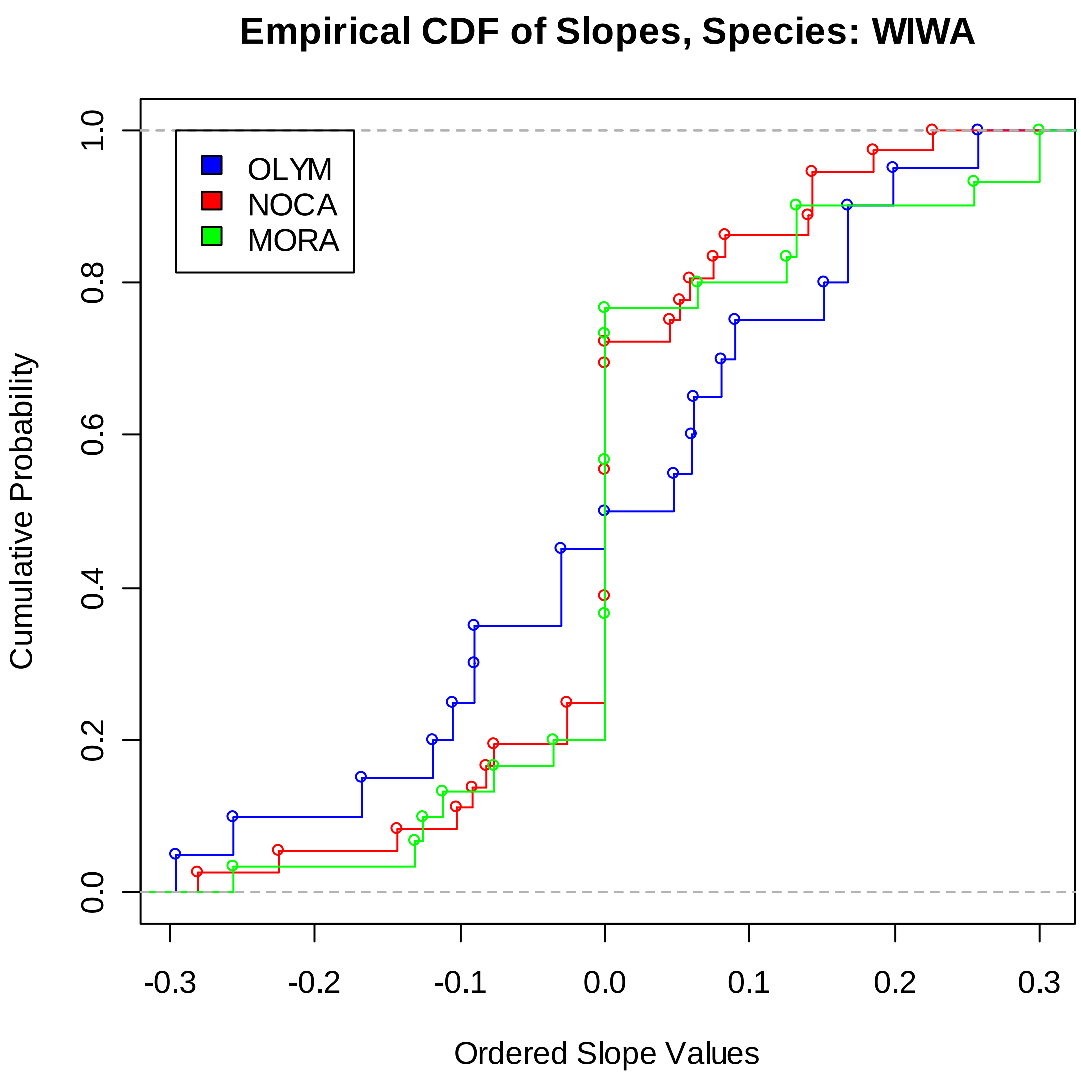

Figure A6.1. Empirical CDF plots by park for WIWA.

References supporting Appendix 6

Buckland, S.T., Anderson, D.R., Burnham, K.P. and Laake, J.L. 1993. *Distance Sampling: Estimating Abundance of Biological Populations.* Chapman and Hall, London, reprinted 1999 by RUWPA, University of St. Andrews, Scotland.

Buckland, S.T., Anderson, D.R., Burnham, K.P., Laake, J.L., Borchers, D.L. and Thomas, L. 2001. Introduction to Distance Sampling. Oxford University Press, London.

Buckland, S.T., Anderson, D.R., Burnham, K.P., Laake, J.L., Borchers, D.L. and Thomas, L. (editors) 2004. *Advanced Distance Sampling.* Oxford University Press, London.

Thomas, L., Laake, J.L., Strindberg, S., Marques, F.F.C., Buckland, S.T., Borchers, D.L., Anderson, D.R., Burnham, K.P., Hedley, S.L., Pollard, J.H., Bishop, J.R.B. and T. A. Marques. 2005. Distance 5.0. Research Unit for Wildlife Population Assessment, University of St. Andrews, UK. http://www.ruwpa.st-and.ac.uk/distance/

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Appendix 7. Landbird Monitoring Protocol Database Documentation

Appendix 7. Landbird Monitoring Protocol Database Documentation

The database for this project consists of three types of tables: core tables describing the "who, where and when" of data collection, project-specific tables, and lookup tables that contain domain constraints for other tables. Although core tables are based on NCCN standards, they may contain fields, domains or descriptions that have been added or altered to meet project objectives.

The database includes the following standard tables:

tbl_Strata	Stratification classes used during design and analysis
tbl_Sites	Sample sites – transects are clusters of sample points used as the basis of sampling, summary and analysis
tbl_Locations	Sample locations – point count positions, transect start points, and locations of rare bird observations
tbl_Coordinates	Coordinate data for sample locations
tbl_GPS_Info	GPS information associated with sample location coordinates
tbl_Sample_Periods	The span of dates during which data collection occurs
tbl_Events	Data collection event for a given location
tbl_Observers	Observers for each sampling event
tbl_QA_Results	Quality assurance query results for the working data set
tbl_Edit_Log	Edit log for changes made to data after certification
tbl_Task_List	Checklist of tasks to be completed at sampling locations
tbl_Markers	Markers placed at a sample location to facilitate relocation
tbl_Images	Images associated with sample locations

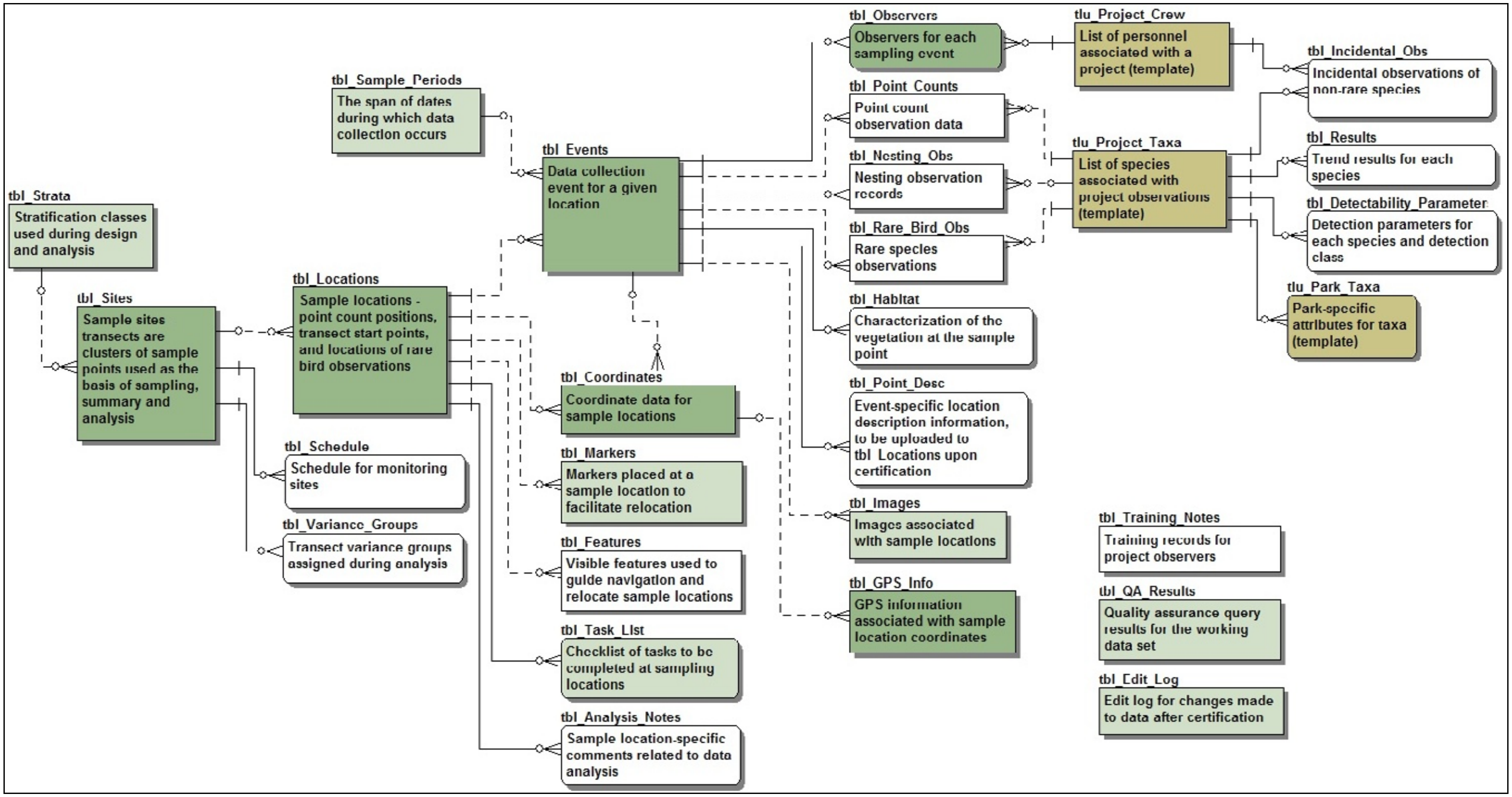
The following are project-specific data tables:

tbl_Point_Counts	Point count observation data
tbl_Rare_Bird_Obs	Rare species observations
tbl_Incidental_Obs	Incidental observations of non-rare species
tbl_Nesting_Obs	Nesting observation records
tbl_Point_Desc	Event-specific location description information, to be uploaded to tbl_Locations upon certification
tbl_Habitat	Characterization of the vegetation at the sample point
tbl_Features	Visible features used to guide navigation and relocate sample locations
tbl_Training_Notes	Training records for project observers
tbl_Schedule	Schedule for monitoring sites
tbl_Variance_Groups	Transect variance groups assigned during analysis
tbl_Analysis_Notes	Sample location-specific comments related to data analysis
tbl_Detectability_Parameters	Detection parameters for each species and detection class
tbl_Results	Trend results for each species

The following are a few of the more prominent, standard lookup tables:

tlu_Project_Crew	List of personnel associated with a project
tlu_Project_Taxa	List of species associated with project observations
tlu_Park_Taxa	Park-specific attributes for taxa

Figure 1. Entity Relationship Diagram of the project database. Relationships between tables are represented by lines. Dark green tables represent core standard tables; light green represents extended standard tables; light brown are standard lookup tables. Project-specific tables are unshaded.



Data Dictionary

Required fields are denoted with an asterisk (*).

tbl_Analysis_Notes - Sample location-specific comments related to data analysis

Index	*Index columns*
Location_ID	Location_ID
pk_tbl_Analysis_Notes (primary)	Location_ID, Analysis_year

Field name	*Index/key**	*Data type*	*Description*
Location_ID	primary (FK)*	text (50)	Sampling location for this event
Analysis_year	primary *	text (4)	The analysis year (e.g., 2007)
Is_included		bit	Indicates whether or not the sampling location is included in the analysis for the specified year
	Default: True		
Analysis_notes		text	Comments about this sample location with regard to analysis

tbl_Coordinates - Coordinate data for sample locations

Index	*Index columns*
pk_tbl_Coordinates (primary)	Coord_ID
udx_Coord_index (unique)	Location_ID, Event_ID
Coord_label	Coord_label
Coord_type	Coord_type
Coord_updated	Coord_updated
Datum	Datum
Event_ID	Event_ID
Field_coord_source	Field_coord_source
GIS_loc_ID	GIS_loc_ID
Location_ID	Location_ID

Field name	*Index/key**	*Data type*	*Description*
Coord_ID	primary *	text (50)	Unique identifier for each coordinate record
	Default: =Format(Now(),"yyyymmddhhnnss") & '-' & 1000000000*Rnd(Now())		
GIS_loc_ID	indexed	text (50)	GIS feature ID for each set of coordinates, to link with geospatial layers
Location_ID	unique (FK)*	text (50)	Sample location
Event_ID	unique (FK)	text (50)	Sampling event of coordinate data collection
Coord_label	indexed	text (25)	Name of the coordinate feature (e.g., plot center, NW corner)
Is_best		bit	Indicates whether this set of coordinates is the best available for this location
UTM_east		double	Final UTM easting (zone 10N, meters), including any offsets and corrections
UTM_north		double	Final UTM northing (zone 10N, meters), including any offsets and corrections
Coord_type	indexed	text (20)	Coordinate type stored in UTM_east and UTM_north: target, field, post-processed
Datum	indexed	text (5)	Datum of UTM_east and UTM_north
	Default: "NAD83"		
Est_horiz_error		double	Estimated horizontal error (meters) of UTM_east and UTM_north
Field_UTME		double	UTM easting (zone 10N) as recorded in the field
Field_UTMN		double	UTM northing (zone 10N) as recorded in the field
Field_datum		text (5)	Datum of field coordinates
Field_horiz_error		double	Field coordinate horizontal error (m)
Field_offset_m		double	Distance (meters) from the field coordinates to the target

	Constraint: Is Null Or >=0		
Field_offset_azimuth		int	Azimuth (degrees, declination corrected) from the coordinates to the target
	Constraint: Is Null Or (>=0 And <=360)		
Field_coord_source	indexed	text (12)	Field coordinate data source
GPS_file_name		text (50)	GPS rover file used for data downloads
GPS_model		text (25)	Make and model of GPS unit used to collect field coordinates
Source_map_scale		text (16)	Approximate scale of the source map
Source_citation		text (250)	Name and date of the source map
Target_UTME		double	Target UTM easting (zone 10N)
Target_UTMN		double	Target UTM northing (zone 10N)
Target_datum		text (5)	Target coordinate datum
	Default: "NAD83"		
Coordinate_notes		text	Notes about this set of coordinates
Coord_created_date		datetime	Time stamp for record creation
	Default: Now()		
Coord_updated	indexed	datetime	Date of the last update to this record
Coord_updated_by		text (50)	Person who made the most recent edits

tbl_Detectability_Parameters - Detection parameters for each species and detection class

Index	*Index columns*
Park_code	Park_code
pk_tbl_Detectability_Parameters (primary)	Analysis_years, Park_code, Taxon_ID, Detection_class

Field name	*Index/key**	*Data type*	*Description*
Analysis_years	primary *	text (20)	Range of years for which the results apply
Park_code	primary *	text (4)	Park code
Detection_class	primary *	text (20)	Detection category
Date_calculated		datetime	Date on which the detection parameter was calculated
Selected_model		text (255)	Selected detection model
Detection_prob		double	Detection probability
	Constraint: Is Null Or >=0 And <=1		
Sampling_width_m		int	Sampling width in meters
	Constraint: Is Null Or >=0 And <=1000		
Std_error		double	Standard error
	Constraint: Is Null Or >=0 And <=1		
Deg_freedom		double	Degrees of freedom
Sort_order		int	Sort order
Taxon_ID	primary (FK)*	text (50)	Taxon record in the taxonomic lookup table

tbl_Edit_Log - Edit log for changes made to data after certification

Index	*Index columns*
pk_tbl_Edit_Log (primary)	Data_edit_ID
Edit_date	Edit_date
Edit_type	Edit_type
Table_affected	Table_affected
User_name	User_name
Project_code	Project_code

Field name	*Index/key**	*Data type*	*Description*
Data_edit_ID	primary *	text (50)	Unique identifier for each data edit record
	Default: =Format(Now(),"yyyymmddhhnnss") & '-' & 1000000000*Rnd(Now())		
Project_code	indexed *	text (10)	Project code, for linking information with other data sets and applications
	Default: "BDa03"		
Edit_date	indexed *	datetime	Date on which the edits took place

	Default: Date()		
Edit_type	indexed *	text (12)	Type of edits made: deletion, update, append, reformat, tbl design
Edit_reason		text (100)	Brief description of the reason for edits
User_name	indexed	text (50)	Name of the person making data edits
Table_affected	indexed	text (50)	Table affected by edits
Fields_affected		text (200)	Description of the fields affected
Records_affected		text (200)	Description of the records affected
Data_edit_notes		text	Comments about the data edits

tbl_Events - Data collection event for a given location

Index	*Index columns*
Certified_by	Certified_by
Certified_date	Certified_date
Cloud_cover	Cloud_cover
Entered_date	Entered_date
Location_ID	Location_ID
Noise_level	Noise_level
Period_ID	Period_ID
Precip_cond	Precip_cond
pk_tbl_Events (primary)	Event_ID
Project_code	Project_code
Start_date	Start_date
Updated_date	Updated_date
Verified_date	Verified_date
Wind_cond	Wind_cond

Field name	*Index/key**	*Data type*	*Description*
Event_ID	primary *	text (50)	Unique identifier for each sampling event
	Default: =Format(Now(),"yyyymmddhhnnss") & '-' & 1000000000*Rnd(Now())		
Location_ID	indexed (FK)*	text (50)	Sampling location for this event
Project_code	indexed *	text (10)	Project code, for linking information with other data sets and applications
	Default: "BDa03"		
Period_ID	indexed (FK)	text (50)	Sample period during which this event occurred
Start_date	indexed *	datetime	Start date of the sampling event
Start_time		datetime	Start time of the sampling event
End_date		datetime	End date of the sampling event (optional)
End_time		datetime	End time of the sampling event (optional)
Declination		text (25)	Declination correction factor for measurement of compass bearings
Surveyed_point		bit	Indicates that the sample point was surveyed at the intended location
	Default: True		
Survey_comments		text (100)	Survey comments (e.g., explaining doubts about being in the intended position)
Site_data_updated		bit	Indicates whether the site data (slope, aspect, etc.) were updated
Coordinates_updated		bit	Indicates whether coordinates were collected
Features_updated		bit	Indicates whether navigation feature descriptions were updated
Photos_taken		bit	Indicates that photos were taken
Habitat_data_taken		bit	Indicates whether or not habitat data (slope, aspect, etc.) were recorded
Markers_updated		bit	Indicates that site markings were updated
Noise_level	indexed	tinyint	Noise level during the sampling event

Wind_cond	indexed	tinyint	Wind conditions during the sampling event
Precip_cond	indexed	tinyint	Precipitation conditions during the sampling event
Cloud_cover	indexed	tinyint	Percent cloud cover in viewable sky
	Constraint: Is Null Or (>=0 And <=100)		
Temp_C		int	Temperature during the sampling event
Misc_obs		text	Wildlife or plant phenology observations
Owl_call_made		bit	Indicates whether or not an owl call was made
Owl_call_response		bit	Indicates whether or not there was any response to the call
Owl_call_details		text	Comments about the owl call: start/stop time, species responding, sex, number, response type
Logistics_notes		text	Comments about logistics difficulties
Event_notes		text	Comments about the sampling event
Entered_by		text (50)	Person who entered the data for this event
Entered_date	indexed	datetime	Date on which data entry occurred
	Default: Now()		
Updated_by		text (50)	Person who made the most recent updates
Updated_date	indexed	datetime	Date of the most recent edits
Verified_by		text (50)	Person who verified accurate data transcription
Verified_date	indexed	datetime	Date on which data were verified
Certified_by	indexed	text (50)	Person who certified data for accuracy and completeness
Certified_date	indexed	datetime	Date on which data were certified
QA_notes		text	Quality assurance comments for the selected sampling event

tbl_Features - Visible features used to guide navigation and relocate sample locations

Index	*Index columns*
Feature_status	Feature_status
Feature_type	Feature_type
Location_ID	Location_ID
pk_tbl_Features (primary)	Feature_ID

Field name	*Index/key**	*Data type*	*Description*
Feature_status	indexed	text (12)	Current status of the feature
	Default: "active"		
Feature_updated		datetime	Date on which the feature record was last updated
Feature_ID	primary *	text (50)	Unique identifier for each feature record
	Default: =Format(Now(),"yyyymmddhhnnss") & '-' & 1000000000*Rnd(Now())		
Location_ID	indexed (FK)*	text (50)	Sample location
Feature_type	indexed	text (16)	Type of feature
Feature_desc		text (100)	Brief description of the feature
Distance_m		double	Distance in meters, measured from the previous point for travel features
	Constraint: Is Null Or >=0		
Feature_azimuth		int	Azimuth (degrees, declination corrected) from the sampling point to the feature
	Constraint: Is Null Or (>=0 And <=360)		
Photo_frame		text (10)	Frame number for photographic images
Image_filename		text (100)	Name of the image including extention (.jpg) but without the image path

tbl_GPS_Info - GPS information associated with sample location coordinates

Index	*Index columns*
Coord_ID	Coord_ID
Corr_type	Corr_type
Datum	GPS_datum
Feat_name	Feat_name
Feat_type	Feat_type
GPS_date	GPS_date
Location_ID	Location_ID
pk_tbl_GPS_Info (primary)	GPS_ID

Field name	*Index/key**	*Data type*	*Description*
GPS_ID	primary *	text (50)	Unique identifier for the GPS record
	Default: =Format(Now(),"yyyymmddhhnnss") & '-' & 1000000000*Rnd(Now())		
Coord_ID	indexed (FK)	text (50)	Coordinate identifier
Location_ID	indexed	text (50)	Sample location, used for temporary links
Feat_type	indexed	text (20)	Feature type (point, line, or polygon) collected with GPS
Data_dict_name		text (50)	Data dictionary name used to collect feature
Feat_name	indexed	text (50)	Feature name in data dictionary
GPS_file		text (50)	GPS file name
GPS_date	indexed	datetime	Date GPS file was collected
GPS_time		datetime	Time GPS file was collected
AM_or_PM		text (2)	Ante-meridian or post-meridian (AM or PM) if a 12 hour clock was used
Corr_type	indexed	text (50)	GPS file correction type
GPS_UTME		double	UTM easting in GPS unit
GPS_UTMN		double	UTM northing in GPS unit
UTM_zone		text (5)	UTM projection system zone
	Default: "10N"		
GPS_datum	indexed	text (5)	Datum of GPS coordinates
Elev_m		double	Elevation (meters) in GPS unit
Num_sat		int	Number of satellites tracked by GPS unit during data collection
GPS_duration		text (25)	Length of time GPS file was open
Filt_pos		int	Number of GPS positions exported from GPS file
PDOP		double	Position dilution of precision scale
HDOP		double	Horizontal dilution of precision scale
H_err_m		double	Horizontal error (meters)
V_err_m		double	Vertical error (meters)
Std_dev_m		double	Standard deviation (meters)
GPS_process_notes		text (255)	GPS file processing notes

tbl_Habitat - Characterization of the vegetation at the sample point

Index	*Index columns*
Canopy_cover	Canopy_cover
PMR_code	PMR_code
pk_tbl_Habitat (primary)	Event_ID, Habitat_num
Tree_size_class	Tree_size_class

Field name	*Index/key**	*Data type*	*Description*
Event_ID	primary (FK)*	text (50)	Sampling event
Habitat_num	primary *	tinyint	Habitat inclusion number assigned in the field
PMR_code	indexed	text (4)	Pacific Meridian vegetation code of the inclusion
Canopy_cover	indexed	text (6)	Percent cover of the vegetation type at the sample point, using PMR cover classes

Tree_size_class	indexed	text (10)	Tree size class of the dominant tree species, using PMR size classes
Habitat_notes		text (200)	Comments about the habitat inclusion

tbl_Images - Images associated with sample locations

Index	*Index columns*
Event_ID	Event_ID
Image_label	Image_label
Image_quality	Image_quality
Image_type	Image_type
pk_tbl_Images (primary)	Image_ID

Field name	*Index/key**	*Data type*	*Description*
Image_ID	primary *	text (50)	Unique identifier for each image record
	Default: =Format(Now(),"yyyymmddhhnnss") & '-' & 1000000000*Rnd(Now())		
Event_ID	indexed (FK)*	text (50)	Sampling event
Image_type	indexed	text (20)	Type of image
	Default: "ground photo"		
Image_label	indexed	text (25)	Image caption or label
Image_desc		text (255)	Brief description of the image bearing, perspective, etc.
Frame_number		text (10)	Frame number for photographic images
Image_date		datetime	Date on which the image was created, if different from the sampling event date
Image_source		text (50)	Name of the person or organization that created the image
Image_quality	indexed	tinyint	Quality of the image
Is_edited_version		bit	Indicates whether this version of the image is the edited (originals = False)
Object_format		text (20)	Format of the image
Orig_format		text (20)	Format of the original image
Image_edit_notes		text (200)	Comments about the editing or processing performed on the image
Image_is_active		bit	Indicates whether the image is still being used for navigation or interpretation
	Default: True		
Image_root_path		text (100)	Drive space location of the main project folder or image library
Image_project_path		text (100)	Location of the image from the main project folder or image library
	Default: "images\"		
Image_filename		text (100)	Name of the image including extention (.jpg) but without the image path
Image_notes		text	Comments about the image

tbl_Incidental_Obs - Incidental observations of non-rare species

Index	*Index columns*
Park_code	Park_code
Start_date	Obs_date
Taxon_ID	Taxon_ID
Contact_ID	Contact_ID
pk_tbl_Incidental_Obs (primary)	Park_code, Obs_date, Taxon_ID, Contact_ID

Field name	*Index/key**	*Data type*	*Description*
Park_code	primary *	text (4)	Park code
Taxon_ID	primary (FK)*	text (50)	Taxon observed
	Default: =Format(Now(),"yyyymmddhhnnss") & '-' & 1000000000*Rnd(Now())		

Contact_ID	primary (FK)*	text (50)	Observer identifier
Obs_date	primary *	datetime	Observation date
Loc_description		text (50)	Brief description of the location of the observation
Obs_notes		text (200)	Comments about this observation

tbl_Locations - Sample locations - point count positions, transect start points, and locations of rare bird observations

Index	*Index columns*
Loc_updated	Loc_updated
Location_code	Location_code
pk_tbl_Locations (primary)	Location_ID
Location_status	Location_status
Location_type	Location_type
Park_code	Park_code
Public_type	Public_type
Public_scale	Public_scale
Site_ID	Site_ID
Trail_or_road	Trail_or_road

Field name	*Index/key**	*Data type*	*Description*
Location_ID	primary *	text (50)	Unique identifier for each sample location
	Default: =Format(Now(),"yyyymmddhhnnss") & '-' & 1000000000*Rnd(Now())		
Park_code	indexed *	text (4)	Park code (optional except for incidental observations not associated with sites)
Site_ID	indexed (FK)	text (50)	Site membership of the sample location (transect)
Location_code	indexed *	text (10)	Alphanumeric code for the sample location (e.g., NN1, or TO for transect origin)
Location_type	indexed *	text (20)	Indicates the type of sample location
Location_name		text (50)	Brief colloquial name of the sample location (generally only used as a landmark name for incidental observations)
UTME_public		double	UTM easting (zone 10N, meters) after any dithering or resolution reduction
UTMN_public		double	UTM northing (zone 10N, meters) after any dithering or resolution reduction
Public_type	indexed	text (50)	Type of processing performed to make coordinates publishable
Public_scale	indexed	text (50)	Estimated accuracy of public coordinates
Elevation		double	Elevation of the location
	Constraint: Is Null Or (>=0 And <14500)		
Elev_units		text (2)	Units for elevation data
	Default: "m"		
Elev_source		text (20)	Source of elevation data
Slope_deg		int	Slope steepness, in degrees
	Constraint: Is Null Or >=0		
Aspect_deg		int	Dominant slope aspect, in degrees, corrected for declination
	Constraint: Is Null Or (>=0 And <=360) Or -1		
Azimuth_to_point		int	Azimuth (degrees, declination corrected) to the sampling point from the previous point, to facilitate relocating the position; 999 signifies points along the trail
	Constraint: Is Null Or (>=0 And <=360) Or 999		
Direction_changed		bit	Indicates whether the azimuth to the point was changed to accommodate navigation
Reason_for_change		text (200)	Brief comments about why the azimuth was changed
Travel_notes		text	Comments about navigation to the point - kept up to date as conditions change

Location_desc		text	Environmental description of the sampling location
Location_status	indexed	text (10)	Status of the sample location (blank for incidental locations)
Location_notes		text	Other notes about the sample location
Loc_established		datetime	Date the sample location was established
Loc_discontinued		datetime	Date the sample location was discontinued
Loc_created_date		datetime	Time stamp for record creation
	Default: Now()		
Loc_updated	indexed	datetime	Date of the last update to this record
Loc_updated_by		text (50)	Person who made the most recent edits
Trail_or_road	indexed	text (15)	Indicates whether or not the sample location is along a road or trail

tbl_Markers - Markers placed at a sample location to facilitate relocation

Index	*Index columns*
Location_ID	Location_ID
Marker_code	Marker_code
Marker_status	Marker_status
Marker_type	Marker_type
pk_tbl_Markers (primary)	Marker_ID

Field name	*Index/key**	*Data type*	*Description*
Marker_ID	primary *	text (50)	Unique identifier for each marker record
	Default: =Format(Now(),"yyyymmddhhnnss") & '-' & 1000000000*Rnd(Now())		
Location_ID	indexed (FK)*	text (50)	Sample location
Marker_code	indexed	text (12)	Field code given to the marker
Marker_type	indexed	text (20)	Type of marker used
Marker_substrate		text (50)	Substrate of the marker (e.g., tree, shrub, ground)
Height_cm		int	Height above ground level, in centimeters
	Constraint: Is Null Or >=0		
Offset_dist_m		double	Offset distance in meters
	Constraint: Is Null Or >=0		
Offset_azimuth		int	Azimuth (degrees, declination corrected) from the actual sampling point to the marker
	Constraint: Is Null Or (>=0 And <=360)		
Marker_status	indexed	text (12)	Current status of the marker
	Default: "active"		
Marker_notes		text	Comments about the marker
Marker_installed		datetime	Date the marker was first installed
Marker_updated		datetime	Date the marker record was last updated
Marker_removed		datetime	Date the marker was removed

tbl_Nesting_Obs - Nesting observation records

Index	*Index columns*
Event_ID	Event_ID
Nest_activity	Nest_activity
pk_tbl_Nesting_Obs (primary)	Nest_obs_ID
Taxon_ID	Taxon_ID

Field name	*Index/key**	*Data type*	*Description*
Nest_obs_ID	primary *	text (50)	Unique identifier for each observation record
	Default: =Format(Now(),"yyyymmddhhnnss") & '-' & 1000000000*Rnd(Now())		
Event_ID	indexed (FK)*	text (50)	Sampling event
Taxon_ID	indexed (FK)	text (50)	Taxon observed
Nest_activity	indexed *	text (20)	Type of nesting activity observed
Nest_obs_notes		text	Comments about this observation

tbl_Observers - Observers for each sampling event

Field name	*Index/key**	*Data type*	*Description*
Event_ID	primary (FK)*	text (50)	Sampling event identifier
Contact_ID	primary (FK)*	text (50)	Observer identifier
Observer_role	primary *	text (25)	Role of the observer during data collection (optional)
Observer_notes		text (200)	Comments about the observer specific to this sampling event

tbl_Point_Counts - Point count observation data

Index	*Index columns*
Event_ID	Event_ID
Obs_distance_m	Obs_distance_m
pk_tbl_Point_Counts (primary)	Observation_ID
Taxon_ID	Taxon_ID
Time_interval	Time_interval

Field name	*Index/key**	*Data type*	*Description*
Observation_ID	primary *	text (50)	Unique identifier for each observation record
	Default: =Format(Now(),"yyyymmddhhnnss") & '-' & 1000000000*Rnd(Now())		
Event_ID	indexed (FK)*	text (50)	Sampling event
Taxon_ID	indexed (FK)*	text (50)	Taxon observed
Obs_distance_m	indexed	int	Observation distance in meters
	Constraint: Is Null Or (>=0 And <1000)		
Seen_first		bit	Indicates whether the initial observation was visual
	Default: False		
Ever_sang		bit	Indicates whether the group/individual observed made territorial vocalizations during the sample time
	Default: True		
Time_interval	indexed	tinyint	Indicates the time interval during which the observation was made: first 3 minutes or last 2 minutes
	Constraint: 2 Or 3 Or Is Null		
Prev_observed		bit	Indicates whether the observed was recorded on more than one point count
	Default: False		
Flyover		bit	Indicates whether the observed was flying over the sample point during sampling
	Default: False		
Group_size		int	Number of individuals observed
	Default: 1		
	Constraint: >0 And <=200		
Obs_notes		text (200)	Comments about this observation

tbl_Point_Desc - Event-specific location description information, to be uploaded to tbl_Locations upon certification

Index	*Index columns*
Event_ID	Event_ID
pk_tbl_Point_Desc (primary)	Event_ID

Field name	*Index/key**	*Data type*	*Description*
Event_ID	primary (FK)*	text (50)	Sampling event
Elevation		double	Elevation of the location
	Constraint: Is Null Or (>=0 And <14500)		
Elev_units		text (2)	Units for elevation data
	Default: "m"		
Elev_source		text (20)	Source of elevation data
Slope_deg		int	Slope steepness, in degrees
	Constraint: Is Null Or >=0		

Aspect_deg		int	Dominant slope aspect, in degrees, corrected for declination
	Constraint: Is Null Or (>=0 And <=360) Or -1		
Azimuth_to_point		int	Azimuth (degrees, declination corrected) to the sampling point from the previous point, to facilitate relocating the position; 999 signifies points along the trail
	Constraint: Is Null Or (>=0 And <=360) Or 999		
Direction_changed		bit	Indicates whether the azimuth to the point was changed to accommodate navigation
Reason_for_change		text (200)	Brief comments about why the azimuth was changed
Travel_notes		text	Comments about navigation to the point - kept up to date as conditions change
Location_desc		text	Environmental description of the sampling location

tbl_QA_Results - Quality assurance query results for the working data set

Index	*Index columns*
pk_tbl_QA_Results (primary)	Query_name, Time_frame
Query_result	Query_result
Query_type	Query_type
Query_name	Query_name

Field name	*Index/key**	*Data type*	*Description*
Query_name	primary *	text (100)	Name of the quality assurance query
Query_type	indexed	text (20)	Severity of data errors being trapped: 1=critical, 2=warning, 3=information
Query_result	indexed	text (50)	Query result as the number of records returned the last time the query was run
Query_run_time		datetime	Run time of the query results
Query_description		text	Description of the query
Query_expression		text	Evaluation expression built into the query
Remedy_desc		text	Details about actions taken and/or not taken to resolve errors
Remedy_date		datetime	When the remedy description was last edited
QA_user		text (50)	Name of the person doing quality assurance
Time_frame	primary *	text (30)	Field season year or range of dates for the data being passed through quality assurance checks

tbl_Rare_Bird_Obs - Rare species observations

Index	*Index columns*
Event_ID	Event_ID
Nest_activity	Nest_activity
Obs_distance_m	Obs_distance_m
pk_tbl_Rare_Bird_Obs (primary)	Rare_bird_obs_ID
Taxon_ID	Taxon_ID

Field name	*Index/key**	*Data type*	*Description*
Rare_bird_obs_ID	primary *	text (50)	Unique identifier for each observation record
	Default: =Format(Now(),"yyyymmddhhnnss") & '-' & 1000000000*Rnd(Now())		
Event_ID	indexed (FK)*	text (50)	Sampling event
Taxon_ID	indexed (FK)*	text (50)	Taxon observed
Obs_distance_m	indexed	int	Observation distance in meters
	Constraint: Is Null Or >=0		
Group_size		int	Number of individuals observed
	Default: 1		
	Constraint: >0 And <=200		
Nest_activity	indexed	text (20)	Type of nesting activity observed
	Default: "no nest observed"		
Rare_obs_notes		text	Comments about this observation

tbl_Results - Trend results for each species

Index	*Index columns*
Park_code	Park_code
pk_tbl_Results (primary)	Analysis_years, Park_code, Taxon_ID
Species_code	Species_code

Field name	*Index/key**	*Data type*	*Description*
Analysis_years	primary *	text (20)	Range of years for which the results apply
Park_code	primary *	text (4)	Park code
Species_code	indexed	text (20)	Species code
Num_nonzero_sites		int	Number of sites where the taxon was detected
Mean_slope		double	Mean trend slope for the taxon
Var_mean_slope		double	Variance of the mean trend slope
Deg_freedom		double	Degrees of freedom
T_stat	double	t statistic	
P_value		double	P value
Taxon_ID	primary (FK)*	text (50)	Taxon record in the taxonomic lookup table

tbl_Sample_Periods - The span of dates during which data collection occurs

Index	*Index columns*
Period_updated	Period_updated
pk_tbl_Sample_Periods (primary)	Period_ID
Protocol_version	Protocol_version
Start_date	Start_date

Field name	*Index/key**	*Data type*	*Description*
Period_ID	primary *	text (50)	Unique identifier for each sample period
	Default: =Format(Now(),"yyyymmddhhnnss") & '-' & 1000000000*Rnd(Now())		
Start_date	indexed *	datetime	Start date of the sample period
End_date	*	datetime	End date of the sample period
Trip_purpose		text (200)	Brief description of the purpose of the trip
Protocol_version	indexed	text (100)	Version of the protocol used for sampling
Trip_notes		text	Details about the trip
Period_created		datetime	Time stamp for record creation
	Default: Now()		
Period_updated	indexed	datetime	Date of the last update to this record
Period_updated_by		text (50)	Person who made the most recent edits

tbl_Schedule - Schedule for monitoring sites

Index	*Index columns*
Site_ID	Site_ID
Calendar_year	Calendar_year
pk_tbl_Schedule (primary)	Calendar_year, Site_ID

Field name	*Index/key**	*Data type*	*Description*
Site_ID	primary (FK)*	text (50)	Monitoring site
	Default: =Format(Now(),"yyyymmddhhnnss") & '-' & 1000000000*Rnd(Now())		
Calendar_year	primary *	text (10)	Calendar year for scheduled sampling (not necessarily actually sampled)
Schedule_notes		text (255)	Comments about this schedule item (especially for out-of-rotation sites)

tbl_Sites - Sample sites - transects are clusters of sample points used as the basis of sampling, summary and analysis

Index	*Index columns*
Evaluation_code	Evaluation_code
Firing_order	Firing_order
Panel_name	Panel_name
Panel_type	Panel_type
Park_code	Park_code
Site_code (unique)	Site_code
pk_tbl_Sites (primary)	Site_ID
Site_status	Site_status
Site_updated	Site_updated
Slope_class	Slope_class
Stratum_ID	Stratum_ID
Substratum	Substratum
Watershed	Park_region

Field name	*Index/key**	*Data type*	*Description*
Site_ID	primary *	text (50)	Unique site identifier
	Default: =Format(Now(),"yyyymmddhhnnss") & '-' & 1000000000*Rnd(Now())		
Park_code	indexed *	text (4)	Park in which the site is located
Site_code	unique *	text (10)	Unique alphanumeric code for each site
Site_name		text (25)	Brief colloquial name of the site
Park_region	indexed	text (25)	Region of the park in which the site is located
Stratum_ID	indexed (FK)	text (50)	Stratum of the site
Slope_class	indexed	text (20)	Slope classification used for site selection
Substratum	indexed	text (20)	Additional criteria used for site selection
Panel_type	indexed	text (20)	Sampling panel for the site
Panel_name	indexed	text (10)	Name of the sampling panel, used to group data for analysis
Firing_order	indexed	int	Site selection and evaluation order
Evaluation_code	indexed	text (2)	Site evaluation status code
Evaluation_notes		text (100)	Brief comment about the site evaluation, rationale for not sampling, etc.
Site_status	indexed	text (10)	Status of the site (i.e., proposed, active, rejected, retired)
Site_notes		text	Comments about the site
Site_established		datetime	Date the sample site was established
Site_discontinued		datetime	Date the sample site was discontinued
Site_created_date		datetime	Time stamp for record creation
	Default: Now()		
Site_updated	indexed	datetime	Date of the last update to this record
Site_updated_by		text (50)	Person who made the most recent edits

tbl_Strata - Stratification classes used during design and analysis

Index	*Index columns*
pk_tbl_Strata (primary)	Stratum_ID
Stratum_updated	Stratum_updated
udx_tbl_Strata (unique)	Park_code, Project_code, Stratification_date, Stratum_name

Field name	*Index/key**	*Data type*	*Description*
Stratum_ID	primary *	text (50)	Unique identifier for each stratum record
	Default: =Format(Now(),"yyyymmddhhnnss") & '-' & 1000000000*Rnd(Now())		
Park_code	unique *	text (4)	4-letter park code of the stratification
Project_code	unique *	text (10)	Project code, for linking information with other data sets and applications
	Default: "BDa03"		

Stratification_date	unique *	datetime	Date on which the stratification occurred, used for grouping strata
Stratum_name	unique *	text (25)	Name of the stratification class (e.g., low, medium, high)
Stratum_definition		text (250)	Brief text definition of the stratum (e.g., elevations below 1000 meters)
N_population		int	Total population in the stratum
Weight_factor		double	Weight factor to be used in analyses; inverse of inclusion probability
Stratum_notes		text	Comments about the stratum
Stratum_created		datetime	Time stamp for record creation
	Default: Now()		
Stratum_updated	indexed	datetime	Date of the last update to this record
Stratum_updated_by		text (50)	Person who made the most recent edits

tbl_Task_List - Checklist of tasks to be completed at sampling locations

Index	*Index columns*
Date_completed	Date_completed
pk_tbl_Task_List (primary)	Location_ID, Request_date, Task_desc

Field name	*Index/key**	*Data type*	*Description*
Location_ID	primary (FK)*	text (50)	Sampling location
Request_date	primary *	datetime	Date of the task request
	Default: Now()		
Task_desc	primary *	text (100)	Brief description of the task
Date_completed	indexed	datetime	Date the task was completed
Task_notes		text	Notes about the task
Requested_by		text (50)	Name of the person making the initial request
Task_status		text (50)	Status of the task
Followup_by		text (50)	Name of the person following up on or completing the task
Followup_notes		text	Comments regarding what was done to follow-up on or complete this task

tbl_Training_Notes - Training records for project observers

Index	*Index columns*
pk_tbl_Training_Notes (primary)	Training_ID
udx_Trainee_and_date (unique)	Trainee_name, Training_date
Training_type	Training_type

Field name	*Index/key**	*Data type*	*Description*
Training_ID	primary *	text (50)	Unique identifier for each training record
	Default: =Format(Now(),"yyyymmddhhnnss") & '-' & 1000000000*Rnd(Now())		
Trainee_name	unique *	text (50)	Name of the person receiving the training
Training_date	unique *	datetime	Date on which training was given
Trainer_name		text (50)	Name of the person doing the training
Training_type	indexed	text (50)	Indicates the type of training provided: pre-season or refresher
	Default: "pre-season"		
Training_notes		text	Comments and results of training

tbl_Variance_Groups - Transect variance groups assigned during analysis

Index	*Index columns*
Analysis_years	Analysis_years
pk_tbl_Variance_Groups (primary)	Site_ID, Analysis_years
Site_ID	Site_ID

Field name	*Index/key**	*Data type*	*Description*
Site_ID	primary (FK)*	text (50)	Site (transect) to which this grouping applies
Analysis_years	primary *	text (20)	Range of years for which the results apply
Variance_group	*	text (10)	Variance group
Assigned_by		text (50)	Name of the person who assigned the
Variance_group_notes		text (255)	Comments about the variance grouping

tlu_Coord_Label - List of project-specific coordinate labels (template)

Field name	*Index/key**	*Data type*	*Description*
Coord_label	primary *	text (25)	
Coord_label_desc		text (100)	
Sort_order		tinyint	

tlu_Coord_Source - List of coordinate data sources (standard)

Field name	*Index/key**	*Data type*	*Description*
Coord_source	primary *	text (12)	
Coord_source_desc		text (100)	
Sort_order		tinyint	

tlu_Coord_Type - List of coordinate types (standard)

Field name	*Index/key**	*Data type*	*Description*
Coord_type	primary *	text (20)	
Coord_type_desc		text (100)	
Sort_order		tinyint	

tlu_Datum - List of coordinate datum codes (standard)

Field name	*Index/key**	*Data type*	*Description*
Datumprimary *	text (5)		
Datum_desc		text (50)	
Sort_order		tinyint	

tlu_Edit_Type - List of the types of post-certification edits made to data (standard)

Field name	*Index/key**	*Data type*	*Description*
Edit_type	primary *	text (12)	
Edit_type_desc		text (100)	
Sort_order		tinyint	

tlu_Elevation_Source - List of elevation data source codes (template)

Field name	*Index/key**	*Data type*	*Description*
Elev_source	primary *	text (20)	
Elev_source_desc		text (100)	
Sort_order		tinyint	

tlu_Evaluation_Status - List of evaluation codes for sample sites (template)

Field name	*Index/key**	*Data type*	*Description*
Eval_code	primary *	text (2)	
Eval_status	*	text (20)	
Eval_status_desc		text (100)	
Sort_order		tinyint	

tlu_Feature_Type - List of feature types used for site relocation

Field name	*Index/key**	*Data type*	*Description*
Feature_type	primary *	text (16)	
Sort_order		tinyint	

tlu_GPS_Model - List of GPS devices used to collect coordinate data (template)

Field name	*Index/key**	*Data type*	*Description*
GPS_model	primary *	text (25)	
Sort_order		tinyint	

tlu_Image_Format - List of image formats (template)

Field name	*Index/key**	*Data type*	*Description*
Image_format	primary *	text (12)	
Image_format_desc		text (100)	
Sort_order		tinyint	

tlu_Image_Quality - List of quality ranks for images (template)

Field name	*Index/key**	*Data type*	*Description*
Quality_code	primary *	tinyint	
Image_quality	*	text (20)	
Image_quality_desc		text (100)	

tlu_Image_Type - List of image types (template)

Field name	*Index/key**	*Data type*	*Description*
Image_type	primary *	text (12)	
Image_type_desc		text (100)	
Sort_order		tinyint	

tlu_Linear_Unit - List of measurement units for linear distances (template)

Field name	*Index/key**	*Data type*	*Description*
Units primary *	text (2)		
Units_desc		text (25)	
Sort_order		tinyint	

tlu_Location_Type - List of location type codes (template)

Field name	*Index/key**	*Data type*	*Description*
Location_type	primary *	text (20)	
Loc_type_desc		text (200)	
Sort_order		tinyint	

tlu_Marker_Status - List of status codes for site markers (template)

Field name	*Index/key**	*Data type*	*Description*
Marker_status	primary *	text (12)	
Marker_status_desc		text (100)	
Sort_order		tinyint	

tlu_Marker_Type - List of marker types used to facilitate site relocation (template)

Field name	*Index/key**	*Data type*	*Description*
Marker_type	primary *	text (20)	
Sort_order		tinyint	

tlu_Nest_Activity - List of nest activity codes

Field name	*Index/key**	*Data type*	*Description*
Nest_activity	primary *	text (20)	
Sort_order		tinyint	

tlu_Noise_Code - List of noise codes for bird observations

Field name	*Index/key**	*Data type*	*Description*
Noise_code	primary *	tinyint	
Noise_code_desc	*	text (100)	

tlu_Observer_Role - List of observer role assignments (template)

Field name	*Index/key**	*Data type*	*Description*
Observer_role	primary *	text (25)	
Role_desc		text (100)	
Sort_order		tinyint	

tlu_Origin_Code - List of origin codes for park taxa (standard)

Field name	*Index/key**	*Data type*	*Description*
Origin_code	primary *	text (16)	
Origin_desc		text (100)	
NPSpp_ID		int	
Sort_order		tinyint	

tlu_Panel_Type - List of sampling panel types (template)

Field name	*Index/key**	*Data type*	*Description*
Panel_type	primary *	text (20)	
Panel_type_desc		text (200)	
Sort_order		tinyint	

tlu_Parks - List of NCCN parks and park codes (standard)

Field name	*Index/key**	*Data type*	*Description*
Park_code	primary *	text (4)	
Park_name		text (50)	

tlu_Park_Taxa - Park-specific attributes for taxa (template)

Index	*Index columns*
Origin	Park_origin
Park_status_source	Park_status_IBP
pk_tlu_Park_Taxa (primary)	Taxon_ID, Park_code
Record_status	Record_status
Taxon_status	Park_status

Field name	*Index/key**	*Data type*	*Description*
Taxon_ID	primary (FK)*	text (50)	Taxon identifier
Park_code	primary *	text (4)	Park code
Park_status	indexed	text (16)	Status of the taxon in this park (from NPSpecies)
	Default: "unknown"		
Park_status_IBP	indexed	text (12)	Park status according to IBP inventory data
Park_origin	indexed	text (16)	Origin of the taxon in this park (from NPSpecies)
	Default: "unspecified"		
Local_list		bit	Indicates that the taxon is the preferred one for use at the park (from NPSpecies)
Local_accepted_TSN		int	Taxonomic serial number of the local preferred taxon (from NPSpecies)
Preferred_sci_name		text (255)	Preferred scientific name of the taxon at the park (from NPSpecies)
Park_taxon_notes		text	Comments about the taxon specific to this park
Record_status	indexed	text (16)	Indicates the status of the record in terms of synchrony with master databases
	Default: "new record"		
Created_date		datetime	Time stamp for record creation

Field name	Index/key*	Data type	Description
	Default: Now()		
Updated_date		datetime	Date of the last update to this record
Updated_by		text (50)	Person who made the most recent edits

tlu_Park_Taxon_Source - List of sources of park species occurrence info

Field name	*Index/key**	*Data type*	*Description*
Taxon_status_code	primary *	text (12)	
Taxon_status_desc		text (250)	
Sort_order		tinyint	

tlu_Park_Taxon_Status - List of codes for park species occurrence (standard)

Field name	*Index/key**	*Data type*	*Description*
Taxon_status_code	primary *	text (16)	
Taxon_status_desc		text (250)	
NPSpp_ID		int	
Sort_order		tinyint	

tlu_PMR_Cover_Class - List of Pacific Meridian vegetation cover classes

Field name	*Index/key**	*Data type*	*Description*
Cover_class	primary *	text (6)	
Cover_class_desc		text (100)	

tlu_PMR_Size_Class - List of Pacific Meridian canopy tree size classes

Field name	*Index/key**	*Data type*	*Description*
Tree_size_class	primary *	text (10)	
Size_class_desc		text (100)	
Sort_order		tinyint	

tlu_PMR_Veg_Type - List of Pacific Meridian vegetation type codes

Index	*Index columns*
pk_tlu_PMR_Veg_Type (primary)	PMR_type_code
Is_forested	Is_forested

Field name	*Index/key**	*Data type*	*Description*
PMR_type_code	primary *	text (4)	
PMR_type_desc		text (100)	
At_NOCA		bit	
At_OLYM		bit	
At_MORA		bit	
At_SAJH		bit	
At_LEWI		bit	
Detection_class		text (20)	
Is_forested	indexed	bit	

tlu_Precip_Code - List of precipitation codes for bird observations

Field name	*Index/key**	*Data type*	*Description*
Precip_code	primary *	tinyint	
Precip_code_desc		text (50)	

tlu_Project_Crew - List of personnel associated with a project (template)

Index	*Index columns*
Contact_location	Contact_location
Contact_updated	Contact_updated
First_name	First_name
Last_name	Last_name
Organization	Organization
pk_tlu_Project_Crew (primary)	Contact_ID
Project_code	Project_code

Field name	*Index/key**	*Data type*	*Description*
Contact_ID	primary *	text (50)	Unique identifier for the individual (Lastname_Firstname_MI)
Project_code	indexed *	text (10)	Project code, for linking information with other data sets and applications
Last_name	indexed *	text (24)	Last name
First_name	indexed	text (20)	First name
Middle_init		text (4)	Middle initials
Organization	indexed	text (50)	Employer (e.g., NPS-MORA)
Position_title		text (50)	Position title held by the individual
Email		text (50)	Email address
Work_voice		text (25)	Work phone number
Work_ext		text (5)	Work extension number
Mobile_voice		text (25)	Mobile phone number
Home_voice		text (25)	Home phone number
Fax		text (25)	Fax number
Contact_location	indexed	text (255)	Where the individual is located
Contact_notes		text	Notes about the contact
Contact_created		datetime	Time stamp for record creation
	Default: Now()		
Contact_updated	indexed	datetime	Date of the last update to this record
Contact_updated_by		text (50)	Person who made the most recent edits
Contact_is_active		bit	Indicates that the contact record is currently available for data entry pick lists
	Default: True		

tlu_Project_Taxa - List of species associated with project observations (template)

Index	*Index columns*
Accepted_TSN	Accepted_TSN
Category	Category
pk_tlu_Project_Taxa (primary)	Taxon_ID
Project_code	Project_code
Record_status	Record_status
Scientific_name (unique)	Scientific_name
Species_code (unique)	Species_code
Subcategory	Subcategory
Taxon_type	Taxon_type
TSN	TSN

Field name	*Index/key**	*Data type*	*Description*
Taxon_ID	primary *	text (50)	Unique identifier for each taxon
	Default: =Format(Now(),"yyyymmddhhnnss") & '-' & 1000000000*Rnd(Now())		
Project_code	indexed *	text (10)	Project code, for linking information with other data sets and applications
	Default: "BDa03"		
Species_code	unique *	text (20)	Unique field code for each project taxon
Scientific_name	unique *	text (100)	Scientific name of the taxon (from ITIS/NPSpecies)

Common_name		text (100)	Common name for the taxon (from ITIS/NPSpecies)
Pref_com_name		text (100)	Preferred common name for this project
TSN	indexed	int	ITIS taxonomic serial number or a provisional number (from NPSpecies)
Accepted_TSN	indexed	int	ITIS taxonomic serial number of the accepted name for this taxon (from NPSpecies)
Category	indexed	text (20)	General category of the taxon (from NPSpecies)
	Default: "unspecified"		
Subcategory	indexed	text (20)	Subcategory specific to the needs of each taxonomic discipline (from NPSpecies)
Authority		text (60)	Taxonomic authority (from ITIS)
Authority_subsp		text (60)	Taxonomic authority for subspecific taxa (from ITIS)
Family		text (60)	Taxonomic family (from ITIS)
Taxon_type	indexed	text (12)	Indicates the taxonomic resolution and certainty represented by this record
	Default: "specific"		
Taxon_notes		text	General notes about the taxon
Created_date		datetime	Time stamp for record creation
	Default: Now()		
Updated_date		datetime	Date of the last update to this record
Updated_by		text (50)	Person who made the most recent edits
Taxon_is_active		bit	Indicates that the record is currently available for data entry pick lists
	Default: True		
Record_status	indexed	text (16)	Indicates the status of the record in terms of synchrony with master databases
	Default: "new record"		
Rec_status_notes		text (255)	Notes about the disposition of the record
Project_taxon_notes		text	Project-specific comments about the taxon
AOU_number		text (5)	AOU number assigned to bird taxa

tlu_Site_Status - List of status codes for sampling stations (standard)

Field name	*Index/key**	*Data type*	*Description*
Site_status	primary *	text (10)	
Site_status_desc		text (200)	
Sort_order		tinyint	

tlu_Source_Scale - List of common map scales associated with maps and imagery (standard)

Field name	*Index/key**	*Data type*	*Description*
Source_scale	primary *	text (16)	
Source_scale_desc		text (100)	
Sort_order		tinyint	

tlu_Taxon_Category - List of taxonomic categories (standard)

Field name	*Index/key**	*Data type*	*Description*
Category	primary *	text (20)	
Category_desc		text (100)	
NPSpp_ID		int	
Sort_order		tinyint	

tlu_Taxon_Rec_Status - List of status codes for taxon records (standard)

Field name	*Index/key**	*Data type*	*Description*
Record_status_code	primary *	text (16)	
Record_status_desc		text (200)	
Sort_order		tinyint	

tlu_Taxon_Type - List of taxon resolution codes (standard)

Field name	*Index/key**	*Data type*	*Description*
Taxon_type	primary *	text (12)	
Taxon_type_desc		text (200)	
Sort_order		tinyint	

tlu_Trail_Or_Road - List of trail or road options for sample locations

Field name	*Index/key**	*Data type*	*Description*
Trail_code	primary *	text (15)	
Trail_code_desc		text (50)	
Sort_order		tinyint	

tlu_Trans_Arm_Code - List of codes for the directional branches of transects

Field name	*Index/key**	*Data type*	*Description*
Arm_code	primary *	text (2)	
Arm_code_desc		text (25)	
Sort_order		tinyint	

tlu_Wind_Code - List of wind codes for bird observations

Field name	*Index/key**	*Data type*	*Description*
Wind_code	primary *	tinyint	
Wind_code_desc	*	text (100)	

Appendix 8. Administrative History for Landbird Monitoring Protocol Development

The following administrative history briefly summarizes the process used to develop the National Park Service's North Coast and Cascades Network breeding landbird monitoring protocol and associated set of standard operating procedures (SOPs). This history also identifies the documents used to develop the protocol and SOPs, and provides a list of these documents.

Choosing and Prioritizing Vital Signs for Long-Term Ecological Monitoring:

In several stages, individual parks of the North Coast and Cascades Network (NCCN) identified topics (vital signs) for ecological monitoring and prioritized them. In the first stage, parks held Vital Signs meetings in which each park enlisted the help of outside experts to identify and justify a list of vital signs and their associated monitoring questions. All seven parks in the NCCN completed their Vital Signs Meetings by June 2001. Next, priorities were set by scientific discipline across parks in February 2002 and within individual parks by June 2003. All seven NCCN parks identified landbird monitoring as a high priority Vital Sign. For a more complete summarization of the Vital Signs process see Weber and others, 2005, North Coast and Cascades Network Vital Signs Monitoring Plan.

Landbird Inventories:

Parallel to the above Vital Signs identification and prioritization process, in January 2000 the Wildlife Research Advisory Committee (WRAC) of Seattle City Light awarded North Cascades National Park Service Complex (NOCA) a grant to develop plans for a long-term monitoring program. The WRAC stipulated that NOCA use part of the grant to host a round-table meeting of landbird monitoring experts to produce recommendations for this plan. This meeting was held in September 2000. The WRAC grant further stipulated that NOCA produce two reports. Through a cooperative agreement (H9471011196), The Institute for Bird Populations (IBP) and NOCA produced reports summarizing recommendations of the September 2000 meeting (Siegel and Kuntz, 2000) and reviewed and summarized existing literature on landbird monitoring methods (Siegel, 2000).

In 2001, NOCA was awarded a second grant from WRAC to initiate a 2-year avian research program and species inventory at NOCA (Siegel and others, 2002a, 2004b). WRAC and the National Park Service's 5-year inventory program provided the funding to inventory NOCA, as well as four other parks in NCCN (table 1). All inventories were completed 2001 through 2004 (Siegel and others, 2002a, 2002b, 2003, 2004a, 2004b, 2004c, 2005; Wilkerson and Siegel, 2005). These inventories provided much needed quantitative data used to help develop the landbird monitoring study plan.

Landbird Monitoring Study Plan:

Siegel and Kuntz (2000) provided a summary of the first set of recommendations for designing a network-wide monitoring program for breeding landbirds. A temporal sampling workshop held in Olympic National Park on November 12-14, 2003, further helped elucidate how the network avian monitoring design would be defined (NCCN I&M Program, 2003). Since the initial workshop in 2000 (NCCN I&M Program 2000), annual meetings also have served to aid in the development of this landbird monitoring program (NCCN I&M Program, 2002, 2003, 2004a, 2004b, 2004c, 2005).

In 2003, USGS-Forest and Rangeland Ecosystem Science Center formally assigned research ecologist Dr. Kurt Jenkins to spearhead an effort to develop and write a landbird monitoring study plan, have the study plan peer-reviewed, and

Table 1. Summary of landbird inventories completed in North Coast and Cascades Network national park units by park, year(s) inventories were conducted, year final report was completed, and cooperative agreement and modifications used to complete work at each park.

Parks[1]	Year(s)	Reports	Cooperative agreements
LEWI	2004	2005	H9471011196+Mod. 6
MORA	2003-04	2005	H9471011196+Mod. 4,5,6
NOCA	2001-02	2004	H9471011196+Mod. 1,2
OLYM	2002-03	2004	H9471011196+Mod. 1,2,4,5
SAJH	2002	2003	H9471011196+Mod. 2

[1] LEWI-Lewis and Clark National Historical Park, MORA-Mount Rainier National Park, NOCA-North Cascades National Park Service Complex, OLYM-Olympic National Park, SAJH-San Juan Island National Historical Park.

produce a landbird monitoring protocol and a set of standard operating procedures for use in NCCN parks. Dr. Jenkins had attended the initial workshop at NOCA in September 2000 and had attended annual workgroup meetings, as a member of the NCCN Landbird Monitoring Group and was familiar with the issues and questions facing NCCN parks in their desire to development a landbird monitoring program. Through USGS cooperative agreement (03WRAC0040), IBP was assigned the lead role in writing the draft study plan and making revision to the plan after peer-review. IBP, with the help of the NCCN landbird monitoring workgroup, completed a draft study plan in 2004. The USGS Forest and Rangeland Ecosystem Science Center conducted peer review of the study plan in March 2005. The study plan was reviewed by six biologists, environmental statisticians, and/or environmental monitoring specialists (Coonan, 2005; Courbois, 2005; Geissler, 2005; Fancy, 2005; Olsen, 2005d; Stevens, 2005). A response was drafted to address the review comments (Jenkins and others, 2005) and a revised final study plan was completed in April 2005 (Siegel and others, 2005).

In 2004, Dr. Jenkins began collaborating with the TerraStat Consulting Group to provide statistical support in developing a landbird monitoring protocol for the NCCN. Through a series of meetings and completed reports, TerraStat Consulting Group provided recommendations on how to analyze and report trends in avian density from data that would result from the sampling design recommended by the NCCN avian monitoring group (TerraStat Consulting Group 2004). TerraStat consultants evaluated the power of trend detection resulting from the preferred sampling design and prepared computer algorithms for computing densities and trends in densities (TerraStat Consulting Group, 2005a), as well as a step-by-step handbook for conducting the analyses described in this protocol (TerraStat Consulting Group, 2005b).

Development of Landbird Monitoring Protocol and Standard Operating Procedures:

The peer-reviewed Landbird Monitoring Study Plan was converted into the Landbird Monitoring Protocol with some clarification added. Additionally, several SOPs have been written to provide instructions detailing how to conduct all phases of the monitoring program, from preparing for the field season, collecting data, handling, storing, and analyzing data, and developing the outputs and products (Siegel and others, 2006a, 2006b, 2006c, 2006d, 2006e, 2006f, 2006g, 2006h, 2006i, 2006j, 2006k, 2006l, 2006m, 2006n, 2006o, 2006p). The USGS Forest and Rangeland Ecosystem Science Center in Corvalis, Oregon, conducted peer review of this draft protocol (with SOPs) in May and June 2006. The draft protocol was reviewed by three biologists, environmental statisticians, and/or environmental monitoring specialists (Fancy, 2006; Geissler, 2006; Olsen, 2006). A response was drafted to address the review comments (Siegel and others, 2006) and a revised final protocol was completed in August 2006 (Siegel and others, 2006).

Selected References

Vital Signs Identification and Prioritization:

Weber, S., Woodward, A., and Freilich, J., 2005, North Coast and Cascades Network Vital Signs Monitoring Plan, revised September 2005: National Park Service, Pacific West Region, for NPS Inventory and Monitoring Program, 218 p.

Avian Inventory and Monitoring Group Reports:

Siegel, R.B., 2000, Methods for monitoring landbirds: a review commissioned by Seattle City Light's Wildlife Research Advisory Committee: USDI Technical Report NPS/NRNOCA/NRTR/00-03.

Siegel, R.B., and Kuntz, R.C. II, 2000, Designing a landbird monitoring program at North Cascades National Park Service Complex: summary recommendations from a September 2000 workshop: USDI Technical Report NPS/NRNOCA/NRTR/00-04.

Siegel, R.B., Wilkerson, R.L., and Hall, S., 2003, Landbird inventory for Olympic National Park (2002), first annual progress report: The Institute for Bird Populations, Point Reyes Station, CA.

Siegel, R.B., Wilkerson, R.L., and Hall, S., 2004a, Landbird inventory for Olympic National Park (2002-2003), final report: The Institute for Bird Populations, Point Reyes Station, CA.

Siegel, R.B., Wilkerson, R.L., Kuntz, R.C., II, McLaughlin, J., and Curtis, E., 2002a, Landbird inventory for North Cascades National Park Service Complex, first annual progress report: The Institute for Bird Populations, Point Reyes Station, CA.

Siegel, R.B., Wilkerson, R.L., Kuntz, R.C., II, and McLaughlin, J.F., 2004b, Landbird inventory for North Cascades National Park Service Complex (2001-2002), final report: The Institute for Bird Populations, Point Reyes Station, CA.

Siegel, R.B., Wilkerson, R.L., Pedersen, H.K., and Kuntz, R.C., II, 2002b, Landbird inventory of San Juan Island National Historical Park: Technical Report NPS D 73 of the National Park Service.

Siegel, R.B., Wilkerson, R.L., and Schaberl, J., 2004c, Landbird inventory of Mount Rainier National Park, first annual progress report: The Institute for Bird Populations, Point Reyes Station, CA.

Wilkerson, R.L., Siegel, R.B., and Schaberl, J., 2005, Landbird inventory of Mount Rainier National Park (2003-2004), final report: The Institute for Bird Populations, Point Reyes Station, CA.

Wilkerson, R.L., and Siegel, R.B., 2005, Landbird inventory of Lewis and Clark National Historical Park (2004): The Institute for Bird Populations, Point Reyes Station, CA.

Annual Monitoring Meeting Minutes:

North Coast and Cascades Network Inventory and Monitoring Program, 2004, Summary of Avian Monitoring Discussions at the Temporal Sampling Workshop at Olympic National Park on November 12-14, 2003 (provided by Kurt Jenkins and including subsequent discussions with P. Geissler, R. Siegel, B. Wilkerson, Andrea Woodward).

North Coast and Cascades Network Inventory and Monitoring Program – Avian Monitoring Group, 2000, Meeting notes of the National Park Service Avian Monitoring Group at a workshop held at North Cascades National Park on September 12-13, 2000.

North Coast and Cascades Network Inventory and Monitoring Program – Avian Monitoring Group, 2002, Meeting notes to design an avian inventory in North Coast and Cascades Network parks: National Park Service Avian Monitoring Group workshop held at North Cascades National Park on September 12-13, 2000.

North Coast and Cascades Network Inventory and Monitoring Program – Avian Monitoring Group, 2003, Landbird inventory meeting notes: National Park Service Avian Monitoring Group meeting held at Olympic Park Institute on February 25-27, 2003.

North Coast and Cascades Network Inventory and Monitoring Program – Avian Monitoring Group, 2004a, Meeting notes for National Park Service Avian Monitoring Group annual meeting held at Mount Rainier National Park on February 25-26, 2004.

North Coast and Cascades Network Inventory and Monitoring Program – Avian Monitoring Group, 2004b, Meeting notes for National Park Service Avian Monitoring Group annual meeting held at Olympic National Park on November 16-17, 2004.

North Coast and Cascades Network Inventory and Monitoring Program – Avian Monitoring Group, 2004c, Supplemental meeting notes (written by John Boetsch) on data management for National Park Service Avian Monitoring Group annual meeting held at Olympic National Park on November 16-17, 2004.

North Coast and Cascades Network Inventory and Monitoring Program – Avian Monitoring Group, 2005, Landbird monitoring meeting notes for National Park Service Avian Monitoring Group annual meeting held at Olympic National Park on November 29-30, 2005.

NCCN Avian Monitoring Study Plan Documents and Study Plan Reviews:

Coonan, T., 2005, Review of “Study plan for establishing a landbird monitoring program for national parks in the North Coast and Cascades Monitoring Network”: Prepared for USGS-Forest and Rangeland Ecosystem Science Center, March 18, 2005.

Courbois, P., 2005, Review of “Study plan for establishing a landbird monitoring program for national parks in the North Coast and Cascades Monitoring Network”: Prepared for USGS-Forest and Rangeland Ecosystem Science Center, March 18, 2005.

Fancy, S., 2005, Review of “Study plan for establishing a landbird monitoring program for national parks in the North Coast and Cascades Monitoring Network”: Prepared for USGS-Forest and Rangeland Ecosystem Science Center, March 30, 2005.

Geissler, P., 2005, Review of “Study plan for establishing a landbird monitoring program for national parks in the North Coast and Cascades Monitoring Network”: Prepared for USGS-Forest and Rangeland Ecosystem Science Center, March 25, 2005.

Jenkins, K., Siegel, R.B., Wilkerson, R.L., Kuntz, R.C., II, Schaberl, J., Happe, P., and Boetsch, J., 2005, Response to peer review of “Study plan for establishing a landbird monitoring program for national parks in the North Coast and Cascades Monitoring Network”: Prepared for USGS-Forest and Rangeland Ecosystem Science Center, April 19, 2005.

Olsen, A.R., 2005a, North Cascades National Park generalized random tessellation stratified (GRTS) survey design. Prepared for USGS-Forest and Rangeland Ecosystem Science Center, January 26, 2005: USEPA-National Health and Environmental Effects Research Laboratory, Corvalis, OR.

Olsen, A.R., 2005b, Olympic National Park generalized random tessellation stratified (GRTS) survey design. Prepared for USGS-Forest and Rangeland Ecosystem Science Center, January 26, 2005: USEPA-National Health and Environmental Effects Research Laboratory, Corvalis, OR.

Olsen, A.R., 2005c, Mount Rainier National Park generalized random tessellation stratified (GRTS) survey design: Prepared for USGS-Forest and Rangeland Ecosystem Science Center, January 26, 2005: USEPA-National Health and Environmental Effects Research Laboratory, Corvalis, OR.

Olsen, A.R., 2005d, Review of “Study plan for establishing a landbird monitoring program for national parks in the North Coast and Cascades Monitoring Network”: Prepared for USGS-Forest and Rangeland Ecosystem Science Center, March 15, 2005.

Siegel, R.B., Wilkerson, R.L., Jenkins, K., Kuntz, R.C., II, Schaberl, J., Happe, P., and Boetsch, J., 2005, Draft study plan for establishing a landbird monitoring program for national parks in the North Coast and Cascades Monitoring Network, February 25, 2005. A report in partial fulfillment of USGS cooperative agreement 03WRAC0040. The Institute for Bird Populations, Point Reyes Station, CA.

Siegel, R.B., Wilkerson, R.L., Jenkins, K., Kuntz, R.C., II, Schaberl, J., Happe, P., and Boetsch, J., 2005, Study plan for establishing a landbird monitoring program for national parks in the North Coast and Cascades Monitoring Network, April 20, 2005: A final report in partial fulfillment of USGS cooperative agreement 03WRAC0040. The Institute for Bird Populations, Point Reyes Station, CA.

Stevens, D.L., Jr., 2005, Review of “Study plan for establishing a landbird monitoring program for national parks in the North Coast and Cascades Monitoring Network”: Prepared for USGS-Forest and Rangeland Ecosystem Science Center, March 28, 2005.

TerraStat Consulting Group, 2004, Protocols for Analyzing and Reporting Trends in Avian Abundance in NCCN parks: Task 1 Report: Prepared for USGS-Forest and Rangeland Ecosystem Science Center, November 5, 2004, Seattle, WA.

TerraStat Consulting Group, 2005a, Protocols for Analyzing and Reporting Trends in Avian Abundance in NCCN parks: Task 2 Report: Prepared for USGS-Forest and Rangeland Ecosystem Science Center, March 11, 2005, Seattle, WA.

TerraStat Consulting Group, 2005b, Protocols for Analyzing and Reporting Trends in Avian Abundance in NCCN parks: Task 3 Report: BirdTrend Program User’s Manual: Prepared for USGS-Forest and Rangeland Ecosystem Science Center, August 31, 2005, Seattle, WA.

Cooperative Agreements, Modifications, and Contracts:

Rolph, B., Kuntz, R.C., II, Siegel, R.B., and McLaughlin, J., 2001, Cooperative agreement between National Park Service, North Cascades National Park Complex, The Institute for Bird Populations, and Western Washington University: National Park Service agreement number H9471011196.

Rolph, B., Kuntz, R.C., II, Siegel, R.B., and McLaughlin, J., 2001, Modification No. 1 - cooperative agreement between National Park Service, North Cascades National Park Complex, The Institute for Bird Populations, and Western Washington University: National Park Service agreement number H9471011196.

Rolph, B., Kuntz, R.C., II, Siegel, R.B., and McLaughlin, J., 2002, Modification No. 2 - cooperative agreement between National Park Service, North Cascades National Park Complex, The Institute for Bird Populations, and Western Washington University: National Park Service agreement number H9471011196.

Rolph, B., Kuntz, R.C., II, Siegel, R.B., and McLaughlin, J., 2003, Modification No. 4 - cooperative agreement between National Park Service, North Cascades National Park Complex, The Institute for Bird Populations, and Western Washington University: National Park Service agreement number H9471011196.

Rolph, B., Kuntz, R.C., II, Siegel, R.B., and McLaughlin, J., 2004, Modification No. 5 - cooperative agreement between National Park Service, North Cascades National Park Complex, The Institute for Bird Populations, and Western Washington University: National Park Service agreement number H9471011196.

Rolph, B., Kuntz, R.C., II, Siegel, R.B., and McLaughlin, J., 2005, Modification No. 6 - cooperative agreement between National Park Service, North Cascades National Park Complex, The Institute for Bird Populations, and Western Washington University: National Park Service agreement number H9471011196.

Stevenson, J., Jenkins, K., and Siegel, R.B., 2003, Cooperative agreement between United States Geological Survey, Forest and Rangeland Ecosystem Science Center, Corvalis, OR and The Institute for Bird Populations: USGS-FRESC agreement number 03WRAC0040.

Stevenson, J., Jenkins, K., and Siegel, R.B., 2004, Modification No. 1 - cooperative agreement between United States Geological Survey, Forest and Rangeland Ecosystem Science Center, Corvalis, OR and The Institute for Bird Populations: USGS-FRESC agreement number 03WRAC0040.

TerraStat Consulting Group and USGS Forest and Rangeland Ecosystem Science Center, 2004, Protocols for analyzing and reporting trends in avian abundance in North Coast and Cascades Network Park: Purchase Order No. 4-FRSAH-00023.

TerraStat Consulting Group and USGS Forest and Rangeland Ecosystem Science Center, 2005, Modify computer program BirdTrend: Requisition No. 6-9355-0004.

Draft Protocol and Standard Operating Procedures:

Siegel, R.B., Wilkerson, R.L., Jenkins, K., Kuntz, R.C., II, Boetsch, J., Schaberl, J., and Happe, P., 2007, Landbird monitoring protocol for national parks in the North Coast and Cascades Monitoring Network (NCCN), Version 1.0. February 2007, A report in partial fulfillment of USGS cooperative agreement 03WRAC0040: The Institute for Bird Populations, Point Reyes Station, CA.

Draft NCCN Avian Monitoring Protocol and Standard Operating Procedures Scientific Reviews and Response to those Reviews:

Fancy, S. 2006, Review of “Landbird Monitoring Protocol for National Parks in the North Coast and Cascades Monitoring Network (NCCN).”: Prepared for S. Zylstra, U.S. Geological Survey Forest and Rangeland Ecosystem Science Center, Corvalis, OR, May 9, 2006.

Geissler, P., 2006, Review of “Landbird Monitoring Protocol for National Parks in the North Coast and Cascades Monitoring Network (NCCN).”: Prepared for S. Zylstra, U.S. Geological Survey Forest and Rangeland Ecosystem Science Center, Corvalis, OR, June 13, 2006.

Olsen, A.R., 2006, Review of “Landbird Monitoring Protocol for National Parks in the North Coast and Cascades Monitoring Network (NCCN).”: Prepared for S. Zylstra, U.S. Geological Survey Forest and Rangeland Ecosystem Science Center, Corvalis, OR, June 12, 2006.

Siegel, R.B., Jenkins, K., Kuntz, R.C., II, 2006, Response to peer review of “Landbird Monitoring Protocol for National Parks in the North Coast and Cascades Monitoring Network (NCCN)”: Prepared for S. Zylstra, U.S. Geological Survey Forest and Rangeland Ecosystem Science Center, Corvalis, OR, August 2006.

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