



Riparian Landbird Monitoring Protocol for Golden Gate National Recreation Area and Point Reyes National Seashore

Version 4.5

Natural Resource Report NPS/SFAN/NRR—2010/207



ON THE COVER

Spotted Towhee (*Pipilo maculatus*)

Photograph by: Rick Lewis

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Natural Resource Report NPS/SFAN/NRR—2010/207

Thomas Gardali (Principal Investigator)¹
Diana Humple (Landbird Biologist)¹
Mark Herzog (Informatics Specialist)¹
Marcus Koenen (Inventory and Monitoring Program Manager)²
David Press (Data Manager)²
William W. Merkle (Wildlife Ecologist)³
Sarah Allen (Senior Science Advisor)⁴

¹PRBO Conservation Science
Palomarin Field Station
P.O. Box 1157
Bolinas CA 94924

²San Francisco Bay Area Network
Fort Cronkhite Bldg. 1063
Sausalito, CA 94965

³Golden Gate National Recreation Area
Fort Cronkhite Bldg. 1061
Sausalito, CA 94965

⁴Point Reyes National Seashore
Point Reyes, CA 94956

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Executive Summary

This document describes a monitoring program for riparian landbirds in two National Park Service units of the San Francisco Bay Area Network (SFAN) in central-coastal California. The purpose of the monitoring program is to detect population trends and underlying demographic rates (productivity and survival) in order to provide information essential to managing network resources. This monitoring plan provides background on past landbird monitoring in the parks, lists measurable objectives for the monitoring program, and summarizes the monitoring scheme, field methods, and data management and analysis. Landbirds are herein defined as passerine (songbirds) and near-passerine (e.g., woodpeckers, hummingbirds) species. The two largest SFAN parks are included in this monitoring plan: Golden Gate National Recreation Area (GOGA) and Point Reyes National Seashore (PORE). A single focal habitat, riparian, is targeted for monitoring due to its importance to landbirds, ecosystem function, and prevalence in the parks.

The diversity and abundance of landbirds in central-coastal California is extraordinary. The PORE bird list alone includes nearly 490 species (Stallcup 2000). Many of these species nest in the region, are year-round or winter residents, or are regular migrants through the area. The region has a long history of ornithological research and monitoring because of this diversity. Recently, the National Inventory and Monitoring Program funded an inventory of landbirds at the San Francisco Bay Area Network of parks between 1998 and 2002 (Flannery et al. 2001, Hammond and Geupel 2001, Haff et al. 2003). In addition to conducting these inventories, PRBO Conservation Science (PRBO; founded as the Point Reyes Bird Observatory) has been conducting landbird monitoring in the region since 1965, when the organization was founded and work began at PORE (see Ballard et al. 2003, Howell and Gardali 2003). Monitoring has been done continually at PRBO's Palomarin Field Station since 1966, and the program helped give birth to such nationally standardized programs as Monitoring Avian Productivity and Survivorship (MAPS, DeSante et al. 2000) and the Breeding Biology and Research Database (BBIRD, Martin and Geupel 1993, Martin et al. 1997). PRBO has also been conducting annual, standardized point count surveys, nest searching, and constant effort mist-netting at select locations within PORE and GOGA for nearly over a decade (Holmes et al. 1998, Scoggin et al. 2000, Gardali et al. 2003a, Gardali et al. 2003b, Michaud et al. 2004, Samuels et al. 2005). PRBO continues to do intensive long-term monitoring in PORE that is outside of the scope of this monitoring plan (i.e., at the Palomarin Field Station) but that can be used in conjunction with the data collected as part of the National Park Service vital signs monitoring program.

The relationship between the National Park Service and PRBO serves as a model partnership that deserves the continued long-term commitment of both entities.

Specific objectives of the long-term monitoring program of landbirds are to:

- 1) Determine population trends for as many landbird species as possible in riparian habitat during the breeding, fall migration, and winter seasons.
- 2) Estimate reproductive success and annual survival for as many landbird species as possible in riparian habitat.

Coordination outside of the network is necessary to interpret results produced locally and, importantly, to protect these species because their movements during migration, foraging, and molting can sometimes range outside park boundaries. PRBO protocols can be integrated with other resource agencies for compatible population analysis. The SFAN monitoring program contributes to California State and U.S. National efforts to assess landbird population status and trends. PRBO contributes landbird data to MAPS, BBIRD, The Bird Banding Lab (USGS, BBL, Patuxent, MD), California Partners in Flight (CalPIF; www.prbo.org/calpif/; Accessed: June 9, 2009), and to the Avian Knowledge Network (AKN; <http://www.avianknowledge.net/>; Accessed: June 9, 2009) via the California Avian Data Center (www.prbo.org/cadc; Accessed: June 9, 2009).

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Background and Objectives

Monitoring Rationale

In 1992, the National Park Service's (NPS) Inventory and Monitoring Program (I&M) developed a national policy "to better understand [the] dynamic nature and condition" of natural resources, to detect or predict changes that may require intervention, and to serve as reference points for more altered parts of the environment. By integrating this information into NPS planning, management and decision-making, scientific knowledge of natural resources will improve NPS stewardship of our heritage lands (NPS 75: Natural Resources Inventory and Monitoring Guideline 1992). The I&M Program identified all parks in the NPS system with significant natural resources and in 1998 created 32 "networks" or groupings of parks linked by geography and shared natural resource characteristics. The goals of the networks are to work together to develop common monitoring methodologies for data comparability, to reduce the level of effort, and to share resources. The San Francisco Bay Area Network (SFAN) is one of eight networks in the Pacific West Region of the NPS.

The objectives of the monitoring plan presented here (see below) are not designed to specifically evaluate management actions. Instead, the results of the monitoring program will be used to evaluate ecosystem health (i.e., provide early warning of resource change) and thereby inform managers when management actions are warranted and research is needed. However, it is possible, under some circumstances, to detect changes due to management actions – e.g., monitoring is taking place during a situation where a management action with marked consequences occurred (Johnson 2002). PRBO Conservation Science's (PRBO; founded as the Point Reyes Bird Observatory) monitoring work that occurred before and after Vision Fire in the Point Reyes National Seashore (PORE) provides a local example of this type of benefit of monitoring (Gardali et al. 2003a, 2005). Additionally, the monitoring approach herein focuses on more than simply counting birds, and as such will provide much more than an "early warning system" (DeSante and Rosenberg 2001, Gardali et al. 2001). Ultimately, the 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.

This monitoring approach has the advantage of being able to evaluate multiple species (community-level) in riparian habitat. The benefit of this approach is that we can look for patterns common to species with similar ecological requirements, which could in turn yield valuable information about the condition of different ecosystem attributes.

Because this planning strategy must include economizing the monitoring workload with the prioritized objectives and, most importantly, budget constraints, we are recommending volunteer monitoring in the smaller urban parks and not including these in the core monitoring scheme. We feel that it is more important to continue and replicate ongoing monitoring projects than to establish new ones in small urban parks that lack significant "natural" areas (e.g., some Historic Sites). Therefore we are only proposing monitoring in the Golden Gate National Recreation Area (GOGA) and PORE. Consequently, although inventories have been done in the other parks (Pinnacles, Fort Point National Historic Site, Eugene O'Neill National Historic Site, John Muir National Historic Site, San Francisco Maritime National Historic Park, and the Presidio of San

Francisco), we only present the monitoring history for the two parks we will monitor as part of this plan.

Additionally, we will focus on one major habitat type – riparian. This is a priority habitat type in SFAN as well as California and the entire West (see below for further discussion). Focusing on this one general habitat is also cost effective; the habitat diversity and total land area in SFAN is great and obtaining adequate samples throughout would be cost prohibitive.

Landbirds as Vital Signs

In 2003, SFAN biologists and cooperators completed a vital sign indicator selection process that ranked resource indicators in priority order for the network (Adams et al. 2006). Vital signs, as used by the NPS, are defined as any measurable feature of the environment that provides insights into changes in the state of the ecosystem. Vital signs are intended to track changes in a subset of park resources and processes that are determined to be the most significant indicators of ecological condition of those specific resources that are of the greatest concern to each park. The SFAN used four criteria to rank indicators: ecological significance, management significance, legal mandate, and cost and feasibility. The SFAN ranked landbirds as the 17th most important resource indicator to monitor out of 63 considered indicators (Adams et al. 2006). This selection was largely because:

- Landbirds are recognized as indicators of ecological change (Carignan and Villard 2002), and they are relatively easy to monitor.
- Landbirds in SFAN have already been shown to be sensitive indicators of climate change (MacMynowski et al 2007).
- Parks in the SFAN network have a long history of monitoring landbirds. Some sites at PRBO's Palomarin Field Station (in PORE) have been monitored since 1966, with several other sites consistently monitored since 1997. In addition, many sites have a history of inventory and other survey work for landbirds.
- Monitoring is done using standardized methods, with data contributed to larger regional, national, and international databases.
- Landbirds are one of the few vital signs indicators that allow for monitoring a suite of species, including common species and rare species, with diverse ecological requirements.
- Landbirds are an important natural resource throughout the network. Landbirds are a highly visible resource with a great deal of public interest: many bird watchers come to the parks, birds are observable by any park visitor, songs and calls/ behavior are inspiring.
- Monitoring is focused within riparian communities that is a priority habitat within the parks and will contribute to other SFAN needs. Riparian habitat was ranked 16th as a vital signs indicator for the network.

- Several landbird species that occur regularly in the parks are state species of special concern, while others are California Partners in Flight Focal Species (Table 1).

History of landbird monitoring in SFAN Parks

Landbird monitoring has been conducted in many units of SFAN at various levels of intensity, with various combinations of methods, and in several seasons depending on study site (Table 2). Many study sites throughout all the parks were located in riparian areas because of their recognized importance to landbirds.

The park units within the SFAN have excellent information on landbird distribution from previous surveys and inventory work, collections, documented reports, and ongoing monitoring efforts. Existing park resources include checklists for all bird taxa (e.g., Stallcup 2000, Emmons, 2006), county breeding bird atlases (e.g., Roberson and Tenney 1993, Shuford 1993), and habitat- and site-specific landbird inventories (Flannery et al. 2001, Hammond and Geupel 2001, Haff et al. 2003). Flannery et al. (2001) and Haff et al. (2003) assessed the adequacy of coverage to detect at least 80% of species during the landbird breeding season. The various SFAN parks have recently completed and uploaded certified bird species lists to the NPS biodiversity database NPSpecies, along with associated reference, voucher, and observation records.

Golden Gate National Recreation Area

Much of the historic monitoring at GOGA was done in combination with landbird monitoring at PORE. PRBO began monitoring at Lagunitas and Redwood creeks in 1997 as part of a monitoring project focused on breeding birds in riparian habitat. Point counts were a continuation of the Kern River Research's Center Brown-headed Cowbird (*Molothrus ater*) Project initiated in 1995, and were continued for monitoring purposes (Haltermann et al. 1999, Haltermann and Laymon 2000).

Additional point count transects were surveyed as part of the inventory in 1999-2000. Nest searching was initiated in 1997 in order to examine breeding productivity in an important habitat type in the region critical to a diverse group and high abundance of birds (riparian), and to evaluate effects of non-native vegetation and habitat restoration on breeding birds; nest searching was discontinued in 2004 due to lack of funding. Mist-netting was initiated in 2001 as part of the NPS Park Flight program to monitor Neotropical migrants and to collaborate with Latin American biologists, and continues today at the same two riparian sites studied in the nest monitoring program. Mist-netting takes place both during the breeding season as well as during migration. Focusing long-term monitoring in the park on these legacy sites for which we have extensive data increases our power to detect long-term trends.

Table 1. California Bird Species of Special Concern and California Partners in Flight (CalPIF) Focal Species regularly occurring within any of the SFAN parks.

Species	Scientific Name	Season of Occurrence	Bird Species of Special Concern ¹	CalPIF Focal Species
Northern Harrier	<i>Circus cyaneus</i>	Year-round	X	X ³
Ferruginous Hawk	<i>Buteo regalis</i>	Winter		X ³
Burrowing Owl	<i>Athene cunicularia</i>	Winter	X	X ^{3, 7}
Acorn Woodpecker	<i>Melanerpes erythrocephalus</i>	Year-round		X ⁴
Nuttall's Woodpecker	<i>Picoides nuttallii</i>	Year-round		X ⁴
Pileated Woodpecker	<i>Dryocopus pileatus</i>	Year-round		X ²
Olive-sided Flycatcher	<i>Contopus cooperi</i>	breeding/migration	X	X ²
Willow Flycatcher	<i>Empidonax traillii</i>	Migration		X ⁶
Ash-throated Flycatcher	<i>Myiarchus cinerascens</i>	breeding/migration		X ⁷
Loggerhead Shrike	<i>Lanius ludovicianus</i>	Winter	X	X ⁸
Warbling Vireo	<i>Vireo gilvus</i>	breeding/migration		X ⁶
Western Scrub-Jay	<i>Aphelocoma californica</i>	Year-round		X ⁴
Yellow-billed Magpie	<i>Pica nuttalli</i>	Year-round		X ⁴
Common Raven	<i>Corvus corax</i>	Year-round		X ⁷
Tree Swallow	<i>Tachycineta bicolor</i>	breeding/migration		X ⁶
Oak Titmouse	<i>Baeolophus inornatus</i>	Year-round		X ⁴
Red-breasted Nuthatch	<i>Sitta Canadensis</i>	Year-round		X ²
Brown Creeper	<i>Certhia Americana</i>	Year-round		X ²
Wrentit	<i>Chamaea fasciata</i>	Year-round		X ⁵
Golden-crowned Kinglet	<i>Regulus satrapa</i>	Year-round		X ²
Blue-gray Gnatcatcher	<i>Polioptila caerulea</i>	Year-round		X ⁴
Western Bluebird	<i>Sialia Mexicana</i>	breeding/migration		X ⁴
Swainson's Thrush	<i>Catharus ustulatus</i>	breeding/migration		X ⁶
Phainopepla	<i>Phainopepla nitens</i>	Breeding		X ⁷
Yellow Warbler	<i>Dendroica petechia</i>	breeding/migration		X ⁶
Black-throated Gray Warbler	<i>Dendroica nigrescens</i>	winter/migration		X ²
MacGillivray's Warbler	<i>Oporornis tolmiei</i>	breeding/migration		X ²
Common Yellowthroat	<i>Geothlypis trichas</i>	Year-round	X	X ⁶
Wilson's Warbler	<i>Wilsonia pusilla</i>	breeding/migration		X ⁶
Yellow-breasted Chat	<i>Icteria virens</i>	breeding/migration	X	X ⁶
Black-headed Grosbeak	<i>Pheucticus melanocephalus</i>	breeding/migration		X ⁶
Rufous-crowned Sparrow	<i>Aimophila ruficeps</i>	breeding/migration		X ⁵
Sage Sparrow	<i>Amphispiza belli</i>	Year-round		X ^{5, 8}
Grasshopper Sparrow	<i>Ammodramus savannarum</i>	breeding/migration	X	X ³
Savannah Sparrow	<i>Passerculus sandwichensis</i>	Year-round		X ³
Nuttall's White-crowned Sparrow	<i>Zonotrichia leucophrys nuttalli</i>	Year-round		X ⁵
Fox Sparrow	<i>Passerella iliaca</i>	Migration		X ²
Song Sparrow	<i>Melospiza melodia</i>	Year-round		X ⁶
Dark-eyed Junco	<i>Junco hyemalis</i>	Year-round		X ²
Western Meadowlark	<i>Sturnella neglecta</i>	Winter		X ^{3, 8}
Tricolored Blackbird	<i>Agelaius tricolor</i>	Winter	X	X ⁶

¹CDFG Bird Species of Special Concern; ²CalPIF 2002b; ³ CalPIF 2000; ⁴CalPIF 2002a; ⁵CalPIF 2004; ⁶RHJV 2004; ⁷CalPIF 2006; ⁸CalPIF 2005

Point Reyes National Seashore

The monitoring at the Palomarin Field Station under cooperative agreement with and within the Point Reyes National Seashore is not part of this monitoring plan. Although the Palomarin is funded by other sources it is mentioned here because it is a crucial component of the landbird monitoring taking place in the SFAN and will be an outstanding complement to this protocol. Continuous long-term monitoring began at Palomarin in 1966 a year after PRBO was founded, when their headquarters became established at Palomarin. The field station is now the headquarters of PRBO's Terrestrial Ecology Division. Constant effort mist-netting began at Palomarin that year, and has been done in a standardized fashion year-round since 1976. PRBO has been nest monitoring there since 1979, point counts nearby there since 1992, running a second mist-netting station at the site since 1992, conducting fall area search surveys since 2003, conducting year-round area search surveys since 2005, and doing Winter Bird Population Studies since 1980. Habitat and bird/habitat association data is collected at all of these sites. It is a top priority to continue monitoring at this site as it is one of the most long-term landbird monitoring stations in North America, and is the longest run banding station in the United States.

PRBO began long-term monitoring at another site (Muddy Hollow) in 1995 as part of a larger study examining the effects of the Mount Vision Fire on landbirds (Gardali et al. 2005); this study includes point counts and mist-netting (for a shorter duration at a second burned site, Coast Trail, as well), and historically included nest searching as well (Halterman et al. 1999). Much of the historic monitoring at PORE was done in combination with landbird monitoring at GOGA. Many point counts stations we surveyed were also a continuation of a project initiated by NPS in cooperation with the Kern River Research Center in 1995, as was the case with GOGA to study Brown-headed Cowbird effects on Neotropical migratory birds. Additional point count transects were surveyed as part of the inventory in 1999-2000. Other point count sites were established in 2002 as part of the Wildland Urban Interface (WUI) project of PORE.

Relevant Sites Outside the Scope of This Monitoring Plan

PRBO conducts year-round constant effort mist-netting; point counts; and area search surveys at Pine Gulch on the Bolinas Lagoon, located on Marin Open Space land. This site has been surveyed since 1994 and is included herein as it will be used as a replicate site for work conducted in the SFAN.

Measurable Objectives

The following objectives provide the basis for the landbird monitoring program for the network. See Figure 1 for the relationships among objectives, methods, and monitoring season.

Objective 1. Population trends of landbirds

Determine population trends for as many riparian-associated landbird species as possible during breeding season (mist-netting, point counts), fall migration (mist-netting), and winter (mist-netting). The objective is the ability to detect a 50% change in the population size (i.e., abundance) over a 20-year period, with an 80% probability of detecting change if it occurs (Bart et al. 2004, Siegel et al. 2007).

Objective 2. Productivity and survival

Determine long-term changes in productivity and annual survival for as many riparian-associated landbird species as possible. This is done using mist-netting.

Linkages between this and other monitoring projects

This protocol is independent and may be implemented without reliance on any other efforts. However, the protocol does have linkages to other monitoring programs especially those that also focus on riparian habitat.

Plant Community Change Protocol

The plant community change protocol focuses on gross change to vegetation communities in the San Francisco Bay Area. However, the plant community change protocol is in early draft; specific commonalities will be discussed once they are identified.

Salmonid Monitoring Protocol

The salmonid monitoring protocol focuses on changes of the population numbers of coho salmon at GOGA and PORE. In particular, the coho monitoring focuses on multiple lifestages including spawning, juvenile, and smolt stages. Monitoring is conducted in the vicinity of point count transects including those at Lagunita, Olema, Pine Gulch, and Redwood Creek.

Spotted Owl Protocol

Spotted Owl monitoring has occurred at GOGA and PORE since the mid 1990's. Monitoring data provide estimates on occupancy and reproductive success. Spotted Owls inhabit forested areas that are commonly adjacent to riparian habitat. Survey areas include those that coincide with landbird transects.

Streamflow and Water Quality Monitoring Protocols

Streamflow is monitored at gaging stages within each park including Lagunitas, Olema, Pine Gulch, and Redwood Creek. Water quality data are collected throughout the network. Parameters include dissolved oxygen, temperature, conductivity, and pH. Point count transects are located in the vicinity of the streamflow and water quality monitoring sampling sites.

Wetland Monitoring Protocol

The wetland monitoring protocol focuses on the amount of wetland cover and quality throughout the network. The protocol for wetland monitoring is still in early draft. Specific commonalities will be discussed once they are identified.

Each protocol will provide insight into the respective resource being monitored. Taken together, these protocols will provide a strong foundation for understanding complex ecological relationships in riparian habitats. For example, changes in hydrology may imply long-term changes in water quality, streamfish populations, stream wetland characteristics, vegetation communities and associated wildlife populations including landbirds. Specific analyses will be identified as the protocols continue to be developed.

Augmenting the Protocol

As noted above, landbird inventories have been conducted at a variety of riparian sites throughout the network including at Pinnacles National Monument (PINN) and GOGA (Presidio,

Milagra Ridge, and Sweeney Ridge). Because of limited funds not all of these areas are covered by this protocol. Both PINN and GOGA have also acquired new lands that cover significant riparian habitats such as those at Cattle Hill, Corral de Tierra, Mori Point, Pedro Point Headlands, Picardo Ranch, Phleger Estate, and Pillar Point. As more funding or in-kind services become available, riparian habitats at PINN and GOGA will be evaluated and considered for inclusion in future versions of this protocol. Monitoring at new sites, however, will only be implemented once future versions of the protocol are properly peer reviewed.

A point count transect was established during the inventory phase of this project at John Muir National Historic Site. This transect is not included in this protocol because the site is isolated from the rest of the network, does not include riparian habitat, and small sample size / single site makes our ability to detect population trends unlikely. Monitoring at this site, however, would provide the park with interesting information about species site-specific changes in diversity and abundance given that the historic site represents an island in a rapidly urbanizing landscape. To provide information to the park, data can be collected through a volunteer citizen science effort and then contributed to the California Avian Data Center (CADC). CADC allows park managers to look at changes in species diversity, abundance, etc. even if statistically robust population trends can not be detected.

Table 2. Study sites, study site code, season of monitoring, methods, and number of years site has been monitored up to 2009 in riparian areas in PORE and GOGA. “Other sites” include sites within or outside SFAN parks where PRBO conducts monitoring and are relevant to this protocol.

Park	Site Name	Code	Season	Methods Used ¹	# of Previous Years
GOGA					
	1. Lagunitas Creek	LACR	Breeding, Fall	PC, MN	13
	2. Redwood Creek 1	RECR	Breeding, Fall	PC, MN	13
	3. Redwood Creek 2	RECR	Breeding	PC	11
	4. Gerbode Valley	GERB	Breeding	PC	3
	5. Tennessee Valley	TEVA	Breeding	PC	3
PORE					
	6. Arroyo Honda	ARHO	Breeding	PC	17
	7. Abbott's / Kehoe	ABKE	Breeding	PC	2
	8. Lower Olema Creek	LOOL	Breeding	PC	6
	9. Muddy Hollow	MUHO	Year-round	PC, MN	14
	10. Bear Valley	BEVA	Breeding	PC	2
	11. Coast Camp	COCA	Breeding	PC	3
	12. Coast Trail Laguna	CTLA	Breeding	PC	2
	13. Upper Olema	UPOL	Breeding	PC	3
	14. M Ranch	MRAN	Breeding	PC	2
Other					
	15. Pine Gulch	PIGU	Year-round	PC, MN	11
	16. Palomarin (PORE)	PALO	Year-round	MN	41

¹PC=point counts, MN=mist-netting; more methods (e.g., area search) have been used at many of these sites but only those relevant to this protocol are noted.

Sampling Design and Field Methods

Populations Being Monitored

Populations of riparian-associated landbirds (including passerines and near passerines) in the parks during three seasonal periods (breeding, fall migration, and winter) are the focus of this monitoring program. This includes year-round residents, Neotropical migrants, short-distance migrants, and winter residents. While some studies focus exclusively on the breeding season, doing so overlooks the potentially population-limiting role these other time periods have for landbirds, and overlooks as well that the parks are used by species and populations occurring solely outside of the breeding season and that equally would benefit from monitoring and management. We will focus on the full landbird communities associated with riparian habitat but acknowledge that some analyses (e.g., adult survival) will necessarily focus on species where sample sizes are sufficient. Some species will be excluded from analyses; these include those that are not appropriately sampled by the methods we employ here (e.g., shorebirds, waterfowl, wading birds, raptors). However, we will record all species observed during point counts and mist-netting in order to have the most complete picture of the local bird communities and to increase our knowledge of the presence, distribution, and phenologies of those species.

Rationale for Sampling Design Selection

It is a challenge to develop a sampling design for long-term monitoring (e.g., >20 years) versus designs formulated to answer short-term (e.g., three to five years) research questions. This is because many unforeseeable factors will likely act to bias or make interpretation and inference of monitoring results difficult (e.g., habitat succession, Ballard et al. 2003). Often the questions to be asked of long term monitoring cannot be anticipated (Johnson 2002). Still, a good design attempts to maximize the ability to make inferences for an entire area (e.g., National Park unit) or habitat (e.g., riparian with a park) while minimizing sampling effort. A design that takes too few samples will not be able to adequately measure an important change and therefore place the resource at risk whereas too many samples will waste time and money.

Estimation of Power to Detect Trends for the Amount of Sampling Being Instituted

The statistical power of our sampling design was evaluated by examining existing point count data from our legacy dataset. Annual density and variance estimates were calculated based on distance sampling methods (Buckland et al. 2004) and Program *Distance* (Thomas et al. 2006). Parameters estimates were derived using over nine years of data from multiple sites for multiple species (Tables 3 and 4). All data were retrieved from the California Avian Data Center (<http://www.prbo.org/cadc/>; Accessed: June 11, 2009) using the “Ravian” package (www.prbo.org/Ravian; Accessed: June 11, 2009). Ravian is an open-source set of quantitative tools for avian scientists developed by PRBO for the R statistical programming language (R Development Core Team 2009).

Since 1997, PRBO has implemented several point count protocols. These protocols differed primarily in how the “distance-from-observer” for a detection was recorded. We removed data collected in 1997, 1998, and 2000, as we did not believe this protocol was comparable enough to current and future survey methods, nor did the data contain adequate information for distance sampling methods.

Table 3. Inventory of protocols used across years for riparian sites surveyed by PRBO Conservation Science within Point Reyes National Seashore and Golden Gate National Recreation Area.

Site Name	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
Abbot's / Kehoe ¹	A ²	A	-	-	-	-	-	-	-	-	-	-
Arroyo Hondo	A	A	B ³	A	B	C ⁴	D ⁵	D	D	D	B	B
Bear Valley	A	A	-	-	-	-	-	-	-	-	-	-
Coast Trail Laguna	A	A	-	-	-	C	-	-	-	-	-	-
Gerbode Valley ¹	A	A	-	-	-	-	-	-	D	-	-	-
Lagunitas Creek	A	A	B	A	B	C	D	D	D	D	B	B
Lower Olema Creek	A	A	-	-	-	C	D	D	D	D	-	-
Muddy Hollow	A	A	B	A	B	C	D	D	D	D	B	B
Pine Gulch	A	A	B	A	B	C	D	D	D	D	B	B
Redwood Creek	A	A	B	A	B	C	D	D	D	D	B	B
Tennessee Valley ¹	A	A	-	-	-	-	-	-	-	-	-	-
Upper Olema Creek	A	A	-	-	-	-	-	-	D	-	-	-

¹ Site was not used in density estimation / power analysis

² Protocol Code = FR50: Detections were reported within 2 bins (0-50m, and 50+) – not used for power analysis

³ Protocol Code = VCP10_50: Detections were reported within bins (0-10m, 10-20m, 20-30m,30-40m, 40-50m, 50-100m, 100+)

⁴ Protocol Code = VCP25: Detections were reported within bins (0-10m, 10-20m, 20-30m,30-40m, 40-50m,50-75m, 75-100m, 100+)

⁵ Protocol Code = VCP10_30: Detections were reported within bins (0-10m, 10-20m, 20-30m, 30-50m, 50-100m, 100+)

Table 4. List of species for which a power analysis was performed.

Common Name	Scientific Name
Black-headed Grosbeak	<i>Pheucticus melanocephalus</i>
Common Yellowthroat	<i>Geothlypis trichas</i>
Song Sparrow	<i>Melospiza melodia</i>
Swainson's Thrush	<i>Catharus ustulatus</i>
Warbling Vireo	<i>Vireo gilvus</i>
Wilson's Warbler	<i>Wilsonia pusilla</i>

Power analyses were performed using TRENDS software (Gerrodette 1993). In this analysis we wanted to understand the power of the current survey methodologies to detect a 50% increase or decline in population size over 21-22 year period for each species. We evaluated power at two significance levels: $\alpha = 0.05$ and $\alpha = 0.10$. For each species, the following steps were taken to estimate the power of the survey protocol:

1. Used Ravian to retrieve data from California Avian Data Center and export into required structure for analyses in Program *Distance* (see Tables 3 and 4, for list of sites and species, respectively).
2. Estimated global densities and variances for each species for each year between 1999-2008 using Program *Distance*.
3. Estimated initial coefficient of variation (CV1) as the Root Mean Squared Error (RMSE) of the log-linear regression of historical data (1999-2008; see Gerrodette 1987).

4. The following parameters were entered into TRENDS to generate an estimate of power (see Table 5 for results):
- a. **Duration of study:** 22 years (for sampling every third year), 21 years (for sampling every other year or sampling every year)
 - b. **Overall change for duration of study:** 0.5 (50% increase or decline)
 - c. **Coefficient of variation (CV1):** (see Table 5 for species specific values)
 - d. **Significance level:** $\alpha = 0.05$ and $\alpha = 0.10$
 - e. **Rate of change:** negative
 - f. **Tails for significance test:** 2 tail
 - g. **Type of change:** Exponential
 - h. **How CV changes with abundance (A):** CV constant with A
 - i. **Intervals between sampling occasions are:** Equal
 - j. **Effort multiplier:** 1.0

Table 5. Results of density estimation and power analysis. Estimate of power is the probability to detect a 50% decline in the population of interest over a 21-22 year period at two significance levels.

Common Name	Mean Density (# birds / ha)	Standard Error (Mean Density)	Initial CV (CV1)	Power when surveyed for 21- 22 yrs ($\alpha = 0.05$), every:			Power when surveyed for 21- 22 yrs ($\alpha = 0.10$), every:		
				3 rd Year ¹	2 nd Year ²	Year ²	3 rd Year ¹	2 nd Year ²	Year ²
Black-headed Grosbeak	0.689	0.060	0.247	0.6	0.76	0.96	0.75	0.87	0.98
Common Yellowthroat	0.269	0.038	0.371	0.33	0.44	0.72	0.48	0.59	0.83
Song Sparrow	4.34	0.22	0.1	1.00	1.00	1.00	1.00	1.00	1.00
Swainson's Thrush	2.96	0.23	0.198	0.78	0.91	1.00	0.89	0.96	1.00
Warbling Vireo	0.754	0.036	0.146	0.95	1.00	1.00	0.99	1.00	1.00
Wilson's Warbler	2.68	0.087	0.094	1.00	1.00	1.00	1.00	1.00	1.00

¹ Based on 22 years of surveys completed

² Based on 21 years of surveys completed

As expected, annual surveys had the greatest power to detect a 50% increase or decline after ~ 20 years followed by surveys every other year and then every third. Because our protocol is currently to survey all sites every three years, we are most interested in these results: When significance was set at $\alpha = 0.05$, power exceeded 80% for three of the six species and near 80% (0.78) for another. When significance was $\alpha = 0.10$, power exceeded 80% for four of the six species and was nearly 80% (0.75) for a fifth species. These results suggest that the proposed monitoring protocol for point counts will be sufficient.

Analysis of power was not done for mist-netting. However, we have already published population trend results in peer-reviewed journals from a single site (Palomarin), for several species, in two seasons in PORE (Johnson and Geupel 1996, Chase et al. 1997, Gardali et al. 2000, Ballard et al. 2003). A power analysis has already been done for the fall season at a single site in PORE (Palomarin) which indicated that the median power (90% chance of detecting a 50% decline in a species' population over a 25 year period with $\alpha = 0.05$) for six species ranged from 0.59 when sampling was done 1 day per week to 0.78 when sampling frequency was seven days per week (Thomas et al. 2004). Our mist-netting protocol will build on Palomarin with the addition of four banding stations. Hence we are confident we will have sufficient power for several species. Finally, mist-netting will provide much more than simple trend estimates including information on reproduction and survival which will complement trends (see below).

We would like to point out that even species with low power using our criterion or any other for that matter will show a statistically significant trend if the rate of change is steep enough and if there are enough years of data. In addition, results that indicate consistent trends across many species and at many sites, from the two methods, will provide the manager and analyst robust information that will be useful in assessing and interpreting population status.

Multiple Methods

Most discussions of sampling designs discuss the important topics of site selection, randomization, stratification, and statistical power, for example. We note, however, that even a well-designed study can suffer from the use of a single, perhaps poor, sampling method with no ability to validate the results (see Silkey et al. 1999, Ballard et al. 2004, Nur et al. 2004 for SFAN examples of the utility of using multiple methods for validation). This protocol also

recognizes the importance of using multiple methods to validate trends and to examine different but complementary objectives (Figure 1). For example, we can assess trends from surveys of population size and examine primary demographic data (e.g., productivity and survival) to determine the key parameters responsible for population increases or decreases. Hence, this approach can provide managers with more useful information on which to base management actions and research priorities (DeSante and Rosenberg 2001).

Areas of Special Interest

Consistent with the objectives outlined above and following NPS monitoring design recommendations, we have selected “Areas of Special Interest” to focus our monitoring efforts. “Areas” in this case refers to one habitat type: riparian woodland. Riparian habitat was ranked as a relatively high monitoring priority for the SFAN (number 16 of 63 for vital signs indicators; Adams et al. 2006). Riparian habitat may be the most important habitat for landbirds in California and is the most critical habitat for landbirds in the West (Miller 1951, Manley and Davidson 1993, Donovan et al. 2002, RHJV 2004). It provides critical breeding grounds, overwintering grounds, migration stopover sites, and movement corridors for a diverse and abundant group of birds, many of which are dependent on this habitat for survival (RHJV 2004). The density of birds breeding within this habitat is higher than in any other in California. However, this habitat has been severely degraded in the Western U.S., with such loss and degradation thought to be the leading cause of population decline of landbirds (DeSante and George 1994, RHJV 2004) and resulting in state and region-wide emphasis on riparian bird species (RHJV 2004). Riparian ecosystems are naturally resilient, provide habitat connectivity, link aquatic and terrestrial ecosystems, and create thermal refugia for wildlife, all characteristics that can contribute to ecological adaptation to climate change (Seavy et al. 2009).

The choice of a single habitat is also pragmatic in that the high diversity of habitat types in the SFAN would make sufficient sampling cost prohibitive. Additionally, the approach to focus on riparian habitat is further justified by our desire to continue to build upon existing monitoring programs. See also site selection below for a discussion of the strengths and shortcomings of this approach.

Legacy Data

In general, our approach prioritizes and relies heavily on “legacy” datasets, and as such strongly defines our monitoring design and philosophy. Legacy data simply refers to sites where we have existing data (Table 2). The results from our legacy data to date (e.g., DeSante and Geupel 1987, Johnson and Geupel 1996, Chase et al. 1997, Gardali et al. 2000, Chase 2002, Ballard et al. 2003, Gardali et al. 2003a, MacMynowski et al. 2007) make a strong case for the utility of our monitoring scheme to NPS land managers. PORE and GOGA have had monitoring in place long enough to provide species status information.

Monitoring Scale

Our monitoring plan focuses on the spatial scale of PORE and GOGA combined. Local changes may occur due to changes in habitat quality or quantity, for example. However, effective and efficient management actions must have knowledge of larger-scale patterns. Local management actions may be ineffective if larger-scale processes (e.g., weather or landscape) are the primary system drivers. We believe our proposal will provide adequate precision at the local scale and

will benefit from being part of, and informed by, larger-scale monitoring efforts (e.g., MAPS, BBIRD, Breeding Bird Survey, CalPIF, Christmas Bird Count).

Known Limitations

This monitoring design approach has several limitations. First, because we are focusing on landbirds in only one habitat type, some species will be monitored minimally or not at all. However, we feel that it is useful to continue and augment our long-term monitoring efforts in riparian habitats. Additionally, riparian areas have the highest diversity birds in PORE and GOGA (Flannery et al. 2001). Second, our focus on a single habitat type may make long term analysis difficult because habitats change – either through succession or overall boundaries. We believe, however, that succession would be an issue regardless of sampling design and that landbird population response to ecological changes like habitat succession are part of our monitoring objectives and the interpretation of our results. The overall boundaries of riparian areas are not likely to change like they might in other vegetation communities. Third, because our choice of study sites was not random, our ability to make strong inferences to other areas are limited. We recognize that our area of inference is restricted to those areas sampled. However, we believe that we have included extensive areas of riparian habitat within PORE and GOGA. Also, we note that our methods will be replicated and agree with Johnson (2002) that randomization is less important than replication in selecting study units. Further, productivity indices generated from mist-net stations provide a landscape-level, rather than site-specific, measure of productivity (see Site Selection below).

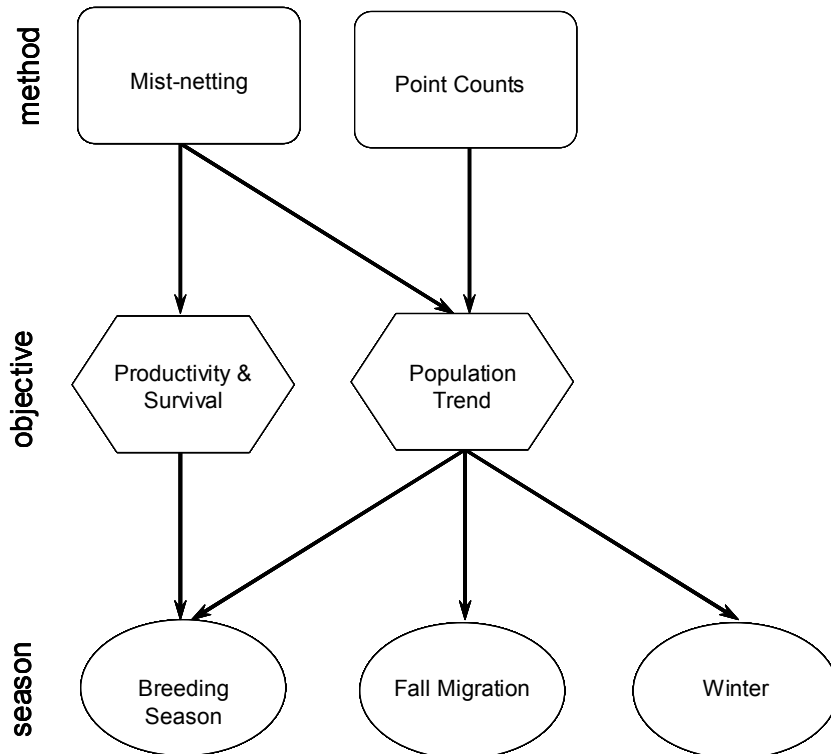


Figure 1. Relationships among field methods, monitoring plan objectives, and monitoring seasons.

Sampling Protocol and Field Methods

We will use nationally standardized monitoring protocols for mist netting (MAPS; DeSante et al. 2000); all data will be contributed to this program. At all point count survey stations we will use the Variable Circular Plot method. In general, we will follow monitoring guidelines outlined in Ralph et al. (1993, <http://www.fs.fed.us/psw/publications/documents/gtr-144/00-front.html>; Accessed: June 9, 2009) and the NPS recommended methods <http://science.nature.nps.gov/im/monitor/protocols/npsbird.doc> (Accessed: June 9, 2009). All PRBO protocols, data structures, field data forms, and programs for data management and analysis are available at <http://www.prbo.org/cadc/> (Accessed: June 9, 2009, Ballard et al. 2008). Field season preparations are provided in more detail in the first Standard Operating Procedure (SOP 1): Preparations and Equipment Setup. Complete protocols for actual field methods (specifically, variable circular plot point count surveys; and mist-netting and banding) and sample data sheets are provided in SOP 4 and SOP 5 and therefore are only introduced here.

Site Selection

Our monitoring efforts are focused on riparian areas, due to the benefits of conducting intensive rather than just extensive monitoring, in order to both examine trends and better understand underlying demographic processes (see also discussion above). The majority of the existing monitoring in SFAN has occurred in riparian habitats. Hence, priority is placed on continuing to monitor at these sites to make the most of previously collected data. By using legacy sites, we will be sampling the majority of willow-alder riparian areas in PORE and GOGA. Legacy point count transect locations were chosen for PORE and GOGA based on number of previous years monitoring and overlap with other methods (Table 2, Figure 2).

All mist-netting locations are from existing sites, and point count transects overlap with these. Mist net stations were picked based on NPS interest within a particular riparian area; Muddy Hollow because of fire, Redwood Creek because of habitat restoration, and Lagunitas Creek and Pine Gulch Creek serve as reference sites. Individual net locations within each station were picked based on expert opinion of their likelihood to capture birds (e.g., appropriate vegetation structure). In many ways, riparian corridors are ideal for establishing mist net stations as they tend to congregate birds from the greater landscape. Additionally, productivity indices generated from mist-net stations provide a landscape-level, rather than site-specific, measure of productivity (see below). This is because the young birds captured include many dispersing individuals from the surrounding landscape, as well as a few individuals that may have fledged from nests nearby the actual netting station. Data on the dispersal characteristics of young and adult birds after the breeding season but before fall migration are just now being obtained for a very few species from radio-telemetry studies (Anders et al. 1997, Vega Rivera et al. 1998) including locally derived studies in GOGA (White et al. 2005). These studies suggest that the landscape from which the dispersing young originate may be on the order of several thousand hectares (perhaps about 10,000-12,000 acres).

For detailed site narratives including GPS coordinates see SOP 4.



Figure 2. Location of point count survey stations and mist-netting stations in riparian habitat, Point Reyes National Seashore and Golden Gate National Recreation Area.

Mist-netting

This protocol uses a standardized constant-effort mist-netting protocol at a network of stations. Each station typically consists of about ten permanent net sites located opportunistically, but rather uniformly, within the interior eight ha of a 20-ha (49.4 ac) study area (DeSante et al. 2001). Typically, one 12-m, 30 or 36 mm mesh mist net is operated at each net site for six morning hours per day, for one day during each of ten consecutive 10-day periods. Starting dates for the MAPS breeding season period are approximately 1 May and operation continues through the ten-day period ending August 8. PRBO continues to run these sites outside the breeding season as well. The fall migration period differs in that periods are shorter (7 days) to avoid missing windows of migration, and goes from mid-August through the end of October. Winter mist-netting stations return to the 10-day period approach and continue from the beginning of November through April. In addition, PRBO runs a more intensive mist-netting station at Palomarin in PORE (3-6 days per week). All birds captured are identified to species, age, and sex using criteria in Pyle (1997) and, if unmarked, are banded with a uniquely numbered aluminum band provided by the U.S. Geological Survey/Biological Resources Division Bird Banding Laboratory. Specifics of the MAPS protocol can be found at <http://www.birdpop.org/MANUALS.HTM> (Accessed: June 9, 2009), and SOP 7 defines how PRBO protocols differ from MAPS protocols.

Point Count Surveys

Variable Circular Plot Counts are a point count methodology that incorporates a measure of detectability into population estimates. In the SFAN these are done during the breeding season. All birds seen or heard at each plot are recorded during a 5-minute sampling period. All birds, regardless of distance detected from the observer are counted and recorded. For all species, each individual bird will be recorded as a separate observation. Distances will be estimated to the nearest 10, 20- or 25-meter interval. Specifics of the PRBO VCP method can be found in SOP 6 and also at: <http://data.prbo.org/cadc2/index.php?page=songbird-point-counts> (Accessed: June 9, 2009).

Sampling Frequency and Schedule

Mist-netting will be conducted every year (Table 6). Mist netting is conducted year-round in PORE at PRBO's Palomarin Field Station and at Muddy Hollow; year-round at Pine Gulch on the Bolinas Lagoon on Marin County Open Space land, included in this narrative as it is used as a replicate site for park sites; and in spring through fall in GOGA at Redwood and Lagunitas creeks (Table 7; also see Table 2 for more details). Mist-netting data are contributed to MAPS, but we also prioritize running them outside of the breeding season in order to sample different species, and to monitor species and individuals during equally critical time periods. The SFAN monitoring program is not only for breeding landbirds but also for other landbird species using the parks, some of which are only present outside the breeding season, but are present in numbers for which population trends could be detected (see Ballard et al. 2003). At the main Palomarin site, nets are run six days per week May through November and three days per week December through April. At all other sites, nets are run approximately once every 10 days May through mid-August, once every seven days mid-August through October, and, when winter

mist-netting is done, once every 10 days November through April. There are 20 nets at Palomarin, 11 at Redwood Creek, and 10 at each of the other sites.

Point counts will be conducted once every third year (Table 6). Point count transects will be surveyed twice per year during the peak landbird breeding season. The first visit will be in May and the second in June (Table 7), with a minimum of 10 days between surveys of each transect.

Table 6. Sampling and reporting schedule from 2011 to 2020.

Activity	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Mist Netting										
Point Count										
Progress Reports										
Analysis & Synthesis										

Table 7. Monthly sampling schedule for mist-netting and point counts surveys.

Activity	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Mist Netting (Muddy Hollow, Pine Gulch, Palomarin)												
Mist Netting (Redwood; Lagunitas Creek)												
Point Counts (all sites)												

Field Season Preparations and Equipment Setup

The field season for mist-netting is year round and hence equipment is constantly inventoried, checked for accuracy (e.g., scales), wear (e.g., nets), and resupplied or repaired as needed. Point counts occur during the breeding season and will be conducted by staff already trained in the songs and call of all birds in the area. More detail (e.g., equipment check lists) can be found in SOP 1.

Field Safety

Field work in the parks of the SFAN presents a variety of safety considerations. Details are provided in the San Francisco Bay Area Network Field Safety SOP 1.1 available on the network drive: X:\Shared\Standard Operating Procedures\SFAN Field SOPs\Standard Operating Procedures\Safety. Safety considerations including excerpts from a Job Hazard Analysis specific to this protocol are also highlighted in SOP 2.

Data Management, Analysis, and Reporting

Data Management

In order for the landbird monitoring program to meet I&M Program goals, a detailed management plan is needed to ensure data quality, interpretability, security, longevity and availability. The data collected by PRBO at the SFAN parks are entered into larger, regional data sets, following formats developed in Visual FoxPro by PRBO that have been in use for over 10 years and available through the California Avian Data Center (see SOP 8). Digital data are transferred annually to the SFAN data manager who converts the data into a relational Microsoft Access XP database that meets I&M standards. By means of a variety of methods, including scanned PDF versions of datasheets, off-site storage, and server back-ups, these data are archived and kept secure for the long-term at both SFAN and PRBO. Following guidance from the NPS I&M Program, a metadata record for the SFAN landbird database will be developed in accordance with current NPS standards and posted to the NR-GIS Data Store.

Standard Operating Procedure #8: Data Management describes in further detail how the SFAN landbird monitoring protocol meets the data management objectives through data entry specifications, database design, quality assurance and control measures, metadata development, data maintenance, data storage and archiving, and data distribution. These procedures are explained for the two types of landbird data included in this monitoring plan that are collected by PRBO for the SFAN: point count surveys and mist-netting. See the data dictionary and other documentation in Appendix 1 of SOP #8.

Data Analysis

PRBO will provide information on timing, effort, and locations of surveys on 3-year schedule consistent with progress reports. PRBO will provide formal analyses of all types of data every sixth year when no fieldwork will be conducted (with the exception of mist-netting which is dependent on outside funding sources). The data analysis for the riparian landbird monitoring program will:

- Conduct analyses of long-term trends for individual species over time.
- Conduct analyses of trends in reproductive success as indexed by capture rates of the ratio of adult to young and/or total captures of young.
- Conduct analyses of adult annual survival for a subset of species using Program MARK (White and Burnham 1999).

Point Count Data

We will use linear (log-linear) regression models of avian density data using point count data for PORE and GOGA combined. Program *Distance* (Buckland et al. 2001, 2004) will be used to calculate densities for those species with sufficient sample sizes. See SOP 9 for more information.

Mist-netting Data

We will examine population trends (as indexed from capture rates) from mist-netting data. These will be presented for species with sufficient sample sizes. We will use regression models of log transformed capture rates (see Ballard et al 2003 for an example). Capture rates of young birds (Hatch-year) will be presented as an index to reproductive productivity and we will look for annual trends in these. Annual apparent survival estimates may be provided for some species depending on sample sizes using Program Mark (White and Burnham 1999). See SOP 9.

Reporting

The two reports developed for this program will be a (1) simple progress report and (2) periodic analysis and synthesis report (see Table 6 for reporting schedule). An overview is provided in this section with further details presented in SOP 10. Templates are available on the NPS Natural Resources Publications Management website: <http://nature.nps.gov/publications/NRPM> (Accessed: June 9, 2009). In addition, Table 8 summarizes all reports, updates (e.g., I&M Updates, website updates), and outreach products developed through the SFAN I&M Program.

Progress Reports

Progress reports will provide a general overview of activities from each year's field season. They will be due 15 November of each year on three year cycles (Table 6). The progress report and responsibilities include:

1. Archive old data
2. Document monitoring activities
3. Document changes in the monitoring protocol
4. Public interest highlights

It should be noted that the California Avian Data Center will be developing online analysis tools that will provide live trend estimates for mist-net and point count data. Hence, annual trend reports for the SFAN will become automated.

Analysis and Synthesis Reports

Analysis and Synthesis Reports will be completed every six years (Table 6) and will provide detailed analyses of population trends and / or another focused analysis. Results will be interpreted to provide specific information related to the measurable monitoring objectives. The content of the Analysis and Synthesis reports will vary and evolve as more data are collected, priorities reassessed, analysis/visualization tools developed (via the California Avian Data Center), and analytical techniques refined. However, in general these reports will cover the following:

1. Estimate patterns and trends in abundance
2. Estimate vital demographic rates such as breeding productivity and survivorship
3. Evaluate the efficacy of current monitoring scheme to achieve objectives
4. Interpret data for the park within a multi-park, regional, or national context
5. Recommend changes to monitoring and management practices
6. Recommend research priorities
7. Public interest highlights

Program and Protocol Reviews

Program reviews will be conducted every six to 10 years in order to ensure that the protocol is meeting stated objectives. The reviews will be conducted by scientists who are not directly involved with the implementation of the protocol. The reviewers may be associated with the NPS, other government agencies (e.g., USGS) or through cooperative agreements (e.g., Cooperative Ecosystem Studies Units).

The protocol reviews include the following and detailed in Table 8:

1. Formal reviews of operations and results and reports
2. Review of protocol design and products to determine if changes are needed
3. Evaluation of methods and objectives

Table 8. Summary of reporting and communication products.

Product	Lead	Audience	Schedule	Summary
Progress Report	PRBO Conservation Science	Park Resource Managers	3 years	- Archive data and document monitoring activities -Document changes (if any) in the monitoring protocol -Increase communication within the park and network
Analysis and Synthesis Report	PRBO Conservation Science	Park Resource Managers	6 years	-Determine abundance patterns -Analyze data to determine the level of change that can be detected using the existing sampling scheme -Provide context, interpret data for the park within a multi-park, regional, or national context -Interpret data in context of trends from other riparian vital signs -Recommend changes to management practices
Program and Protocol Reviews	Network Program Manager	Program Lead, I&M Technical Steering Committee	6-10 years	-Periodic formal reviews of operations and results -Review of protocol design and product to determine if changes are needed -Part of the quality assurance – peer review process
Executive Briefing	Network Program Manager	Program Managers, Superintendents, Front line interpretation staff	3 years (upon completion of annual report)	Two-page summary that lists monitoring objectives and questions, discusses annual results, and provides a regional context.

Table 8. Summary of reporting and communication products. (continued)

Product	Lead	Audience	Schedule	Summary
Vital Sign Report Card	Network Program Manager	Program Managers, Superintendents, Front line interpretation staff	6 years (upon completion of Analysis and Synthesis Report)	Two-page summary that aggregates trend data into an index.
Web Site Intranet	Network Program Manager	Park Staff	Annually or as needed	Post all completed reports
Web Site Internet	Network Program Manager	Park Staff, General Public	Annually or as needed	Post all Executive Briefings, Report Cards,
Park Presentations	PRBO Conservation Science	Park Staff	6 years	Provide a presentation to park staff during senior staff, all employee, or division meetings at each park upon request. Gives staff an opportunity to ask questions about the program.
IM Update	Network Program Manager	Park Staff	Quarterly	This one-page monthly e-mail provides park staff with a short update on vital signs projects. Text should be no more than one paragraph.
Photos	PRBO Conservation Science	For all reports and publication	Continuous	High quality publication quality photo are needed to support all communication products. For digital photos that means 300 pixels per inch resolution in a plain or compressed TIF format. Specialist should make every effort to document ongoing work, special incidents, site visits for communication purposes.

Operations

Principal Cooperators and NPS Lead

Protocol development was completed through a cooperative agreement with PRBO Conservation Science. Principal cooperators are Thomas Gardali, Diana Humple, Mark Herzog, Grant Ballard, and Geoffrey R. Geupel from PRBO; William Merkle, GOGA Wildlife Biologist, Marcus Koenen, SFAN Network Program Manager, David Press, SFAN Data Manager, and Sarah Allen, PORE Senior Science Advisor.

In past years, PRBO has been in a cooperative agreement with NPS to conduct monitoring at GOGA and PORE. PRBO has an intensive and extensive training program for the study of landbirds.

Key roles for implementing the landbird monitoring program include:

PRBO Project Lead - Terrestrial Landbird Ecologist

Coordinates PRBO activities. Trains and supervises field staff, coordinates site visits, oversees data entry, manages and archives data, develops annual reports, analysis and syntheses reports.

PRBO Data Manager

Reviews and enters data into PRBO databases. Runs queries and prepares data for progress and analysis and syntheses reports.

PRBO Statistician

Conducted power analysis. Responsible for data analysis presented in analysis and trend reports. Also involved in preparing and reviewing data for analyses.

PRBO Senior Biologist, Banding Supervisor, Field Staff, and Interns

Field work is lead by the PRBO senior biologist and banding supervisor. Each year, staff and four interns are hired to run mist-nets. PRBO staff will conduct all point counts. Both staff and interns will enter data and be responsible for error checking.

SFAN I&M Program Manager

Responsible for overseeing the cooperative agreement. Key liaison between PRBO and parks. Is responsible for internal oversight and program review. Reviews annual and long-term trend reports. Oversees the process for publication and distribution of reports.

SFAN I&M Data Manager

Transfers data from PRBO to the Network and works with PRBO to construct the metadata record.

Wildlife Ecologist and Science Advisor

Review protocol, progress reports, and analysis and synthesis reports.

Cooperative Agreement

PRBO has a long relationship with the National Park Service because they established their bird banding lab at the Point Reyes National Seashore in 1965, shortly after the park was established.

The monitoring program is exercised under a cooperative agreement between Point Reyes National Seashore and PRBO Conservation Science (Agreement number 1443-CA-8530-00-044). This agreement has been in place for several years. Under this agreement, the cooperators share resources, personnel and equipment.

Research Permits

This sampling strategy is an extension of ongoing work within PORE and GOGA and has thus already been permitted and deemed in compliance with local park-level and national standards. PRBO is authorized to capture and mark birds by the U.S. Department of Interior, U.S. Geological Survey Biological Resources Division Bird Banding Laboratory (permit Number 09316-DC). All researchers are required to file for permits and to have copies on hand when in the field. Details for the permit application process are provided in the SOP 2: Site Visits.

Scheduling

General schedules for fieldwork and reporting can be found in Tables 6 and 7. Other scheduling details can be found in the Standard Operating Procedures: e.g., scheduling field crews (SOP 1); obtaining site visit permission (SOP 2); training field crews (SOP 3).

Budget

The annual estimated cost for monitoring ranges between \$93,588.00 and \$157,108.00. The program budget is presented separately for: (1) overall program FY11-15 (Table 9), (2) mist-netting (Table 10), (3) point count surveys (Table 11), (4) project management (Table 12), and (5) Analysis and Synthesis Reports (Table 13). Project management includes salaries for PRBO Project Leader and PRBO Data Manager to provide program oversight along with quality assurance and quality control of all data.

The funds needed to implement this program are contributed by NPS Inventory and Monitoring Program, PRBO, and, occasionally, by other partners. PRBO contributes in kind costs for all surveys at the Palomarin Field Station, all mist-netting operations, and most of the data management prior to its transfer to NPS (Tables 9 – 13). Both GOGA and PORE provide in kind support through involvement of the Wildlife Ecologist and Science Advisor. The NPS Inventory and Monitoring Program provides in kind support through involvement of the data manager and network program manager.

Although data management time is not presented as a line item in the budget, data management is part of all staff members including interns, field staff, senior field biologist, banding supervisor, project leader, and statistician. In addition the NPS network data manager reviews data and completes metadata. We estimate that approximately 1/3 of total project cost is directed toward data management, reporting and analysis.

The SFAN will cover \$44,520.00 of the total during years when point counts are conducted and will support the project with \$25,000 during years that Analysis and Syntheses Reports are completed. PRBO will cover each year's balance.

Table 9. Overall program budget scenarios FY11 - FY15.

Description	FY11	FY12	FY13	FY14	FY15
Income					
NPS Inventory and Monitoring Program Funding	\$44,520	25,000		\$44,520	
NPS In-kind*	\$24,000	\$24,000		\$24,000	
PRBO In-kind	\$73,771	\$84,108	\$93,588	\$36,071	\$93,588
Total Income	\$118,291	\$133,108	\$93,588	\$104,591	\$93,588
Expense					
Mist Netting (See Table 10)	\$79,888	\$79,888	\$79,888	\$79,888	\$79,888
Point Count Surveys (See Table 11)	\$24,703			\$24,703	
Project Management (See Table 12)	\$13,700**	\$13,700	\$13,700	\$13,700**	\$13,700
Analysis and Synthesis Report (See Table 13)		\$39,520			
Total Project Cost	\$118,291	\$133,108	\$93,588	\$104,591	\$93,588

* NPS in-kind contribution includes approximately 1 pay period each for GOGA wildlife ecologist, PORE science advisor, I&M program manager, and I&M data manager.

** Includes cost of progress reports

Table 10. PRBO Budget for mist netting.

Staff	Hourly Rate	#Months	Total Salaries
<u>Salaries & Benefits</u>			
Project Leader	\$41.24		
Banding Supervisor (includes some data mgt)	\$31.12	4	\$21,578
Data Manager	\$34.19		
Total Salaries & Benefits			\$21,578
<u>Other Direct Costs:</u>			
Interns (4 interns x \$826 per month)			\$39,648
Project Supplies & Equipment			\$3,000
Travel (mileage, gas, etc.)			\$4,000
Total Other Direct Costs			\$46,648
Total Direct Costs			\$68,226
Overhead *			\$11,662
Total Mist Netting Costs			\$79,888

*Overhead is 25% of non-salary expenses

Table 11. PRBO Budget for point count surveys.

Staff	Hourly Rate	#Months	Total Salaries
<u>Salaries & Benefits</u>			
Project Leader	\$41.24		
Senior Field Biologist (includes some data mgt)	\$31.12	4	\$21,578
Data Manager	\$34.19		
Total Salaries & Benefits			\$21,578
<u>Other Direct Costs:</u>			
Project Supplies & Equipment			\$500
Travel (mileage, gas, etc.)			\$2,000
Total Other Direct Costs			\$2,500
Total Direct Costs			\$24,078
Overhead*			\$625
Total Point Count Costs			\$24,703

*Overhead is 25% of non-salary expenses

Table 12. PRBO Budget for project management.

Staff	Hourly Rate	#Months	Total Salaries
<u>Salaries & Benefits</u>			
Project Leader (includes some data mgt)	\$41.24	1	\$7,148
Senior Field Biologist	\$31.12		
Data Manager	\$34.19	1	\$5,927
Total Salaries & Benefits			\$13,075
<u>Other Direct Costs:</u>			
Travel (mileage, gas, etc.)			\$500
Total Other Direct Costs			\$500
Total Direct Costs			\$13,575
Overhead*			\$125
Total Project Management Costs			\$13,700

*Overhead is 25% of non-salary expenses

Table 13. PRBO Budget for Analysis and Synthesis Report

Staff	Hourly Rate	#Months	Total Salaries
<u>Salaries & Benefits</u>			
Project Leader (includes some data mgt)	\$47.42	2	\$16,440
Senior Field Biologist	\$31.12		
Statistician (includes some data mgt)	\$52.27	2.5	\$22,648
Total Salaries & Benefits			\$39,088
<u>Other Direct Costs:</u>			
Travel (mileage, gas, etc.)			\$200
Total Other Direct Costs			\$200
Total Direct Costs			\$39,288
Overhead*			\$50
Total Analysis and Synthesis Report Costs			\$39,338

*Overhead is 25% of non-salary expenses

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Standard Operating Procedure (SOP) 1: Preparations and Equipment Set up V.2.0

Revision History Log

Prev. Version #	Revision Date	Author	Changes Made	Reason for Change	New Version #
1.0	Oct 2006	T. Gardali	Minor suggestions	NPS internal review comments	2.0

This Standard Operating Procedure explains the procedures for (1) preparing field narratives and maps; (2) preparing GPS units for use and with coordinates; (3) determining equipment needs; (4) reviewing training protocols and topics; and (5) scheduling field crews.

Prepare Field Narratives and Maps

Each field biologist or crew will be given printouts of the most recently updated narratives and maps for each site. This applies to point count transect and mist-netting station locations. These include navigation to the site and navigation around the site (to facilitate finding points or nets once in the field). Point count transect narratives will include GPS coordinates for all stations in case of GPS unit malfunction.

Prepare GPS Units

Each point count field biologist will receive a hand-held Garmin GPS unit with newly uploaded point count station locations. These will be uploaded prior to the field season in order to ensure that any changes made in previous years are included. Additionally they will be set up in appropriate datum and configuration (NAD83 and UTM's, respectively). See also SOP#8.

Equipment Needs

Equipment should be inventoried, organized and made ready for the field season a few weeks in advance of it beginning in order to address any needs that have to be met. Some of these items will be provided and others (e.g., binoculars, watch) are expected to be owned by the biologist.

Each point count surveyor needs:

- Park Radio or cell phone
- Binoculars (high quality)
- Field Notebook
- Standard Datasheets
- Narratives

- Field Maps
- Pens (black ballpoint and permanent marker)
- Flagging
- Clipboard (with rubber band or clip)
- Watch (must indicate seconds)
- GPS unit (with extra battery set)
- Range finder (for distance determination)
- Compass
- Bird ID reference book (National Geographic, Peterson's, or Sibley's)
- Bird songs CD
- First aid kit
- Sunscreen/Hat
- Water/snacks
- Camping gear (if applicable)
- Rain shell/warm clothes

Each mist-netting crew needs:

General Items:

- 2-way radios
- Pyle (1997) Identification guide
- Tabular Pyle identification guide
- Field guide
- Black pens (4+)
- Bands: for all sizes, both current/pre-strung bands and backup string of each
- Leg Measurement Gauge
- Color bands: for all sizes, all colors
- Banding pliers
- Wing rule(s) (make sure it works for the specific banders, i.e. "leftie" vs. "rightie")
- Plastic ruler
- Calipers
- Calculator
- Scale
- Backup 9V battery for scale
- Weighing canisters, all sizes
- Scissors
- Sharpie pen
- Band remover and aluminum wire
- Fresh sugar water
- Compass
- Thermometer
- Clipboard (3)
- Extra flagging
- Acetone
- Q-tips
- Pyroopen

Data Binder:

- current banding sheets
- extra banding sheets
- journal pages
- net location maps

Color band note book (as applicable):

- printout of all color banded birds
- new color combo sheets

Informational Binder:

- Copy of current banding permits
- AOU codes and band sizes
- Banding sheet codes
- Palo special handling notes
- Education Handouts

Other supplies:

- First Aid Kit
- Nets, including 1 extra (12)
- Poles (if not left at site)
- Extra set of poles (all riparian sites)
- Bird bags (clean)
- Extra rope
- Hammer/mallet
- Extra stakes/rebar
- Clothespins (marked)
- Extra plastic bags for nets
- Transportable Hot Box
- Machete/clippers
- Grass cutters

Review Training Protocols and Topics:

In preparation for training incoming biologists, trainers will review all appropriate:

- Protocols and SOPs
- Training of bird plumage and calls
- Field safety considerations

Scheduling Field Crews

- Field crews will have been hired or identified as early as possible (for the breeding season, this is generally done late winter).
- Prepare a timetable for conducting each point count visit. Determine appropriate windows for each visit (see SOP on conducting point count surveys for frequency and timing of visits). Generally a single transect (9 to 18 points) will be counted within a single morning.
- Assign point count transects to biologists and provide them with the timetable in which they must be completed. As much as possible vary observers between visits to a transect.
- Schedule mist-netting visits to each site and assign crews to each visit (see SOP on conducting mist-netting for frequency and timing of visits).

Literature Cited

Pyle, P. 1997. Identification Guide to North American Birds, Part I. Slate Creek Press, Bolinas, Calif.

Standard Operating Procedure (SOP) 2: Site Visits and Field Safety V1.1.

Revision History Log

Prev. Version #	Revision Date	Author	Changes Made	Reason for Change	New Version #
1.0	6/2009	Marcus Koenen	Minor formatting and editing. Added field safety.	To meet NRR guidelines	1.1

Purpose

This SOP provides guidelines that should be followed before, during, and after all site visits. Field safety procedures are also discussed.

Scope and Applicability

All park researchers are required to report to NPS staff regarding activities and itinerary within the parks for monitoring biologists safety and that of others. Especially, in these times of heightened national security, your itinerary is critical to NPS staff. Park staff may need to contact you while you are in the field and may need to provide assistance in case of emergency. In addition, park researchers will need to be aware of any recent access restrictions.

Park rangers need to be aware of research activities because you may be conducting activities that regular park visitors are not allowed. Informing park staff can minimize information stops by park rangers and can provide interpretive opportunities to park visitors. In addition, many parks have staff and seasonal employees that would like to accompany you in the field and help in any way they can.

This SOP provides a checklist of activities that must occur in order to streamline site visits and ensure appropriate communication with parks has occurred

Procedures and General Requirements

Permit

Field staff, if cooperators, need to make sure that all permits are on hand. For reference, the permit application form can be accessed online: <http://science.nature.nps.gov/research>

Site visit notification

Prior to conducting site visits, field staff should review the Site Visit Checklist (Table 14). Contacting park staff should be done at least one day before heading into the field (Table 15) as a

matter of courtesy and safety. This gives park staff an opportunity to pass on important safety considerations. In some areas you may also need to arrange for access to study sites. E-mail notification is generally acceptable. Follow up phone calls may be needed if changes take place.

Table 14. Site Visit Checklist

Check	Required Action
	Copy of permit is on hand.
	Contact indicated on permit has been informed regarding your site visit including sampling locations, mode of transportation, number of field technicians, and expected sampling times.
	I & M Staff has been cc'd with same information to the park.
	Park and I & M Staff has your contact information
	Your cell phone or radio is fully charged.
	All field technicians have reviewed SOP Field Safety and know how to contact emergency personnel or park staff if needed

Table 15. I&M Contacts for the following parks

Park	Contact	Number
GOGA	Bill Merkle	415-331-2894
PORE	Natalie Gates	415-464-5189

Environmental Precautions

Sudden Oak Death

When sampling in areas known to carry *Phytophthora ramorum*, the organism responsible for causing Sudden Oak Death, you must disinfect yourself, your vehicle, and your gear to avoid spreading the infection.

The Crew Leader should familiarize herself with known infection sites, and sites where infection is possible due to presence of potential host plants. To minimize the risk of spread, the following measures should be incorporated into field surveys:

- avoid parking in mud;
- do not transport water, soil or plant material;
- carry cleaning materials in your vehicle; use an old screwdriver, stiff brush, and towel for removing mud and other debris, then rinse with water and spray with a disinfectant, such as Lysol or a 10% bleach solution;
- consider having separate sets of footwear for infected and non-infected sites; and
- if you suspect you have found a new infestation site, record the location and symptomatic hosts and report to Vegetation Management for the site's park.

Marijuana Cultivation

Marijuana cultivation has been an increasing problem at both Golden Gate and Point Reyes. Tens of thousands of plants have been removed at these parks in recent years. Marijuana fields were often found by field technicians who came across them accidentally. Fields are often in the understory and include infrastructure such as water pipes, small ponds, sheds, and other obvious signs of activity. Guns and ammunition have also been found and these areas are considered dangerous with High Risk to personnel. If field staff accidentally enter a marijuana field, they MUST leave immediately. These incidents must be reported to law enforcement at either GOGA or PORE immediately. Location information including maps or GPS are valuable to law enforcement staff for relocating fields.

Safety Precautions

Weather and Field Attire

Summer conditions are often mild (between 60 - 80°F), but when conducting fieldwork along the coastal environment, it is important to dress appropriately for a range of weather conditions. Because of the possibility of encountering poison oak and general uneven terrain found off-trail, field personnel should wear long pants and high-topped hiking boots. Leg gaiters are also recommended to reduce the exposure to poison oak and the risk of tick bites during surveys. Since surveys can last longer than anticipated, field personnel are encouraged to take extra food and drinking water into the field.

Field Hazards

Biting or stinging invertebrates (wasps, spiders, ticks) may be encountered. The bites or stings from these animals can be painful, but usually not fatal. If bitten or stung and painful swelling or an allergic reaction occurs, seek medical attention immediately. Check your clothing and exposed skin frequently when in the field for ticks and upon returning from the field, do a more thorough body search for ticks.

Poison oak is found throughout the owl habitat in the study area. Before doing any fieldwork personnel should become familiar with the dangers associated with exposure to this native plant. If exposure occurs wash thoroughly with soap and rinse with plenty of water upon returning from the field and then apply Tecnu® ointment (provided at headquarters). If a strong reaction occurs, seek medical attention and alert your supervisor as soon as possible.

Job hazard analysis (JHA) for landbird monitoring activities.

Table 16 is excerpted from the Job Hazard Analysis (JHA) developed for landbird monitoring at Point Reyes National Seashore. The JHA analyzes the duties, tasks, and potential hazards associated with the program, and addresses the hazards through safe work behaviors and procedures.

Table 16. Excerpt from landbird Job Hazard Analysis

Work activities	Hazards	Controls and Safe Behaviors
Office Work- Computer use for email and data entry	Muscle and eye strain, repetitive stress injury	Proper posture and use of ergonomic furniture Take breaks every hour

Table 16. Excerpt from landbird Job Hazard Analysis (continued).

Work activities	Hazards	Controls and Safe Behaviors
Travel to Field Locations in Vehicle	Driving hazards such as accident	Use defensive driving techniques Expect oncoming traffic on one-lane roads in park Be alert for foggy conditions Watch for deer, elk and other wildlife, and adjust speeds to safely operate around areas of high use Obey traffic laws and wear seatbelt at all times Do not drive when fatigued, be familiar with route or prepare for unknown route Do not talk on radio or cell phone while driving Do not put hot drinks on your lap Be familiar with the vehicle and its operation Check gauges, tires, wipers, fluids and replace when necessary Check vehicle has spare tires, jumper cable and jack with all parts.
Hiking to work areas on trails, routes or off trail navigation	Getting lost or confused as a group Losing a crew member Loose footing Lightning storms	Have map, compass, GPS and other navigational aids and know how to use them. Travel together when off-trail Make sure both members of the team are aware of location, and can find route out if they are separated. When trail hiking, plan stops at trail junctions to regroup. Arrange meeting places and times -- all crewmembers must wear a watch. Have a travel plan for each day and make sure it is understood by all crewmembers Stay in communication via radio or stay in sight Cell phone and/or radio and spare batteries If lost or disorientated, stay calm, assess location by consulting map and landmarks, and proceed to nearest road or trail. Do not panic -- Have a mental plan for what to do if lost If injured, stay put and radio dispatch. When traveling in areas with steep or unstable terrain, stagger your positions so that you are not immediately below someone, yell "rock" if you dislodge one. In the event of a lightning storm, turn your radio off, if near a vehicle, get entirely inside. If in the out of doors try to do the following: separate the group, get off ridge tops and away from trees, get as low as possible and if possible lie on non-conductive material.

Table 16. Excerpt from landbird Job Hazard Analysis (continued).

Work activities	Hazards	Controls and Safe Behaviors
	Wind storms	If it is windy enough to blow small twigs and branches out of the trees, try to get out of the woods or find an area away from hazard trees
	Exposure to cold, wet conditions	Wear proper equipment- and bring extra layers. Recognize the signs of hypothermia in yourself and others Carry and eat high-calorie foods, stay well-hydrated
	Exposure to heat and sun	Have hat, sunscreen and sunglasses
	Overexertion and dehydration	Recognize the signs of dehydration Take frequent rest stops (15 min per every two hours) and stay hydrated
	Injuries due to hiking (aches, sprains and blisters)	Pay attention to footing- plan ahead for the route to avoid steep, unstable terrain Use appropriate footwear, boots and socks. Prevent blisters and have blister treatments (moleskin, tape etc) accessible.
	Injuries due to falling (lacerations, broken bones, head injuries)	Pay particular attention to traveling on steep slopes, unstable terrain, through dense vegetation, and in foggy conditions. Practice fall- arrest techniques (roll on to stomach, dig elbow, feet and knees in). Have first aid kit, stabilize injured person, treat for shock and know how to initiate rescue via radio
	Injuries due to carrying a heavy pack	Reduce pack weights when possible Pay attention to how you put your pack on (avoid twisting motions- get help or place pack on surface or against tree) Make sure your pack is properly fitted and balanced
	Hiking to work areas- Stream and river crossings	Avoid swift or deep water crossings by using foot or automobile bridges. Be careful on slippery logs and watch footing on either side of stream crossing.
Working in the outdoors	Exposure to allergy-causing plants and insects	Alert crew members to possible problems with allergens. Be alert for toxic plants and alert to common bee and wasp nesting habitat and activity-especially the person in front. Carry Benadryl, epi-pen or other antihistamine

Table 16. Excerpt from landbird Job Hazard Analysis (continued).

Work activities	Hazards	Controls and Safe Behaviors
	Exposure to toxic plants	Avoid poison oak when possible. Wear long-sleeved shirts, long pants, and hiking boots. Wash skin exposed to poison oak with Tecnu or other appropriate cleaner and change clothes if necessary at end of day/survey. Do not eat any fungus or plant unless you are 100% sure it is edible.
	Exposure to ticks	Wear proper attire (long-sleeved shirts and long pants) and do frequent tick checks. If bitten by black legged tick, properly remove tick and monitor general health condition.
	Exposure to giardia, E. coli and other pathogens	Do not drink any water unless it has been filtered, boiled or treated in some fashion Do not create more contaminated areas- urinate away from streams and water, dig a cathole for solid waste and bury toilet paper. Wash hands when possible and carry hand cleaner
	Improper nutrition due to inappropriate food choices	Bring a variety of healthy, nutritious food that will give you good energy during travel and work. Do not rely on sugar snacks.
	Loss of food to ravens, raccoons, small animals	Prevent animals from getting into your food by not leaving your backpack open or accessible to animals.
	Cougar attack	If approached by cougar make yourself large and noisy, wave arms, yell, grab a stick. Back away from cougars but do not turn and run, ever. If attacked, fight back.
	Strange or aggressive human interactions	Terminate contact with visitor and leave the area, contact dispatch (GOGA: 415-561-5656; PORE: 415-464-5170 or emergency numbers (911))

Standard Operating Procedure (SOP) 3: Training Observers V2.0

Revision History Log

Prev. Version #	Revision Date	Author	Changes Made	Reason for Change	New Version #
1.0	Oct. 2006	T. Gardali	Minor wordsmith	NPS internal revision comments	2.0

This Standard Operating Procedure explains the training procedures that all supervisors should follow to teach (1) how to identify birds by sight and sound; (2) steps for conducting point count surveys, including distance estimations; (3) how to conduct banding and mist-netting; and (4) steps for data entry, proofing, and management.

Identifying birds by sight and sound

Any observers who do not already have extensive experience identifying local birds by sight and sound will be trained in identification and will study and practice identification prior to conducting any surveys on their own. Point count observers will always have some previous experience with local birds, and frequently will have previous experience point counting local birds. Even experienced observers will review identification and bird lists prior to the point count season. Point count observers who are new to point counting in the area will work with a locally-experienced point counter, practicing calls, songs, and visual identification of birds they encounter while birding and during mock point count surveys.

Learning birds by sight and sound is a multi-faceted process. It involves (1) regular independent birding and seeking out any birds the observer does not recognize by sight or sound; (2) accompanying experienced observers who can help them identify the birds they see, hear, or band; (3) studying bird sounds via CDs and multi-media DVDs; (4) studying birds in field guides; and (5) studying study skins in order to learn how to identify birds in the hand.

Point Count Surveys (VCP)

Point counters with prior experience using our point count protocols will carefully review the protocols before the point count season. Point counters without prior experience either point counting local birds or using PRBO's point count protocols will accompany an experienced biologist in the field to conduct mock point count surveys until the trainer is confident that the trainee is (1) familiar with all aspects of the point count protocols; (2) is correctly identifying almost all the birds by sight and sound; and (3) is appropriately placing birds in distance bands. Our biologists use Range Finders when conducting point counts in order to increase accuracy of distance estimation, but we still require biologists to be able to estimate distances as they will not

use the range finder for every single bird detected, especially those detected aurally. In addition, throughout the point count season, it is critical that both experienced and new point counters continually recalibrate their distance estimations using the range finder or by actually pacing out a distance. This is done while walking between points or while walking back to the car after having completed the transect.

Mist-netting

It is critical that new banders receive intensive training in handling and extracting techniques, safety issues, data collection and field protocols, and bird identification.

Novice banders are trained intensively by their supervisor for their first two weeks of banding. Their training continues by experienced banders for up to an additional four more weeks (length of time required depends on individual ability to quickly pick up skills and numbers of bird captured). They band exclusively as a third, or “extra”, bander until they have attained the skills and experience to band with only one other person, skills which includes (1) safe, quick and competent extraction of birds from mist-nets; (2) good handling skills; (3) accurate collection of data during processing; and (4) identification skills. Experienced banders who have never banded with PRBO receive 1-4 days of intensive training on our specific protocols, depending on need, in order to learn our specific protocols, coding systems, and local species. For all banders, training continues throughout the season by regularly banding with their supervisor or a more experienced bander, and weekly check-in meetings to discuss banding topics and questions.

Data entry, proofing and management

Data entry, proofing and management are obviously integral components of data collection and must be done regularly and rigorously. Biologists are trained in the process by their supervisor and through hands-on learning with an experienced person. The supervisor conducts regular check-ins throughout the field season on the status of the data to ensure that these steps are taking place with the frequency and precision required. See also Data Management SOP for more details.

Standard Operating Procedure (SOP) 4: Marking and Relocating Sampling Plots V2.0

Revision History Log

Prev. Version #	Revision Date	Author	Changes Made	Reason for Change	New Version #
1.0	Oct. 2006	T. Gardali	Minor wordsmith and suggestions	NPS internal review comments	2.0

This Standard Operating Procedure explains the procedure for establishing and marking sampling plots to (1) locate point count stations, (2) locate net lanes, and (3) establish, modifying and mark point count stations. Detailed descriptions of all sampling sites are provided.

Locating Point Count Stations

All pre-existing point count stations are relocated with a combination of means: (1) they are previously marked with colored flagging for visual location and are re-flagged each field season if flagging has ripped, faded, or been removed; (2) GPS coordinates; (3) a narrative is written for each transect describing any details and important features useful for relocating the points; and (4) maps showing location of entire transect and individual points.

Locating Net Lanes

All pre-existing net lanes, where possible, are relocated through (1) permanent nets; (2) permanent net equipment (net poles, ropes); (3) marked flagging identifying both ends of the net lane; (4) maps revealing locations of net lanes; and (5) GPS locations of net lanes. However, net lanes are relocated only by experienced banders with knowledge of those net lanes in order to avoid minor movements of mist-nets.

Modifying and Marking Point Count Stations

- Point count stations are already established and selected. Consideration to add new point count stations will require modification of this SOP.
- Occasionally biologists will encounter previously established point count stations for which (1) the GPS coordinates do not appear as accurate as possible (due to suboptimal conditions when coordinates were originally recorded), and (2) for which physical features have changed and therefore the narrative is either misleading or requires updating. If coordinates appear inaccurate and current conditions appear optimal for recording new coordinates, the biologist will record the updated coordinates and provide them to the PRBO GIS Specialist and the SFAN Data Manager, change the coordinates on the narrative, and change them in any GPS units that contain them. When narratives

need to be updated, the biologist will make sure this is changed for all locations of the narrative (keeping the retired version in an electronic folder specifically for this purpose).

Site Narratives

Each narrative contains all relevant information necessary for relocating points and mist-net locations. For some sites, the narratives are excellent and up-to-date (Upper and Lower Redwood Creek, Muddy Hollow, Pine Gulch, Lagunitas Creek, and Arroyo Hondo), others are old and will be revised during the 2010 field season (Lower Olema Creek, Bear Valley, Coast Trail Laguna, Upper Olema, and M Ranch), and still other are non-existent (likely only hard copy available) and these will be drafted during the 2010 field season (Gerbode Valley, Tennessee Valley, Abbott's / Kehoe, and Coast Camp). UTM coordinates are available for all sites.

Point Count Sites

Point Reyes National Seashore, Marin County, CA

Abbotts/ Kehoe (ABKE) –

No. Points: 16

Getting there: From Inverness, head N on Sir Francis Drake. Take a right on Pierce Point Road to N. Continue past Abbotts Lagoon until you get to the first coordinate.

Notes: none at this time

Narratives: Will be completed during the 2011 field season.

Coordinates (Latitude/longitude, NAD83, Zone 10S):

ABKE_1	38.15337879	-122.9426013
ABKE_10	38.12587866	-122.9378413
ABKE_11	38.12673393	-122.936081
ABKE_12	38.12866157	-122.9341418
ABKE_13	38.12792068	-122.9309195
ABKE_14	38.12755882	-122.9286557
ABKE_15	38.12706641	-122.9266834
ABKE_16	38.12660094	-122.9246024
ABKE_2	38.15200707	-122.9390363
ABKE_3	38.15351152	-122.9377792
ABKE_4	38.15461018	-122.9361273
ABKE_5	38.15619569	-122.9348279
ABKE_6	38.15800673	-122.9339185
ABKE_7	38.15983262	-122.9354043
ABKE_8	38.16071635	-122.9363063
ABKE_9	38.12574461	-122.9400184

Arroyo Hondo (ARHO)

No. Points: 6

Getting there: From Bolinas, head N on Mesa Rd. The first point is on the R side of the road just past Ridge Road.

Notes: none at this time

Narratives:

ARHO 14: 230 paces from gate, heading up arroyo on dirt road/trail. Opposite from bank of thimbleberry and buckeye tree. At *Ceanothus* tree on the right beneath a Doug Fir, just before (15 m) road goes under “bridge” of ceanothuses and oaks on either side of road; lots of *Equisetum* (horsetail) nearby. Also 50 m before “bridge” of two large bay laurels.

ARHO 15: 220 paces from point count 14. Look for Douglas fir tree straight up the road at 306 degrees. Point is just past gentle right hand curve (through grove of bays and Doug Firs) in clearing just at the start of a line of elderberries on the left.

ARHO 16: 10 m before rocky cut in hill on the right (with small rock slide). Canyon narrow. Open view of creek on the left. Road is in direction of 321 degrees; tied into young Douglas fir, eight meters high.

ARHO 17: 475 paces from point 16. Cross the river twice. Point is 30 m past 2nd xing just before small clearing. At this point the road travels in a direction of 353 degrees, almost due north. Lots of sword ferns on steep bank on east side of road.

ARHO 18: 200 paces from point 17. On top of small rise in road. Flag is tied to maple tree. Plastic pullout marker with reflector on left. 20 m past drainage with metal pipe across the left side of it.

ARHO 19: Very topmost reach of the water road near entrance of foot trail, blue and red flags tied to bay tree on dirt bank on the right. New “parking area” as of 6/25/97 – a cleared space about 4meters in diameter.

Coordinates (Latitude/longitude, NAD83, Zone 10S):

ARHO_14	37.93301374	-122.7345636
ARHO_15	37.93440124	-122.7361285
ARHO_16	37.93768934	-122.7383954
ARHO_17	37.94086834	-122.7391566
ARHO_18	37.94299844	-122.7410644
ARHO_19	37.94527644	-122.7432104

Bear Valley (BEVA)

No. Points: 16

Getting there: From Point Reyes NS, head N on Bear Valley Road. The first point is just past Marsh Road but before Limantour Split.

Notes: Original documentation in 1997.

Narratives:

BEVA 30: At intersection, Limantour Road and Bear Valley Road, on willow at gravel drainage ditch.

BEVA 31: Walk along horse trail - marker in small Live Oak along trail indicates that point is back along riparian vegetation about 15 meters off trail.

BEVA 32: Continue along horse trail - at overhanging vegetation, old oak and Bay, point is on left side of trail.

BEVA 33: Continue along horse trail, then take first opening left into willows, down through grassy area, to where grassiness narrows into trail-width, point is here on willows.

BEVA 34: Travel along willows - point is set back in nook, before first willow "gate."

BEVA 35: Through first willow "gate," point is halfway to second willow "gate," behind big sawgrass patch

BEVA 36: Through second willow gate, behind sawgrass patch - there is a patch of coyote bush here, next to sawgrass. Point is on willow.

BEVA 37: Through third willow "gate," at edge of cattail marsh.

BEVA 38: Cross through alder that's across marsh from point #37. Continue up drainage to small cattail marshes, just past clump of Bays.

BEVA 39: On small alder, across creek from wooden post in new chain-link maintenance yard fence.

BEVA 40: Small oak behind offices, where lawn borders riparian zone.

BEVA 41: At barn corral, on willow.

BEVA 42: At end of corral, in alders, off paved "Earthquake Trail", down towards creek.

BEVA 43: Follow paved trail until it curves around, get off and follow riparian zone - point is on alder between two Bays.

BEVA 44: Cut through field and large oaks - point is along grazed riparian, on alder across from solitary huge oak.

BEVA 45: 100 meters up Olema Marsh Road.

Coordinates (Lat / long, NAD83, Zone 10S):

BEVA_30	38.05809352	-122.8110771
BEVA_31	38.05614997	-122.8102742
BEVA_32	38.05435894	-122.8091652
BEVA_33	38.05284639	-122.8072654
BEVA_34	38.05166875	-122.8063727
BEVA_35	38.05059413	-122.8051012
BEVA_36	38.04941483	-122.8032222
BEVA_37	38.04793053	-122.802214
BEVA_38	38.04656883	-122.8017593
BEVA_39	38.04539395	-122.7998645
BEVA_40	38.04398672	-122.7991425
BEVA_41	38.0425243	-122.7977776
BEVA_42	38.04114324	-122.7965602
BEVA_43	38.03947336	-122.7951168
BEVA_44	38.03820972	-122.7966502
BEVA_45	38.05901053	-122.8096541

Coast Camp (COCA)

No. Points: 8

Getting there: Once in Point Reyes NS, take Limantour Spit Road toward Limantour Beach. Approximately ¼ mile before the beach and opposite from the Estero Trail, take a L onto side road (also called Limantour Spit Road). After 50 yards, take R onto Coast Road. Follow along until GPS indicates first point. Points continue E up Firelane Trail.

Notes: none at this time

Narratives: Will be completed during the 2010 field season.

Coordinates (Lat / long, NAD83, Zone 10S):

COCA_91	38.01715764	-122.8560441
COCA_92	38.01855475	-122.8548422
COCA_93	38.01989224	-122.854609
COCA_94	38.02131475	-122.8542834
COCA_95	38.02094752	-122.8523778
COCA_96	38.02307759	-122.8538033
COCA_97	38.02384119	-122.8517416
COCA_98	38.02553008	-122.8504929

Coast Trail/Laguna (CTRA)

No. Points: 14

Getting there: Once in Point Reyes NS, take Limantour Spit Road toward Limantour Beach. Approximately ¼ mile before the beach and opposite from the Estero Trail, take a L onto side road (also called Limantour Spit Road). Continue S on Limantour Spit Road until you get to the hostel.

Notes: Original documentation in 1997.

Narratives:

CTRA 17-19: These points are across from hostel, spaced 200 m. apart between parking lot and Coast Trailhead.

CTRA 20: Along Coast Trail, at start of scrub.

CTRA 21: In second meadow

CTRA 22: On alder at edge of swamp, end of meadow.

CTRA 23: On willow in patch between large, old snags.

CTRA 24: On sapling in old snags - trail flagged.

CTRA 25: At end of cattail swamp, on coyote bush.

CTRA 26: Four meters before culvert, at end of coffeeberry patch, flag under coyote bush along trail.

CTRA 27: On small dead alder behind cattails, at bend in trail.

CTRA 28: On small alder off trail 15 meters, at end of open alder stand, before willow/alder stand.

CTRA 29: At last 100 meters of alder.

Coordinates (Lat / long, NAD83, Zone 10S):

CTLA_17	38.04337055	-122.8588348
CTLA_18	38.04362541	-122.8609338
CTLA_19	38.04328113	-122.8632522
CTLA_20	38.04273353	-122.8651354
CTLA_21	38.04102657	-122.8659897
CTLA_22	38.0395725	-122.8673126
CTLA_23	38.03792025	-122.8687449
CTLA_24	38.0361644	-122.8702291
CTLA_25	38.03440768	-122.8709423
CTLA_26	38.03310202	-122.872041
CTLA_27	38.03157868	-122.8718909
CTLA_28	38.02989416	-122.872696

Lower Olema Creek (LOOL)

No. of points: 11

Getting there: These points are located approximately ½ between Woodville and Olema on Highway 1 (Shoreline Hwy). From intersection of Hwy 1 and Bolinas Road, go N 3.8 miles to first point.

Notes: Degrees are relative to magnetic, not true, north. Rubber boots are helpful on this route. Fair amount of Poison Oak. Points 57-60 are at Five Brooks and must be driven to, and are not being surveyed as part of the monitoring. See older versions of narratives for details if you need them.

Narratives:

LOOL 46: Across from first eucalyptus tree to the northerly end of white “bat house” on Hwy. 1, at willow edge across street.

LOOL 47: Walk south along riparian corridor. Point in line with 4th telephone pole after bat house, at willow edge; right after “turn out” sign.

LOOL 48: Walk south along riparian corridor, point directly in line with last oak in line with oaks along road.

LOOL 49: Walk 150 meters, through grassy area along willows, then cross creek at flagging (couldn't find flagging in 2005). Crossing is in line with 1st willow patch along the road, which is next to a mound. May require some crawling. Point is 240° at 17 meters from lone doug fir. Point is across a grassy patch from the fir, to willow edge.

LOOL 50: Walk 200 m. From #49 point is at end of U shaped corridor, 220° 25 m. from low flat coyote bush on mound. Point is along willow edge, about 10 meters off the trail.

LOOL 51: Walk along trail toward highway – point is 150 25 m. from willow/blackberry patch, right along trail, and is also about 25 meters before low willow just to the left of the trail.

LOOL 52: Cross creek just before lone doug fir (if impassable, which it was in 2005, go out to road to cross and then head back in). Crossing spot is marked w/blue flagging. Point is along willows ~20m before Hagmaier driveway. There are no trees between the point on the willow and the highway.

LOOL 53: Cross driveway. Follow the edge of the willows left of and around the big willow clump ahead. The point is 10m from the creek next to a coffeeberry just past 1st old eucalyptus grove (all stumps), about 80m past PRNS building.

LOOL 54: Cross creek next to pt #53 (thru euc stumps). Follow deer trails on the other side of the creek through scrub, up small hill, and back down to riparian strip. Follow riparian edge to lone bay tree. Point is seven m. at 374° from bay tree which is approx. 5m tall.

LOOL 55: Point is 62°, 3m. from big oak tree at edge of riparian. Tag on alder. There is a dense poison oak/blackberry thicket in the way, so if you want to avoid it you can go around this thicket (to the right) and come back to the riparian on the other side, where access to the point is much easier.

LOOL 56: Walk past treeless part of creek, point at beginning of last large willow patch. (Pass smaller willows and coyotebush). Point is on south side of creek and fence. Corresponds approximately to mile marker 19.87, and also to sign with Horse & Rider Crossing symbol (can park here).

Coordinates(Latitude / Longitude, NAD83, Zone 10S):

LOOL_46	37.97880769	-122.7362789
LOOL_47	37.97770419	-122.7345365
LOOL_48	37.97578351	-122.7341228
LOOL_49	37.97406176	-122.7339978
LOOL_50	37.97212308	-122.7336016
LOOL_51	37.97196056	-122.7314895
LOOL_52	37.97126866	-122.7304345
LOOL_53	37.96957688	-122.729626
LOOL_54	37.96829304	-122.7278903
LOOL_55	37.96671758	-122.7267245
LOOL_56	37.96551888	-122.7247996
LOOL_57	37.99902454	-122.7610592
LOOL_58	37.99741154	-122.7591412
LOOL_59	37.99348997	-122.75971
LOOL_60	37.99171991	-122.75935

M Ranch (MRAN)

No. of points: 8

Getting there: Park at the big pullout at the “School Bus Stop 400 Feet” sign, just before you reach Drakes Bay Oyster Farm sign when heading out from Inverness towards the Lighthouse.

Notes: All the points are near the riparian vegetation along the creek, but are to be surveyed from the road due to the marshy nature of the vegetation. From point one simply pace go back along the road headed toward Inverness to reach points two through eight. Do the point from the side of the road that the riparian habitat is on; when it crosses the road, you should do the same.

Narratives:

MRAN 1: The first point (point #1) is at the edge of the pullout (the furthest edge from the oyster farm sign; i.e., the first end you reach).

MRAN 2: This point is just after the power-line crosses the road, but before it crosses back (by about 50 m) to the riparian side.

MRAN 3: This point is about eight meters past the first pole, once the power-line crosses across from the riparian (adjacent to the 2nd reflector on the riparian side).

MRAN 4: Directly across the rd. from the drainage with pine trees. Again in a spot where the powerline begins crossing back to the riparian side.

MRAN 5: At dead tree

MRAN 6: Across from ranch/pasture. This point is about 10 m. upstream of the culvert where it goes under the road.

MRAN 7: This point is at the road for the estero. I counted this in 1998 (for lack of any narrative) on the estero rd., on the ranch side of the creek.

MRAN 8: Just before an alder on the creek side, and a pine across the street. This spot is primarily willow. On the hillside above the creek are several pines.

Coordinates(Latitude / Longitude, NAD83, Zone 10S):

MRAN_1	38.09158292	-122.9260906
MRAN_2	38.09140586	-122.9240248
MRAN_3	38.0918822	-122.9219923
MRAN_4	38.09235413	-122.9201419
MRAN_5	38.09285292	-122.9180846
MRAN_6	38.0927703	-122.9159578
MRAN_7	38.09364315	-122.9140391
MRAN_8	38.09487668	-122.9123932

Muddy Hollow (MUHO)

No. Points: 15 (originally 17 but points 76 and 77 have not been repeated since 1998, due to the thickness of the off-trail vegetation, which causes quite a disturbance plus takes a long time to navigate through. Please see older narratives if interested in the location of these points.

Getting there: On road to Limantour, turn right at sign for Muddy Hollow (left is Youth Hostel and Clem Miller Environmental Center), park in lot. Points are in both directions from Muddy Hollow parking lot. Points #70 - #61 are south, down Muddy Hollow Trail. Points #71 - #77 are north, up the Bayview Trail. Have to return to parking lot between each of the two sets of points.

Notes: Because of the nature of the post-burned habitat, some of the landmarks may have changed - i.e. snags fallen down, heavy vegetation growth, etc. Points are approximately 200 meters apart. Some flagging missing. Need rubber boots as some areas extremely flooded. Degrees relative to magnetic not true north. Note that dam removal and lack of trail maintenance

are predicted in near future and will influence points 61-66. Original documentation by D. Humple, 2005.

Narratives:

MUHO 70: Through gate at parking lot, point is about 50 meters down trail, left side of trail on large horizontal willow. Is about 20 meters beyond the first telephone pole. Is just before willow immediately to right of trail that has a huge and odd-growing base.

MUHO 69: Point is ~12m just before 3rd pole, left side of trail on mid-sized alder (closest alder to trail).

MUHO 68: Right side of trail, in a patch of shrubs across the road from low willow patch. Halfway between the 4th and 5th telephone poles. Flagging is on a shrub, ~50m past 4th pole.

MUHO 67: 20 meters before the pump shed on the right side of the road. Point is 10 meters off the road to the right at the elbow of the "L" of the elderberry patch and by blackberry bramble.

MUHO 66: Just before end of alders on right side of road. About 20 meters beyond the 2nd telephone pole after the pump shed. Point is about five meters off the trail to the right.

MUHO 65: Narrative changed from historical description due to major change in vegetation. Follow the GPS unit. Take trail but then go off to right of trail in young alder forest, is 15-20m in from trail cross 1st slough. Note: understory vegetation, trail location, and slough location subject to seasonal changes due to extensive winter flooding in this area as well as extreme mud deposition.

MUHO 64: Narrative AND location changed from historical description/old narrative. Follow trail until you cross main creek and end up along the east side of the creek with coastal scrub to your left and creek to your right. Can be tricky getting to creek crossing spot as there are many trail-like paths you could follow and lack of trail maintenance - trails signs should help and if having a problem, creek crossing is NAD83 10S 0510677 4210242. Point is 10m past where trail first starts being *immediately* adjacent to alders (alders to your right), after going through a scrubby area and by huge *Ceanothus* nearby in scrub. Just over 150m (paced) from creek crossing, and 100m (paced) from when you pass under telephone wires.

MUHO 63: Continue along main trail. Point is at break in willows where can see the marsh/sedge area to your right. Willow just after this break is flagged. Just after you get out of alders that are directly along trail.

MUHO 62: Continue on main trail. Point is about 25 meters before lone fir tree on left, and flagged on large alder to right.

MUHO 61: Dead leaning S-shaped willow at edge of pond, just before full view of pond. Aluminum tag is visible on second dead willow from the end of willows, right side of trail.

The following points once again start from the Muddy Hollow parking lot, but are along the Bayview Trail to the north (pt 74 is actually before the trail).

MUHO 71: Along Muddy Hollow Road walking towards Bayview Trailhead, at the first scrubby clearing on right, turn in as if walking to net 10 - point is about 25 meters into clearing, along willows. Is about 15 meters from the 1st pole of net 10, about 10m before big alder, and adjacent to large coyote bush.

MUHO 72: From 71, walk back to fire road, then turn off road to your right up the signed Bayview Trail. Go through cypresses, point is on right side of trail at the 2nd drainage that crosses the trail and goes to the creek once you hit the red elderberry shrubs lining the trail, and once you pass the first large live alder directly on the left.

MUHO 73: After you've come down hill, point is at beginning of big scrub meadow to the right of the trail and at middle of the smaller first distinct and bowl-shaped part of the meadow; is across from the buckeye patch, point is set back about 10-15 meters off trail to right. Flagging is on fallen dead alder, leaning towards the trail.

MUHO 74: At first bridge, left side of trail before crossing creek.

MUHO 75: About 20 meters before fork in trail, point is on large alder just to right of trail, at point where trail goes uphill about 3 feet.

Coordinates(Latitude / Longitude, NAD83, Zone 10S):

MUHO_61	38.0344963	-122.882402
MUHO_62	38.03563891	-122.8809375
MUHO_63	38.0370283	-122.8801489
MUHO_64	38.03883074	-122.8793658
MUHO_65	38.04098724	-122.8782822
MUHO_66	38.04281115	-122.8765924
MUHO_67	38.04393767	-122.875439
MUHO_68	38.04500518	-122.8739262
MUHO_69	38.04613708	-122.8720755
MUHO_70	38.04748891	-122.8702141
MUHO_71	38.04910897	-122.8696079
MUHO_72	38.05066465	-122.8684063
MUHO_73	38.05252073	-122.8679449
MUHO_74	38.054291	-122.8671456
MUHO_75	38.05547653	-122.8656919
MUHO_76	38.05656015	-122.8645922
MUHO_77	38.05732726	-122.8626288

Upper Olema Creek (UPOL)

No. points: 13

Getting there: From Olema, go 1.9 miles to intersection with Shoreline Hwy. Continue L on Sir Francis Drake. This first point is 0.3 miles after the intersection.

Notes: none at this time

UPOL 90: Across pasture from large pullout on Bear Valley Road between Olema and Bear Valley Headquarters.

UPOL 89: Just upstream from red cattle feed bin – eight posts down from wood crossbeam and posts.

UPOL 88: Just upstream from creek bend and big Live Oaks, at new barbed wire fence.

UPOL 87: On right in small grassy opening in next pasture after cattle crossing.

UPOL 86: On willow nest to small planted Oaks.

UPOL 85: On willow down stream from red feed bin, up from oak forest and gap in willows.

UPOL 84: Opposite fence on big willow, downstream from clearing.

UPOL 83: On giant Live Oak, opposite fence where trail dips into woods.

Heading downstream, take middle trail past Poison Oak patches – follow willow drainage.

UPOL 82: On willow at P.O. clump, where trail goes into open pasture.

UPOL 81: At small willow on side of grassy hill, upstream from fence 40 m.

UPOL 80: On alder among willows near dead fallen snag, in willow cove.

UPOL 79: On willow near blackberry clump. Downstream from house and barbed wire fence with phone pole.

UPOL 78: At corner where willows along stream meet willow along road.

Coordinates (Latitude / Longitude, NAD83, Zone 10S):

UPOL_78	38.06346334	-122.809956
UPOL_79	38.06189704	-122.8082852
UPOL_80	38.06032506	-122.8060742
UPOL_81	38.05866987	-122.805266
UPOL_82	38.05671731	-122.8044889
UPOL_83	38.05579412	-122.8021661
UPOL_84	38.0542189	-122.8006922
UPOL_85	38.05194458	-122.7988804
UPOL_86	38.05014019	-122.7978143
UPOL_87	38.04892175	-122.7968186
UPOL_88	38.04678887	-122.7960437
UPOL_89	38.04505095	-122.7943454

UPOL_90 38.04327273 -122.7928102

Golden Gate National Recreation Area
Gerbode Valley (GERB)

No. Points: 14

Getting there: The first point is in the Marin Headlands. Take Bunker road from the tunnel. Look for the parking area on the right just after the Left turn-off for the hostel. Park and walk to the first point indicated by your GPS.

Notes: none at this time

Narratives: Will be completed during the 2011 field season.

Coordinates (Lat / long, NAD83, Zone 10S):

GERB_10	37.83426064	-122.51975
GERB_11	37.83608101	-122.5174879
GERB_12	37.83793586	-122.5170439
GERB_13	37.83978094	-122.5164182
GERB_14	37.84128204	-122.5154309
GERB_15	37.84310078	-122.5149757
GERB_16	37.84421169	-122.5133545
GERB_17	37.84601357	-122.5131835
GERB_18	37.84745108	-122.5120828
GERB_19	37.848805	-122.5103916
GERB_20	37.8332682	-122.5173017
GERB_21	37.83251167	-122.5152497
GERB_22	37.83193551	-122.5132306
GERB_23	37.83301992	-122.5117461
GERB_24	37.83324512	-122.5095513
GERB_25	37.83368649	-122.5073322
GERB_8	37.83314964	-122.523587
GERB_9	37.83391781	-122.5218774

Lagunitas Creek (LACR)

No. Points: 18

Getting there: To begin at point 65, park at Platform Bridge Rd/Sir Francis Drake Blvd. and walk up the bike path. To begin at point 62, park in the large turnout on Platform Bridge Rd. at this point. Points #48 – 62 are all located on the west (riparian) side of Platform Bridge Rd.

Notes: Original documentation by V. Toniolo in 2005.

Narratives:

LACR 65: The point is 400 meters down the bike path trail, the tag is on a willow across from a willow patch, which is before the slope.

LACR 64: Backtrack on bike trail. The tag is on the creek side of the path, on a large coyote bush (*Baccharus pilularis*) across from an alder grove.

LACR 63: Located before the bike trail goes under the bridge if walking to pt #63 from pt #64. The tag is on an oak (*Quercus agrifolia*) on the creek side of the bike path, directly across from a cement retaining wall.

LACR 48: Go north on Platform Bridge Rd. The point is on a roadside willow located about 50 meters before the turnout with the gate and road into the meadow.

LACR 49: Go through the gate, towards the riparian until you hit the gravel wash, and walk north on the gravel wash. The tag is on a large willow in a small group of large willows. Across the wash is a patch of small willows.

LACR 50: Continue downstream hugging the creek edge when you can until you get to a group of large alders right at the creek edge. The point is on one of these large alders. You can also approach by going back up to the road at your first opportunity and then back towards the creek at the black plastic culvert. Then continue downstream to the alders.

LACR 51: Go back up to the road. The point is on a box elder (*Acer negundo*) which is down the bank of the creek visible from the road. Two potential ways to get down to the point are before the point through the periwinkle and after the point where the barbed wire is low enough.

LACR 52: Go back to the road and continue northward. Look for the pink flagging on the barbed wire fence (directly across from a telephone pole) walk through the barbed wire and straight towards the creek, the point is on the first large willow. The point is before the open field.

LACR 53: Continue along road to the solitary bay past the transformer. Go towards the creek. The point is on a willow at the edge of the creek, directly in from the bay.

LACR 54: Continue on the road, go to riparian at the white barn, which is the last structure before the road curves. The tag is on a large alder tree.

LACR 55: Continue on the road, past the bend to 10 meters before the bays (on the opposite side of the road). The point is on a roadside box elder.

LACR 56: Walk on the road, take side path into the riparian for approx. 35 m., then 20 m towards creek (Can also find point by walking down steep bank at the large turnout).

LACR 57: Go back out to the road, continue for 200 m. Point is on a bay with an NPS boundary sign.

LACR 58: Continue along road for 200 m. At flagging, walk 25 m. in towards creek to the point.

LACR 59: Point on road, 200 meters further (25 m. before mile marker with .88 and 1.416).

LACR 60: Continue 200 meters further along road. Point is across from an oak tree.

LACR 61: Continue 200 meters further along road. Point is 20 meters before the 30 mph sign.

LACR 62: Continue 200 meters further. Point is at the end of the turnout on willow tree next to buckeye.

Coordinates(Latitude / Longitude, NAD83, Zone 10S):

LACR_48	38.05128	-122.759678
LACR_49	38.05318	-122.7599339
LACR_50	38.05497	-122.7592669
LACR_51	38.05654	-122.7602648
LACR_52	38.05736	-122.7625077
LACR_53	38.05786	-122.7647175
LACR_54	38.05893	-122.7668685
LACR_55	38.05947	-122.7686793
LACR_56	38.0589	-122.7708469
LACR_57	38.06039	-122.7712184
LACR_58	38.06212	-122.7715208
LACR_59	38.06389	-122.7712417
LACR_60	38.06549	-122.7724337
LACR_61	38.06723	-122.7731579
LACR_62	38.06873	-122.7717282
LACR_63	38.04978	-122.7599222
LACR_64	38.04857	-122.757943
LACR_65	38.048	-122.7556768

Redwood Creek (RECR), Upper Section

No. Points: 14

Getting there: ~35 min. drive from Bolinas. From Hwy 1 head S from Bolinas; turn left onto Muir Woods Road at town of Muir Beach just past the dirt road to the RECR banding station. The lower end of transect (pt. 45) is just up Muir Woods Rd from volleyball net area you will see on your left; park at Santos Meadow a little further up road. The upper end of it (pt 47) is by NPS greenhouse area on left, park across road from greenhouses at pullout on right before No Parking/Fire Lane sign

Notes: Flags generally orange and red; intervals ~200m. Rubber boots required. Veg makes access difficult at some points. Done as a separate transect from the “Lower Section”; numbers unique, but all are called RECR. Points unusually ordered! Original documentation by D. Humple, 2006.

Narratives:

RECR 47: Cross road, go toward riparian at “No Parking Fire Lane” sign on left; go past and in to right of green house. Cross the small field with coyote bush and in hemlock and some red restoration flags. The point is under a large buckeye that is beneath a huge alder, after

RECR 46: Walk back out to road, then towards Hwy 1 along dirt road/path that runs along Muir Woods Rd (opposite side of road from parking spot). The point is 252 deg. from large Doug fir before you reach a telephone pole across road (basically on other side of fir from path). Can be hard to access because of vegetation, and may need to do point on path-side of fir.

RECR 36: Continue down road. Go in toward riparian from Muir Woods Rd at buckeye which is 114 deg. at 11m from C107 M1.99 k M3.202 sign across road. Go beneath buckeye; point is 16 deg. at 17m from open patch; the tag is on a small willow attached to the tree with wire. Point should possibly be slightly moved since access to exact point is so challenging (because of thick vegetation and poison oak), OR transect should be visited before breeding season to cut a path to it.

RECR 35: Continue down road; go down Miwok trail (to left of paved road when heading down to Hwy 1; across from fire road). Point is about 50m down trail from road, and 8m from the trail, to right, where vegetation opens up a bit. Note: after this point whenever trail forks, never take trail that goes to road; stay for the most part along creek.

RECR 37: Continue along trail. 22m after bridge; tag on a large buckeye on right side of the trail before a large redwood tree.

RECR 38: 294 deg. and ~20m from Muir Beach/Hwy 1 trail marker; on right, on other side of little meadow that is separated from trail by border of coyotebush.

RECR 39: Continue on trail; do not fork left (if coming from pt. 38), stay on RECR Trail. Is on the creek bank in the alder grove to right of trail and before solid willow patch. Across meadow from the near edge of buckeye. Note: used to be near lone coyotebush but meadow being taken over by coyotebush.

RECR 40: Continue on trail. Fork left (staying on RECR trail). Is down creek bank at level ground in an alder patch before the creek. On trail, turn in before coyote brush patch that comes out to trail on the right.

RECR 41: Continue on trail. 9m past southerly wall of abandoned building (on far side if coming from pt 40); at willow edge.

RECR 42: Continue on trail. Cross bridge and pass short spur trail to road. 178 deg. 20m from Doug fir that is past spur trail, at willow clump near the trail on the left side of trail.

RECR 66: Continue on trail. Go down bank on left of trail to level alder patch which is directly across from willow patch adjacent to Muir Woods Rd (road to right of trail). Go into herbaceous area, point on left-most of three huge alders.

RECR 43: Cont on trail. Go left towards the creek at willows ~15 m before bridge at junction of the trail that goes toward the road. (no longer a well established trail); before sawed-off trunk on right.

RECR 44: Continue, cross bridge (taking left fork of trail immediately after bridge). At Coastal Trail / Muir Beach sign, bear to the right; continue walking parallel to riparian corridor. The point is approx. 15m past the sign and 7m in from the trail, on right. Marked on trail near point as well. If doing transect in reverse order, can access points 44 and 45 from a horse trail next to

road not far from point 44, or can climb down under bridge from the road (which can be more difficult).

RECR 45: From point 44, continue down trail to creek, turn left, then walk along creek toward bridge. The point is on the 3rd alder before auto bridge on left. To get out, climb up beneath this bridge to the road, or retrace your steps and find horse trail that takes you out to road across from Santos Meadow (it's near where you first hit the creek when coming from 44 to point 45). If starting at this point, cross road from Santos Meadow and walk in the Frank Valley Horse Camp Spur trail and down to creek, then walking in creek towards bridge (to the right) until you get to point.

Coordinates(Latitude / Longitude, NAD83, Zone 10S):

RECR_35	37.88583218	-122.5684441
RECR_36	37.88742541	-122.5673176
RECR_37	37.88437842	-122.5694741
RECR_38	37.88360594	-122.5713409
RECR_39	37.88304268	-122.5727571
RECR_40	37.88207171	-122.5747527
RECR_41	37.8806877	-122.576421
RECR_42	37.87981867	-122.5775743
RECR_43	37.87744223	-122.5808198
RECR_44	37.87585972	-122.5817049
RECR_45	37.87484585	-122.5829119
RECR_46	37.88904546	-122.5670493
RECR_47	37.89007543	-122.5677789
RECR_66	37.87847756	-122.5786633

Redwood Creek (RECR), Lower Section

No. Points: 10

Getting there: ~35 min drive from Bolinas. Points 32-34 and 68-69 are around Muir Beach, the rest follow creek upstream. Take Hwy 1 south from Bolinas to town of Muir Beach. For lower points, if being dropped off turn right at Muir Beach Rd. just after the Pelican Inn, and get dropped off at Muir Beach parking lot. There is no longer any public parking on Muir Beach Road that early in the morning, so if you are driving and starting at the lower end or the middle, you will need to instead turn left off of Hwy 1 onto the banding station dirt road, and park on pullout on right (putting you in middle of transect). To start at the upstream end, turn left off Hwy 1 up Muir Woods Road and park on left at pullout above the volleyball net area along creek (if you hit Santos Meadow you've gone too far).

Notes: Flagging if present is usually orange; intervals ~200 meters. This is done as a separate transect from the RECR "Upper Section", and numbers are unique. Rubber boots are needed. Points 70-73 are part of restoration, so landmarks, especially vegetation, are changing. Original documentation by D. Humple, 2006.

Narratives:

RECR 32: Walk on fire road before Muir Beach parking lot (to left on way to parking lot). Tag on a dead willow branch; may not be visible. Flagging on large horizontal willow. About 50 m in from gate, & across fire road from telephone pole.

RECR 33: Continue walking on fire road. Point on riparian side of trail across from two [fruit?] trees. Before a row of single fruit trees also on left, and at break where you can see the marsh well.

RECR 34: From 33, continue on trail; turn right when trail forks (2x), cross foot bridge, and enter riparian forest that is near herbaceous area directly across from parking lot to your left, before boardwalk takes you to parking lot. Point is on the northerly side of the alder grove inside the grove, just before the creek, & just before section of creek where it bends in direction of beach. Also even with ~1/3 way up parking area (from boardwalk).

RECR 68: Point is ~100 meters in from Muir Beach Rd along “trail” (this is an exaggeration, as it’s barely a trail and there are many other barely-trails around there). Go in just past the Pelican Inn Carpark (closer to Muir Beach than to Highway 1), between the two no parking signs, following “trail” (vegetation depression) in on the Pelican Inn side of the road. Point is JUST before (and closer to the Inn/Hwy 1) you reach a Wood Duck nest box on snag that is not visible from road, but which after you’ve hiked in a ways will be to your left. If doing the transect from upstream to downstream, still approaching point #68 this way as trying shortcuts will just cause frustration.

RECR 69: From 68, go back to Muir Beach Rd, Pelican Inn and Hwy 1, walk N on Hwy 1. Take 1st dirt road to left (NOT the dirt driveway into a van parking area); residential addresses posted at the beginning of the dirt road (e.g., 1821, 1795). Point is at 1st tall elderberry near base of large snag, at beginning of riparian forest, next to log.

RECR 70: Follow the dirt road to the Hwy, go left (north) along the Hwy to the private road on right (road to banding station). Continue ~130m up road and head towards creek. Point is on an alder, about five m from creek side of net #9, in direction of Hwy 1, on 3rd alder over.

RECR 71: Go back out to the road. Follow the road until the creek turns. Turn right into the grass and continue paralleling the creek. Point is in what used to be a eucalyptus grove (where restoration work began 2003), on one of last remaining mature alders on creek bank, on same side of creek as you have been walking. 15 m before net 1.

RECR 72: Continue to parallel creek for another 200m through grass, ivy and other veg. Point on and alder at a very narrow area of mature alders. Across field from house.

RECR 73: Continue to parallel creek. ~50 m past telephone pole, walk down to creek to right, and cross creek to reach point. Point is on the far side of the creek hanging from a skinny alder limb. [note: this point used to use dilapidated car as the landmark but it is no longer there, and restoration has altered the vegetation landmarks]

RECR 74: >200m from last. From 73, go back so you're walking as you have been in to the left of the creek, and continue along creek. Walk almost all the way to the cypresses at end of valley, then cross the human area with wooden structures to your right. Flagging is hanging from low willow limb adjacent to field (possibly mowed), ~15m in from elbow (L-shape) of willow patch. If you are accessing point #74 first in your transect order, via the volleyball/junkyard parking area, you will have to cross a walking bridge to get to this point.

Coordinates(Latitude / Longitude, NAD83, Zone 10S):

RECR_32	37.8632587	-122.5748707
RECR_33	37.86159037	-122.5743718
RECR_34	37.86037801	-122.5754715
RECR_68	37.86474465	-122.5757826
RECR_69	37.86634861	-122.5768823
RECR_70	37.86702989	-122.5795055
RECR_71	37.86869286	-122.5803638
RECR_72	37.86992668	-122.581941
RECR_73	37.87166474	-122.5827188
RECR_74	37.87376224	-122.5835074

Tennessee Valley (TEVA)

No. of points: 13

Getting there: These points are located along the coastal trail starting from the end of Bunker Road in the Marin Headlands. Park in the large paved parking lot by Rodeo Beach and next to the bathrooms.

Notes: none at this time

Narratives: Will be completed during the 2011 field season.

Coordinates(Latitude / Longitude, NAD83, Zone 10S):

TEVA_1	37.84318163	-122.5511987
TEVA_2	37.84600875	-122.5480785
TEVA_26	37.86815412	-122.5253627
TEVA_27	37.8690803	-122.5270623
TEVA_28	37.86186918	-122.5359079
TEVA_29	37.86316116	-122.5344218
TEVA_3	37.84683232	-122.5466185
TEVA_30	37.86472567	-122.5334797
TEVA_31	37.86611812	-122.5323339
TEVA_4	37.84741011	-122.5445349
TEVA_5	37.84844839	-122.5426757
TEVA_6	37.84904306	-122.5403191
TEVA_7	37.85029825	-122.538629

Marin County Open Space

Pine Gulch (PIGU)

No. of points: 5

Getting there: Park at pullout on Olema-Bolinas Road next to Pine Gulch Forest, and take trail into forest. Same location as mist-netting station

Notes: Original documentation by D. Humple, 2006.

Narratives:

PIGU 1: At end of net number one (end that is closer to net 2 than net 5).

PIGU 2: At end of net number 2, closer to trail that you walk into Pine Gulch on then to the end that is nearer to net 1.

PIGU 3: Follow path through willow swath by net 10; trail turns into opening, and head left into willows about 20 feet to do point.

PIGU 4: At “far” end of net number 9 (end that is furthest from trail).

PIGU05: At “far end of net number 6 (end that is furthest from trail).

Coordinates(Latitude / Longitude, NAD83, Zone 10S):

PIGU_1	37.92141324	-122.6907483
PIGU_2	37.92009624	-122.6909539
PIGU_3	37.91916594	-122.6902816
PIGU_4	37.92042174	-122.6890412
PIGU_5	37.92132824	-122.6895716

Mist Net Sites

Point Reyes National Seashore

Lagunitas Creek

Coordinates (Latitude / Longitude, NAD83, Zone 10S) and map:

LACR01	38.05158198	-122.7599806
LACR02	38.05180728	-122.7600826
LACR03	38.05209696	-122.7601738
LACR04	38.05241346	-122.7599055
LACR05	38.0530411	-122.7600289
LACR06	38.05325031	-122.7596695
LACR07	38.05353463	-122.7595569
LACR08	38.05393159	-122.759412
LACR09	38.05373848	-122.7589399
LACR10	38.05330396	-122.7590043

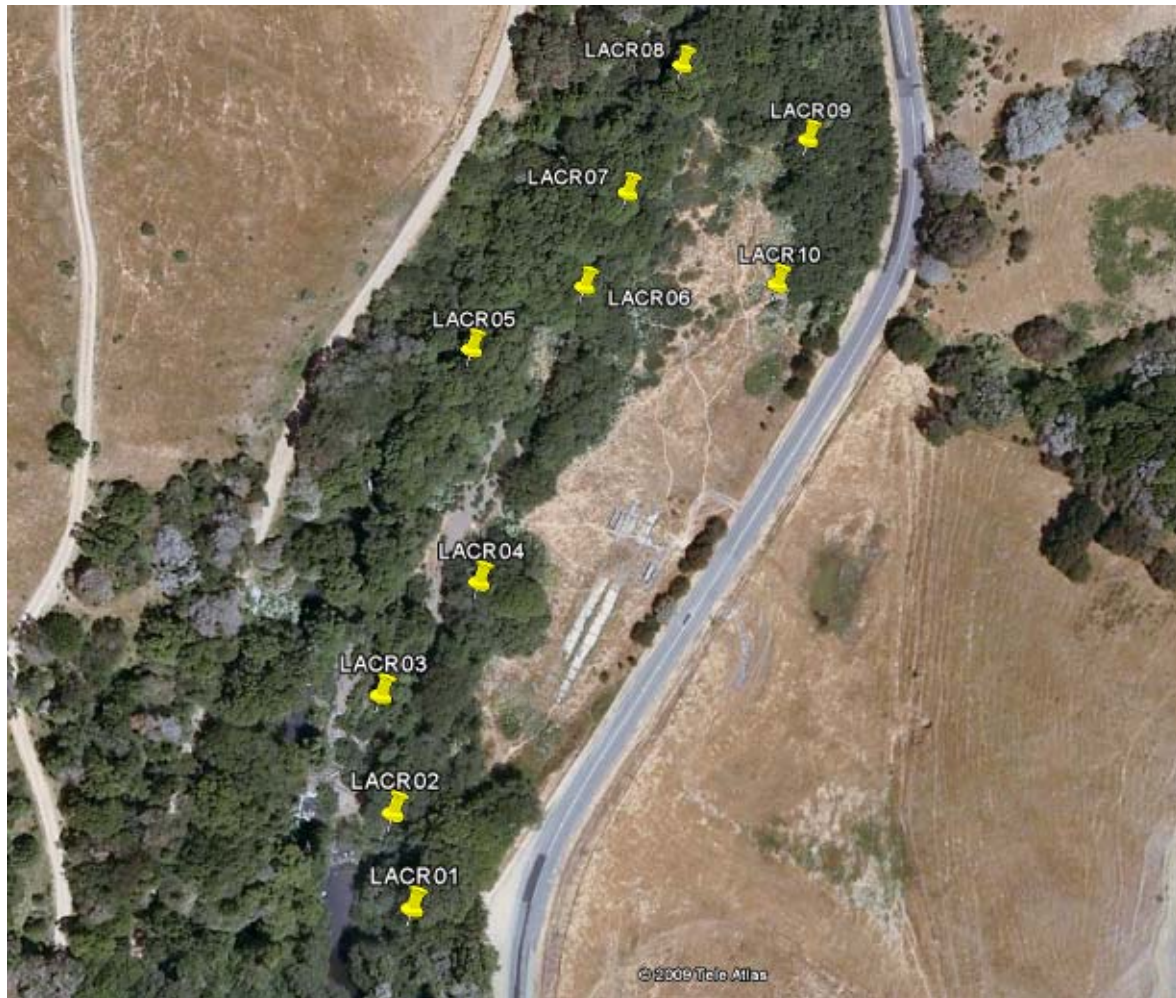


Figure 3. Mist net lanes at Lagunitas Creek.

Muddy Hollow

Coordinates (Latitude / Longitude, NAD83, Zone 10S) and map:

MUHO01	38.0477947	-122.8695596
MUHO02	38.04799855	-122.8701174
MUHO03	38.04790199	-122.870434
MUHO04	38.04744602	-122.8711743
MUHO05	38.04802001	-122.8709436
MUHO06	38.04855108	-122.8715391
MUHO07	38.04836869	-122.8704233
MUHO08	38.0487603	-122.8700263
MUHO09	38.04987609	-122.8706271
MUHO10	38.04928065	-122.8694631



Figure 4. Mist net lanes at Muddy Hollow.

Pine Gulch Mist-net locations

Coordinates (Latitude / Longitude, NAD83, Zone 10S) and map:

PIGU01	37.92147338	-122.6905812
PIGU02	37.92023957	-122.6906885
PIGU03	37.92040587	-122.6901896
PIGU04	37.92083502	-122.6899321
PIGU05	37.9219079	-122.6899857
PIGU06	37.92140365	-122.689578
PIGU07	37.92124272	-122.6887787
PIGU08	37.92097986	-122.6887197
PIGU09	37.92041124	-122.6889075
PIGU10	37.9196924	-122.6897711



Figure 5. Mist net lanes at Pine Gulch.

Golden Gate National Recreation Area
Redwood Creek

Coordinates (Latitude / Longitude, NAD83, Zone 10S) and map:

RECR01	37.86878943	-122.580557
RECR02	37.86893427	-122.5803585
RECR03	37.86853194	-122.5803209
RECR04	37.86742151	-122.5805462
RECR05	37.86766827	-122.5803638
RECR06	37.86717475	-122.5800634
RECR07	37.86738932	-122.5796289
RECR08	37.86706746	-122.5792963
RECR09	37.86712647	-122.5795592
RECR10	37.86609113	-122.5793982
RECR11	37.86589265	-122.5797308



Figure 6. Mist net lanes at Redwood Creek.

Standard Operating Procedure (SOP) 5: Using the GPS Unit V1.0

Revision History Log

Prev. Version #	Revision Date	Author	Changes Made	Reason for Change	New Version #

This Standard Operating Procedure explains how to setup a GPS unit, upload and download points, and use it to reach a specific location for the San Francisco Bay Area Network of Parks. This information and additional specifics on using GPS and associated programs are also found at <http://data.prbo.org/cadc2/index.php?page=songbird-taking-gps-points> (Accessed: June 9, 2009).

Checklist for GPS users

- Know what coordinate system (e.g., UTM, zone 10) and datum (e.g., NAD83) your project uses. The PRBO default is UTM, WGS84 (same as NAD83). In the UTM coordinate system, your zone depends on where you are (see map).
- Download your GPS coordinates daily, using GPS Utility (www.gpsu.co.uk/; Accessed: June 9, 2009) or Waypoint+ (www.tapr.org/~kh2z/Waypoint/; Accessed: June 9, 2009) shareware. It is not uncommon for Garmin units to die in the field. You will need a PC Interface cable to download your data and a registration key for GPS Utility. If you are unable to download, record your coordinates by hand in the field.
- Always carry extra batteries, especially if you're not planning to revisit the site, and turn off your GPS unit when not in use to avoid draining the internal lithium battery. Contact Garmin (www.garmin.com; Accessed: June 9, 2009) for replacement or repair under warranty if your unit dies.
- Submit copies of your GPS coordinate files to the GIS lab at the end of the field season for archiving and general mapping purposes.

GPS Unit Setup

The following general directions are based on the Garmin II, III, 12, and 76 series, but should be similar for other Garmin units. Please refer to your user manuals for specific instructions.

Before taking waypoints in the field, the **GPS navigation display** should be set up to match the **coordinate system**, **horizontal datum**, and **units** used at a particular field project's location. The most common coordinate system used on PRBO projects is **UTM** (Universal Transverse Mercator), with some projects also using decimal degree coordinates (latitude/longitude). Most projects use a **NAD83** (North American Datum of 1983) or **WGS84** (World Geodetic System of

1984) datum. NAD27 is also used by some projects that work with federal agencies such as the U.S. Forest Service.

How to set up your Garmin GPS unit's navigation display

1. Navigate to the **MAIN** menu using either the **PAGE** or **QUIT** buttons.
2. Scroll down to the **SETUP** menu using the multi-directional pad and press **ENTER**.
3. From the **SETUP** menu, go to the **NAVIGATION** or **LOCATION** menu.
4. The **POSITION FORMAT** or **LOCATION FORMAT** menu item is where you will choose the type of coordinates that your GPS will display and record. Cursor down, highlight the currently selected value and press **ENTER** to scroll through the list of formats and highlight the one that applies to your project/location. For UTM, select **UTM/UPS**; for decimal degrees, select **hddd.ddddd**; for degrees-minutes-seconds (DMS) – select **hddmm.mmm**.
5. Under the **MAP DATUM** or **DATUM** menu item, highlight the one that applies to your project/location, and press **ENTER**. Most commonly used are NAD83 and NAD27 CONUS.
6. **CDI Scale settings** (not found on all units): The course deviation indicator (CDI) lets you select the +/- range (sensitivity) of the CDI bar scale, letting you know how much your current course is deviating from your destination waypoint. It is probably best to keep this at its lowest setting (+/-0.25) to prevent you from straying too far from your destination.
7. Under the **UNITS** menu, select **METRIC**.
8. The **HEADING** or **NORTH REFERENCE** category applies whether or not you will be navigating using true north or magnetic north (automatic or user-defined). All units on a project should maintain the same settings as this will affect what direction you will need to travel to get from site to site. This especially applies if you are using your GPS unit to record compass bearings in your directions for the next person who needs to find the points! Record on your point count directions whether your bearings are true north, magnetic north, and/or what user-deviation (declination) was set when recorded. This will make finding poorly flagged points much easier for future observers when satellite coverage is poor. (**See note on true vs. magnetic north.**)

How to log waypoints

1. Navigate to the satellite reception display using either the **PAGE** or **QUIT** buttons and wait until a **3D GPS location** is reported (2D means your accuracy will be low, but it's usually better than nothing).
2. If you have a **WAAS-enabled** unit (GPS 76 series, some Geko and Rino units), go to the general setup menu and make sure WAAS is enabled.
3. Hit the **ENTER** or **MARK** button to record your position. Use the multi-direction pad to enter an ID code for your waypoint. For point counts, enter the full site/station code if possible; it will make your life easier later. If you need more than six digits for your point count site/station code or nest code (and you are using an older Garmin that restricts the number of digits to 6), then take careful notes so that you can rename the waypoint record later. If your unit has an **AVERAGE** function, make sure to select this option and wait a minute or so before selecting **SAVE**.

- Waypoints can be deleted or edited using the **WAYPOINT LIST** or **POINTS** menu.

How to navigate to a waypoint

GPS units differ in their navigation functions, but in general, look for the **NAV** or **GOTO** button. Select the waypoint of interest and choose which window you want to use (compass needle or map) using the **PAGE** button.

Coordinate Systems, Map Projections, and Datums

UTM coordinates are “projected” coordinates, which means they reference a map projection (Transverse Mercator). A **map projection** is a method for **converting the earth’s three-dimensional round surface to the two-dimensional planar surface** of a map. Other commonly used map projections at PRBO include Albers equal-area and Lambert conformal conic (“equal-area” and “conformal” describe the properties of these projections). **Latitude and longitude** coordinates (degrees-minutes-seconds or decimal degrees) are referred to as **geographic** coordinates, meaning that they refer to an exact location on the earth’s three-dimensional surface.

Whether you are using projected (e.g., UTM) or geographic (e.g., lat/long) coordinates, you will need to reference a **horizontal datum**, which can be described as a **base reference** for a coordinate system. It includes the position of a point of origin, a network of surveyed control points, and a model for the shape of the earth. For more information on horizontal datums, see this ESRI website: <http://www.esri.com/news/arcuser/0401/datum.html> (Accessed: June 9, 2009).

True vs. Magnetic North

It's said that a compass points north. That isn't exactly true. The magnet in a compass aligns itself with the magnetic field of the planet. This field flows between the earth's two magnetic poles, the northern of which is the magnetic north pole. True north is the axial pole centered at the top of the planet where the meridians of longitude converge. **Magnetic declination**--the amount and direction of difference between true and magnetic north—changes with location. At Palomarin, for example, magnetic north is to the east of true north and the difference is approximately 15°. The variation is therefore 15°E. The variation in Chicago is 0°. From there true north is in line with magnetic north. Figure 7 shows 2004 magnetic declination contours for the continental U.S. To calculate the declination at a specific study site, go to the following NOAA website: <http://www.ngdc.noaa.gov/geomagmodels/Declination.jsp> (Accessed: June 9, 2009).

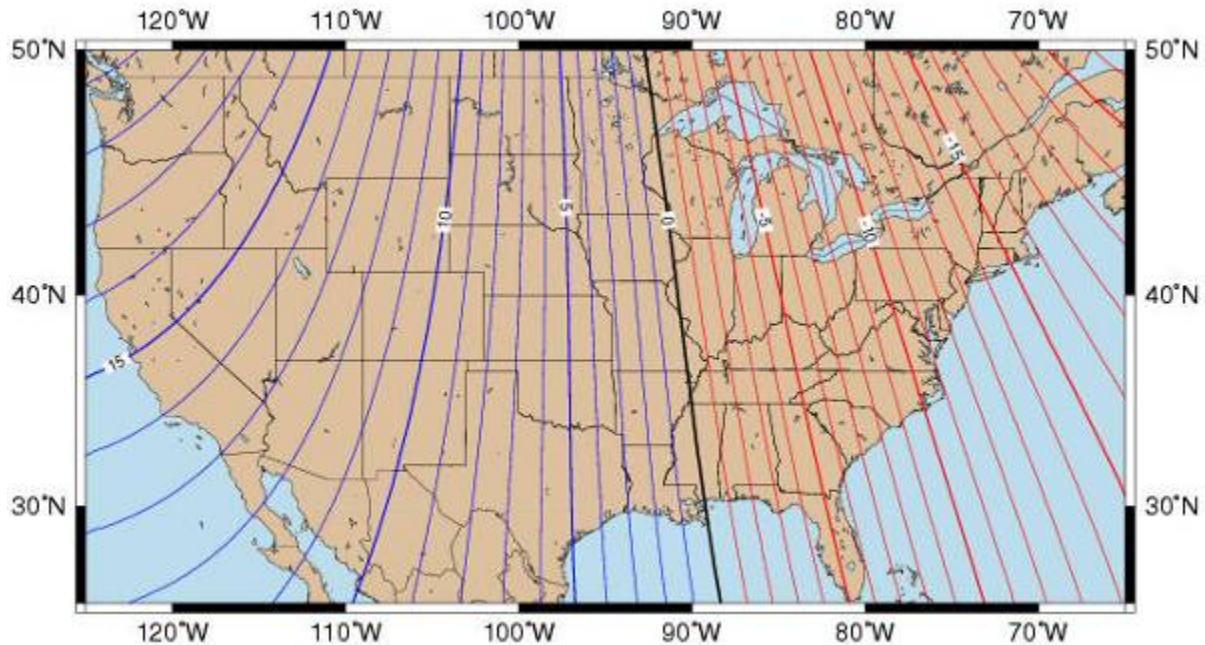


Figure 7. 2004 magnetic declination contours

Downloading GPS Waypoints

An important part of collecting GPS data is retrieving it quickly and efficiently, so that it may be used for analysis purposes later. **Daily data downloads** are **STRONGLY encouraged** in order to prevent loss of data. Every field office should have at least one data / **PC interface cable** (make sure that your cables match your GPS units). Once you are set up, this should take less than five minutes per day, and will save you frustration later if your GPS unit falls off a cliff containing the only copy of your data. Upload and download instructions can also be found at <http://data.prbo.org/cadc2/index.php?page=songbird-taking-gps-points> (Accessed: June 9, 2009).

Generally, there are two steps involved in downloading GPS data:

1. **Transferring coordinate data from your GPS unit to your computer (in text or shapefile format).** This is best done with a shareware program such as **Waypoint Plus** (see below or <http://data.prbo.org/cadc2/index.php?page=songbird-taking-gps-points> for instructions; Accessed: June 9, 2009) or **GPS Utility** (see <http://data.prbo.org/cadc2/index.php?page=songbird-taking-gps-points> for instructions; Accessed: June 9, 2009).
2. **Importing coordinates into ArcView software for viewing with basemaps.** PRBO's **Waypoint Express** extension can be used to create shapefiles from **Waypoint Plus** text files (see below or <http://data.prbo.org/cadc2/index.php?page=songbird-taking-gps-points> for instructions; Accessed: June 9, 2009). If you use **GPS Utility** and export using the shapefile option, you can add the **shapefile** to your ArcView project directly (see <http://data.prbo.org/cadc2/index.php?page=songbird-taking-gps-points> for instructions; Accessed: June 9, 2009).

Waypoint Plus (GPS download shareware currently used by many PRBO projects) is only compatible with older Garmin (PCX5 format) units. For newer Garmin units (including all WAAS-enabled units) you will need a different shareware program (GPS Utility is recommended). Please refer to the following table to determine which combinations will work together. Links to shareware and extensions can be found on the PRBO tools website: <http://data.prbo.org/cadc2/index.php?page=songbird-taking-gps-points>; Accessed: June 9, 2009).

Downloading Garmin GPS waypoints using Waypoint Plus and the Waypoint Express Extension for ArcView

Downloading Garmin GPS coordinates and importing them into ArcView in the proper projection is a two-step process. First you need to download your data from the GPS unit using Waypoint Plus (shareware available at <http://www.tapr.org/~kh2z/Waypoint/>; Accessed: June 9, 2009). Then you can import them into ArcView using an extension developed by PRBO (available at <http://data.prbo.org/cadc2/index.php?page=songbird-taking-gps-points>; Accessed: June 9, 2009). Here's how:

1. Turn on the Garmin GPS unit and connect it to the computer's serial port (probably COM1) using the PC interface cable.
2. Launch Waypoint Plus and go to the *File – Configuration – Modes* menu. Set the coordinates to either **UTM** or **Decimal Degrees** and units to **meters**. Then go to the *File – Datum* menu and select either **North America 1927 mean (NAD27) North America 1983 (NAD83)**, or **WGS84**. UTM NAD83 is preferred unless you know that you need to work in another datum. Make a note of the coordinate system and datum that you select since you will need this information later.
3. Go to *GPS – Port* and make sure the port is set to **COM1** (or whichever port you are using).
4. Select *Waypoints – Download* or *GPS – Download* from *GPS – Waypoints* to download your waypoints. Save the waypoints as a **comma-delimited text file** (*File – Save – Waypoint*). Make sure to note where you save your waypoint file.
5. Make sure you have the following files in your esri\avgis_30\arcview\ext32 directory: **waypoint_express.avx** and **wpt_utmzones_namerica.bmp (bitmap)**.
6. Launch ArcView and load the Waypoint Express extension (from the *File – Extensions* dialog). Select *Waypoint Express – Waypoint → Shapefile* and follow the prompts:
 - Use the file dialog box to navigate to the **text file** that you created in Waypoint+.
 - Select the **coordinate system**. Alternatively, you can look at the text file and note the code after “WP” at the beginning of each line under the header, which will be either “D” or “UTM” depending on the coordinate system.
 - If you are working in UTMs, you will be asked for a **UTM zone**. If you don’t know what zone you are in, select *Show Map* from the dialog. You can also find the zone by looking at the text file. The zone number (followed by a letter, which you don’t have to worry about) is located before the x and y coordinates on each line of text.
 - Select the **datum**. Again, this is the same as what selected in Waypoint+. The datum is also specified in the header of the text file.

- Give a **directory path and a name** for your output shapefile. Consider including the datum and coordinate system within the file name for easier file management.

NOTE: If you get an error message at any point while using this extension please open the text file that you created and make sure that you are inputting the correct information.

7. Once the shapefile is added to the current project you can begin to overlay other shapefiles and images relevant to your project.

Garmin GPS Model	Up/download Software	ArcView Extension
12/12XL 12CX 12Map II Plus III Plus 48 92 126/128 180/185 215/225	Waypoint Plus (www.tapr.org/~kh2z/Waypoint/)	Waypoint Express (www.prbo.org/tools/gps/gps.htm)
PCX5 format	GPS Utility (www.gpsu.co.uk/)	None needed if shapefile option is used
GPS 72/76 GPSMap 60/76 series eTrex series Geko series Rino series	GPS Utility (www.gpsu.co.uk/)	None needed if shapefile option is used

Important: Contact the GIS lab for a GPS Utility registration key.

Uploading Coordinates to your Garmin GPS Unit

Uploading coordinates to your GPS is often necessary for re-finding point count locations, nests or other GPS'ed features that will help you navigate in the field. Some projects may wish to keep all waypoints on the GPS unit to circumvent this step, but space is limited (generally 500-1000 waypoints), and oftentimes coordinates will need to be transferred from one GPS unit to another.

From Waypoint Plus text files

If you are using an older Garmin unit and Waypoint Plus shareware, the easiest way to upload coordinates is to save your Waypoint Plus download text files and use them to upload points back to your GPS unit. You can also combine several text files in one (as long as they are in the same coordinate system and reference the same datum) by cutting and pasting lines of text (each line is a waypoint) from one text file to another. Refer to the Waypoint Plus / Waypoint Express instructions, also included below, for specific directions.

From Shapefiles

If you have coordinates in shapefile format, you can do either of the following:

1. If you have an older Garmin unit (PCX5 format), use the Waypoint Express extension to export your shapefile to Waypoint Plus text file format; then upload the coordinates to the GPS unit using Waypoint Plus. (Refer to the Waypoint Plus / Waypoint Express instructions for specific directions.)
2. With any Garmin unit, you can use GPS Utility to upload shapefiles directly to your GPS unit, bypassing ArcView. (Refer to the GPS Utility instructions for specific directions.)

Uploading coordinates to Garmin GPS units using ArcView and Waypoint Plus

If you have only a few points, it's easiest to enter them directly into a GPS unit by creating a new waypoint and manually editing its coordinates. Alternatively, you can enter your coordinates into Waypoint Plus (shareware available at <http://www.tapr.org/~kh2z/Waypoint/>) using the **Create Waypoint** feature (select *Waypoints – Create Waypoint*) and then upload them to the Garmin unit (select *Waypoints – Upload*). This is slightly faster if you are near a computer.

If you have an ArcView point **shapefile or a dbf file** containing coordinates, you can also export the entire file to Waypoint Plus using the Waypoint Express extension and then uploading them to your Garmin unit through Waypoint Plus. Here's how:

1. Turn on the Garmin GPS unit and connect it to the computer's serial port (probably COM1) using the PC interface cable.
2. Determine the UTM zone and datum for your coordinates (e.g., Zone 10, NAD83) and make sure you have `waypoint_express.avx` in your `esri\avgis_30\arcview\ext32` directory (download from <http://data.prbo.org/cadc2/index.php?page=songbird-taking-gps-points>; Accessed: June 9, 2009). If you are working with a datum other than NAD27, NAD83, or WGS84 contact dstralberg@prbo.org before you continue.
3. Launch ArcView and load the **Waypoint Express** extension from the *File – Extensions* dialog.
4. Add the **point shapefile** to the view window. If you are working with a **dbf file**, you need to convert it to a shapefile first (add it to the project as a table, then go to the view and select *View – Add Event Theme*, select the table and its x and y coordinates, and once it appears in the view go to *Theme – Convert to Shapefile*). Select the points that you want to upload to Garmin using the select tool  (no more than 500 total).
5. Make sure that your attribute table contains a unique ID (up to six characters long) by which you can recognize each point (e.g., PALO01).
6. Go to the *Waypoint Express – Shapefile → Waypoint* and follow the prompts.
 - Select the **theme** that contains the points you want to upload.
 - Select the field that contains the unique **ID** (see #5).
 - Input the **coordinate system, zone** if UTMs (select *Show Map* if you don't know your zone), and **datum**.
 - Name your **Waypoint text file** (comma-delimited text) and pathname when prompted.

7. Turn on your Garmin GPS unit and connect it to your computer's serial port. Go to *GPS – Port* and make sure the port is set to **COM1** (or whichever port you are using).
8. Launch Waypoint Plus and go to the *File – Configuration – Modes* menu. Set the **coordinate system** of the file you just made to and units to **meters**. Then go to the *File – Datum* menu and select the datum that corresponds with your data points (**North America 1983, North America 1927 mean** or **WGS 84**). It is important that you do this *before* the next step to ensure that maintain the correct coordinates.
9. Go to *File – Open* and open your Waypoint Plus text file. To view and check your waypoint file, go to *Waypoints – List Waypoints*. Make sure that the coordinate system, UTM zone (if the coordinate system is in UTM's you should see a letter appended to the zone number), easting/northing coordinates, and Waypoint IDs look correct. (If necessary, clear out old waypoint files using *File – Clear – Waypoints* before opening a new file).
10. Select *Waypoints – Upload* and watch your points being uploaded to the GPS unit. If you see them on your GPS unit, you're done!

Troubleshooting

If some or all of your GPS points don't upload, try checking the following:

1. Is your GPS unit turned on and set to the Garmin receiver mode? (As opposed to real-time differential correction mode). If not, you may need to exit Waypoint Plus and restart after turning on your GPS unit.
2. Are your site codes (IDs) unique in their first six characters? Waypoint Plus will only read in the first six characters, so if you have multiple points with the same first six characters, only one will be uploaded.
3. Does your Waypoint Plus text file have the proper header? Check the parameters below.

GPS Data Management / GIS Lab Coordination

At the **beginning of each field season**, project leaders should **obtain a current copy of the “allpc” shapefile** maintained by the GIS lab in the appropriate coordinate system and datum. This shapefile can be used to obtain coordinates for upload into GPS units, or for creating maps. **Relevant basemaps** such as **roads, streams and topo quads** can also be obtained from the GIS lab or copied from the GIS server at Palomarin or the Wetlands Center (**v:/gis_data** and **v:/gis_projects** directories).

At the **end of each field season**, project leaders should compile all point count, nest, and other relevant GPS datasets into one shapefile or Waypoint Plus text file (per data type) and **submit them to the GIS lab** via e-mail. Please make sure that the coordinate system, UTM zone if applicable, datum, and units are specified within the shapefile or in an associated text file.

Standard Operating Procedure (SOP) 6: Conducting Variable Circular Plot (VCP) Point Count Surveys V1.0

Revision History Log

Prev. Version #	Revision Date	Author	Changes Made	Reason for Change	New Version #

This Standard Operating Procedure explains the PRBO procedures for conducting variable circular plot (VCP) point count surveys. We follow the guidelines established by Ralph et al. (1993) and detailed by PRBO. Included herein are the two types of VCP forms used for this project.

Preparation and Equipment

See SOP # 1 for equipment needed, scheduling crews, training, and preparing for point count season.

Daily timing and conditions of count

Counts begin approximately 15 minutes after local sunrise and should be completed within 3-4 hours, generally by 10AM. Prepare to arrive at your first point at the appropriate time. Do not conduct surveys during weather conditions that likely reduce detectability (e.g., high winds, rain, very dense fog). If conditions change for the worse while doing a count, remaining points can be completed within seven days from the first day, but this should be avoided as much as possible and it is preferable to redo the entire count.

Point count visits

We conduct two visits per season to each transect, with visits at least 10-15 days apart. Timing of the field season will vary by location, but should cover the local breeding season with as little overlap with migration or dispersal as possible. First visit is conducted in May and the second visit in June. When possible, the order in which points are surveyed should vary between visits, so before embarking on the second visit for any site be sure to determine the order the points were done initially. Efforts should be made to try to vary observers between visits to a transect.

Starting and timing your count

At the top of the form, fill out the state, region (county), point count station code, observer name and information, date, visit number, and page number. Approach the point with as little disturbance to the birds as possible, and begin your count as soon as you are oriented and are

confident you can estimate distances accurately (less than 1 minute). During that period of orientation you will want to estimate, with your range finder, distances to a number of features around your point, in order to increase your ability to place birds accurately within distance bands during the point. Record the point count number under the POINT # column. Point counts are five minutes duration at each point. Record the time the survey begins at each point using the 24-hour clock under the TIME column; record seconds as well if you are not starting at the exact minute, as your count needs to be *exactly* five minutes long. If something interferes with your ability to detect birds during the 5-minute count, stop the count until the disturbance has passed and start over. Cross out the interrupted data and note what happened on your form. After five minutes, do not record any new individuals or species detected, and proceed to the next point.

Species detections

Every species detected at a point is recorded, regardless of how far from the observer. Use the standardized banding lab 4-letter abbreviation for species codes (<http://www.pwrc.usgs.gov/bbl/manual/bandsize.htm>) that follow the naming conventions maintained by the American Ornithologists Union <http://www.aou.org/checklist/north/>; Accessed: June 9, 2009). For unknown species, record "XXXX." For unknown members of various families, use "XX" plus two letters to signify the family (e.g., "XXHU" for unidentified hummingbird). You can follow birds after the completion of a point in order to verify identification. No attracting devices, recordings, or "pishing" should be used during the point, but you may use pishing to help identify a bird following the point. If no birds are detected at a point, write "No birds detected" on your form. For each point, one line of data is used for each species, with multiple individuals, if they occur, included on that line of data.

Distances of detections

For each individual detected we record the distance to the initial detection. Make every effort to avoid double counting individuals detected at a single point. However, if an individual is known or thought to have been counted at a previous point, record its presence at the current point anyway, while making a note of it being the same individual. For this project we use the Variable Circular Plot (VCP) method in which the distance of each detection is recorded in the appropriate distance band. If the bird subsequently moves, *do not change the original distance recorded*. The distance should be measured as though a tape were laid across the ground, that is, including any intervening topographic features. Birds that are flying over but not using the habitat on the study area are recorded in the fly-over column. Birds flying below canopy level, flying from one perch to another, actively foraging on or above the study area, or perched high in a tree are put in distance bands according to the distance from the point at which a plumb line would hit the ground if hung from the point at which the bird was first observed. A bird flushed from within 10m of the point when you arrive should be included in the count in the 0-10m band. Birds that are flushed from farther away should be noted on the margins of the form if they are species that didn't occur during the count.

Types of detections

We record the cue that alerted us to the presence of the individual: generally "S" for song, "V" for visual, or "C" for call, in that hierarchical order; (less common are also "D" for drumming woodpecker and "H" for humming hummingbird or wing whir of a dove). If a bird is initially detected using two cues (for instance, you saw it and heard it call simultaneously), we give it the cue highest in the hierarchy (in that example you would indicate the bird with a V). Do not change the type of initial detection if you detect the bird in a different manner later. However, if a bird sings after it has been detected via a different cue, this is indicated in the data by circling the original detection cue (V, C, D or H) to note that a bird was singing subsequent to its initial detection. Juvenile birds are recorded as "J"s regardless of their behavior, so they can be excluded from most analyses as appropriate.

Breeding observations

For each species we record any indications of breeding status if noted during the point count survey at each point as follows (also detailed on bottom of form):

- CO – copulation
- DI – territorial display
- DD – distraction display
- FC – food carry
- FL – fledglings
- FS – fecal sac carry
- MC – material carry
- NF – nest found
- PA - pair

Going between points

After completing the first point, continue as quickly as possible to the next point, navigating with your GPS unit, compass, narrative and/or map as appropriate. Follow the directions outlined above for this and every point. Any interesting species or observations made between each point should be noted in the margins of your point count form. If you have fewer blank lines left on the page than you think you will get species at the next point, cross off those lines and continue on the next page in order to reduce page flipping during the point.

Estimating weather

Around the timing of your first point of the morning, fill out the weather at the bottom of the page to the best of your abilities, estimating temperature, cloud cover, and wind speed. Each time you start a new point count page, estimate the weather again.

Form

Attached is the VCP form. Note that it has been reduced in size to fit the page here. For field purposes the form should be obtained from <http://data.prbo.org/cadc2/index.php?page=songbird-point-counts> (Accessed: June 9, 2009).

Standard Operating Procedure (SOP) 7: Conducting Mist-netting and Banding V2.0

Revision History Log

Prev. Version #	Revision Date	Author	Changes Made	Reason for Change	New Version #
1.0	Oct 2006	T. Gardali	Added info on effort – time of day	NPS internal review comments	2.0

Except where noted, we follow the Institution for Bird Population's (IBP) MAPS (Monitoring Avian Productivity and Survival) Manual for mist-netting and banding (available at <http://www.birdpop.org/maps.htm>; Accessed: June9, 2009). This Standard Operating Procedure explains any variations from those protocols. PRBO's forms, programs and database files are available at <http://www.prbo.org/tools/band/band.htm>, and our full protocols are available in our Palomarin Handbook upon request. IBP and the MAPS program was created after PRBO established our own standardized mist-netting procedures, but the creator of the MAPS program came from PRBO and the protocols are therefore quite similar. Additionally, the manner in which we vary from their protocols does not prevent us from contributing our data annually to IBP, nor does it prevent them from being able to combine our data with data from other MAPS contributors. This SOP also includes our banding form.

Preparation and Equipment

See SOP # 1 for equipment needed, scheduling crews, training, and preparing for point count season.

Effort

Our effort – frequency, number of hours, and seasonality of netting – differs from MAPS in the following ways:

- We run nets for six hours daily; starting from 15 min past local sunrise. Nets are not operated in rainy or excessively windy conditions.
- We are interested in more than the breeding season and breeding species. We run nets at all of our sites in the fall, and at three of the five sites (Palomarin, Muddy Hollow, and Pine Gulch) during winter months.
- During the winter months (November-April), we use the 10-day period MAPS advocates during the breeding season, and band each site other than Palomarin once per period. During the fall, however, we shorten our periods to 7-days, and band each site other than Palomarin once per 7-day period. Ten days are too long during fall migration to go between pulses as you could entirely miss waves of birds passing through the area.

- At Palomarin, we conduct mist-netting more intensively than at standard MAPS stations. During the peak of breeding season and through fall (May-November), we run nets six days per week. During winter (December-April), we run nets three days per week (generally Wednesdays, Saturdays, and Sundays), and never more than two days in a row. This is consistent with how Palomarin banding was conducted before the MAPS program was created, and the heightened intensity of effort increases our ability to conduct many analyses.

Data Forms

Instead of the banding sheet provided by IBP to many of its MAPS contributors, we use our own PRBO banding form (attached). This form meets our specific needs better than the MAPS form would, and has been used at more than 75 banding sites in California and throughout the west. We also provide a copy of our net hour data sheet (for keeping track of the number of hours each net is open for standardization and analysis).

Data Codes

Some of the data codes we use differ from those of MAPS; however, all can be inter-converted. See attached list of codes used by PRBO, taken from the Palomarin Handbook.

Station _____
Permit No. _____

USE 3 FOR DATA NOT TAKEN								
Plum, Juv	J	Breed Patch	1	Feather Wear	F	PP Covert Shape	Y	
Plum, 1st Win	H	Bill/Mouth	1	Molt	M	Primary Shape	Y	
Plum, Adult	A	Skull	5	Wing Chord	X	Feetrix Shape	Y	
Cloacal Pn.	C	Eye	5	Other	X	Tail Length	T	

Band Size

Page _____

New	N
Scrap	S
Unended	U
Destroyed	D
Changed	C
Lost	L

Start Date:

End Date:

U	0	ANY	3	TV	6
Local	1	SV	4	ATV	7
EY	2	ASV	5		

Male	M
Female	F
?	U

300	Wichol
301	Color Banded
415	Injured
010	Unbanded

[illegible]

Banders:

80-6796 DB 85

"Closed Early" Codes: W = wind R = rain H = heat C = cold *O = other

Banding Data Log Codes (from Palomarin Handbook)

Skull pneumaticization

Record as 0, 1, 2, 3, 4, 5, or 6. Record it as "9" if unknown or not taken, but get a second opinion if you are unable to determine the skull yourself, especially if without it you will not be able to age this individual.

- 0 Skull not pneumaticized, that is, only a single thin layer of bone covers the entire brain which shows through the thin covering of bone and appears as an unmarked pinkish color. Beware of thick-skinned birds whose skulls can be very difficult to see because the skin itself tends to be rather opaque.
- 1 A trace of skull pneumaticization can be seen at the very back of the skull, usually appearing as an opaque grayish crescent or a very small triangular area. Between 1% and 5% of the skull is pneumaticized.
- 2 Skull less than 1/3 pneumaticized. Generally, the posterior part of the cranium has a triangular shaped area of pneumaticization that is usually distinctly grayish and contrasts with the non-pneumaticized area. The grayish area typically shows the characteristic small whitish dots of a pneumaticized skull.
- 3 Skull greater than 1/3 but less than 2/3 pneumaticized. Typically, most of the rear half of the skull is pneumaticized as well as a small portion of the front part extending back to the eyes. This front part of the skull is usually difficult to see because the feathers of the forehead are dense, short and difficult to move.
- 4 Skull greater than 2/3 and less than 95% pneumaticized. Non-ossified areas generally show either as two oval spots of pinkish on either side of the cranium or a single spot in the center of the skull.
- 5 Almost complete pneumaticization, between 95-99% complete. These birds show tiny dull, pinkish areas or "windows".
- 6 Complete pneumaticization.

Age

Record as 0 (unknown), 1 (local), 2 (HY), 3 (AHY), 4 (SY), 5 (ASY), 6 (TY), or 7 (ATY). "How aged" codes are at the top of the banding sheet, determine using Pyle (1997). If aged as unknown, put "9" in each of the how aged categories for not applicable.

Reproductive condition

Brood patch (0, 1, 2, 3, 4); Cloacal protuberance (0, 1, 2, 3).

Brood Patch:

- 0 No brood patch present. Breast more or less feathered. Non-feathered areas of the breast and abdomen smooth without evident vascularization. In some species (hummingbirds) and in most juveniles, the breast is normally not feathered. This can look like a brood patch to the inexperienced but the area will be smooth and dark red.
- 1 Smooth skin. A loss of breast and some abdomen feathers, but most of the area is still rather smooth and dark red.
- 2 Vascularization is evident, some wrinkles are present, and fluid is present under the skin giving the area a pale opaque pinkish color as opposed to the normal dark red muscle color. This is the peak of incubation.
- 3 Wrinkled. Abdominal skin is thinning, wrinkly and scaly.
- 4 The vascularization and fluid are entirely gone, and most wrinkles are gone. New pin feathers are present as the area begins to become re-feathered.

Cloacal Protuberance

- 0 No swelling detected
- 1 Cloaca is slightly enlarged. Shape of the protuberance is often such that it is widest at the base and most narrow near the tip.
- 2 Cloacal protuberance is moderate. It is large with a diameter fully as large near the tip as at the base.

- 3 Cloacal protuberance very large and with a diameter considerably larger at the tip than at the base.

Sex

Record the gender (U, M, or F) and how this was determined using the codes at the top of the banding sheet and the Pyle Guide. If sexed as unknown, put "9" in each of the how sexed categories for not applicable.

Fat

Record the fat class of the bird (0, 1, 2, 3, 4, 5, 6, 7).

- 0 No fat in furculum or anywhere on body.
- 1 Furculum less than 5% filled, abdomen with none or trace.
- 2 Furculum less than 1/3 filled, abdomen with a trace or thin layer.
- 3 Furculum half filled in small patches, abdomen with small patches, not covering some areas.
- 4 Furculum more than 2/3 filled, level with clavicles, abdomen with covering pad, slightly mounded.
- 5 Furculum slightly bulging with fat, abdomen well mounded.
- 6 Furculum bulging greatly, abdomen with greatly distended mound.
- 7 Very large fat pads of furculum and abdomen meet.

Body Molt

Classify as 0, 1, 2, or 3. Juvenal birds growing in their juvenal body feathers are NOT going through body molt, while those molting into their first-prebasic or other plumages ARE going through body molt. Body molt should be rated by an overall feeling into the following classes:

- 0 No body molt. No feathers in sheath or growing.
- 1 Light body molt. - a few feathers molting from a few feather tracts or a number of feathers (less than 1/2) molting from only one tract. In general, less than 1/3 of the contour feathers on the birds are in molt.
- 2 Medium body molt. - a number of feathers (generally less than 1/2) are molting from most tracts or a large number of feathers (generally more than 1/2) are molting from one or a few tracts. In general, from 1/3 to 2/3 of a bird's contour feathers are in molt. This class, 2, should also be used in spring when birds may molt only their head feathers but virtually all head feathers are in molt. Such a bird would be given a class 2 even though less than 1/3 of all its contour feathers are in molt.
- 3 Heavy body molt - a large number of feathers (generally greater than 1/2) are molting from many or most tracts. In general, greater than 2/3 of the contour feathers on the bird are in molt. You should note that your mind should be integrating a number of factors in making your rating, including the number of feather tracts in molt as well as the proportion of feathers in molt in each feather tract. Use notes on the back of the page as necessary to describe the extent and location of body molt especially when it is difficult to make a decision as to the proper classification for a given individual.

Flight Feather Molt

Use the following codes for flight feather molt:

- 0 None

- F Flight Feather Molt (regular) - describe in detail on the back of the data sheet.
 A Adventitious Molt (irregular - due to something other than the annual or semi-annual molt sequence) - describe in detail on the back of the data sheet, if there is time to do so.

When recording wing and tail molt use the following codes:

Prim, pp, or 1' = Primaries
 Sec, ss, or 2' = Secondaries
 Rec = Rectrices
 L = left
 R = right
 O = old feather still present - identifiable by wear and fading.
 X = feather missing.
 S = feather still in sheath.
 G = new feather growing. In parentheses record the approximate % of full length that the feather has attained.
 N = new feather fully grown.

Feather Wear

Record the degree of Primary feather wear (0, 1, 2, 3, 4, 5) on the outer 4-5 primaries.

- 0 No wear at all, feather edges perfect and without nicks; a light colored edge exists all the way around the feathers including the tips.
- 1 Very little wear; feather edges only slightly worn and no actual fraying or nicks have occurred; the light colored edge may still exist around the sides of the feathers but not at the tips.
- 2 Slight wear, some nicks, but most feathers still in almost new condition.
- 3 Moderate wear, more nicks, most feathers' tips blunted or worn noticeably.
- 4 Heavy wear, most feathers with nicks, tips worn down significantly. Feather tips often completely off down even to the "fade line."
- 5 Excessive wear; feathers extremely ragged and torn up; shafts usually exposed well beyond the vane; all the tips are usually completely worn or broken off; one wonders how well the bird can fly.

Fade

Record the degree of Primary feather fade (0, 1, 2, 3).

- 0 No fade line present.
- 1 Very faint fade line present; usually visibly only when looking down on the feather in strong light.
- 2 Moderate fade line present; visible upon close examination without having to look down on the feather in very strong light.
- 3 Pronounced fade line present; very obvious pale color to the tips of the primaries, easily discernible in any light situations.

Wing chord

Record the unflattened wing length (wing chord) in mm.

Status

- a. 300 for uninjured silver banded birds
- b. 301 for color banded birds
- c. 000 for California Quail, dead unbanded birds that were processed, and birds that were not given a band due to oversight, injury or decision, but were brought back to the lab or *intentionally* released before then.

Date

Month and then day; the year is accounted for on the top of the banding sheet.

Time

Record the time of net run to the nearest 10 minutes (i.e., record 1240 as “124” and 0715 as “071”)

Location

Location, e.g., PN (standard nets), G1, G2, G3, G4, OG (Off Grid), PS (special captures, i.e. caught in buildings), PA (Palo target nets), PT (Palo trap). For locals, use the grid number as above; for non-Palomarin sites use 4-letter code (e.g., MUHO).

Site

Net number (For birds captured on the grids, use the closest grid marker; for locals, use the nest number (i.e. 12B); for special captures, write a line through it (999's in database) and explain location and method of capture on back of sheet.

Notes (including Special Handling Notes)

Write a complete description of any vagrant species or subspecies or any species new or rare to Palomarin, including all relevant and diagnostic measurements. Describe any unusual plumage characteristics that you encounter. Record and describe any deformities or abnormalities that you encounter (deformed bills, feet, eyes, etc.). Also record other pertinent details or circumstances of your capture – e.g., why all the data was not taken for a bird.

Weight

Record the weight of the bird to nearest 0.1 g.

Literature Cited

Pyle, P. 1997. Identification Guide to North American Birds, Part I. Slate Creek Press, Bolinas, Calif.

Standard Operating Procedure (SOP) 8: Data Management V3.0

Revision History Log

Prev. Version #	Revision Date	Author	Changes Made	Reason for Change	New Version #
1.0	Oct 2006	T. Gardali, D. Press	Added SFAN/NPS protocols as they work with PRBO protocols	NPS internal review comments	2.0
2.0	Oct 2006	M. Fitzgibbon, T. Gardali, D. Press	Modified to use the myCADDC web applications	Change of systems used in process	3.0

Two critical long-term goals of the SFAN I&M Program are to:

- integrate natural resource inventory and monitoring information into National Park Service planning, management, and decision making
- share National Park Service accomplishments and information with other natural resource organizations and form partnerships for attaining common goals and objectives

In order for the landbird monitoring program to meet I&M Program goals, a detailed management plan is needed to ensure data quality, interpretability, security, longevity and availability. This Standard Operating Procedure describes how the SFAN landbird monitoring protocol meets these data management objectives through data entry specifications, database design, quality assurance and control measures, metadata development, data maintenance, data storage and archiving, and data distribution. These procedures are explained for the two types of landbird data included in this monitoring plan that are collected by PRBO for the SFAN: point count surveys and mist-netting.

Database Design

The data collected by PRBO at the SFAN parks are part of larger, regional data sets contained in the California Avian Data Center (CADDC), a data node of the Avian Knowledge Network. All data is stored in the PRBOdb, a set of MySQL databases used for managing avian research data for California and the Pacific flyway. Data is entered, managed, retrieved and analyzed using the MyCADDC web application suite, a set of research-intelligent and easy to use browser applications that include features to maintain high data integrity during entry, proofing and review. See also SOP 8: Appendix 1: PRBO Database Documentation.

In order to ensure the accessibility of the data by NPS staff, to provide the NPS with greater ability to query the data, and to meet I&M database design standards, data are available for

downloading as FoxPro tables from the MyCADDC applications. The data are downloaded as they become available and integrated into a relational Microsoft (MS) Access XP database designed and maintained by the SFAN I&M program. Simple import tools and a series of append queries have been developed to streamline the annual upload process into the SFAN MS Access database. During the append process, some fields are re-formatted to meet I&M data standards. For example, the “data” field in the downloaded data file is a multi-value field storing the type and distance of bird observations and the length of time of the point count. In the MS Access database, this field is split and appended to separate type, timing and distance fields in the point count data table.

Although the SFAN’s MS Access database is modeled from the I&M Natural Resource Database Template (NRDT), its design is limited by the extent and format of the data products made available by PRBO. The concept of organizing the data by sampling events and locations is retained from the NRDT, but certain elements, such as observer contact information, are not delivered from the MyCADDC applications, and therefore not included in the MS Access database. To the greatest extent possible, the MS Access database attempts to mimic the format of the FoxPro data tables, which further limits NRDT compliance. For example, data are currently downloaded by the SFAN as flat text files, and at this time, no effort is being made to normalize the data in the MS Access database. In addition, table and field names in the database are derived from the MySQL databases, and do not conform to the NRDT standards.

Within the SFAN’s MS Access database, data are grouped into two sets of tables representing the point count and mist-netting/banding components of the landbird program. Related data tables are linked in time and space by way of standardized event and location fields that cascade through the tables. Several look-up tables have been established within the database to help decipher data codes used within the core data tables. At this time, the SFAN is only actively acquiring the point count data from PRBO on an annual basis. Although an MS Access template has been developed for the bird banding data, the SFAN and PRBO are still discussing the need to transfer the raw bird banding data to the NPS.

The primary table for storing bird point count data is tblPC_Data. This table contains information about bird observation details collected at pre-determined point count locations. Variables in tblPC_Data include the species detected, type of detection, distance from the observer, duration of the detection, and relevant breeding observations. The table tblPC_Locations provides detailed location information associated with each sampling point, including UTM coordinates, and is linked to the tblPC_Data records by the “UNIQUECODE” field, which uniquely identifies each point count location. Because fields in tblPC_Data use pre-set codes, supporting elements of the point count data include bird species, detection type, distance, and breeding observation look-up tables. Tables relationships for the point count data are illustrated in Figure 13.

The upper tier of the bird banding data set is tblNetHrs, which stores daily event information for banding sites, such as location, date, start/end times, and bander initials. Related to tblNetHrs is tblNetWeather, which details banding weather conditions. Opening and closing times of individual nets at the banding sites are stored in tblNetHrsByNet. Finally, the core bird banding data is stored by individual bird within tblBand. Species, band information, and all of the bird

measurements detailed in the banding SOP are contained in tblBand, with bird species codes referenced to the look-up table tluSpMastr. Tables relationships for the bird banding data are illustrated in Figure 14.

Data Entry and Proofing

For each type of data collected as part of the SFAN monitoring program (point count and banding), data entry and proofing is done by the observer who collected the data. Data is entered and proofed using the MyCADC web applications. All data is stored in the MySQL databases on PRBO servers.

Point Count Data

Using the MyCADC Biologists web application (Figure 8; <http://data.prbo.org/apps/biologists/>; Accessed: June9, 2009), we first enter information about the visit:

The screenshot shows a web browser window titled "Biologist - Add Point Count Transect Visit Observations 1a - Mozilla Firefox". The address bar shows the URL <http://data.prbo.org/apps/biologists/index.php?page=add-point-count-transect-visits>. The page has a blue header with the "prbo" logo and the word "Biologist" in yellow. Below the header is a navigation bar with links: Home, Sampling Units, Field Observations, and Feedback. The main content area is titled "Add New Point Count Transect Visit" and shows a breadcrumb trail: "Presidio (PRES) > Presidio [studyarea](PRES) > Presidio(PRES)". On the right, it says "You are logged in as" with a "log out" button. The "Visit Information" section asks the user to enter information about their visit. It includes fields for: *Visit # (1), *Date of Visit (2009-06-09), *Protocol (VCP with 10m bands to 50m, then 100m, >100m (VCP10_50)), and Researcher (My own observations). At the bottom are "next" and "cancel" buttons.

Figure 8. MyCADC Biologists web application.

Then information about the specific point is selected (Figure 9):

Biologist - Add Point Count Transect Visit Observations 2b - Mozilla Firefox

File Edit View History Bookmarks Tools Help

http://data.prbo.org/apps/biologists/index.php?page=add-point-count-transect-visit-i

Google

Presidio (PRES) > Presidio [studyarea](PRES) > Presidio(PRES)

You are logged in as
log out

Visit: 1 Date: 2009-06-09 Protocol: VCP with 10m bands to 50m, then 100m, >100m (VCP10_50)

No Observations found for this Point Count Transect Visit.

Select an Observation Point

Select the observation point you want to add observations under, and provide a start time for observations at that location, your time interval and any comments related to this point in this visit. Click **add observations** to enter your species observation data. If you didn't collect any observations at a point, click **no observations** to save the selected point without observations explicitly in the database.

When you are finished, click on **Proof your observations** to review the data for this event and make sure your entries accurately reflect your field work.

*Point: 1 (PRES_1) *Observ. Time: 905 *Time Interval: 0 to 5 minutes

Point
Comments

add observations no observations cancel

Proof your observations

Figure 9. MyCADCBiologists web application – selecting observation point.

Next, specific observation data is added (Figure 10):

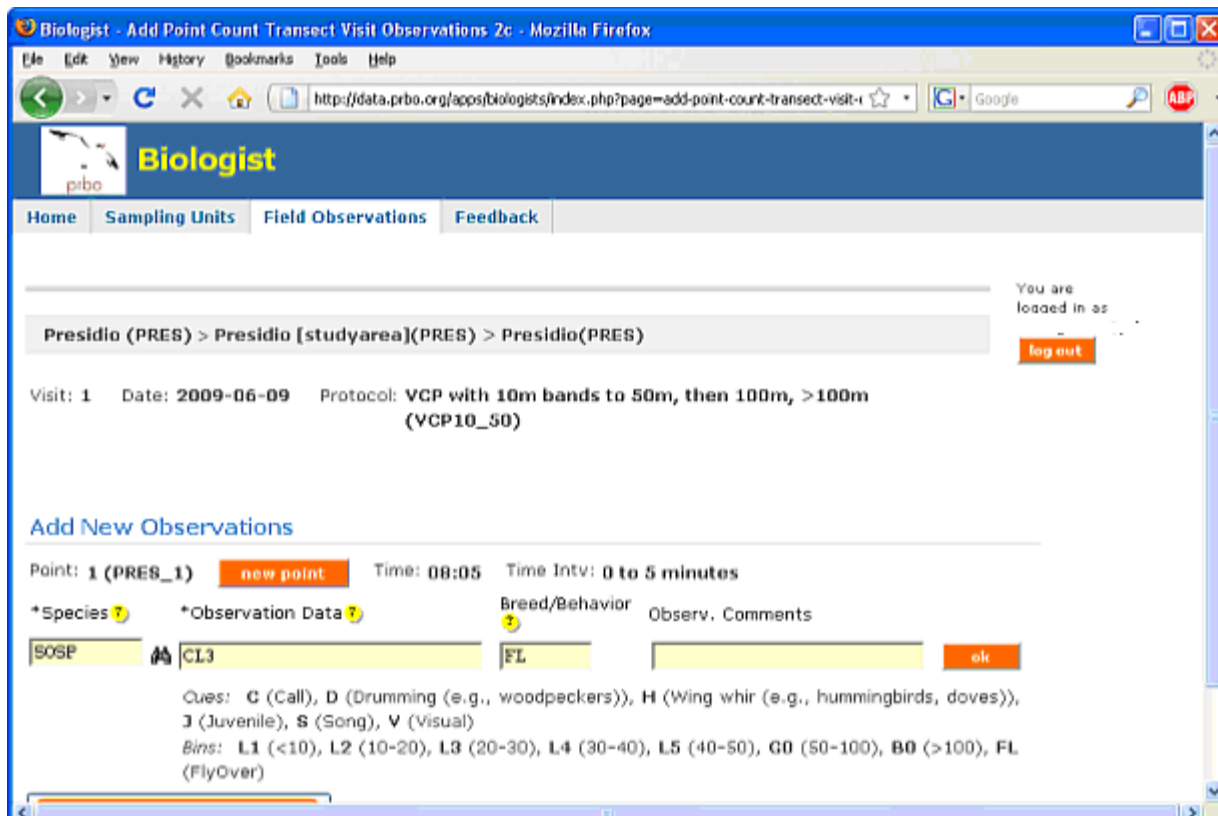


Figure 10. MyCADCBiologists web application – add new observations.

We then proof the data using the same program, and selecting "Proof your observations" button. We proof from the raw data to the computer screen, on which the program presents the summarized data to look like the data sheet for streamlined proofing (Figure 11):

Biologist - List Observations - Mozilla Firefox

File Edit View History Bookmarks Tools Help

http://data.prbo.org/apps/biologists/index.php?page=list-point-count-transect-visit-cl

Add more observations

Proofing completed

statistics

copy table to: [CSV](#) [HTML](#) [DOC](#) [PDF](#)

Point	Time	Mins	Spp	<10	10-20	20-30	30-40	40-50	50-100	>100	FlyOver	Brd/Bhv	Rsrchr	Remarks
PRES_12	07:00	5	CORA						1C					
PRES_12	07:00	5	ANHU		1C									
PRES_12	07:00	5	AMRO		1V			2C						
PRES_12	07:00	5	PYNU			3C								
PRES_12	07:00	5	VATH					1V						
PRES_12	07:00	5	AMGO							1C				
PRES_12	07:00	5	SOSP						1S					
PRES_12	07:00	5	PUFI						1S					

Figure 11. Proofing data.

The program also provides other summary tools to help improve the quality of proofing. We write in red on the data forms any corrections/deletions/additions that need to be made, and then make corrections to the point count database file. When finished, we select “Proofing completed”.

Next, the project leader reviews the point counts in the MyCADDC Project Leaders application (Figure 12; <http://data.prbo.org/apps/projectleaders>; Accessed: June 9, 2009). The project leader reviews the raw and summarized data for the point count, and, when finished, decides the level of availability to set for the data:

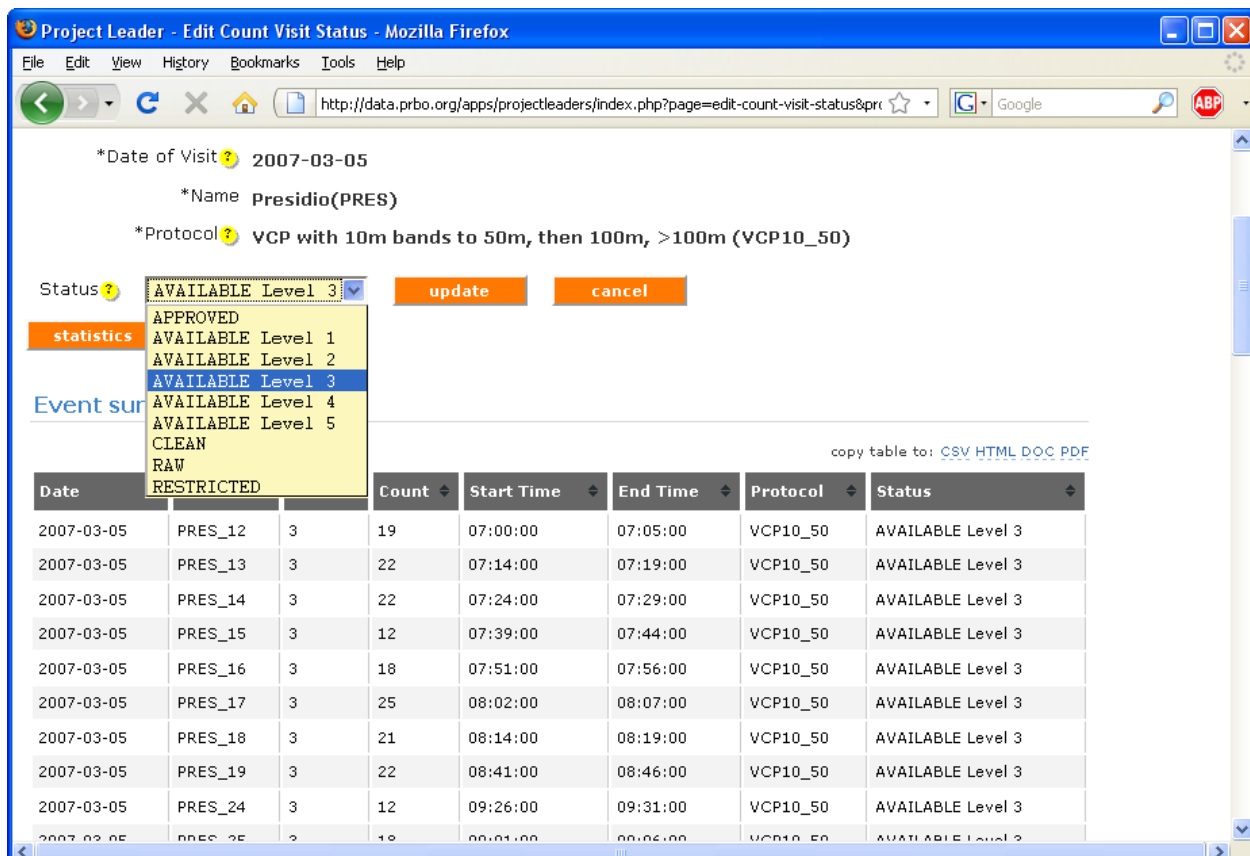


Figure 12. Project leader review.

Descriptions of the levels of availability are described in the application. All data entered in 2007 and earlier are stored as “AVAILABLE Level 3”, which is defined as

Data can be used in publicly available, predefined visualizations (i.e. maps and graphs). Additionally, data is made available to existing bioinformatic efforts (GBIF and ORNIS).

After completing all point counts for the season, we also proof species codes, visits, sites, and data types. This data entry and proofing process for point counts is completed by the end of the breeding season.

Banding Data

Any bird that receives a line of data must be entered into the computer database. It is essential that this data entry be done daily, in order for the bander to correct any errors that were made. It is done via PRBO’s Visual FoxPro data entry program, available at <http://www.prbo.org/tools/band/band.htm>. Through this we also enter weather data and net hours data. We then proof the data daily and again monthly, each time proofing them manually by reading from the raw data and checking the entered data for mistakes, and each time also proofing them through a computer generated program (created by PRBO) that checks for other types of errors (e.g., discrepancy between ageing or sexing data; invalid or illogical codes). We also view the compiled historical capture history for each recaptured bird from a given day to

look for errors in the current or previous captures of an individual. In addition, before we submit banding data to the USGS Bird Banding Laboratory (BBL), it undergoes another computer proofing process through a BBL computer program for select error types (e.g., wing chord out of range for the species, age illogical given time of year).

Providing SFAN with Data

All data is available to the SFAN at any time via the MyCADC Project Leaders applications. From this application, any set of visits can be downloaded for any set of locations into a variety of data formats, including the FoxPro format used to append data into the Access database.

Quality Assurance and Quality Control

Data must meet certain quality assurance (QA) and quality control (QC) standards in order to ensure that the data are consistent, repeatable and reliable, and so that the data stand up to external review. QA ensures that data meet defined standards of quality with a stated level of confidence. QA refers to the overall management system, which includes the organization, planning, data collection, documentation, metadata, evaluation, and reporting activities of the program. QC refers to the technical procedures involved in controlling errors, such as personnel training, calibration of equipment, repeated measuring to determine differences among observers and the repeatability of measurements by the same person, and exercises to identify the level of error during data recording and data entry.

Before the data are received by SFAN parks, the handling of the data follow a rigorous process, established and refined over many years at PRBO. The data entry and proofing process, described above, follows clearly defined protocols provided on our website (<http://data.prbo.org/cadc2/index.php?page=field-research>; Accessed: June 9, 2009) and in our Palomarin Handbook. Additionally, the user-friendly MyCADC web applications created by PRBO provide guidance through the data entry and proofing steps.

Other Data QA/QC steps include the following:

- Intensive and extensive training of interns and staff (including high retention rate of trained personnel, including field biologists and supervising biologists)
- Data forms are consistent over years (minor improving changes are occasionally made, with date on the bottom of each form representing versioning changes), and most recent versions are available at <http://data.prbo.org/cadc2/index.php?page=field-research> (Accessed: June 9, 2009).
- Data entry completed by the observer who collected the data
- The data are proofed for errors and consistency (daily, monthly and seasonally for banding data; daily and seasonally for point count data), both manually (all types of data) and with a program that detects inconsistencies (banding program only)
- Data are also proofed for outliers (e.g., quantities that do not make sense) or unlikely observations (e.g., species that do not occur locally).
- Annual summary analysis help to ensure that data are managed and collected properly

Metadata Procedures

The NPS GIS Committee recently required all NPS GIS data layers be described with the NPS Metadata Profile, which combines the FDGC standard, elements of the ESRI metadata profile, the Biological Data Profile, and NPS-specific elements. Although no standard has been applied to natural resource databases, the SFAN will complete the NPS Metadata Profile to the greatest extent possible to document databases developed for the SFAN I&M program.

A complete metadata record for the SFAN landbird monitoring MS Access database will be generated in compliance with current NPS standards by the SFAN data manager. Because the location data for this project is stored as UTM coordinates with the MS Access database, there are no spatial data products associated with this protocol that require metadata records.

The metadata record will initially be developed in Dataset Catalog v3.0, an MS Access metadata development and catalog tool developed by the NPS I&M Program. Dataset Catalog is currently the preferred tool to begin metadata records for MS Access databases because of its ability to harvest entity and attribute information from this database format.

The metadata record will be exported from Dataset Catalog as an XML file and completed in NPS Metadata Tools and Editor v1.0, thus allowing for all NPS-specific elements in the metadata record to be completed. The final metadata record will be posted to the NR-GIS Data Store for public discovery and consumption. Although the actual database will not be posted at the NR-GIS Data Store, contact information within the metadata record will direct interested parties to the SFAN lead data manager for further inquiries.

Data Maintenance and Version Control

Data sets are rarely static. They often change through additions, corrections, and improvements made following the archival of a data set. There are three main caveats to this process:

- Only make changes that improve or update the data while maintaining data integrity.
- Once archived, document any changes made to the data set.
- Be prepared to recover from mistakes made during editing.

Version control is the process of documenting the temporal integrity of files as they are being changed or updated. Change includes any alteration in the structure or content of the files, and such changes should not be made without the ability to undo mistakes caused by incorrect manipulation of the data. Data progresses through various lifecycle stages, and whenever a set of changes is complete, the user should save the file with a unique name.

At the SFAN, version control guidelines for the MS Access landbird monitoring database will follow those presented in the SFAN's Data Management Plan (Press 2005). Prior to any major changes to the database, a copy should be archived with the appropriate version number that allows the tracking of changes over time. Version numbers should increase incrementally by hundredths (e.g. version 1_01, version 1_02, ...etc) for minor changes. Major revisions should be designated with the next whole number (e.g., version 2_0, 3_0, 4_0 ...). With proper controls

and communication, versioning ensures that only the most current database version is used for queries and analyses.

Database revisions will be documented within the landbird monitoring database utilizing the “tbl_DB_Meta” and “tbl_DB_Revisions” tables developed for the NRDT (Figure 15).

Significant database re-design may require approval by the project manager and review by other data management staff. Following completion of a new database version, metadata records and online postings will be updated. Program revision (pointcnt.exe, band.exe, etc.) is also kept track of within the program through versioning, and is documented within the appropriate SOP.

Data Storage and Archival Procedures

All completed raw data are filed in a binder for the current year at the Palomarin Field Station, which is the headquarters of PRBO’s Terrestrial Ecology Division. In addition, the CADC databases of observation data are kept on servers at PRBO Conservation Science headquarters in Petaluma, and are backed up to disk nightly as well as archived on tape. Data is also contributed to national databases (banding data: to the USGS Bird Banding Lab in Patuxent, MD, and to the Institute for Bird Population, Point Reyes Station, CA, and point counts to the Avian Knowledge Network, based on the level of Availability discussed earlier) as well as to the SFAN of the National Park Service. Hard copies of all banding data and, eventually, all other types of data, will also be scanned and stored digitally as Adobe Acrobat PDFs; these are stored on the Palomarin server (under Z:\Terrestrial\raw_data_archive) with backups kept at PRBO headquarters.

PRBO uses a variety of servers, storage arrays, and tape subsystems to ensure data integrity and availability. All servers and arrays are configured with redundant hard drives in RAID 1, RAID 5, or RAID 50 configurations. All servers and arrays have redundant power supplies and cooling fans. All servers and arrays are also connected to uninterruptible power supplies (UPS) to ensure orderly shut down in the event of a power failure. In general, files stored on servers or arrays at remote offices will be synchronized nightly with systems at the PRBO headquarters in Petaluma, California. Data at Petaluma is backed up to tape on an ongoing basis and tapes are rotated off-site weekly.

At the SFAN, all documents and data related to the landbird monitoring program are stored on the Marin Headlands server in the Golden Gate National Recreation Area. The landbird directory is found on the Network I&M drive, with data and documents stored in separate folders (Figure 16). The Dell PE 4600 Marin Headlands server has several built-in redundancy features to ensure data are kept safe, including a pair of hard drives configured as level-1 RAID (mirroring), data storage on a level-5 RAID with data capacity of 200GB, and redundant power supply. A SDLT 110/220 GB tape drive is also connected to back up data. The backup scheme is full nightly backup on every Tuesday and Friday. The remaining days of the week, including Saturday and Sunday, are incremental and are appended to the same tape that is used for full backup. The last tape of the month is taken offsite to further protect the data. GOGA IT team members are responsible for managing the tape backup jobs and tapes.

The SFAN maintains an archive directory on the Marin Headlands server where landbird monitoring data will be archived annually. Once incorporated into the landbird MS Access database (Figures 13 - 16), all raw data exports received from PRBO will be stored in the archive directory, separated by field season. The landbird database will be archived annually after that year's field data has been incorporated by the SFAN data manager. All data files in the archive directory are stored in read-only format. Each year, a CD will be created with that year's raw field data, the updated MS Access database, the accompanying annual report, and the landbird monitoring protocol.

Data Distribution

In order for the landbird monitoring program to inform park management and to share its information with other organizations and the general public, guidance documents, reports, and data must be easily discoverable and obtainable. The main mechanism for distribution of the landbird monitoring documents and data will be the Internet. The protocols and forms used in this monitoring program, in addition to being included and referenced in the other SOPs, are available at:

<http://data.prbo.org/cadc2/index.php?page=field-research> (Accessed: June 9, 2009)

The landbird monitoring protocol, accompanying SOPs, and all annual reports will be made available for download at the SFAN website:

<http://science.nature.nps.gov/im/units/sfan/index.cfm>

Although the landbird monitoring database will not be posted for public download, as previously mentioned, a metadata record for the database will be maintained at the NR-GIS Data Store. The metadata record will direct interested parties to the SFAN lead data manager for further inquiries.

In addition to the NR-GIS Data Store, the NPS I&M Program maintains an on-line natural resource bibliographic database known as NatureBib. NatureBib records will be created for all of the landbird monitoring documents, including the protocol, annual reports, and any resulting publications. The public version of NatureBib is in development by the NPS I&M program.

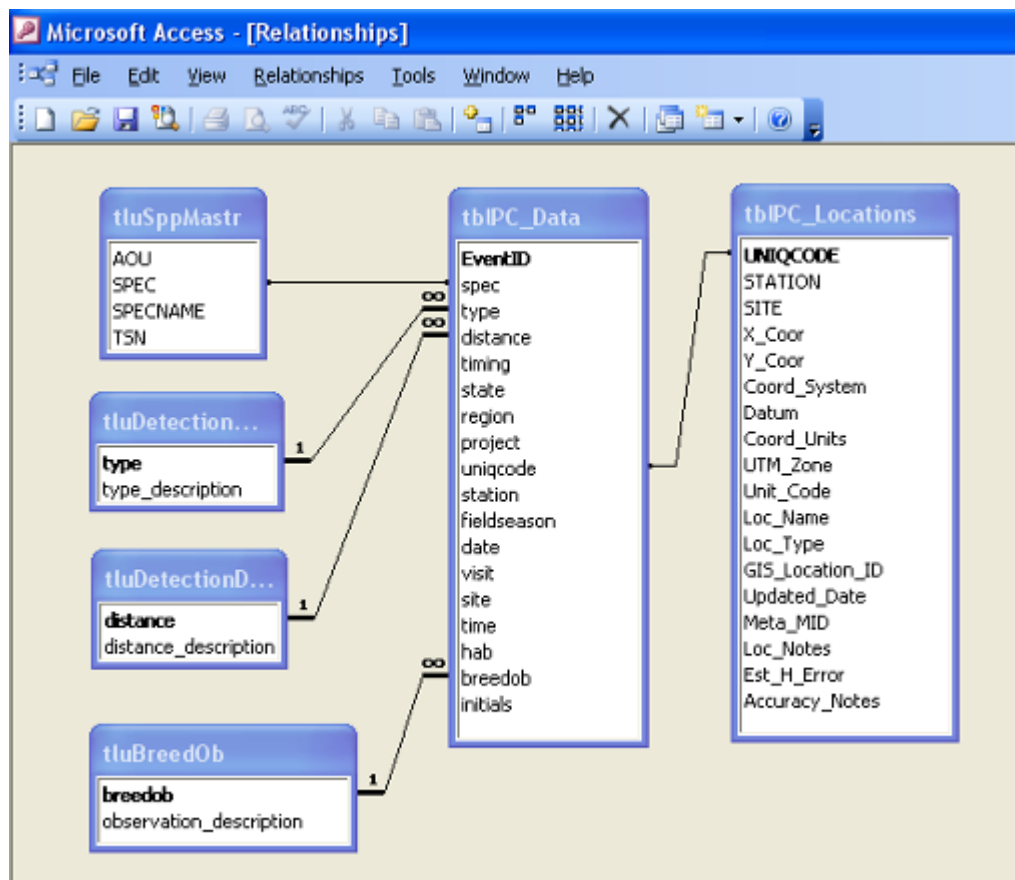


Figure 13. Table relationships for the landbird monitoring point count data set.

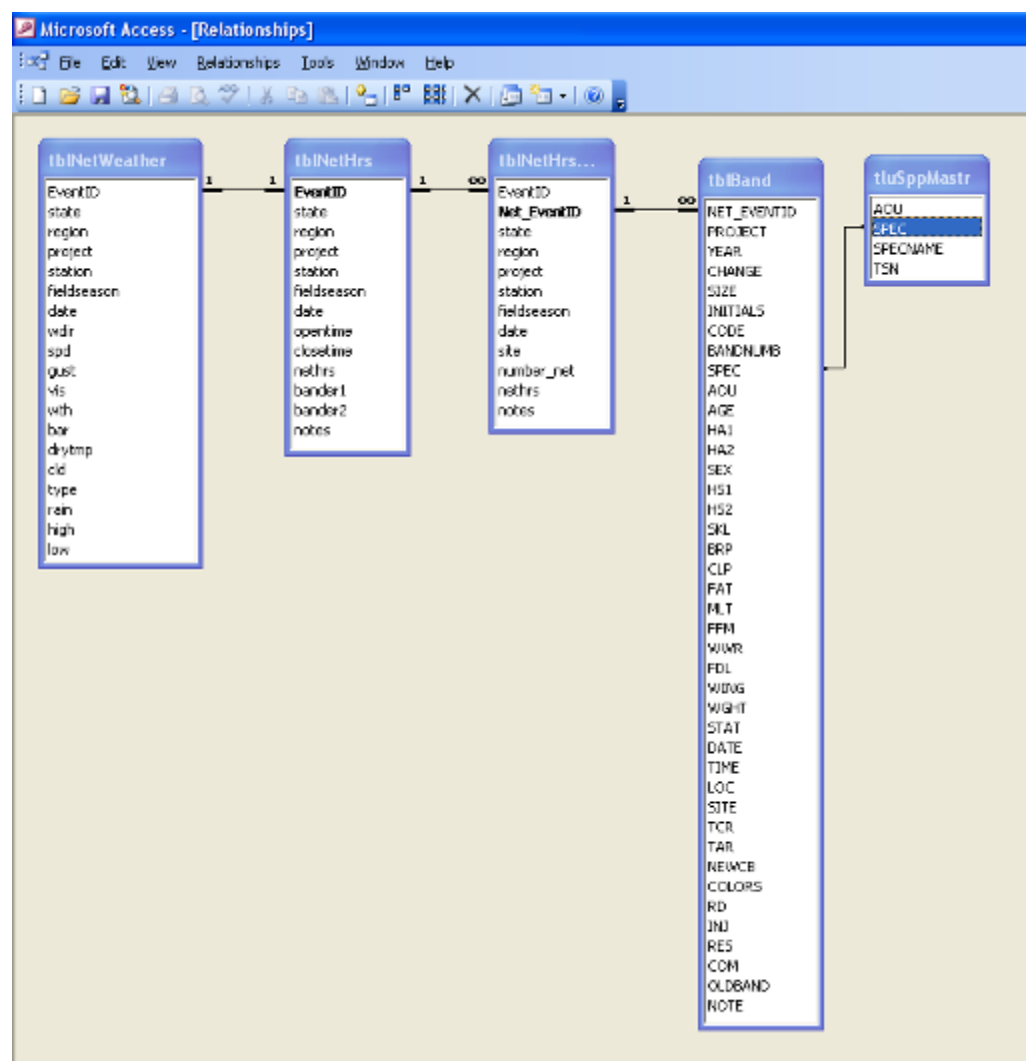


Figure 14. Table relationships for the landbird monitoring bird banding data set.

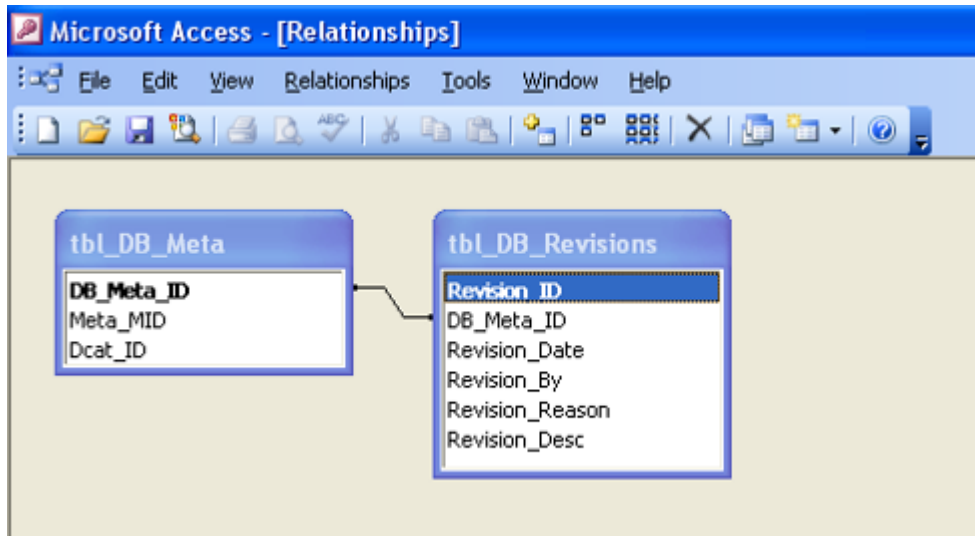


Figure 15. Tables used to document revisions and updates to the landbird monitoring database.

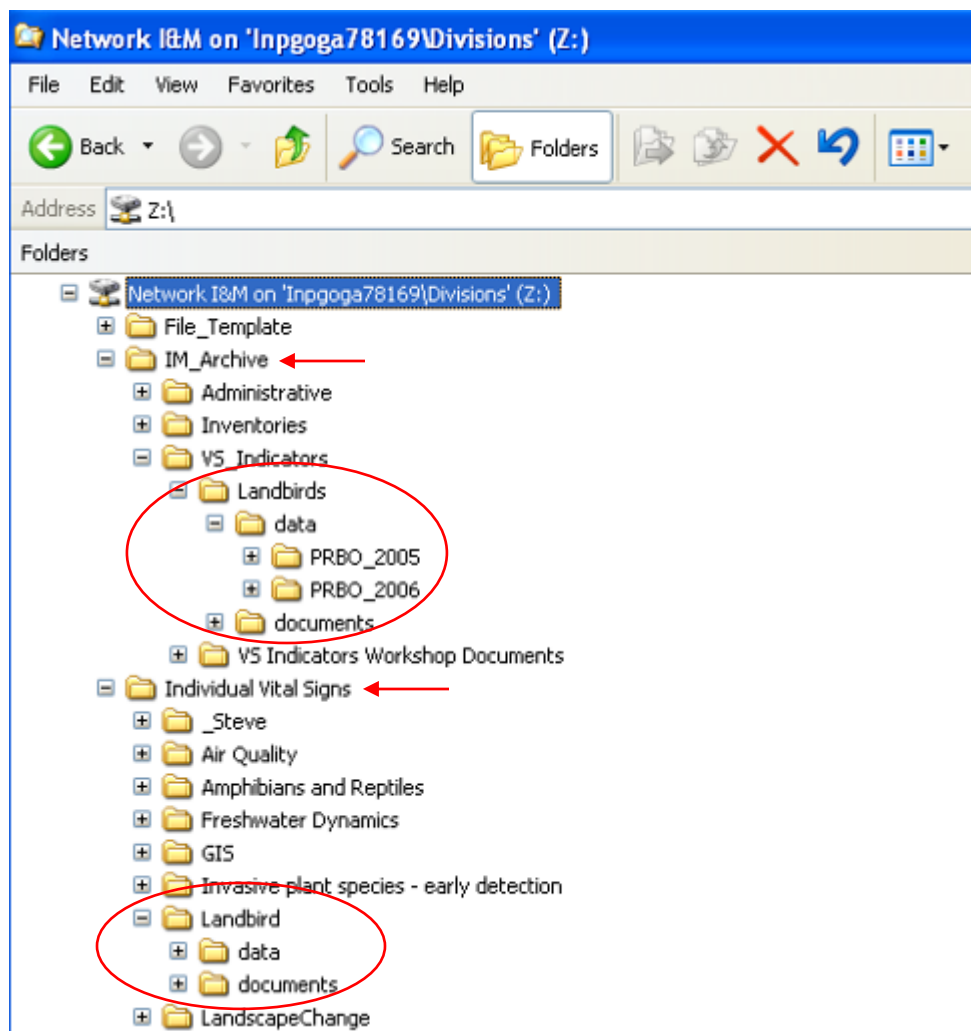
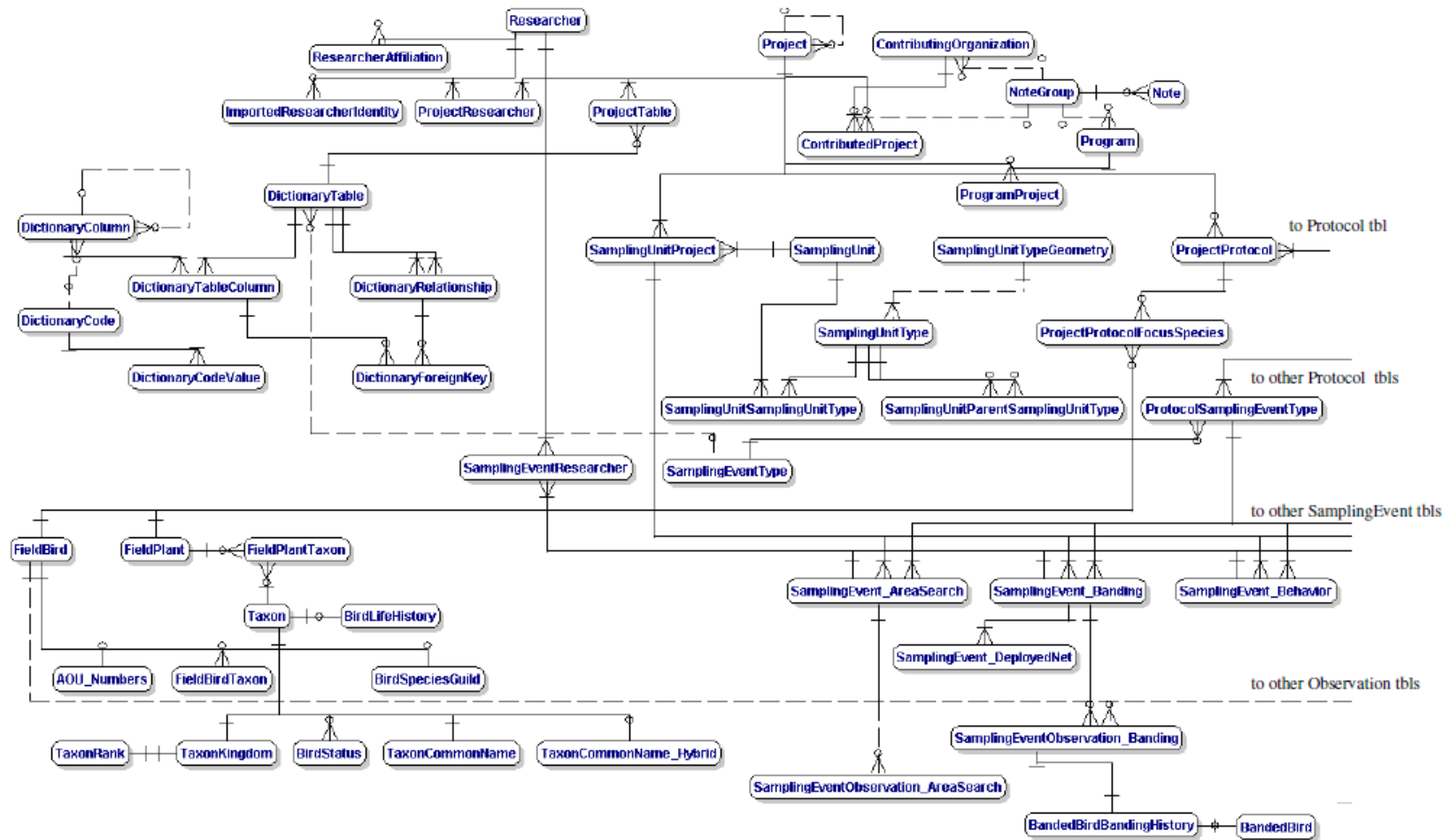


Figure 16. Directory structure of landbird files stored on the Marin Headlands server at the Golden Gate National Recreation Area.

SOP 8: Appendix 1: PRBO Database Documentation

These tables can be grouped in six broad categories of data, as shown in the following figures:



to ProjectProtocol tbl



to ProtocolSamplingEventType tbl

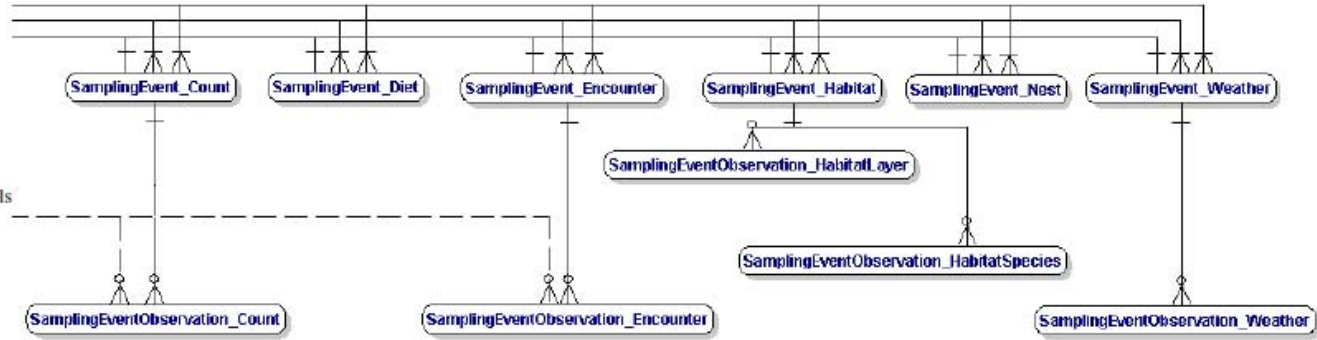


ProtocolDetectionCue

ProtocolTimeBin

ProtocolDistanceBin

to other SamplingEvent tbls



SamplingEvent_Count

SamplingEvent_Diet

SamplingEvent_Encounter

SamplingEvent_Habitat

SamplingEvent_Nest

SamplingEvent_Weather

SamplingEventObservation_HabitatLayer

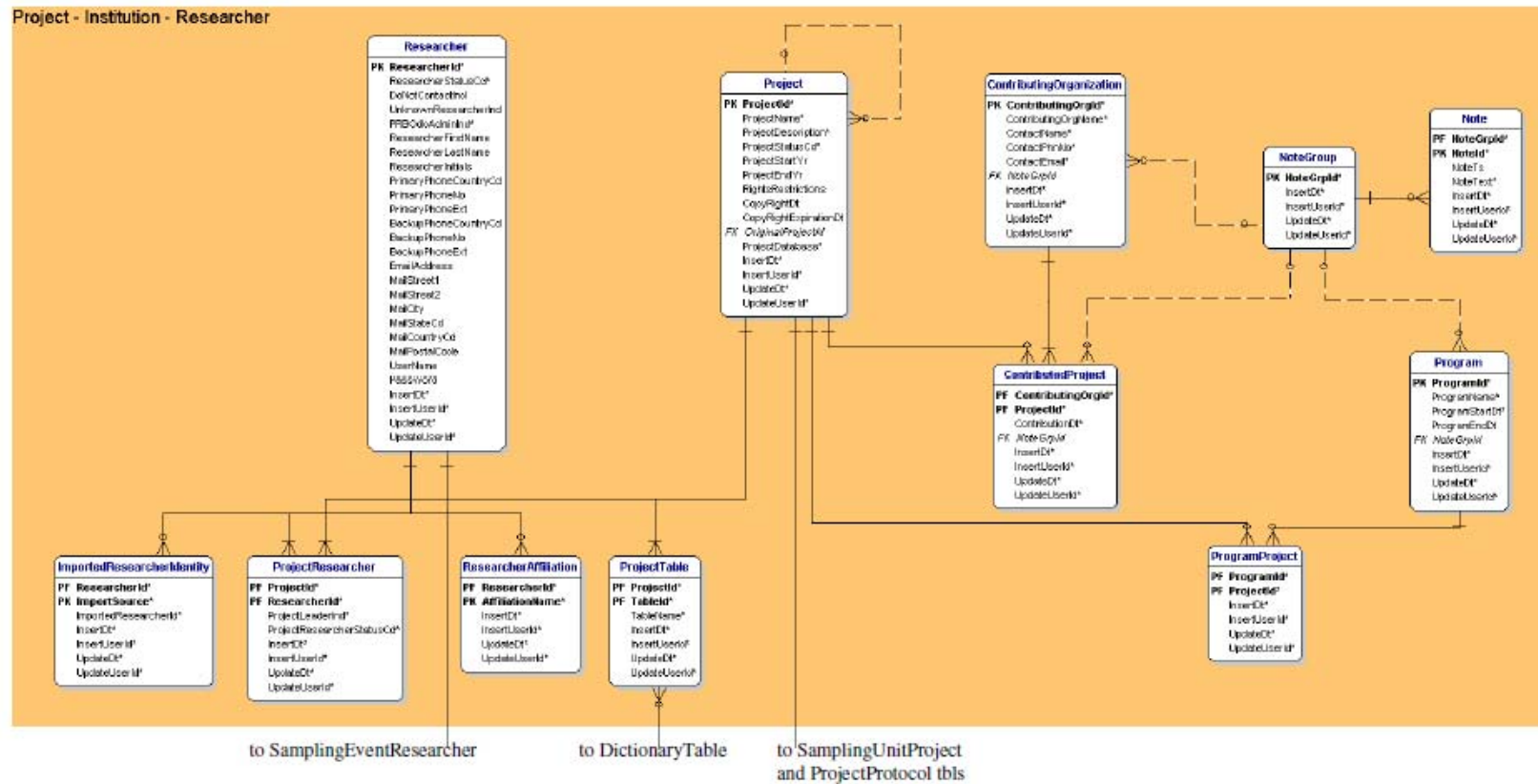
SamplingEventObservation_HabitatSpecies

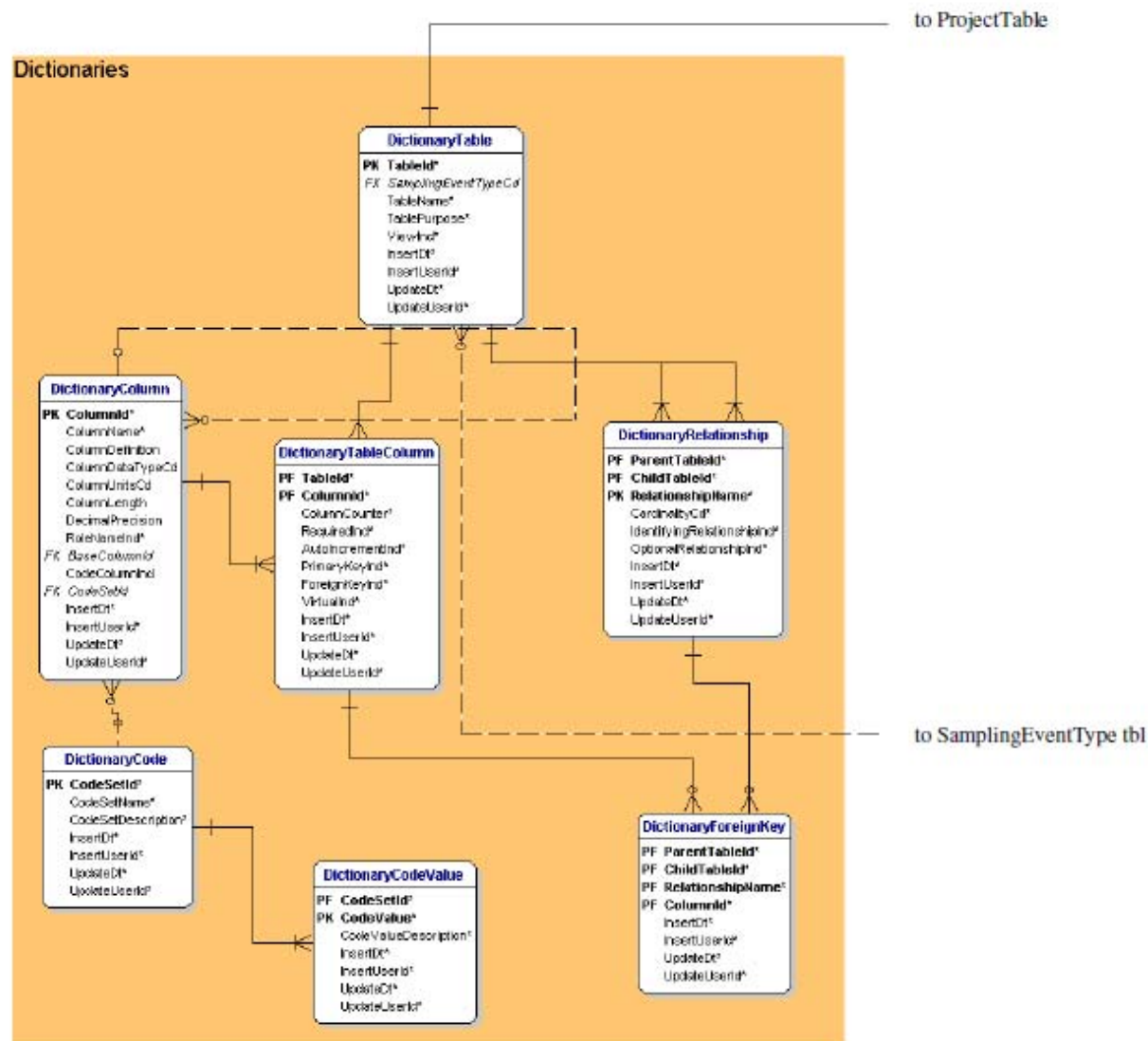
SamplingEventObservation_Count

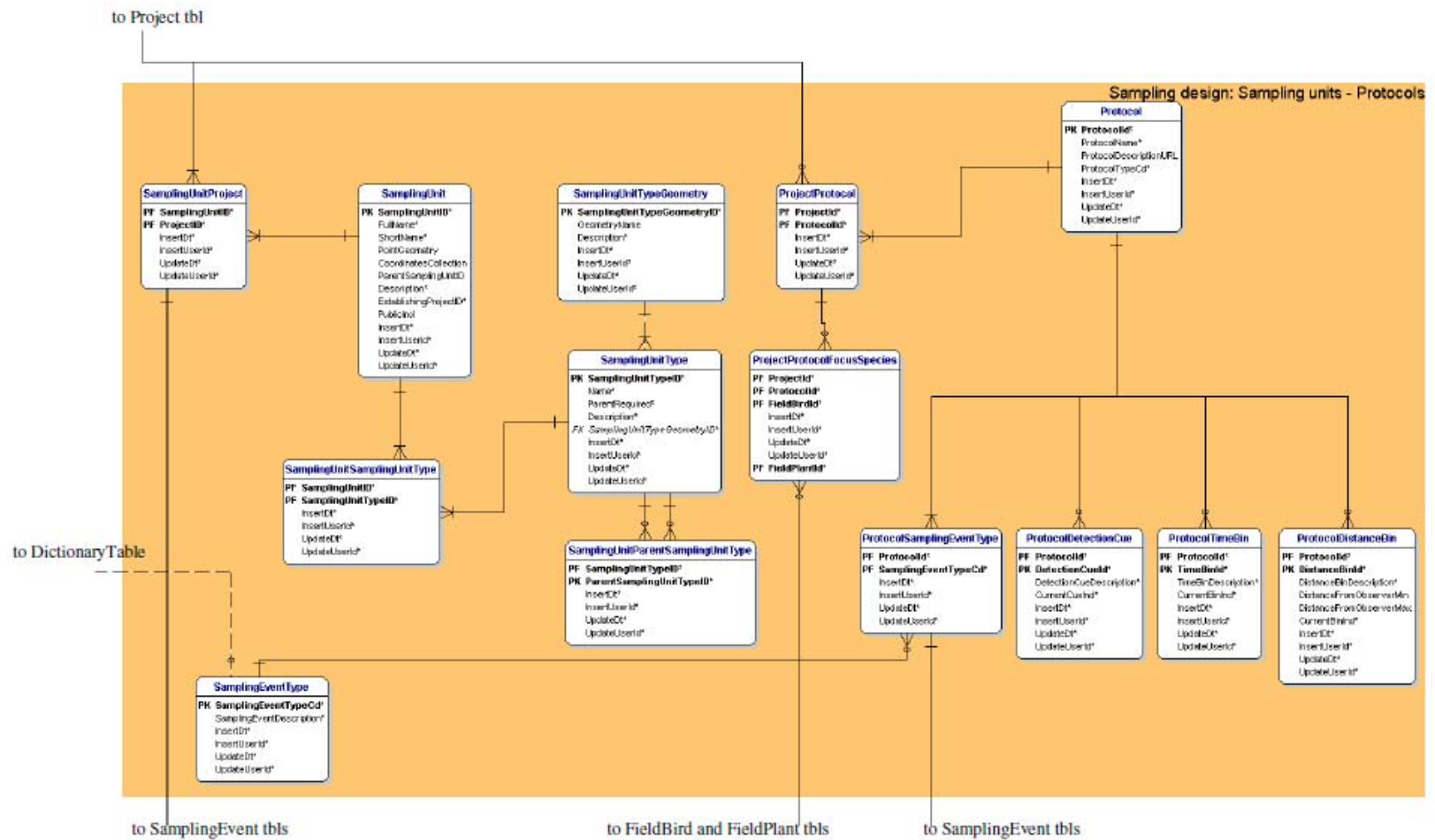
SamplingEventObservation_Encounter

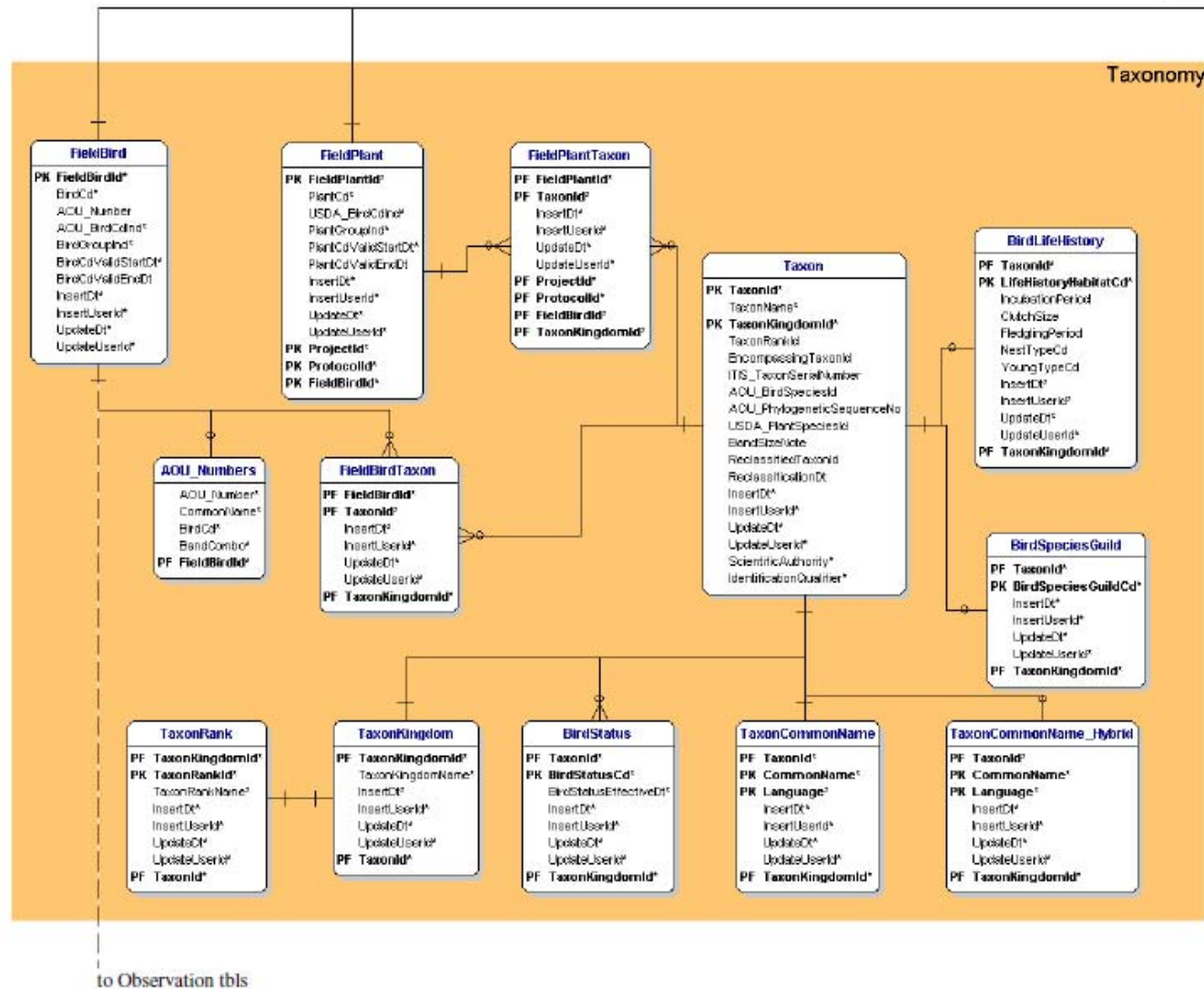
SamplingEventObservation_Weather

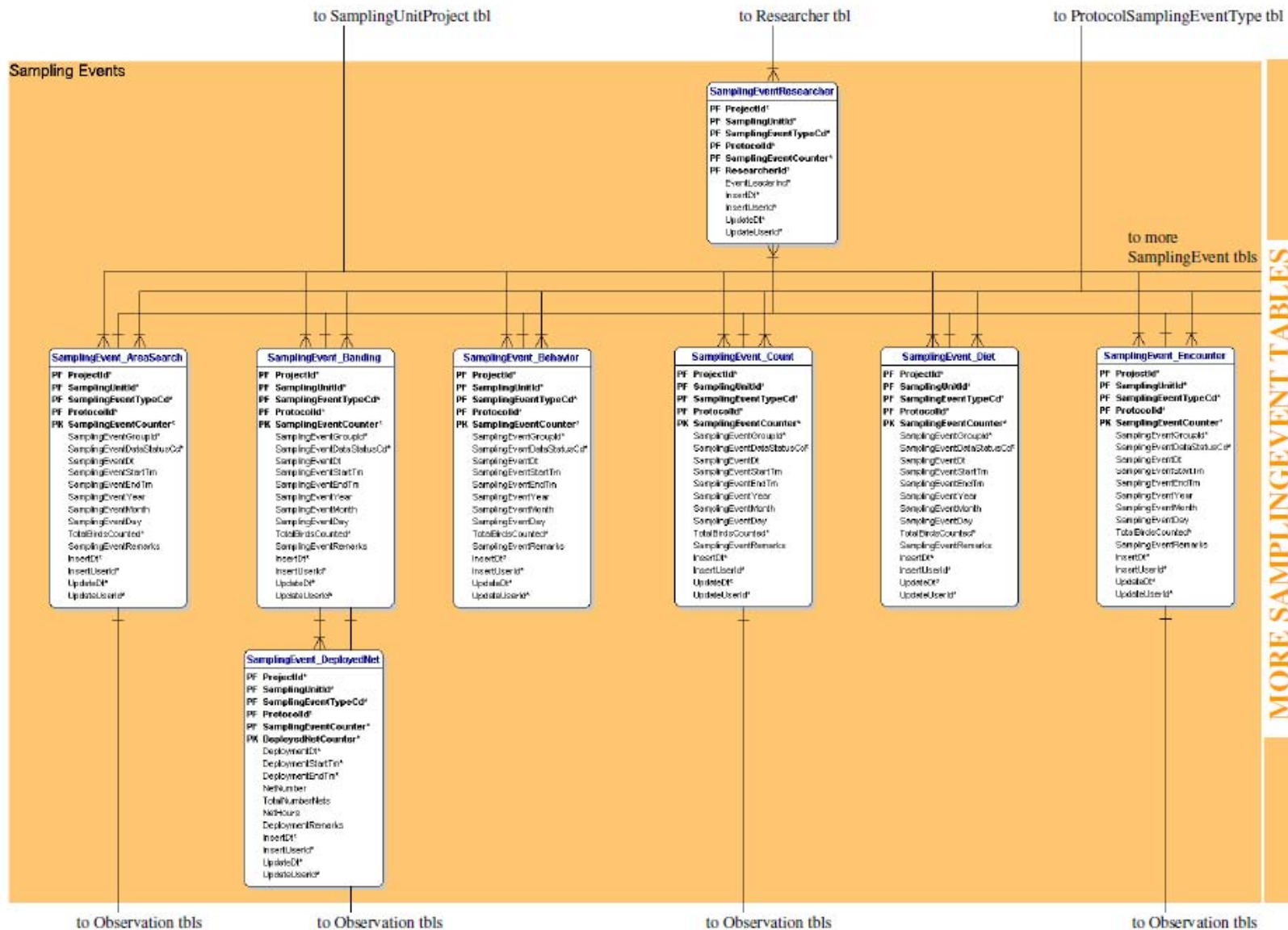
These tables can be grouped in six broad categories of data, as shown in the following figures:

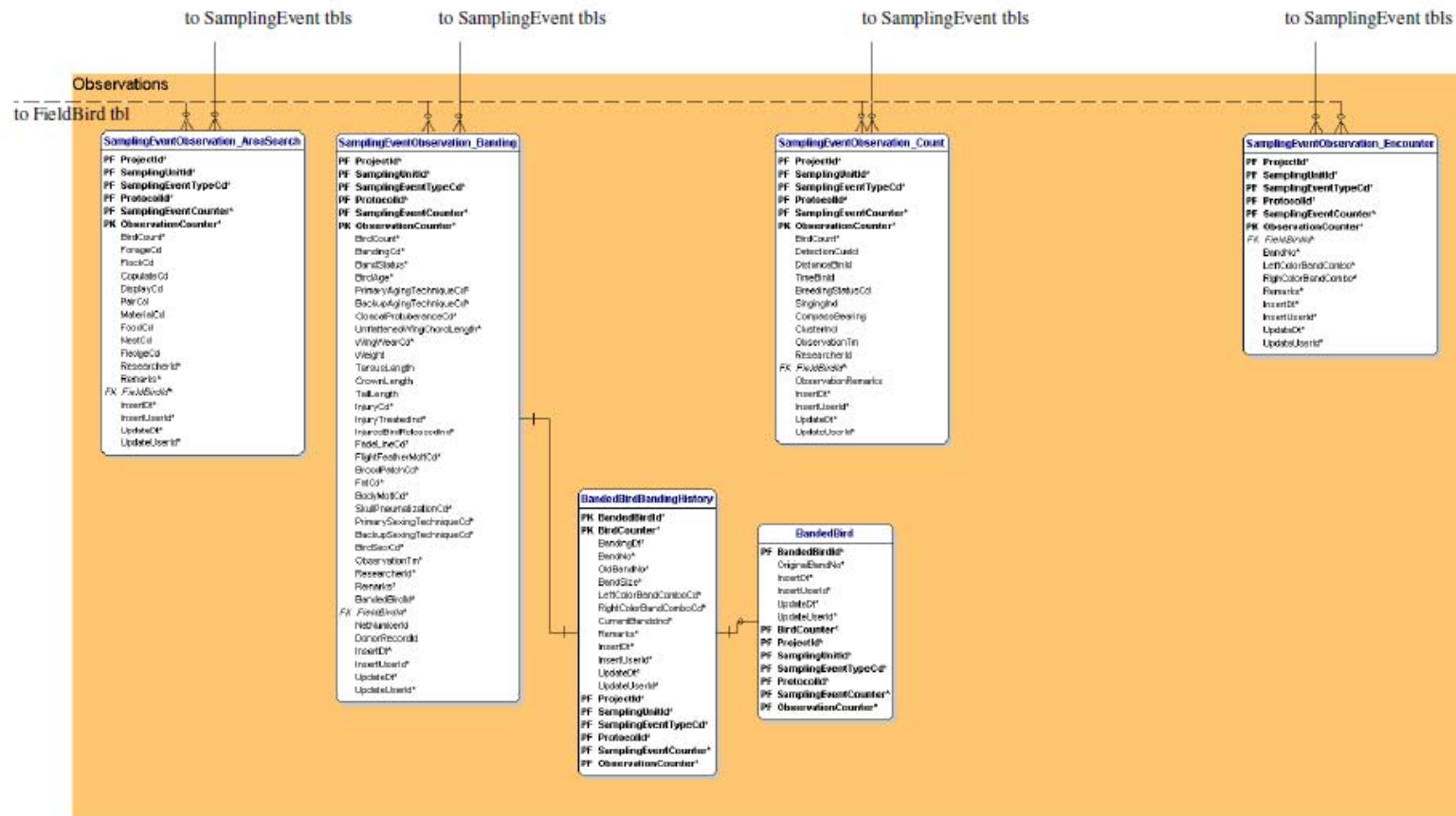












Descriptive metadata of PRBO Conservation Science's enterprise database

Table: AOU_Numbers

Provides the AOU identifier number to an avian taxon, links to BBL four-letter species code and provides recommended band size for the taxon

No indices

<i>Field name</i>	<i>Index</i>	<i>Data type</i>	<i>Description</i>
AOU_Number*		varchar(12)	The numerical identifier of the taxon given by the AOU
CommonName*		varchar(255)	A common name for taxon in a particular language.
BirdCd*		varchar(4)	A four character code used to indicate the type of a bird observed by a field biologist. The code can represent a specific group of species or it could indicate only a general identification, such as sparrow.
BandCombo*		varchar(255)	Recommended band sizes for the species

Table: BandedBird

Records a unique identifier to every banded bird, regardless of changes in band number

<i>Index</i>	<i>Column</i>
PRIMARY	BandedBirdId
OriginalBandNo	OriginalBandNo

<i>Field name</i>	<i>Index</i>	<i>Data type</i>	<i>Description</i>
BandedBirdId*	PRI	int	Unique identifier to banded bird
OriginalBandNo*	UNI	int	First band number assigned to banded bird
InsertDt*		date	The date upon which a row was added to the PRBOdb database.
InsertUserId*		varchar(64)	The userid of the individual who initially added the row to the PRBOdb database.
UpdateDt*		date	The most recent date upon which a row was updated in the PRBOdb database.
UpdateUserId*		varchar(64)	The userid of the individual to most recently update a row in the PRBOdb database.

Table: BandedBirdBandingHistory

Tracks capture history of banded birds

<i>Index</i>	<i>Column</i>
PRIMARY	BandedBirdId
PRIMARY	BirdCounter

<i>Field name</i>	<i>Index</i>	<i>Data type</i>	<i>Description</i>
BandedBirdId*	PRI	int	Unique identifier of every banded bird
BirdCounter*	PRI	int	Counter: number of times a bird has been captured
BandingDt*		date	Date banded
BandNo*		int	Band number assigned to captured bird
OldBandNo*		int	Old band number, if band changed
BandSize*		varchar(4)	Size of band applied to bird
LeftColorBandComboCd*		varchar(128)	Color bands applied to left leg of bird
RightColorBandComboCd*		varchar(128)	Color bands applied to right leg of bird
CurrentBandsInd*		tinyint	THIS FIELD HAS ONLY 0's!!
Remarks*		text	
InsertDt*		date	The date upon which a row was added to the PRBOdb database.
InsertUserId*		varchar(64)	The userid of the individual who initially added the row to the PRBOdb database.
UpdateDt*		date	The most recent date upon which a row was updated in the PRBOdb database.

Descriptive metadata of PRBO Conservation Science's enterprise database (continued).

UpdateUserId*	varchar(64)	The userid of the individual to most recently update a row in the PRBOdb database.
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Table: BirdLifeHistory

Some species of birds may have adapted to different habitats with changes to their life history. Factors such as the incubation period of eggs or type of nest can vary according by habitat.

<i>Index</i>	<i>Column</i>
PRIMARY	TaxonId
PRIMARY	LifeHistoryHabitatCd

<i>Field name</i>	<i>Index</i>	<i>Data type</i>	<i>Description</i>
TaxonId*	PRI	int	Identifies a taxon entry.
LifeHistoryHabitatCd*	PRI	varchar(32)	A code indicating the habitat in which a species may have different life history factors. The domain of this code is documented in DataDictionaryCodeSetValue.
IncubationPeriod		smallint	The number of days over which the eggs of a species of bird typically incubate.
ClutchSize		smallint	The typical number of eggs laid by a particular species of bird.
FledglingPeriod		smallint	The number of days which constitutes the fledgling period for the young of a particular species.
NestTypeCd		varchar(32)	A code indicating a nest type. The domain of this code is documented in DataDictionaryCodeSetValue.
YoungTypeCd		varchar(32)	Indicates the type of young produced by a bird species. The domain of this code is documented in DataDictionaryCodeSetValue.
InsertDt*		date	The date upon which a row was added to the PRBOdb database.
InsertUserId*		varchar(64)	The userid of the individual who initially added the row to the PRBOdb database.
UpdateDt*		date	The most recent date upon which a row was updated in the PRBOdb database.
UpdateUserId*		varchar(64)	The userid of the individual to most recently update a row in the PRBOdb database.

Table: BirdSpeciesGuild

Some species of bird may be grouped into guilds such as waterfowl.

<i>Index</i>	<i>Column</i>
PRIMARY	TaxonId
PRIMARY	BirdSpeciesGuildCd

<i>Field name</i>	<i>Index</i>	<i>Data type</i>	<i>Description</i>
TaxonId*	PRI	int	Identifies a taxon entry.
BirdSpeciesGuildCd*	PRI	varchar(32)	A code representing a guild which a particular bird species is a member of i.e. waterfowl. The values of this code are documented in DataDictionaryCodeSetValue.
InsertDt*		date	The date upon which a row was added to the PRBOdb database.
InsertUserId*		varchar(64)	The userid of the individual who initially added the row to the PRBOdb database.
UpdateDt*		date	The most recent date upon which a row was updated in the PRBOdb database.
UpdateUserId*		varchar(64)	The userid of the individual to most recently update a row in the PRBOdb database.

Descriptive metadata of PRBO Conservation Science's enterprise database (continued).

Table: BirdStatus

A species of bird may be designated a Partners In Flight Focus Species or endangered or threatened according to State and Federal government. A bird may have a combination of up to three designations.

<i>Index</i>	<i>Column</i>
PRIMARY	TaxonId
PRIMARY	BirdStatusCd

<i>Field name</i>	<i>Index</i>	<i>Data type</i>	<i>Description</i>
TaxonId*	PRI	int	Identifies a taxon entry.
BirdStatusCd*	PRI	varchar(32)	A code representing the status of a particular bird species as established by various organizations. The values of this code are documented in DataDictionaryCodeSetValue.
BirdStatusEffectiveDt*		date	The date upon which the status became effective for the bird.
InsertDt*		date	The date upon which a row was added to the PRBOdb database.
InsertUserId*		varchar(64)	The userid of the individual who initially added the row to the PRBOdb database.
UpdateDt*		date	The most recent date upon which a row was updated in the PRBOdb database.
UpdateUserId*		varchar(64)	The userid of the individual to most recently update a row in the PRBOdb database.

Table: ContributedProject

Indicates what organizations contributed what projects.

<i>Index</i>	<i>Column</i>
PRIMARY	ContributingOrgId
PRIMARY	ProjectId
ProjectContributor_ibfk_1	ProjectId
ContributedProjectNote_ibfk_1	NoteGrpId

<i>Field name</i>	<i>Index</i>	<i>Data type</i>	<i>Description</i>
ContributingOrgId*	PRI	int	The internal identifier for a contributing organization.
ProjectId*	PRI	varchar(32)	A mnemonic identifier for a project.
ContributionDt*		date	The date on which a project's data was contributed to PRBOdb.
NoteGrpId	MUL	int	Identifies a group of one or more notes related to a subject.
InsertDt*		date	The date upon which a row was added to the PRBOdb database.
InsertUserId*		varchar(64)	The userid of the individual who initially added the row to the PRBOdb database.
UpdateDt*		date	The most recent date upon which a row was updated in the PRBOdb database.
UpdateUserId*		varchar(64)	The userid of the individual to most recently update a row in the PRBOdb database.

Table: ContributingOrganization

Records information about organizations contribution data to PRBOdb.

<i>Index</i>	<i>Column</i>
PRIMARY	ContributingOrgId
CntrbtgOrgNotes_ibfk_1	NoteGrpId

<i>Field name</i>	<i>Index</i>	<i>Data type</i>	<i>Description</i>
ContributingOrgId*	PRI	int	The internal identifier for a contributing organization.

Descriptive metadata of PRBO Conservation Science's enterprise database (continued).

ContributingOrgName*		varchar(64)	The name of a contributing organization.
ContactName*		varchar(64)	A name to which enquiries regarding a contributing organization should be directed.
ContactPhnNo*		varchar(32)	The phone number of the contact at a contributing organization.
ContactEmail*		varchar(128)	The email address of the contact at a contributing organization.
NoteGrpId	MUL	int	Identifies a group of one or more notes related to a subject.
InsertDt*		date	The date upon which a row was added to the PRBOdb database.
InsertUserId*		varchar(64)	The userid of the individual who initially added the row to the PRBOdb database.
UpdateDt*		date	The most recent date upon which a row was updated in the PRBOdb database.
UpdateUserId*		varchar(64)	The userid of the individual to most recently update a row in the PRBOdb database.

Table: DictionaryCode

Some values in the database are codes. The set of values that make up the domain of a code is known as a code set. A code set is identified by a number. When a column in the database contains codes, the appropriate code set is related to the column by its identifier. This assists in editing the column for valid values and for presenting the user with the meaning of code values.

<i>Index</i>	<i>Column</i>
PRIMARY	CodeSetId

<i>Field name</i>	<i>Index</i>	<i>Data type</i>	<i>Description</i>
CodeSetId*	PRI	int	Identifies a code set in DataDictionaryCodeSet.
CodeSetName*		varchar(32)	The name of a code set in DataDictionaryCodeSet.
CodeSetDescription*		varchar(512)	A description of the purpose of a code set.
InsertDt*		date	The date upon which a row was added to the PRBOdb database.
InsertUserId*		varchar(64)	The userid of the individual who initially added the row to the PRBOdb database.
UpdateDt*		date	The most recent date upon which a row was updated in the PRBOdb database.
UpdateUserId*		varchar(64)	The userid of the individual to most recently update a row in the PRBOdb database.

Table: DictionaryCodeValue

Each codeset contains a list of code values. This table contains the meaning of each of these values.

<i>Index</i>	<i>Column</i>
PRIMARY	CodeSetId
PRIMARY	CodeValue

<i>Field name</i>	<i>Index</i>	<i>Data type</i>	<i>Description</i>
CodeSetId*	PRI	int	Identifies a code set in DataDictionaryCodeSet.
CodeValue*	PRI	varchar(32)	A value in the domain of a code set as defined in DataDictionaryCodeSetValue.
CodeValueDescription*		varchar(512)	A description of the meaning of a value in the domain of a code set as defined in DataDictionaryCodeSetValue.
InsertDt*		date	The date upon which a row was added to the PRBOdb database.
InsertUserId*		varchar(64)	The userid of the individual who initially added the row to the PRBOdb database.

Descriptive metadata of PRBO Conservation Science's enterprise database (continued).

UpdateDt*	date	The most recent date upon which a row was updated in the PRBOdb database.
UpdateUserId*	varchar(64)	The userid of the individual to most recently update a row in the PRBOdb database.

Table: DictionaryColumn

The PRBOdb database consists of tables containing columns. Each column in the database is uniquely defined. Attributes of the column such as datatype and length are captured, as well as, the definition of the column.

<i>Index</i>	<i>Column</i>		
PRIMARY	ColumnId		
datadict_rolename_fk	BaseColumnId		
datadict_codeset_fk	CodeSetId		

<i>Field name</i>	<i>Index</i>	<i>Data type</i>	<i>Description</i>
ColumnId*	PRI	int	Identifies a column.
ColumnName*		char	Identifies a column defined in DataDictionaryColumn and is the name of a column that appears in one or more tables in the PRBOdb database.
ColumnDefinition		varchar(1024)	The definition of a column appearing in the PRBOdb database.
ColumnDataTypeCd		char	A code indicating the data type of a column in a table. The domain of this code is documented in DataDictionaryCodeSetValue.
ColumnUnitsCd		varchar(32)	A code identifying the unit of measurement of a column that indicates quantities. The domain of this code is documented in DataDictionaryCodeSetValue.
ColumnLength		smallint	The length of a column in the database when the column is of a datatype where length is a factor i.e. VARCHAR and DECIMAL.
DecimalPrecision		smallint	The number of positions to the right of the decimal point supported by a particular decimal data type declaration.
RoleNameInd*		tinyint	Indicates if the column name is a role name for another column.
BaseColumnId	MUL	int	Identifies the base name of a role-named column.
CodeColumnId		tinyint	Indicates if the domain of a column is a code set that appears in DataDictionaryCodeSet.
CodeSetId	MUL	int	Identifies a code set in DataDictionaryCodeSet.
InsertDt*		date	The date upon which a row was added to the PRBOdb database.
InsertUserId*		varchar(64)	The userid of the individual who initially added the row to the PRBOdb database.
UpdateDt*		date	The most recent date upon which a row was updated in the PRBOdb database.
UpdateUserId*		varchar(64)	The userid of the individual to most recently update a row in the PRBOdb database.

Table: DictionaryForeignKey

Relationships between tables in the database are represented by repeating the columns making up the primary key of the parent table in the child table. These columns are known as a foreign key in the child table. A table may contain many foreign keys. The value of a set of foreign key columns in a child table must appear in the parent table.

<i>Index</i>	<i>Column</i>
PRIMARY	ParentTableId
PRIMARY	ChildTableId
PRIMARY	RelationshipName
PRIMARY	ColumnId

Descriptive metadata of PRBO Conservation Science's enterprise database (continued).

datadict_tableColumn_fk	ChildTableId		
datadict_tableColumn_fk	ColumnId		
<i>Field name</i>	<i>Index</i>	<i>Data type</i>	<i>Description</i>
ParentTableId*	PRI	int	Identifies a table acting in the role of parent in a relationship.
ChildTableId*	PRI	int	Identifies a table acting in the role of child in a relationship.
RelationshipName*	PRI	varchar(64)	A phrase describing the nature of the relationship between two tables.
ColumnId*	PRI	int	Identifies a column.
InsertDt*		date	The date upon which a row was added to the PRBOdb database.
InsertUserId*		varchar(64)	The userid of the individual who initially added the row to the PRBOdb database.
UpdateDt*		date	The most recent date upon which a row was updated in the PRBOdb database.
UpdateUserId*		varchar(64)	The userid of the individual to most recently update a row in the PRBOdb database.

Table: DictionaryRelationship

Tables in the database may be related. A relationship is always between a parent table and a child table. For each row in a parent table, there may be one or more related rows in the child table.

<i>Index</i>	<i>Column</i>
PRIMARY	ParentTableId
PRIMARY	ChildTableId
PRIMARY	RelationshipName
datadict_childtable_fk	ChildTableId

<i>Field name</i>	<i>Index</i>	<i>Data type</i>	<i>Description</i>
ParentTableId*	PRI	int	Identifies a table acting in the role of parent in a relationship.
ChildTableId*	PRI	int	Identifies a table acting in the role of child in a relationship.
RelationshipName*	PRI	varchar(64)	A phrase describing the nature of the relationship between two tables.
CardinalityCd*		varchar(32)	A code indicating the cardinality of a relationship between tables. Cardinality is represented as a ratio between the parent and child tables in the relationship. The values of this code are documented in DataDictionaryCodeSetValue.
IdentifyingRelationshipInd*		tinyint	Indicates if a relationship between tables is identifying. In an identifying relationship the foreign key columns associated with the relationship appear in the primary key of the child table. The information in the child table would be considered characteristic of the parent entity and not merely associated.
OptionalRelationshipInd*		tinyint	Indicates if a relationship between to tables is optional for any given row in the child table. If the relationship is optional, the foreign key may be null in the child table. Only non-identifying relationships can be optional.
InsertDt*		date	The date upon which a row was added to the PRBOdb database.
InsertUserId*		varchar(64)	The userid of the individual who initially added the row to the PRBOdb database.

Descriptive metadata of PRBO Conservation Science's enterprise database (continued).

UpdateDt*	date	The most recent date upon which a row was updated in the PRBOdb database.
UpdateUserId*	varchar(64)	The userid of the individual to most recently update a row in the PRBOdb database.

Table: DictionaryTable

The PRBOdb database stores data in tables. Each table represents a thing, event, multi-valued characteristics of a thing or event, or a many to many relationship between things or events.

<i>Index</i>	<i>Column</i>		
PRIMARY	TableId		
TableSamplingEventType_ibfk_1	SamplingEventTypeCd		
TBL_NAME_IX	TableName		

<i>Field name</i>	<i>Index</i>	<i>Data type</i>	<i>Description</i>
TableId*	PRI	int	Identifies a table or view.
SamplingEventTypeCd	MUL	varchar(32)	A mnemonic identifier for a type of sampling event. The type identifies what data is collected during a sampling event.
TableName*	MUL	char	The name of a table in the PRBOdb database.
TablePurpose*		varchar(1024)	A description of the purpose of the table in the PRBOdb database.
ViewInd*		tinyint	Indicates if the table in the PRBOdb database is a view and not a physical table.
InsertDt*		date	The date upon which a row was added to the PRBOdb database.
InsertUserId*		varchar(64)	The userid of the individual who initially added the row to the PRBOdb database.
UpdateDt*		date	The most recent date upon which a row was updated in the PRBOdb database.
UpdateUserId*		varchar(64)	The userid of the individual to most recently update a row in the PRBOdb database.

Table: DictionaryTableColumn

The tables in the PRBOdb database are made up of columns. Each column is either part of a identifying key or is data about the thing or event represented by the table. Some columns may be foreign keys. The data for columns may be required or optional.

<i>Index</i>	<i>Column</i>		
PRIMARY	TableId		
PRIMARY	ColumnId		
datadict_Column_fk	ColumnId		

<i>Field name</i>	<i>Index</i>	<i>Data type</i>	<i>Description</i>
TableId*	PRI	int	Identifies a table or view.
ColumnId*	PRI	int	Identifies a column.
ColumnCounter*		int	A number indicating the position of a column in a table.
RequiredInd*		tinyint	Indicates whether a field is required or not (boolean)
AutoIncrementInd*		tinyint	Indicates if the value of a column is automatically set to the next highest integer
PrimaryKeyInd*		tinyint	Indicates if the column is a member of the primary key of the table.
ForeignKeyInd*		tinyint	Indicates if the column is a member of a foreign key in the table.
VirtualInd*		tinyint	What is this? It's empty
InsertDt*		date	The date upon which a row was added to the PRBOdb database.

Descriptive metadata of PRBO Conservation Science's enterprise database (continued).

InsertUserId*	varchar(64)	The userid of the individual who initially added the row to the PRBOdb database.
UpdateDt*	date	The most recent date upon which a row was updated in the PRBOdb database.
UpdateUserId*	varchar(64)	The userid of the individual to most recently update a row in the PRBOdb database.

Table: FieldBird

In practice, a researcher identifies species of birds, or groups of species of birds, using four character codes specified by the U.S. Bird Banding Lab when collecting observation data in the field. These codes have and can change over time as the underlying concept of what denotes a species or group of species changes. A code may be reassigned to a different species or the code associated with a particular species may change. Some codes may not originate with the AOU.

<i>Index</i>	<i>Column</i>		
PRIMARY	FieldBirdId		
BirdCd	BirdCd		

<i>Field name</i>	<i>Index</i>	<i>Data type</i>	<i>Description</i>
FieldBirdId*	PRI	int	Identifies a particular instance of a four character code used to identify birds in the field in time. The meaning of a four character code can change over time.
BirdCd*	UNI	char	A four character code used to indicate the type of a bird observed by a field biologist. The code can represent a specific group of species or it could indicate only a general identification, such as sparrow.
AOU_Number		decimal	The identifier number given to the taxon by the AOU
AOU_BirdCdInd*		tinyint	Indicates if the bird code was issued by the American Ornithological Union.
BirdGroupInd*		tinyint	Indicates if the four character bird code represents a group of birds.
BirdCdValidStartDt*		date	The date upon which the four character bird code started representing a particular species or group of species or general identification of a bird.
BirdCdValidEndDt		date	The date upon which the four character bird code stopped representing a particular species or group of species or general identification of a bird.
InsertDt*		date	The date upon which a row was added to the PRBOdb database.
InsertUserId*		varchar(64)	The userid of the individual who initially added the row to the PRBOdb database.
UpdateDt*		date	The most recent date upon which a row was updated in the PRBOdb database.
UpdateUserId*		varchar(64)	The userid of the individual to most recently update a row in the PRBOdb database.

Table: FieldBirdTaxon

The four character codes used to identify birds in the field are mapped to specific entries in the Taxon table.

<i>Index</i>	<i>Column</i>		
PRIMARY	FieldBirdId		
PRIMARY	TaxonId		
TaxonBird_fk	TaxonId		

<i>Field name</i>	<i>Index</i>	<i>Data type</i>	<i>Description</i>
FieldBirdId*	PRI	int	Identifies a particular instance of a four character code used to identify birds in the field in time. The meaning of a four character code can change over time.
TaxonId*	PRI	int	Identifies a taxon entry.

Descriptive metadata of PRBO Conservation Science's enterprise database (continued).

InsertDt*	date	The date upon which a row was added to the PRBOdb database.
InsertUserId*	varchar(64)	The userid of the individual who initially added the row to the PRBOdb database.
UpdateDt*	date	The most recent date upon which a row was updated in the PRBOdb database.
UpdateUserId*	varchar(64)	The userid of the individual to most recently update a row in the PRBOdb database.

Table: FieldPlant

In practice, a researcher identifies species of plants, or groups of species of plants, using six character codes specified by the United States Department of Agriculture when collecting observation data in the field. These codes have and can change over time as the underlying concept of what denotes a species or group of species changes. A code may be reassigned to a different species or the code associated with a particular species may change. Some codes may not originate with the USDA.

<i>Index</i>	<i>Column</i>		
PRIMARY	FieldPlantId		

<i>Field name</i>	<i>Index</i>	<i>Data type</i>	<i>Description</i>
FieldPlantId*	PRI	int	Identifies a particular instance of a six character code used to identify plants in the field in time. The meaning of a six character code can change over time.
PlantCd*		char	A six character code used by field biologists to identify plants. These codes may be assigned by the USDA.
USDA_BirdCdInd*		tinyint	This field is null. What is it?
PlantGroupInd*		tinyint	Indicates if the six character plant code represents a specific group of plants.
PlantCdValidStartDt*		date	The date upon which the six character plant code started representing a particular species or group of species or general identification of a plant.
PlantCdValidEndDt		date	The date upon which the six character plant code stopped representing a particular species or group of species or general identification of a plant.
InsertDt*		date	The date upon which a row was added to the PRBOdb database.
InsertUserId*		varchar(64)	The userid of the individual who initially added the row to the PRBOdb database.
UpdateDt*		date	The most recent date upon which a row was updated in the PRBOdb database.
UpdateUserId*		varchar(64)	The userid of the individual to most recently update a row in the PRBOdb database.

Table: FieldPlantTaxon

The six character codes used to identify plants in the field are mapped to specific entries in the Taxon table.

<i>Index</i>	<i>Column</i>		
PRIMARY	FieldPlantId		
PRIMARY	TaxonId		
TaxonPlant_fk	TaxonId		

<i>Field name</i>	<i>Index</i>	<i>Data type</i>	<i>Description</i>
FieldPlantId*	PRI	int	Identifies a particular instance of a six character code used to identify plants in the field in time. The meaning of a six character code can change over time.
TaxonId*	PRI	int	Identifies a taxon entry.
InsertDt*		date	The date upon which a row was added to the PRBOdb database.

Descriptive metadata of PRBO Conservation Science's enterprise database (continued).

InsertUserId*	varchar(64)	The userid of the individual who initially added the row to the PRBOdb database.
UpdateDt*	date	The most recent date upon which a row was updated in the PRBOdb database.
UpdateUserId*	varchar(64)	The userid of the individual to most recently update a row in the PRBOdb database.

Table: ImportedResearcherIdentity

Contains the researcher identifier used by a legacy system

<i>Index</i>	<i>Column</i>
PRIMARY	ResearcherId
PRIMARY	ImportSource

<i>Field name</i>	<i>Index</i>	<i>Data type</i>	<i>Description</i>
ResearcherId*	PRI	int	Identifies a researcher in the PRBOdb database.
ImportSource*	PRI	varchar(128)	The name of the source of the imported researcher identifier.
ImportedResearcherId*		varchar(32)	A researcher identifier imported from another system.
InsertDt*		date	The date upon which a row was added to the PRBOdb database.
InsertUserId*		varchar(64)	The userid of the individual who initially added the row to the PRBOdb database.
UpdateDt*		date	The most recent date upon which a row was updated in the PRBOdb database.
UpdateUserId*		varchar(64)	The userid of the individual to most recently update a row in the PRBOdb database.

Table: Note

Is a note about some subject.

<i>Index</i>	<i>Column</i>
PRIMARY	NoteGrpId
PRIMARY	NoteId

<i>Field name</i>	<i>Index</i>	<i>Data type</i>	<i>Description</i>
NoteGrpId*	PRI	int	Identifies a group of one or more notes related to a subject.
NoteId*	PRI	int	Identifies a note.
NoteTs		timestamp	The timestamp of when the note was originally written.
NoteText*		varchar(2048)	The text of a note.
InsertDt*		date	The date upon which a row was added to the PRBOdb database.
InsertUserId*		varchar(64)	The userid of the individual who initially added the row to the PRBOdb database.
UpdateDt*		date	The most recent date upon which a row was updated in the PRBOdb database.
UpdateUserId*		varchar(64)	The userid of the individual to most recently update a row in the PRBOdb database.

Table: NoteGroup

Groups sets of notes about a common subject.

<i>Index</i>	<i>Column</i>
PRIMARY	NoteGrpId

<i>Field name</i>	<i>Index</i>	<i>Data type</i>	<i>Description</i>
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Descriptive metadata of PRBO Conservation Science's enterprise database (continued).

NoteGrpId*	PRI	int	Identifies a group of one or more notes related to a subject.
InsertDt*		date	The date upon which a row was added to the PRBOdb database.
InsertUserId*		varchar(64)	The userid of the individual who initially added the row to the PRBOdb database.
UpdateDt*		date	The most recent date upon which a row was updated in the PRBOdb database.
UpdateUserId*		varchar(64)	The userid of the individual to most recently update a row in the PRBOdb database.

Table: Program

Records information about a program that conducts a related set of projects.

<i>Index</i>	<i>Column</i>
PRIMARY	ProgramId
ProgramNote_ibfk_1	NoteGrpId

<i>Field name</i>	<i>Index</i>	<i>Data type</i>	<i>Description</i>
ProgramId*	PRI	varchar(32)	The identifier for a research program.
ProgramName*		varchar(128)	The name of a research program.
ProgramStartDt*		date	The inception date of a program.
ProgramEndDt		date	The date upon which a program was terminated.
NoteGrpId	MUL	int	Identifies a group of one or more notes related to a subject.
InsertDt*		date	The date upon which a row was added to the PRBOdb database.
InsertUserId*		varchar(64)	The userid of the individual who initially added the row to the PRBOdb database.
UpdateDt*		date	The most recent date upon which a row was updated in the PRBOdb database.
UpdateUserId*		varchar(64)	The userid of the individual to most recently update a row in the PRBOdb database.

Table: ProgramProject

Maps projects to their sponsoring programs, if they have such.

<i>Index</i>	<i>Column</i>
PRIMARY	ProjectId
PRIMARY	ProgramId
ProgramProject_ibfk_2	ProgramId

<i>Field name</i>	<i>Index</i>	<i>Data type</i>	<i>Description</i>
ProgramId*	PRI	varchar(32)	The identifier for a research program.
ProjectId*	PRI	char	A mnemonic identifier for a project.
InsertDt*		date	The date upon which a row was added to the PRBOdb database.
InsertUserId*		varchar(64)	The userid of the individual who initially added the row to the PRBOdb database.
UpdateDt*		date	The most recent date upon which a row was updated in the PRBOdb database.
UpdateUserId*		varchar(64)	The userid of the individual to most recently update a row in the PRBOdb database.

Table: Project

A project represents an effort to collect data for some purpose. The project usually is active for some defined period of time. A project will use certain protocols in the collection of data.

<i>Index</i>	<i>Column</i>
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Descriptive metadata of PRBO Conservation Science's enterprise database (continued).

PRIMARY	ProjectId		
ProjectName	ProjectName		
OriginalProject_fk	OriginalProjectId		
<i>Field name</i>	<i>Index</i>	<i>Data type</i>	<i>Description</i>
ProjectId*	PRI	char	A mnemonic identifier for a project.
ProjectName*	UNI	varchar(128)	The full, official name of a project.
ProjectDescription*		varchar(1028)	A description of a project, including project goals.
ProjectStatusCd*		varchar(32)	A code indicating the current status of a project. The domain of this code is documented in DataDictionaryCodeSetValue.
ProjectStartYr		year	The year in which the project originally became active.
ProjectEndYr		year	The year in which all project activity was terminated without the expectation of renewal.
RightsRestrictions		varchar(1028)	A description of any restrictions a project is placing on access to or use of data collected under the auspices of the project.
CopyRightDt		date	The effective date of a project copy right.
CopyRightExpirationDt		date	The date on which a project copy right expires.
OriginalProjectId	MUL	char	Only null or empty values in here. What is it?
ProjectDatabase*		varchar(64)	The name of the database containing the project data.
InsertDt*		date	The date upon which a row was added to the PRBOdb database.
InsertUserId*		varchar(64)	The userid of the individual who initially added the row to the PRBOdb database.
UpdateDt*		date	The most recent date upon which a row was updated in the PRBOdb database.
UpdateUserId*		varchar(64)	The userid of the individual to most recently update a row in the PRBOdb database.

Table: ProjectProtocol

A project will use one or more protocols when collecting data.

<i>Index</i>	<i>Column</i>
PRIMARY	ProjectId
PRIMARY	ProtocolId
ProtocolProject_fk	ProtocolId

<i>Field name</i>	<i>Index</i>	<i>Data type</i>	<i>Description</i>
ProjectId*	PRI	char	A mnemonic identifier for a project.
ProtocolId*	PRI	char	A mnemonic identifying a protocol.
InsertDt*		date	The date upon which a row was added to the PRBOdb database.
InsertUserId*		varchar(64)	The userid of the individual who initially added the row to the PRBOdb database.
Updatedt*		date	The most recent date upon which a row was updated in the PRBOdb database.
UpdateUserId*		varchar(64)	The userid of the individual to most recently update a row in the PRBOdb database.

Table: ProjectProtocolFocusSpecies

A project may use a specific protocol when collecting data about specific species of birds.

<i>Index</i>	<i>Column</i>
PRIMARY	ProjectId
PRIMARY	ProtocolId
PRIMARY	FieldBirdId
FocusSpeciesFieldBird_fk	FieldBirdId

Descriptive metadata of PRBO Conservation Science's enterprise database (continued).

<i>Field name</i>	<i>Index</i>	<i>Data type</i>	<i>Description</i>
ProjectId*	PRI	char	A mnemonic identifier for a project.
ProtocolId*	PRI	char	A mnemonic identifying a protocol.
FieldBirdId*	PRI	int	Identifies a particular instance of a four character code used to identify birds in the field in time. The meaning of a four character code can change over time.
InsertDt*		date	The date upon which a row was added to the PRBOdb database.
InsertUserId*		varchar(64)	The userid of the individual who initially added the row to the PRBOdb database.
UpdateDt*		date	The most recent date upon which a row was updated in the PRBOdb database.
UpdateUserId*		varchar(64)	The userid of the individual to most recently update a row in the PRBOdb database.

Table: ProjectResearcher

A project will employ one or more researchers in various roles. A researcher may perform more than one role on a project.

<i>Index</i>	<i>Column</i>
PRIMARY	ProjectId
PRIMARY	ResearcherId
ResearcherProject_fk	ResearcherId

<i>Field name</i>	<i>Index</i>	<i>Data type</i>	<i>Description</i>
ProjectId*	PRI	char	A mnemonic identifier for a project.
ResearcherId*	PRI	int	Identifies a researcher in the PRBOdb database.
ProjectLeaderInd*		int	Indicates the researcher possesses Project Leader privileges.
ProjectResearcherStatusCd*		varchar(32)	A code indicating the current status of a researcher assigned to a project. The domain of this code is documented in DataDictionaryCodeSetValue.
InsertDt*		date	The date upon which a row was added to the PRBOdb database.
InsertUserId*		varchar(64)	The userid of the individual who initially added the row to the PRBOdb database.
UpdateDt*		date	The most recent date upon which a row was updated in the PRBOdb database.
UpdateUserId*		varchar(64)	The userid of the individual to most recently update a row in the PRBOdb database.

Table: ProjectTable

PRBO encompasses many research areas and many collaborators. Each project's data is stored in a set of sampling event and observation tables. This table documents which tables contain data for what project.

<i>Index</i>	<i>Column</i>
PRIMARY	ProjectId
PRIMARY	TableId
ProjectTable_ibfk_2	TableId

<i>Field name</i>	<i>Index</i>	<i>Data type</i>	<i>Description</i>
ProjectId*	PRI	varchar(32)	A mnemonic identifier for a project.
TableId*	PRI	int	Identifies a table or view.
TableName*		varchar(64)	The name of a table in the PRBOdb database.
InsertDt*		date	The date upon which a row was added to the PRBOdb database.
InsertUserId*		varchar(64)	The userid of the individual who initially added the row to the PRBOdb database.

Descriptive metadata of PRBO Conservation Science's enterprise database (continued).

UpdateDt*	date	The most recent date upon which a row was updated in the PRBOdb database.
UpdateUserId*	varchar(64)	The userid of the individual to most recently update a row in the PRBOdb database.

Table: Protocol

A protocol represents the rules and procedures employed when collecting data.

<i>Index</i>	<i>Column</i>
PRIMARY	ProtocolId

<i>Field name</i>	<i>Index</i>	<i>Data type</i>	<i>Description</i>
ProtocolId*	PRI	char	A mnemonic identifying a protocol.
ProtocolName*		varchar(128)	The full, official name of a protocol.
ProtocolDescriptionURL		varchar(128)	A URL pointing to a pdf document describing the protocol in detail.
ProtocolTypeCd*		varchar(32)	A code indicating the type of protocol i.e. Marine, Terrestrial, Wetlands, etc. The domain of this code is documented in DataDictionaryCodeSetValue.
InsertDt*		date	The date upon which a row was added to the PRBOdb database.
InsertUserId*		varchar(64)	The userid of the individual who initially added the row to the PRBOdb database.
UpdateDt*		date	The most recent date upon which a row was updated in the PRBOdb database.
UpdateUserId*		varchar(64)	The userid of the individual to most recently update a row in the PRBOdb database.

Table: ProtocolDetectionCue

A protocol may have a set of cues defined that can lead to the detection of a bird, and which are to be recorded when gathering bird observation data.

<i>Index</i>	<i>Column</i>
PRIMARY	ProtocolId
PRIMARY	DetectionCueId

<i>Field name</i>	<i>Index</i>	<i>Data type</i>	<i>Description</i>
ProtocolId*	PRI	char	A mnemonic identifying a protocol.
DetectionCueId*	PRI	char	Identifies a detection cue being employed a part of a protocol.
DetectionCueDescription*		varchar(128)	A description of a detection cue being employed a part of a protocol.
CurrentCueInd*		tinyint	Logical field indicating which cue detection codes are considered current and should be used in an application.
InsertDt*		date	The date upon which a row was added to the PRBOdb database.
InsertUserId*		varchar(64)	The userid of the individual who initially added the row to the PRBOdb database.
UpdateDt*		date	The most recent date upon which a row was updated in the PRBOdb database.
UpdateUserId*		varchar(64)	The userid of the individual to most recently update a row in the PRBOdb database.

Table: ProtocolDistanceBin

A protocol may have a set of distance bins defined in which bird sightings may be made, and which are to be recorded when gathering bird observation data. A distance bin represents a range in which a sighting was made i.e. 1 to 50 meters.

<i>Index</i>	<i>Column</i>
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Descriptive metadata of PRBO Conservation Science's enterprise database (continued).

PRIMARY	ProtocolId		
PRIMARY	DistanceBinId		
<i>Field name</i>	<i>Index</i>	<i>Data type</i>	<i>Description</i>
ProtocolId*	PRI	char	A mnemonic identifying a protocol.
DistanceBinId*	PRI	char	Identifies a distance bin being employed a part of a protocol.
DistanceBinDescription*		varchar(128)	The description of a distance bin being employed a part of a protocol.
DistanceFromObserverMin		smallint	If exact distance is unknown, a range minimum value may be provided
DistanceFromObserverMax		smallint	If exact distance is unknown, a range maximum value may be provided
CurrentBinInd*		tinyint	Logical field indicating which protocol bins are considered current and should be used in an application.
InsertDt*		date	The date upon which a row was added to the PRBOdb database.
InsertUserId*		varchar(64)	The userid of the individual who initially added the row to the PRBOdb database.
UpdateDt*		date	The most recent date upon which a row was updated in the PRBOdb database.
UpdateUserId*		varchar(64)	The userid of the individual to most recently update a row in the PRBOdb database.

Table: ProtocolSamplingEventType

Lists the sampling event types associated with a sampling protocol

<i>Index</i>	<i>Column</i>		
PRIMARY	ProtocolId		
PRIMARY	SamplingEventTypeCd		
SamplingEventProtocol_fk	SamplingEventTypeCd		
<i>Field name</i>	<i>Index</i>	<i>Data type</i>	<i>Description</i>
ProtocolId*	PRI	char	A mnemonic identifying a protocol.
SamplingEventTypeCd*	PRI	char	A mnemonic identifier for a type of sampling event. The type identifies what data is collected during a sampling event.
InsertDt*		date	The date upon which a row was added to the PRBOdb database.
InsertUserId*		varchar(64)	The userid of the individual who initially added the row to the PRBOdb database.
UpdateDt*		date	The most recent date upon which a row was updated in the PRBOdb database.
UpdateUserId*		varchar(64)	The userid of the individual to most recently update a row in the PRBOdb database.

Table: ProtocolTimeBin

A protocol may have a set of time bins defined during which bird sightings may be made, and which are to be recorded when gathering bird observation data. A time bin represents a block of time during which observations are collected i.e. 5 minutes.

<i>Index</i>	<i>Column</i>		
PRIMARY	ProtocolId		
PRIMARY	TimeBinId		
<i>Field name</i>	<i>Index</i>	<i>Data type</i>	<i>Description</i>
ProtocolId*	PRI	char	A mnemonic identifying a protocol.

Descriptive metadata of PRBO Conservation Science's enterprise database (continued).

TimeBinId*	PRI	char	Identifies a time bin used by a protocol when making observations.
TimeBinDescription*		varchar(128)	Description of an individual time bin, usually a duration.
CurrentBinInd*		tinyint	Logical field indicating which protocol bins are considered current and should be used in an application.
InsertDt*		date	The date upon which a row was added to the PRBOdb database.
InsertUserId*		varchar(64)	The userid of the individual who initially added the row to the PRBOdb database.
UpdateDt*		date	The most recent date upon which a row was updated in the PRBOdb database.
UpdateUserId*		varchar(64)	The userid of the individual to most recently update a row in the PRBOdb database.

Table: Researcher

A researcher is a user of the PRBOdb database and may also be associated with collected data. Each researcher is assigned a type code which is used to define the functions they may perform within the database.

<i>Index</i>	<i>Column</i>
PRIMARY	ResearcherId
Index_2	ResearcherFirstName

<i>Field name</i>	<i>Index</i>	<i>Data type</i>	<i>Description</i>
ResearcherId*	PRI	int	Identifies a researcher in the PRBOdb database.
ResearcherStatusCd*		varchar(32)	Indicates the status of the Researcher
DoNotContactInd		tinyint	If true, the Researcher should not be contacted by PRBO.
UnknownResearcherInd		tinyint	If true, the Researcher cannot be identified.
PRBOdbAdminInd*		tinyint	Indicates if the researcher is a PRBOdb Administrator.
ResearcherFirstName	MUL	varchar(64)	The first name of a researcher.
ResearcherLastName		varchar(64)	The last name of a researcher.
ResearcherInitials		varchar(6)	Initials of a researcher
PrimaryPhoneCountryCd		char	The country code that must be dialed before dialing the rest of the primary phone number.
PrimaryPhoneNo		char	The primary phone number of the researcher, including area code.
PrimaryPhoneExt		char	The extension associated the primary phone number of the researcher.
BackupPhoneCountryCd		char	The country code that must be entered before dialing the remainder of the researcher backup phone number.
BackupPhoneNo		char	The backup phone number of a researcher, including area code.
BackupPhoneExt		char	The extension associated with the backup phone number of a researcher.
EmailAddress		varchar(128)	An email address.
MailStreet1		varchar(64)	The first line of a street address in a mailing address.
MailStreet2		varchar(64)	The second line of a street address in a mailing address.
MailCity		varchar(64)	The city name in a mailing address.
MailStateCd		varchar(32)	A code indicating the state in a mailing address. The domain of this code is documented in DataDictionaryCodeSetValue under the code set StateCd.

Descriptive metadata of PRBO Conservation Science's enterprise database (continued).

MailCountryCd	varchar(32)	The country code in a mailing address. The domain of this code is documented in DataDictionaryCodeSetValue under the CountryCd code set.
MailPostalCode	varchar(32)	column-definition-placeholder
UserName	varchar(64)	The userid associated with a researcher used for managing security.
Password	varchar(128)	The encrypted value of a researchers password.
InsertDt*	date	The date upon which a row was added to the PRBOdb database.
InsertUserId*	varchar(64)	The userid of the individual who initially added the row to the PRBOdb database.
UpdateDt*	date	The most recent date upon which a row was updated in the PRBOdb database.
UpdateUserId*	varchar(64)	The userid of the individual to most recently update a row in the PRBOdb database.

Table: ResearcherAffiliation

A researcher may have one or more affiliations with institutions or organizations.

<i>Index</i>	<i>Column</i>		
PRIMARY	ResearcherId		
PRIMARY	AffiliationName		
<i>Field name</i>	<i>Index</i>	<i>Data type</i>	<i>Description</i>
ResearcherId*	PRI	int	Identifies a reseacher in the PRBOdb database.
AffiliationName*	PRI	varchar(128)	The name of an organization or institution with which a researcher is affiliated.
InsertDt*		date	The date upon which a row was added to the PRBOdb database.
InsertUserId*		varchar(64)	The userid of the individual who initially added the row to the PRBOdb database.
UpdateDt*		date	The most recent date upon which a row was updated in the PRBOdb database.
UpdateUserId*		varchar(64)	The userid of the individual to most recently update a row in the PRBOdb database.

Table:

SamplingEventObservation_AreaSearch

Specific observations made as part of an area search

<i>Index</i>	<i>Column</i>		
PRIMARY	ProjectId		
PRIMARY	SamplingUnitId		
PRIMARY	SamplingEventTypeCd		
PRIMARY	ProtocolId		
PRIMARY	SamplingEventCounter		
PRIMARY	ObservationCounter		
SamplingUnitEvent_fk	SamplingUnitId		
SamplingEventType_fk	SamplingEventTypeCd		
ProtocolEvent_fk	ProtocolId		
<i>Field name</i>	<i>Index</i>	<i>Data type</i>	<i>Description</i>
ProjectId*	PRI	char	A mnumonic identifier for a project.

Descriptive metadata of PRBO Conservation Science's enterprise database (continued).

SamplingUnitId*	PRI	int	An identifier for a sampling unit. Historically, sampling units have been identified using other identifiers. The sampling unit table acts as a mechanism for translating these legacy identifiers into a common surrogate key in the PRBOdb database.
SamplingEventTypeCd*	PRI	char	A mnemonic identifier for a type of sampling event. The type identifies what data is collected during a sampling event.
ProtocolId*	PRI	char	A mnemonic identifying a protocol.
SamplingEventCounter*	PRI	int	An identifier that distinguishes between sampling events conducted by a project using a particular protocol and collecting a particular set of data points at a location.
ObservationCounter*	PRI	int	A value used to identify a particular observation within those collected for a sampling event. It does not necessarily indicate the order in which observations were collected, but it does indicate the order in which they were entered into the PRBOdb database.
BirdCount*		int	The number of birds observed in a single observation record.
ForageCd		char	Indicates if foraging behavior observed
FlockCd		char	Indicates if flocking behavior observed
CopulateCd		char	Indicates if copulation observed
DisplayCd		char	Indicates if breeding display observed
PairCd		char	Indicates if a mating pair/courtship behavior observed
MaterialCd		char	Indicates if carrying nesting material observed
FoodCd		char	Indicates if carrying food observed
NestCd		char	Indicates if active nest found
FledgeCd		char	Indicates if dependent fledgeling observed (being fed by adult, begging, fledgling-length tail)
ResearcherId*		int	Identifies a researcher in the PRBOdb database.
Remarks*		text	
FieldBirdId*		int	Identifies a particular instance of a four character code used to identify birds in the field in time. The meaning of a four character code can change over time.
InsertDt*		date	The date upon which a row was added to the PRBOdb database.
InsertUserId*		varchar(64)	The userid of the individual who initially added the row to the PRBOdb database.
UpdateDt*		date	The most recent date upon which a row was updated in the PRBOdb database.
UpdateUserId*		varchar(74)	The userid of the individual to most recently update a row in the PRBOdb database.

Table: SamplingEventObservation_Banding

Specific observations made as part of a banding event

<i>Index</i>	<i>Column</i>
PRIMARY	ProjectId
PRIMARY	SamplingUnitId
PRIMARY	SamplingEventTypeCd
PRIMARY	ProtocolId
PRIMARY	SamplingEventCounter
PRIMARY	ObservationCounter
SamplingUnitEvent_fk	SamplingUnitId
SamplingEventType_fk	SamplingEventTypeCd
ProtocolEvent_fk	ProtocolId

Descriptive metadata of PRBO Conservation Science's enterprise database (continued).

<i>Field name</i>	<i>Index</i>	<i>Data type</i>	<i>Description</i>
ProjectId*	PRI	char	A mnemonic identifier for a project.
SamplingUnitId*	PRI	int	An identifier for a sampling unit. Historically, sampling units have been identified using other identifiers. The sampling unit table acts as a mechanism for translating these legacy identifiers into a common surrogate key in the PRBOdb database.
SamplingEventTypeCd*	PRI	char	A mnemonic identifier for a type of sampling event. The type identifies what data is collected during a sampling event.
ProtocolId*	PRI	char	A mnemonic identifying a protocol.
SamplingEventCounter*	PRI	int	An identifier that distinguishes between sampling events conducted by a project using a particular protocol and collecting a particular set of data points at a location.
ObservationCounter*	PRI	int	A value used to identify a particular observation within those collected for a sampling event. It does not necessarily indicate the order in which observations were collected, but it does indicate the order in which they were entered into the PRBOdb database.
BirdCount*		int	The number of birds observed in a single observation record.
BandingCd*		char	Disposition of the band, as to the type of capture and banding event: new, recapture, etc.
BandStatus*		mediumint	Status of banded bird, following the BBL 300-numbering system
BirdAge*		char	Age of the bird as determined by aging technique
PrimaryAgingTechniqueCd*		char	The main parameter used to determine the age of the bird
BackupAgingTechniqueCd*		char	The backup parameter used to determine the age of the bird
CloacalProtuberanceCd*		char	Size of the cloacal protuberance
UnflattenedWingChordLength*		decimal	Unflattened wing chord
WingWearCd*		char	Degree of flight feather wear in first 4-5 primaries
Weight		decimal	Weight of the bird to the nearest gram
TarsusLength		decimal	Tarsal bone length
CrownLength		decimal	Distance from most proximal to most distal crown feather, to the nearest mm
TailLength		decimal	Measurement of longest rectrice from base, to the nearest mm
InjuryCd*		char	Description of injury observed in bird
InjuryTreatedInd*		varchar(255)	Description of treatment given to injured bird
InjuredBirdReleasedInd*		varchar(255)	
FadeLineCd*		mediumint	Intensity of primary feather emargination; feather-tip wear
FlightFeatherMoltCd*		char	Presence and type of flight feather molt
BroodPatchCd*		char	Status of brood patch
FatCd*		char	Estimate of total (abdominal + furcular) body fat
BodyMoltCd*		char	Amount of molting in body (countour) feathers, including wing covert and tail covert feathers
SkullPneumatizationCd*		char	Degree of skull pneumaticization by wet skulling method
PrimarySexingTechniqueCd*		char	The main parameter used to determine the sex of the bird

Descriptive metadata of PRBO Conservation Science's enterprise database (continued).

BackupSexingTechniqueCd*	char	The backup parameter used to determine the sex of the bird
BirdSexCd*	char	Sex of the bird as determined by sexing technique
ObservationTm*	time	The time at which an observation was made.
ResearcherId*	int	Identifies a researcher in the PRBOdb database.
Remarks*	text	
BandedBirdId*	int	Unique identifier of a banded bird (see BandedBird table)
FieldBirdId*	int	Identifies a particular instance of a four character code used to identify birds in the field in time. The meaning of a four character code can change over time.
NetNumberId	smallint	Identifier of net where beird was captured.
DonorRecordId	int	If data from cooperator, unique identifier of record in original dataset is kept here
InsertDt*	date	The date upon which a row was added to the PRBOdb database.
InsertUserId*	varchar(64)	The userid of the individual who initially added the row to the PRBOdb database.
UpdateDt*	date	The most recent date upon which a row was updated in the PRBOdb database.
UpdateUserId*	varchar(74)	The userid of the individual to most recently update a row in the PRBOdb database.

Table: SamplingEventObservation_Count

Specific observations made as part of a point count visit

<i>Index</i>	<i>Column</i>
PRIMARY	ProjectId
PRIMARY	SamplingUnitId
PRIMARY	SamplingEventTypeCd
PRIMARY	ProtocolId
PRIMARY	SamplingEventCounter
PRIMARY	ObservationCounter
DetectionCue_fk	ProtocolId
DetectionCue_fk	DetectionCueId
DistanceBin_fk	ProtocolId
DistanceBin_fk	DistanceBinId
TimeBin_fk	ProtocolId
TimeBin_fk	TimeBinId
CountObservationFieldBird_fk	FieldBirdId
SamplingUnitId	SamplingUnitId

<i>Field name</i>	<i>Index</i>	<i>Data type</i>	<i>Description</i>
ProjectId*	PRI	char	A mnemonic identifier for a project.
SamplingUnitId*	PRI	int	An identifier for a sampling unit. Historically, sampling units have been identified using other identifiers. The sampling unit table acts as a mechanism for translating these legacy identifiers into a common surrogate key in the PRBOdb database.
SamplingEventTypeCd*	PRI	char	A mnemonic identifier for a type of sampling event. The type identifies what data is collected during a sampling event.
ProtocolId*	PRI	char	A mnemonic identifying a protocol.
SamplingEventCounter*	PRI	smallint	An identifier that distinguishes between sampling events conducted by a project using a particular protocol and collecting a particular set of data points at a location.

Descriptive metadata of PRBO Conservation Science's enterprise database (continued).

ObservationCounter*	PRI	smallint	A value used to identify a particular observation within those collected for a sampling event. It does not necessarily indicate the order in which observations were collected, but it does indicate the order in which they were entered into the PRBOdb database.
BirdCount*		smallint	The number of birds observed in a single observation record.
DetectionCueId		char	Identifies a detection cue being employed a part of a protocol.
DistanceBinId		char	Identifies a distance bin being employed a part of a protocol.
TimeBinId		char	Identifies a time bin used by a protocol when making observations.
BreedingStatusCd		varchar(32)	A code indicating the breeding status of an observed bird. The values of this code are documented in DataDictionaryCodeSetValue.
SingingInd		tinyint	Indicates if a bird was singing while observed.
CompassBearing		smallint	The direction in degrees in which the subject of an observation was seen.
ClusterInd		tinyint	Indicates if the observed birds were in a cluster.
ObservationTm		time	The time at which an observation was made.
ResearcherId		int	Identifies a researcher in the PRBOdb database.
FieldBirdId*	MUL	int	Identifies a particular instance of a four character code used to identify birds in the field in time. The meaning of a four character code can change over time.
ObservationRemarks		varchar(255)	Remarks recorded by the field biologist at the time of recording an observation in the field.
InsertDt*		date	The date upon which a row was added to the PRBOdb database.
InsertUserId*		varchar(64)	The userid of the individual who initially added the row to the PRBOdb database.
UpdateDt*		date	The most recent date upon which a row was updated in the PRBOdb database.
UpdateUserId*		varchar(64)	The userid of the individual to most recently update a row in the PRBOdb database.

Table: SamplingEventObservation_Encounter

Bird observations that do not follow standard sampling procedures may be stored in this table

<i>Index</i>	<i>Column</i>
PRIMARY	ProjectId
PRIMARY	SamplingUnitId
PRIMARY	SamplingEventTypeCd
PRIMARY	ProtocolId
PRIMARY	SamplingEventCounter
PRIMARY	ObservationCounter
SamplingUnitEvent_fk	SamplingUnitId
SamplingEventType_fk	SamplingEventTypeCd
ProtocolEvent_fk	ProtocolId

<i>Field name</i>	<i>Index</i>	<i>Data type</i>	<i>Description</i>
ProjectId*	PRI	char	A mnemonic identifier for a project.
SamplingUnitId*	PRI	int	An identifier for a sampling unit. Historically, sampling units have been identified using other identifiers. The sampling unit table acts as a mechanism for translating these legacy identifiers into a common surrogate key in the PRBOdb database.

Descriptive metadata of PRBO Conservation Science's enterprise database (continued).

SamplingEventTypeCd*	PRI	char	A mnemonic identifier for a type of sampling event. The type identifies what data is collected during a sampling event.
ProtocolId*	PRI	char	A mnemonic identifying a protocol.
SamplingEventCounter*	PRI	int	An identifier that distinguishes between sampling events conducted by a project using a particular protocol and collecting a particular set of data points at a location.
ObservationCounter*	PRI	int	A value used to identify a particular observation within those collected for a sampling event. It does not necessarily indicate the order in which observations were collected, but it does indicate the order in which they were entered into the PRBOdb database.
FieldBirdId*		int	Identifies a particular instance of a four character code used to identify birds in the field in time. The meaning of a four character code can change over time.
BandNo*		int	The band number, if any, seen/found on the bird
LeftColorBandCombo*		varchar(128)	Band color combination seen/found, if any, on the left leg
RightColorBandCombo*		varchar(128)	Band color combination seen/found, if any, on the right leg
Remarks*		text	
InsertDt*		date	The date upon which a row was added to the PRBOdb database.
InsertUserId*		varchar(64)	The userid of the individual who initially added the row to the PRBOdb database.
UpdateDt*		date	The most recent date upon which a row was updated in the PRBOdb database.
UpdateUserId*		varchar(74)	The userid of the individual to most recently update a row in the PRBOdb database.

Table:

SamplingEventObservation_HabitatSpecies

Observations of habitat layers in habitat sampling events

<i>Index</i>	<i>Column</i>
PRIMARY	ProjectId
PRIMARY	SamplingUnitId
PRIMARY	SamplingEventTypeCd
PRIMARY	ProtocolId
PRIMARY	SamplingEventCounter
PRIMARY	ObservationCounter
SamplingUnitEvent_fk	SamplingUnitId
SamplingEventType_fk	SamplingEventTypeCd
ProtocolEvent_fk	ProtocolId

<i>Field name</i>	<i>Index</i>	<i>Data type</i>	<i>Description</i>
ProjectId*	PRI	char	A mnemonic identifier for a project.
SamplingUnitId*	PRI	int	An identifier for a sampling unit. Historically, sampling units have been identified using other identifiers. The sampling unit table acts as a mechanism for translating these legacy identifiers into a common surrogate key in the PRBOdb database.
SamplingEventTypeCd*	PRI	char	A mnemonic identifier for a type of sampling event. The type identifies what data is collected during a sampling event.
ProtocolId*	PRI	char	A mnemonic identifying a protocol.

Descriptive metadata of PRBO Conservation Science's enterprise database (continued).

SamplingEventCounter*	PRI	int	An identifier that distinguishes between sampling events conducted by a project using a particular protocol and collecting a particular set of data points at a location.
ObservationCounter*	PRI	int	A value used to identify a particular observation within those collected for a sampling event. It does not necessarily indicate the order in which observations were collected, but it does indicate the order in which they were entered into the PRBOdb database.
VegetationLayerId		char	Unique identifier of the habitat layer where an observation was made
UpperBoundPlantHeight		float	To the nearest 0.1 meter, the average height of the upper bounds of the vegetation sublayers
UpperBoundPlantId		int	The 6-letter code of the dominant plant species that make up the upper bounds of the vegetation sublayer
UpperBoundPlantPercentCover		float	The relative cover made up by each species in the upper bounds of each vegetation sublayer
LowerBoundPlantHeight		float	To the nearest 0.1 meter, the average height of the lower bounds of the vegetation sublayers
LowerBoundPlantId		int	The 6-letter code of the dominant plant species that make up the lower bounds of the vegetation sublayer
LowerBoundPlantPercentCover		float	The relative cover made up by each species in the lower bounds of each vegetation sublayer
BreastHeightMinPlantDiameter		float	Diameter-at-breast-height of the plant with narrowest trunk in the tree (or if applicable, shrub) sublayer
BreastHeightMinPlantId		int	Identifier of the plant taxon of the plant with the narrowest diameter-at-breast-height in the tree (or if applicable, shrub) sublayer
BreastHeightMaxPlantDiameter		float	Diameter-at-breast-height of the plant with widest trunk in the tree (or if applicable, shrub) sublayer
BreastHeightMaxPlantId		int	Identifier of the plant taxon of the plant with the widest diameter-at-breast-height in the tree (or if applicable, shrub) sublayer
InsertDt*		date	The date upon which a row was added to the PRBOdb database.
InsertUserId*		varchar(64)	The userid of the individual who initially added the row to the PRBOdb database.
UpdateDt*		date	The most recent date upon which a row was updated in the PRBOdb database.
UpdateUserId*		varchar(74)	The userid of the individual to most recently update a row in the PRBOdb database.

Table: SamplingEvent_HabitatLayer

Observations of vegetation layers in habitat sampling events

<i>Index</i>	<i>Column</i>
PRIMARY	ProjectId
PRIMARY	SamplingUnitId
PRIMARY	SamplingEventTypeCd
PRIMARY	ProtocolId
PRIMARY	SamplingEventCounter
PRIMARY	ObservationCounter
SamplingUnitEvent_fk	SamplingUnitId
SamplingEventType_fk	SamplingEventTypeCd
ProtocolEvent_fk	ProtocolId

<i>Field name</i>	<i>Index</i>	<i>Data type</i>	<i>Description</i>
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Descriptive metadata of PRBO Conservation Science's enterprise database (continued).

ProjectId*	PRI	char	A mnemonic identifier for a project.
SamplingUnitId*	PRI	int	An identifier for a sampling unit. Historically, sampling units have been identified using other identifiers. The sampling unit table acts as a mechanism for translating these legacy identifiers into a common surrogate key in the PRBOdb database.
SamplingEventTypeCd*	PRI	char	A mnemonic identifier for a type of sampling event. The type identifies what data is collected during a sampling event.
ProtocolId*	PRI	char	A mnemonic identifying a protocol.
SamplingEventCounter*	PRI	int	An identifier that distinguishes between sampling events conducted by a project using a particular protocol and collecting a particular set of data points at a location.
ObservationCounter*	PRI	int	A value used to identify a particular observation within those collected for a sampling event. It does not necessarily indicate the order in which observations were collected, but it does indicate the order in which they were entered into the PRBOdb database.
VegetationLayerCd		char	Unique identifier of the habitat layer/sublayer where vegetation observations were made
InsertDt*		date	The date upon which a row was added to the PRBOdb database.
InsertUserId*		varchar(64)	The userid of the individual who initially added the row to the PRBOdb database.
UpdateDt*		date	The most recent date upon which a row was updated in the PRBOdb database.
UpdateUserId*		varchar(74)	The userid of the individual to most recently update a row in the PRBOdb database.

Table: SamplingEventObservation_Weather

Specific observations made at weather observation events

<i>Index</i>	<i>Column</i>
PRIMARY	ProjectId
PRIMARY	SamplingUnitId
PRIMARY	SamplingEventTypeCd
PRIMARY	ProtocolId
PRIMARY	SamplingEventCounter
PRIMARY	ObservationCounter
SamplingUnitEvent_fk	SamplingUnitId
SamplingEventType_fk	SamplingEventTypeCd
ProtocolEvent_fk	ProtocolId

<i>Field name</i>	<i>Index</i>	<i>Data type</i>	<i>Description</i>
ProjectId*	PRI	char	A mnemonic identifier for a project.
SamplingUnitId*	PRI	int	An identifier for a sampling unit. Historically, sampling units have been identified using other identifiers. The sampling unit table acts as a mechanism for translating these legacy identifiers into a common surrogate key in the PRBOdb database.
SamplingEventTypeCd*	PRI	char	A mnemonic identifier for a type of sampling event. The type identifies what data is collected during a sampling event.
ProtocolId*	PRI	char	A mnemonic identifying a protocol.

Descriptive metadata of PRBO Conservation Science's enterprise database (continued).

SamplingEventCounter*	PRI	int	An identifier that distinguishes between sampling events conducted by a project using a particular protocol and collecting a particular set of data points at a location.
ObservationCounter*	PRI	int	A value used to identify a particular observation within those collected for a sampling event. It does not necessarily indicate the order in which observations were collected, but it does indicate the order in which they were entered into the PRBOdb database.
ObservationTm		time	The time at which an observation was made.
AvgTrueWindDirection		char	Average wind direction
AvgWindForce		float	Average wind force in Beaufort scale
HighestWindGust		float	Highest wind gust in Beaufort scale
CurrentRainFall		float	Current rainfall reading at the gauge in milimeters
RainGaugeDumpedInd		int	
RainGaugeDumpedVolume		float	
RainGaugeFullInd		int	
WeatherConditidionsCd		char	
CloudCover		float	
CloudTypeCd		char	
EstimatedTemperature		decimal	Temperature estimate
EstimatedTemperatureUnitsCd		varchar(32)	Units of temperature (Fahrenheit or Celsius)
EstimatedCloudCoverPercentage		int	Estimated percent cloud cover
EstimatedWindSpeed		decimal	The estimated wind speed
EstimatedWindSpeedUnitsCd		varchar(32)	Units of wing speed (knots, mph, km/h)
InsertDt*		date	The date upon which a row was added to the PRBOdb database.
InsertUserId*		varchar(64)	The userid of the individual who initially added the row to the PRBOdb database.
UpdateDt*		date	The most recent date upon which a row was updated in the PRBOdb database.
UpdateUserId*		varchar(74)	The userid of the individual to most recently update a row in the PRBOdb database.

Table: SamplingEventResearcher

Identifies the researchers who participated in a count sampling event.

<i>Index</i>	<i>Column</i>
PRIMARY	ProjectId
PRIMARY	SamplingUnitId
PRIMARY	SamplingEventTypeCd
PRIMARY	ProtocolId
PRIMARY	SamplingEventCounter
PRIMARY	ResearcherId
ResearcherSamplingEvent_fk	ResearcherId

<i>Field name</i>	<i>Index</i>	<i>Data type</i>	<i>Description</i>
ProjectId*	PRI	char	A mnumonic identifier for a project.
SamplingUnitId*	PRI	int	An identifier for a sampling unit. Historically, sampling units have been identified using other identifiers. The sampling unit table acts as a mechanism for translating these legacy identifiers into a common surrogate key in the PRBOdb database.
SamplingEventTypeCd*	PRI	char	A mnumonic identifier for a type of sampling event. The type identifies what data is collected during a sampling event.
ProtocolId*	PRI	char	A mnumonic identifying a protocol.

Descriptive metadata of PRBO Conservation Science's enterprise database (continued).

SamplingEventCounter*	PRI	smallint	An identifier that distinguishes between sampling events conducted by a project using a particular protocol and collecting a particular set of data points at a location.
ResearcherId*	PRI	int	Identifies a researcher in the PRBOdb database.
EventLeaderInd*		tinyint	
InsertDt*		date	The date upon which a row was added to the PRBOdb database.
InsertUserId*		varchar(64)	The userid of the individual who initially added the row to the PRBOdb database.
UpdateDt*		date	The most recent date upon which a row was updated in the PRBOdb database.
UpdateUserId*		varchar(64)	The userid of the individual to most recently update a row in the PRBOdb database.

Table: SamplingEventType

A sampling event type represents a named set of data points defined in the PRBOdb database that are collected during a sampling event.

<i>Index</i>	<i>Column</i>		
PRIMARY	SamplingEventTypeCd		
<i>Field name</i>	<i>Index</i>	<i>Data type</i>	<i>Description</i>
SamplingEventTypeCd*	PRI	char	A mnemonic identifier for a type of sampling event. The type identifies what data is collected during a sampling event.
SamplingEventDescription*		varchar(2048)	A description of the purposes and procedures for a particular type of sampling event.
InsertDt*		date	The date upon which a row was added to the PRBOdb database.
InsertUserId*		varchar(64)	The userid of the individual who initially added the row to the PRBOdb database.
UpdateDt*		date	The most recent date upon which a row was updated in the PRBOdb database.
UpdateUserId*		varchar(64)	The userid of the individual to most recently update a row in the PRBOdb database.

Table: SamplingEvent_AreaSearch

Identifies and describes area search sampling events

<i>Index</i>	<i>Column</i>		
PRIMARY	ProjectId		
PRIMARY	SamplingUnitId		
PRIMARY	SamplingEventTypeCd		
PRIMARY	ProtocolId		
PRIMARY	SamplingEventCounter		
SamplingUnitEvent_fk	SamplingUnitId		
SamplingEventType_fk	SamplingEventTypeCd		
ProtocolEvent_fk	ProtocolId		
<i>Field name</i>	<i>Index</i>	<i>Data type</i>	<i>Description</i>
ProjectId*	PRI	char	A mnemonic identifier for a project.
SamplingUnitId*	PRI	int	An identifier for a sampling unit. Historically, sampling units have been identified using other identifiers. The sampling unit table acts as a mechanism for translating these legacy identifiers into a common surrogate key in the PRBOdb database.

Descriptive metadata of PRBO Conservation Science's enterprise database (continued).

SamplingEventTypeCd*	PRI	char	A mnemonic identifier for a type of sampling event. The type identifies what data is collected during a sampling event.
ProtocolId*	PRI	char	A mnemonic identifying a protocol.
SamplingEventCounter*	PRI	smallint	An identifier that distinguishes between sampling events conducted by a project using a particular protocol and collecting a particular set of data points at a location.
SamplingEventGroupId*		smallint	An identifier used to group individual sampling events into a larger logical group. For instance, sometimes a research effort may bridge two days or mornings and afternoons.
SamplingEventDataStatusCd*		varchar(32)	A code indicating the status of all data associated with a sampling event. The domain of this code is documented in DataDictionaryCodeSetValue.
SamplingEventDt		date	The date a sampling event took place.
SamplingEventStartTm		time	The time at which collecting observations during a sampling event began.
SamplingEventEndTm		time	The time at which collecting observations during a sampling event ended.
SamplingEventYear		smallint	The year the sampling event took place
SamplingEventMonth		tinyint	The month the sampling event took place
SamplingEventDay		tinyint	The day of the month the sampling event took place
TotalBirdsCounted*		smallint	The total number of birds observed during a sampling event.
SamplingEventRemarks		varchar(255)	Free form text to record remarks associated with a sampling event.
InsertDt*		date	The date upon which a row was added to the PRBOdb database.
InsertUserId*		varchar(64)	The userid of the individual who initially added the row to the PRBOdb database.
UpdateDt*		date	The most recent date upon which a row was updated in the PRBOdb database.
UpdateUserId*		varchar(64)	The userid of the individual to most recently update a row in the PRBOdb database.

Table: SamplingEvent_Banding

Identifies and describes bird banding sampling events

<i>Index</i>	<i>Column</i>
PRIMARY	ProjectId
PRIMARY	SamplingUnitId
PRIMARY	SamplingEventTypeCd
PRIMARY	ProtocolId
PRIMARY	SamplingEventCounter
SamplingUnitEvent_fk	SamplingUnitId
SamplingEventType_fk	SamplingEventTypeCd
ProtocolEvent_fk	ProtocolId

<i>Field name</i>	<i>Index</i>	<i>Data type</i>	<i>Description</i>
ProjectId*	PRI	char	A mnemonic identifier for a project.
SamplingUnitId*	PRI	int	An identifier for a sampling unit. Historically, sampling units have been identified using other identifiers. The sampling unit table acts as a mechanism for translating these legacy identifiers into a common surrogate key in the PRBOdb database.

Descriptive metadata of PRBO Conservation Science's enterprise database (continued).

SamplingEventTypeCd*	PRI	char	A mnemonic identifier for a type of sampling event. The type identifies what data is collected during a sampling event.
ProtocolId*	PRI	char	A mnemonic identifying a protocol.
SamplingEventCounter*	PRI	smallint	An identifier that distinguishes between sampling events conducted by a project using a particular protocol and collecting a particular set of data points at a location.
SamplingEventGroupId*		smallint	An identifier used to group individual sampling events into a larger logical group. For instance, sometimes a research effort may bridge two days or mornings and afternoons.
SamplingEventDataStatusCd*		varchar(32)	A code indicating the status of all data associated with a sampling event. The domain of this code is documented in DataDictionaryCodeSetValue.
SamplingEventDt		date	The date a sampling event took place.
SamplingEventStartTm		time	The time at which collecting observations during a sampling event began.
SamplingEventEndTm		time	The time at which collecting observations during a sampling event ended.
SamplingEventYear		smallint	The year the sampling event took place
SamplingEventMonth		tinyint	The month the sampling event took place
SamplingEventDay		tinyint	The day of the month the sampling event took place
TotalBirdsCounted*		smallint	The total number of birds observed during a sampling event.
SamplingEventRemarks		varchar(255)	Free form text to record remarks associated with a sampling event.
InsertDt*		date	The date upon which a row was added to the PRBODB database.
InsertUserId*		varchar(64)	The userid of the individual who initially added the row to the PRBODB database.
UpdateDt*		date	The most recent date upon which a row was updated in the PRBODB database.
UpdateUserId*		varchar(64)	The userid of the individual to most recently update a row in the PRBODB database.

Table: SamplingEvent_Behavior

Identifies and describes behavioral study sampling events

<i>Index</i>	<i>Column</i>
PRIMARY	ProjectId
PRIMARY	SamplingUnitId
PRIMARY	SamplingEventTypeCd
PRIMARY	ProtocolId
PRIMARY	SamplingEventCounter
SamplingUnitEvent_fk	SamplingUnitId
SamplingEventType_fk	SamplingEventTypeCd
ProtocolEvent_fk	ProtocolId

<i>Field name</i>	<i>Index</i>	<i>Data type</i>	<i>Description</i>
ProjectId*	PRI	char	A mnemonic identifier for a project.
SamplingUnitId*	PRI	int	An identifier for a sampling unit. Historically, sampling units have been identified using other identifiers. The sampling unit table acts as a mechanism for translating these legacy identifiers into a common surrogate key in the PRBODB database.

Descriptive metadata of PRBO Conservation Science's enterprise database (continued).

SamplingEventTypeCd*	PRI	char	A mnemonic identifier for a type of sampling event. The type identifies what data is collected during a sampling event.
ProtocolId*	PRI	char	A mnemonic identifying a protocol.
SamplingEventCounter*	PRI	smallint	An identifier that distinguishes between sampling events conducted by a project using a particular protocol and collecting a particular set of data points at a location.
SamplingEventGroupId*		smallint	An identifier used to group individual sampling events into a larger logical group. For instance, sometimes a research effort may bridge two days or mornings and afternoons.
SamplingEventDataStatusCd*		varchar(32)	A code indicating the status of all data associated with a sampling event. The domain of this code is documented in DataDictionaryCodeSetValue.
SamplingEventDt		date	The date a sampling event took place.
SamplingEventStartTm		time	The time at which collecting observations during a sampling event began.
SamplingEventEndTm		time	The time at which collecting observations during a sampling event ended.
SamplingEventYear		smallint	The year the sampling event took place
SamplingEventMonth		tinyint	The month the sampling event took place
SamplingEventDay		tinyint	The day of the month the sampling event took place
TotalBirdsCounted*		smallint	The total number of birds observed during a sampling event.
SamplingEventRemarks		varchar(255)	Free form text to record remarks associated with a sampling event.
InsertDt*		date	The date upon which a row was added to the PRBOdb database.
InsertUserId*		varchar(64)	The userid of the individual who initially added the row to the PRBOdb database.
UpdateDt*		date	The most recent date upon which a row was updated in the PRBOdb database.
UpdateUserId*		varchar(64)	The userid of the individual to most recently update a row in the PRBOdb database.

Table: SamplingEvent_Count

Identifies and describes count (fixed-radius point counts, variable radius point counts, etc.) sampling events

<i>Index</i>	<i>Column</i>		
PRIMARY	ProjectId		
PRIMARY	SamplingUnitId		
PRIMARY	SamplingEventTypeCd		
PRIMARY	ProtocolId		
PRIMARY	SamplingEventCounter		
SamplingUnitEvent_fk	SamplingUnitId		
SamplingEventType_fk	SamplingEventTypeCd		
ProtocolEvent_fk	ProtocolId		
<i>Field name</i>	<i>Index</i>	<i>Data type</i>	<i>Description</i>
ProjectId*	PRI	char	A mnemonic identifier for a project.
SamplingUnitId*	PRI	int	An identifier for a sampling unit. Historically, sampling units have been identified using other identifiers. The sampling unit table acts as a mechanism for translating these legacy identifiers into a common surrogate key in the PRBOdb database.

Descriptive metadata of PRBO Conservation Science's enterprise database (continued).

SamplingEventTypeCd*	PRI	char	A mnemonic identifier for a type of sampling event. The type identifies what data is collected during a sampling event.
ProtocolId*	PRI	char	A mnemonic identifying a protocol.
SamplingEventCounter*	PRI	smallint	An identifier that distinguishes between sampling events conducted by a project using a particular protocol and collecting a particular set of data points at a location.
SamplingEventGroupId*		smallint	An identifier used to group individual sampling events into a larger logical group. For instance, sometimes a research effort may bridge two days or mornings and afternoons.
SamplingEventDataStatusCd*		varchar(32)	A code indicating the status of all data associated with a sampling event. The domain of this code is documented in DataDictionaryCodeSetValue.
SamplingEventDt		date	The date a sampling event took place.
SamplingEventStartTm		time	The time at which collecting observations during a sampling event began.
SamplingEventEndTm		time	The time at which collecting observations during a sampling event ended.
SamplingEventYear		smallint	The year the sampling event took place
SamplingEventMonth		tinyint	The month the sampling event took place
SamplingEventDay		tinyint	The day of the month the sampling event took place
TotalBirdsCounted*		smallint	The total number of birds observed during a sampling event.
SamplingEventRemarks		varchar(255)	Free form text to record remarks associated with a sampling event.
InsertDt*		date	The date upon which a row was added to the PRBOdb database.
InsertUserId*		varchar(64)	The userid of the individual who initially added the row to the PRBOdb database.
UpdateDt*		date	The most recent date upon which a row was updated in the PRBOdb database.
UpdateUserId*		varchar(64)	The userid of the individual to most recently update a row in the PRBOdb database.

Table: SamplingEvent_DeployedNet

Identifies and describes nets deployed during a bird banding sampling event where nets were used

<i>Index</i>	<i>Column</i>
PRIMARY	ProjectId
PRIMARY	SamplingUnitId
PRIMARY	SamplingEventTypeCd
PRIMARY	ProtocolId
PRIMARY	SamplingEventCounter
PRIMARY	DeployedNetCounter
SamplingUnitEvent_fk	SamplingUnitId
SamplingEventType_fk	SamplingEventTypeCd
ProtocolEvent_fk	ProtocolId
ProjectId	ProjectId
ProjectId	SamplingUnitId
ProjectId	SamplingEventTypeCd
ProjectId	ProtocolId
ProjectId	SamplingEventCounter

<i>Field name</i>	<i>Index</i>	<i>Data type</i>	<i>Description</i>
ProjectId*	PRI	char	A mnemonic identifier for a project.

Descriptive metadata of PRBO Conservation Science's enterprise database (continued).

SamplingUnitId*	PRI	int	An identifier for a sampling unit. Historically, sampling units have been identified using other identifiers. The sampling unit table acts as a mechanism for translating these legacy identifiers into a common surrogate key in the PRBOdb database.
SamplingEventTypeCd*	PRI	char	A mnemonic identifier for a type of sampling event. The type identifies what data is collected during a sampling event.
ProtocolId*	PRI	char	A mnemonic identifying a protocol.
SamplingEventCounter*	PRI	int	An identifier that distinguishes between sampling events conducted by a project using a particular protocol and collecting a particular set of data points at a location.
DeployedNetCounter*	PRI	int	
DeploymentDt*		date	
DeploymentStartTm*		time	
DeploymentEndTm*		time	
NetNumber		int	
TotalNumberNets		int	
NetHours		decimal	
DeploymentRemarks		text	
InsertDt*		date	The date upon which a row was added to the PRBOdb database.
InsertUserId*		varchar(64)	The userid of the individual who initially added the row to the PRBOdb database.
UpdateDt*		date	The most recent date upon which a row was updated in the PRBOdb database.
UpdateUserId*		varchar(64)	The userid of the individual to most recently update a row in the PRBOdb database.

Table: SamplingEvent_Diet

Identifies and describes diet study sampling events

<i>Index</i>	<i>Column</i>
PRIMARY	ProjectId
PRIMARY	SamplingUnitId
PRIMARY	SamplingEventTypeCd
PRIMARY	ProtocolId
PRIMARY	SamplingEventCounter
SamplingUnitEvent_fk	SamplingUnitId
SamplingEventType_fk	SamplingEventTypeCd
ProtocolEvent_fk	ProtocolId

<i>Field name</i>	<i>Index</i>	<i>Data type</i>	<i>Description</i>
ProjectId*	PRI	char	A mnemonic identifier for a project.
SamplingUnitId*	PRI	int	An identifier for a sampling unit. Historically, sampling units have been identified using other identifiers. The sampling unit table acts as a mechanism for translating these legacy identifiers into a common surrogate key in the PRBOdb database.
SamplingEventTypeCd*	PRI	char	A mnemonic identifier for a type of sampling event. The type identifies what data is collected during a sampling event.
ProtocolId*	PRI	char	A mnemonic identifying a protocol.

Descriptive metadata of PRBO Conservation Science's enterprise database (continued).

SamplingEventCounter*	PRI	smallint	An identifier that distinguishes between sampling events conducted by a project using a particular protocol and collecting a particular set of data points at a location.
SamplingEventGroupId*		smallint	An identifier used to group individual sampling events into a larger logical group. For instance, sometimes a research effort may bridge two days or mornings and afternoons.
SamplingEventDataStatusCd*		varchar(32)	A code indicating the status of all data associated with a sampling event. The domain of this code is documented in DataDictionaryCodeSetValue.
SamplingEventDt		date	The date a sampling event took place.
SamplingEventStartTm		time	The time at which collecting observations during a sampling event began.
SamplingEventEndTm		time	The time at which collecting observations during a sampling event ended.
SamplingEventYear		smallint	The year the sampling event took place
SamplingEventMonth		tinyint	The month the sampling event took place
SamplingEventDay		tinyint	The day of the month the sampling event took place
TotalBirdsCounted*		smallint	The total number of birds observed during a sampling event.
SamplingEventRemarks		varchar(255)	Free form text to record remarks associated with a sampling event.
InsertDt*		date	The date upon which a row was added to the PRBOdb database.
InsertUserId*		varchar(64)	The userid of the individual who initially added the row to the PRBOdb database.
UpdateDt*		date	The most recent date upon which a row was updated in the PRBOdb database.
UpdateUserId*		varchar(64)	The userid of the individual to most recently update a row in the PRBOdb database.

Table: SamplingEvent_Encounter

Identifies and describes general bird encounter sampling events

<i>Index</i>	<i>Column</i>
PRIMARY	ProjectId
PRIMARY	SamplingUnitId
PRIMARY	SamplingEventTypeCd
PRIMARY	ProtocolId
PRIMARY	SamplingEventCounter
SamplingUnitEvent_fk	SamplingUnitId
SamplingEventType_fk	SamplingEventTypeCd
ProtocolEvent_fk	ProtocolId

<i>Field name</i>	<i>Index</i>	<i>Data type</i>	<i>Description</i>
ProjectId*	PRI	char	A mnemonic identifier for a project.
SamplingUnitId*	PRI	int	An identifier for a sampling unit. Historically, sampling units have been identified using other identifiers. The sampling unit table acts as a mechanism for translating these legacy identifiers into a common surrogate key in the PRBOdb database.
SamplingEventTypeCd*	PRI	char	A mnemonic identifier for a type of sampling event. The type identifies what data is collected during a sampling event.
ProtocolId*	PRI	char	A mnemonic identifying a protocol.

Descriptive metadata of PRBO Conservation Science's enterprise database (continued).

SamplingEventCounter*	PRI	smallint	An identifier that distinguishes between sampling events conducted by a project using a particular protocol and collecting a particular set of data points at a location.
SamplingEventGroupId*		smallint	An identifier used to group individual sampling events into a larger logical group. For instance, sometimes a research effort may bridge two days or mornings and afternoons.
SamplingEventDataStatusCd*		varchar(32)	A code indicating the status of all data associated with a sampling event. The domain of this code is documented in DataDictionaryCodeSetValue.
SamplingEventDt		date	The date a sampling event took place.
SamplingEventStartTm		time	The time at which collecting observations during a sampling event began.
SamplingEventEndTm		time	The time at which collecting observations during a sampling event ended.
SamplingEventYear		smallint	The year the sampling event took place
SamplingEventMonth		tinyint	The month the sampling event took place
SamplingEventDay		tinyint	The day of the month the sampling event took place
TotalBirdsCounted*		smallint	The total number of birds observed during a sampling event.
SamplingEventRemarks		varchar(255)	Free form text to record remarks associated with a sampling event.
InsertDt*		date	The date upon which a row was added to the PRBOdb database.
InsertUserId*		varchar(64)	The userid of the individual who initially added the row to the PRBOdb database.
UpdateDt*		date	The most recent date upon which a row was updated in the PRBOdb database.
UpdateUserId*		varchar(64)	The userid of the individual to most recently update a row in the PRBOdb database.

Table: SamplingEvent_Habitat

Identifies and describes habitat sampling events

<i>Index</i>	<i>Column</i>
PRIMARY	ProjectId
PRIMARY	SamplingUnitId
PRIMARY	SamplingEventTypeCd
PRIMARY	ProtocolId
PRIMARY	SamplingEventCounter
SamplingUnitEvent_fk	SamplingUnitId
SamplingEventType_fk	SamplingEventTypeCd
ProtocolEvent_fk	ProtocolId

<i>Field name</i>	<i>Index</i>	<i>Data type</i>	<i>Description</i>
ProjectId*	PRI	char	A mnemonic identifier for a project.
SamplingUnitId*	PRI	int	An identifier for a sampling unit. Historically, sampling units have been identified using other identifiers. The sampling unit table acts as a mechanism for translating these legacy identifiers into a common surrogate key in the PRBOdb database.
SamplingEventTypeCd*	PRI	char	A mnemonic identifier for a type of sampling event. The type identifies what data is collected during a sampling event.
ProtocolId*	PRI	char	A mnemonic identifying a protocol.

Descriptive metadata of PRBO Conservation Science's enterprise database (continued).

SamplingEventCounter*	PRI	int	An identifier that distinguishes between sampling events conducted by a project using a particular protocol and collecting a particular set of data points at a location.
PrimaryHabitatCd		char	
PercentPrimaryHabitat		float	
SecondaryHabitatCd		char	
SurveyUnitAspect		char	
SurveyUnitSlope		char	
SurveyUnitAspectMeasurementCd		char	
WaterInd		char	
SnagsGT10cmCount		char	
SnagsLT10cmCount		char	
LogCount		char	
RiparianZoneWidth		float	
RiparianZoneLength		float	
ChannelWidth		float	
AdjacentLandUseCd		char	
InsertDt*		date	The date upon which a row was added to the PRBOdb database.
InsertUserId*		varchar(64)	The userid of the individual who initially added the row to the PRBOdb database.
UpdateDt*		date	The most recent date upon which a row was updated in the PRBOdb database.
UpdateUserId*		varchar(74)	The userid of the individual to most recently update a row in the PRBOdb database.

Table: SamplingEvent_Nest

Identifies and describes nest study sampling events

<i>Index</i>	<i>Column</i>
PRIMARY	ProjectId
PRIMARY	SamplingUnitId
PRIMARY	SamplingEventTypeCd
PRIMARY	ProtocolId
PRIMARY	SamplingEventCounter
SamplingUnitEvent_fk	SamplingUnitId
SamplingEventType_fk	SamplingEventTypeCd
ProtocolEvent_fk	ProtocolId

<i>Field name</i>	<i>Index</i>	<i>Data type</i>	<i>Description</i>
ProjectId*	PRI	char	A mnemonic identifier for a project.
SamplingUnitId*	PRI	int	An identifier for a sampling unit. Historically, sampling units have been identified using other identifiers. The sampling unit table acts as a mechanism for translating these legacy identifiers into a common surrogate key in the PRBOdb database.
SamplingEventTypeCd*	PRI	char	A mnemonic identifier for a type of sampling event. The type identifies what data is collected during a sampling event.
ProtocolId*	PRI	char	A mnemonic identifying a protocol.
SamplingEventCounter*	PRI	smallint	An identifier that distinguishes between sampling events conducted by a project using a particular protocol and collecting a particular set of data points at a location.

Descriptive metadata of PRBO Conservation Science's enterprise database (continued).

SamplingEventGroupId*	smallint	An identifier used to group individual sampling events into a larger logical group. For instance, sometimes a research effort may bridge two days or mornings and afternoons.
SamplingEventDataStatusCd*	varchar(32)	A code indicating the status of all data associated with a sampling event. The domain of this code is documented in DataDictionaryCodeSetValue.
SamplingEventDt	date	The date a sampling event took place.
SamplingEventStartTm	time	The time at which collecting observations during a sampling event began.
SamplingEventEndTm	time	The time at which collecting observations during a sampling event ended.
SamplingEventYear	smallint	The year the sampling event took place
SamplingEventMonth	tinyint	The month the sampling event took place
SamplingEventDay	tinyint	The day of the month the sampling event took place
TotalBirdsCounted*	smallint	The total number of birds observed during a sampling event.
SamplingEventRemarks	varchar(255)	Free form text to record remarks associated with a sampling event.
InsertDt*	date	The date upon which a row was added to the PRBOdb database.
InsertUserId*	varchar(64)	The userid of the individual who initially added the row to the PRBOdb database.
UpdateDt*	date	The most recent date upon which a row was updated in the PRBOdb database.
UpdateUserId*	varchar(64)	The userid of the individual to most recently update a row in the PRBOdb database.

Table: SamplingEvent_Weather

Identifies and describes weather sampling events

<i>Index</i>	<i>Column</i>
PRIMARY	ProjectId
PRIMARY	SamplingUnitId
PRIMARY	SamplingEventTypeCd
PRIMARY	ProtocolId
PRIMARY	SamplingEventCounter
	SamplingUnitId

<i>Field name</i>	<i>Index</i>	<i>Data type</i>	<i>Description</i>
ProjectId*	PRI	char	A mnemonic identifier for a project.
SamplingUnitId*	PRI	int	An identifier for a sampling unit. Historically, sampling units have been identified using other identifiers. The sampling unit table acts as a mechanism for translating these legacy identifiers into a common surrogate key in the PRBOdb database.
SamplingEventTypeCd*	PRI	char	A mnemonic identifier for a type of sampling event. The type identifies what data is collected during a sampling event.
ProtocolId*	PRI	char	A mnemonic identifying a protocol.
SamplingEventCounter*	PRI	int	An identifier that distinguishes between sampling events conducted by a project using a particular protocol and collecting a particular set of data points at a location.

Descriptive metadata of PRBO Conservation Science's enterprise database (continued).

SamplingEventGroupID	int	An identifier used to group individual sampling events into a larger logical group. For instance, sometimes a research effort may bridge two days or mornings and afternoons.
SamplingEventDataStatusCd*	varchar(32)	A code indicating the status of all data associated with a sampling event. The domain of this code is documented in DataDictionaryCodeSetValue.
SamplingEventDt	date	The date a sampling event took place.
SamplingEventStartTm	time	The time at which collecting observations during a sampling event began.
SamplingEventEndTm	time	The time at which collecting observations during a sampling event ended.
SamplingEventYear	char	The year the sampling event took place
SamplingEventMonth	tinyint	The month the sampling event took place
SamplingEventDay	tinyint	The day of the month the sampling event took place
DiurnalLowTemperature	decimal	
DiurnalHighTemperature	decimal	
SamplingEventRemarks	varchar(255)	Free form text to record remarks associated with a sampling event.
InsertDt*	date	The date upon which a row was added to the PRBOdb database.
InsertUserId*	varchar(64)	The userid of the individual who initially added the row to the PRBOdb database.
UpdateDt*	date	The most recent date upon which a row was updated in the PRBOdb database.
UpdateUserId*	varchar(64)	The userid of the individual to most recently update a row in the PRBOdb database.

Table: SamplingUnit

A sampling unit is a field location where research is conducted or an area containing these locations.

<i>Index</i>	<i>Column</i>
PRIMARY	SamplingUnitID
ShortName	ShortName
ShortName	FullName
ShortName	EstablishingProjectID
FullName	FullName
FullName	ShortName
FullName	EstablishingProjectID

<i>Field name</i>	<i>Index</i>	<i>Data type</i>	<i>Description</i>
SamplingUnitID*	PRI	int	An identifier for a sampling unit. Historically, sampling units have been identified using other identifiers. The sampling unit table acts as a mechanism for translating these legacy identifiers into a common surrogate key in the PRBOdb database.
FullName*	MUL	varchar(128)	
ShortName*	MUL	char	
PointGeometry		point	
CoordinatesCollection		geometrycollection	
ParentSamplingUnitID		int	
Description*		text	
EstablishingProjectID*		char	
PublicInd		int	Indicates sampling units on public land.
InsertDt*		date	The date upon which a row was added to the PRBOdb database.

Descriptive metadata of PRBO Conservation Science's enterprise database (continued).

InsertUserId*	varchar(64)	The userid of the individual who initially added the row to the PRBOdb database.
UpdateDt*	date	The most recent date upon which a row was updated in the PRBOdb database.
UpdateUserId*	varchar(64)	The userid of the individual to most recently update a row in the PRBOdb database.

Table: SamplingUnitParentSamplingUnitType

Lists the parent sampling unit type of a sampling unit type

<i>Index</i>	<i>Column</i>
PRIMARY	SamplingUnitTypeID
PRIMARY	ParentSamplingUnitTypeID

<i>Field name</i>	<i>Index</i>	<i>Data type</i>	<i>Description</i>
SamplingUnitTypeID*	PRI	int	
ParentSamplingUnitTypeID*	PRI	int	
InsertDt*		date	The date upon which a row was added to the PRBOdb database.
InsertUserId*		varchar(64)	The userid of the individual who initially added the row to the PRBOdb database.
UpdateDt*		date	The most recent date upon which a row was updated in the PRBOdb database.
UpdateUserId*		varchar(64)	The userid of the individual to most recently update a row in the PRBOdb database.

Table: SamplingUnitProject

Lists the projects associated with a sampling unit

<i>Index</i>	<i>Column</i>
PRIMARY	SamplingUnitID
PRIMARY	ProjectID
samplingunitproject_ibfk_1	ProjectID

<i>Field name</i>	<i>Index</i>	<i>Data type</i>	<i>Description</i>
SamplingUnitID*	PRI	int	An identifier for a sampling unit. Historically, sampling units have been identified using other identifiers. The sampling unit table acts as a mechanism for translating these legacy identifiers into a common surrogate key in the PRBOdb database.
ProjectID*	PRI	char	A mnemonic identifier for a project.
InsertDt*		date	The date upon which a row was added to the PRBOdb database.
InsertUserId*		varchar(64)	The userid of the individual who initially added the row to the PRBOdb database.
UpdateDt*		date	The most recent date upon which a row was updated in the PRBOdb database.
UpdateUserId*		varchar(64)	The userid of the individual to most recently update a row in the PRBOdb database.

Table: SamplingUnitSamplingUnitType

Lists the type of a sampling unit

<i>Index</i>	<i>Column</i>
PRIMARY	SamplingUnitID
PRIMARY	SamplingUnitTypeID
samplingunitsamplingunittype_ibfk_2	SamplingUnitTypeID

<i>Field name</i>	<i>Index</i>	<i>Data type</i>	<i>Description</i>
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Descriptive metadata of PRBO Conservation Science's enterprise database (continued).

SamplingUnitID*	PRI	int	An identifier for a sampling unit. Historically, sampling units have been identified using other identifiers. The sampling unit table acts as a mechanism for translating these legacy identifiers into a common surrogate key in the PRBOdb database.
SamplingUnitTypeID*	PRI	int	
InsertDt*		date	The date upon which a row was added to the PRBOdb database.
InsertUserId*		varchar(64)	The userid of the individual who initially added the row to the PRBOdb database.
UpdateDt*		date	The most recent date upon which a row was updated in the PRBOdb database.
UpdateUserId*		varchar(64)	The userid of the individual to most recently update a row in the PRBOdb database.

Table: SamplingUnitType

Describes each sampling unit type in this database

<i>Index</i>	<i>Column</i>		
PRIMARY	SamplingUnitTypeID		
samplingunittype_ibfk_1	SamplingUnitTypeGeometryID		
<i>Field name</i>	<i>Index</i>	<i>Data type</i>	<i>Description</i>
SamplingUnitTypeID*	PRI	int	
Name*		varchar(128)	
ParentRequired*		tinyint	
Description*		text	
SamplingUnitTypeGeometryID*	MUL	int	
InsertDt*		date	The date upon which a row was added to the PRBOdb database.
InsertUserId*		varchar(64)	The userid of the individual who initially added the row to the PRBOdb database.
UpdateDt*		date	The most recent date upon which a row was updated in the PRBOdb database.
UpdateUserId*		varchar(64)	The userid of the individual to most recently update a row in the PRBOdb database.

Table: SamplingUnitTypeGeometry

Names and describes the geometry (point, polygon, etc.) of a sampling unit type (see SamplingUnitType table)

<i>Index</i>	<i>Column</i>		
PRIMARY	SamplingUnitTypeGeometryID		
<i>Field name</i>	<i>Index</i>	<i>Data type</i>	<i>Description</i>
SamplingUnitTypeGeometryID*	PRI	int	
GeometryName		set	
Description*		text	
InsertDt*		date	The date upon which a row was added to the PRBOdb database.
InsertUserId*		varchar(64)	The userid of the individual who initially added the row to the PRBOdb database.
UpdateDt*		date	The most recent date upon which a row was updated in the PRBOdb database.
UpdateUserId*		varchar(64)	The userid of the individual to most recently update a row in the PRBOdb database.

Table: Taxon

Taxon represents the scientific identification of organisms. This information is largely borrowed from the ITIS.

Descriptive metadata of PRBO Conservation Science's enterprise database (continued).

<i>Index</i>	<i>Column</i>
PRIMARY	TaxonId
TaxonId	TaxonId
TaxonId	EncompassingTaxonId

<i>Field name</i>	<i>Index</i>	<i>Data type</i>	<i>Description</i>
TaxonId*	PRI	int	Identifies a taxon entry.
TaxonName*		varchar(140)	The scientific name of an individual species, or family, or genus, etc. under the taxonomic system.
TaxonKingdomId		smallint	Identifies a taxon kingdom. All life on earth is divided into kingdoms.
TaxonRankId		smallint	Identifies a rank within a taxon kingdom. Ranks may be families, genus, species, etc.
EncompassingTaxonId		int	Identifies another taxon which contains or encompasses the taxon.
ITIS_TaxonSerialNumber		int	The serial number from the ITIS system identifying a particular taxon entry. This column is null if the entry did not originate in ITIS.
AOU_BirdSpeciesId		char	
AOU_PhylogeneticSequenceNo		smallint	A number indicating the position of a bird species in the phylogenetic sequence established by the American Ornithological Union.
USDA_PlantSpeciesId		varchar(6)	
BandSizeNote		varchar(32)	Lists band sizes appropriate for a specific species of bird.
ReclassifiedTaxonId		int	The taxon identifier that was previously assigned to a taxon.
ReclassificationDt		date	The date upon which the reclassification of a taxon was effective.
InsertDt*		date	The date upon which a row was added to the PRBOdb database.
InsertUserId*		varchar(64)	The userid of the individual who initially added the row to the PRBOdb database.
UpdateDt*		date	The most recent date upon which a row was updated in the PRBOdb database.
UpdateUserId*		varchar(64)	The userid of the individual to most recently update a row in the PRBOdb database.
ScientificAuthority*		varchar(100)	
IdentificationQualifier*		varchar(100)	

Table: TaxonCommonName

Each taxon may have a common name or descriptive label in more than one language.

<i>Index</i>	<i>Column</i>
PRIMARY	TaxonId
PRIMARY	CommonName
PRIMARY	Language

<i>Field name</i>	<i>Index</i>	<i>Data type</i>	<i>Description</i>
TaxonId*	PRI	int	Identifies a taxon entry.
CommonName*	PRI	varchar(80)	A common name for taxon in a particular language.
Language*	PRI	varchar(15)	The name of a language.
InsertDt*		date	The date upon which a row was added to the PRBOdb database.
InsertUserId*		varchar(64)	The userid of the individual who initially added the row to the PRBOdb database.

Descriptive metadata of PRBO Conservation Science's enterprise database (continued).

UpdateDt*	date	The most recent date upon which a row was updated in the PRBOdb database.
UpdateUserId*	varchar(64)	The userid of the individual to most recently update a row in the PRBOdb database.

Table: TaxonCommonName_Hybrid

Supplemental table to TaxonCommonName, listing and providing unique identifiers for hybrids of taxa

<i>Index</i>	<i>Column</i>
PRIMARY	TaxonId
PRIMARY	CommonName
PRIMARY	Language

<i>Field name</i>	<i>Index</i>	<i>Data type</i>	<i>Description</i>
TaxonId*	PRI	int	Identifies a taxon entry.
CommonName*	PRI	varchar(80)	A common name for taxon in a particular language.
Language*	PRI	varchar(15)	The name of a language.
InsertDt*		date	The date upon which a row was added to the PRBOdb database.
InsertUserId*		varchar(64)	The userid of the individual who initially added the row to the PRBOdb database.
UpdateDt*		date	The most recent date upon which a row was updated in the PRBOdb database.
UpdateUserId*		varchar(64)	The userid of the individual to most recently update a row in the PRBOdb database.

Table: TaxonKingdom

All living things are divided into kingdoms in the taxonomic system.

<i>Index</i>	<i>Column</i>
PRIMARY	TaxonKingdomId

<i>Field name</i>	<i>Index</i>	<i>Data type</i>	<i>Description</i>
TaxonKingdomId*	PRI	smallint	Identifies a taxon kingdom. All life on earth is divided into kingdoms.
TaxonKingdomName*		char	The name of the taxon kingdom.
InsertDt*		date	The date upon which a row was added to the PRBOdb database.
InsertUserId*		varchar(64)	The userid of the individual who initially added the row to the PRBOdb database.
UpdateDt*		date	The most recent date upon which a row was updated in the PRBOdb database.
UpdateUserId*		varchar(64)	The userid of the individual to most recently update a row in the PRBOdb database.

Table: TaxonRank

Each taxonomic kingdom contains taxonomic ranks i.e. family, species.

<i>Index</i>	<i>Column</i>
PRIMARY	TaxonKingdomId
PRIMARY	TaxonRankId

<i>Field name</i>	<i>Index</i>	<i>Data type</i>	<i>Description</i>
TaxonKingdomId*	PRI	smallint	Identifies a taxon kingdom. All life on earth is divided into kingdoms.
TaxonRankId*	PRI	smallint	Identifies a rank within a taxon kingdom. Ranks may be families, genus, species, etc.
TaxonRankName*		char	The name of the rank within the taxon kingdom.
InsertDt*		date	The date upon which a row was added to the PRBOdb database.

Descriptive metadata of PRBO Conservation Science's enterprise database (continued).

InsertUserId*	varchar(64)	The userid of the individual who initially added the row to the PRBOdb database.
UpdateDt*	date	The most recent date upon which a row was updated in the PRBOdb database.
UpdateUserId*	varchar(64)	The userid of the individual to most recently update a row in the PRBOdb database.

Standard Operating Procedure (SOP) 9: Data Analysis

Revision History Log

Prev. Version #	Revision Date	Author	Changes Made	Reason for Change	New Version #
NA	November 2006	M. Koenen	Created document		1.0
1.0	June 2009	T. Gardali, M. Herzog	Added content to document for first time		1.0

This SOP provides details about specific analysis that will be presented in the 6-year Analysis and Synthesis reports.

Querying from the Databases

All data can be retrieved and processed with Ravian (www.prbo.org/ravian; Accessed: June 12, 2009) from the California Avian Data Center (www.prbo.org/cadc; Accessed: June 12, 2009). Detectability modeling, density estimation, and temporal trend analysis currently require exporting data to other software applications, but is expected to be supported within the Ravian package (via the California Avian Data Center) and available for the development of the first 6-year Analysis and Synthesis report. The Data Analysis SOP (#9) will be updated as these features become available.

Developing Parameters for Trend Analysis in Abundance

An annual density estimate from point count data will be used in trend analyses. A first step to calculating density is to compute a detectability parameter. The data analyst should use the most recently available version of the free software program *Distance* (Thomas et al. 2006), available at <http://www.rupa.st-and.ac.uk/distance/> (Accessed: June 12, 2009), to model detectability and estimate density of landbirds. Describing in detail how to use *Distance* and the underpinnings of the available analyses is beyond the scope of the SOP. Program *Distance* includes a users manual which assumes that the user is familiar with distance sampling concepts and statistics. There are numerous resources available including Buckland et al. (2001) and Buckland et al. (2004).

The analyst should use program *Distance* to fit the appropriate detectability function and estimate densities for each species with year as a stratum, and site as a substratum, and points within a substratum; these will be considered samples. These annual stratum estimates of density should be based on mean estimates at the substratum level and weighted by sample effort within each substratum. Each site should be considered a replicate sample that will contribute to an overall annual mean estimate.

An annual index of abundance from mist-net data will be used in trend analyses. Abundance is the natural log of the total number of captures in each season (removing within season

recaptures) per net 1000 hours (to control for effort) plus 1 (to allow for log-transformation for years with zero captures). This should be done for adults (those aged After Hatch-Year) in summer and fall, young (Hatch-Year) in summer and fall, and for all captures in winter (most cannot be aged at this time of year).

Season	Analysis Dates*
Summer (breeding season)	1 May – 10 August
Fall (migration)	18 August – 25 November
Winter	1 December – 28 February

* Winter and summer dates may be refined based on future analyses including developing dates tailored to each species when possible.

Annual Apparent Survival of Adults

The 6-year report should estimate annual survival for all species with adequate data. The Ravian package integrates directly with the RMark (Laake and Rexstad 2008) package. RMark provides a very rich and simple R interface to Program MARK (White and Burnham 1999). For these simple estimates of survival we will not perform model selection or model averaging, but instead will just include the model that includes sex, year, and month, fully crossed. We will, however account for transients using the process described in Pradel et al. (1997).

While apparent survival may not accurately represent true survival, observed trends in apparent survival, in conjunction with corroborating results in point count results or mist netting captures, will provide significant support for detecting and discovering the cause of any long-term trends within the region.

Assessing Temporal Trends

Once density (point count), abundance (mist-net), and survival estimates are available, trend analyses will be performed on these data. Trend analysis for survival rates is available directly within the Ravian -> RMark -> Mark interface, by incorporating additional models where year is analyzed as a continuous variable. For trend analysis in density and abundance the analyst will import results back into the Ravian package, where simple trends can be calculated using a weighted linear regression of log-transformed density or abundance by year for each species. These log-linear regressions will be weighted by the inverse of the variance of each estimate.

Literature 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, UK.
- 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, Oxford, UK.
- Laake, J. and E. Rexstad. 2008. Appendix C: RMark – An alternative approach to building linear models in MARK in Program MARK, A Gentle Introduction, 8th Edition. Cooch, E. and G. White, editors. <http://www.phidot.org/software/mark/docs/book/>
- Pradel, R., J. E. Hines, J.-D. Lebreton and J. D. Nichols. 1997. Capture–recapture survival models taking account of transients. *Biometrics* 53:60–72.
- 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. 2006. Distance 5.0. Release 2. Research Unit for Wildlife Population Assessment, University of St. Andrews, UK. <http://www.ruwpa.st-and.ac.uk/distance/> (Accessed: June 11, 2009).
- White, G. C. and K. P. Burnham. 1999. Program MARK: Survival estimation from populations of marked animals. *Bird Study* 46 Supplement, 120-138.

Standard Operating Procedure (SOP) 10: Data Reporting V2.0

Revision History Log

Prev. Version #	Revision Date	Author	Changes Made	Reason for Change	New Version #
		Marcus Koenen	Adapted to landbird monitoring protocol		1.0
1.0	June 2009	T. Gardali	Totally revised	Reviewer comments	2.0

Standard Report Format

Progress and Synthesis and Analysis reports will use the format established for manuscripts and technical reports by the Natural Resources Publications Management:

<http://www.nature.nps.gov/publications/NRPM> (Accessed: June 10, 2009). A report checklist (below) should be used and submitted with each report to ensure the report completeness and quality.

	Report Checklist
	Cover page lists all authors and addresses.
	Document has been reviewed for content, spelling and grammar.
	Abstract and keywords are provided on page three of final report.
	Body of document includes introduction, description of study area, methods, results, and discussion.
	Conclusion Section includes Public Interest Highlights.
	Conclusion Section includes Management Recommendations.
	Conclusion Section includes Research Recommendations.
	Tables, figures, maps, and illustrations have descriptive titles and are sequentially numbered.
	Document is supported by scientific literature.
	Literature Cited has been checked against the text.
	Submission Checklist
	Two hard copies are being submitted.
	Electronic copy is in MS Word Format (2002 or later) and is submitted on cd, zip, dvd, or sent by email as an attachment.
	Data is being submitted electronically in MS Excel or MS Access format.
	All raw data sheets have been submitted.
	Metadata is provided for all electronic databases (Data fields are defined and database structure is discussed).
	Metadata is provided for any GIS data (following FGDC standards)
	Metadata is provided for raw data sheets (may include field sheet instructions or other documentation that defines fields).
	Photographs have been submitted along with permission for their use in brochures, websites, or other published materials.
	Final Check
	Checklist has been reviewed and all items checked off before final submission. Indicate YES or NO.

Report Review Procedure

Internal Review

PRBO should submit a draft of the annual report to the Network Program Manager for internal review. Internal review by person(s) skilled in technical writing for clarity and directness should

fulfill this review requirement. Internal reviews will be conducted by the individuals associated with the program or other SFAN staff or individuals known to be skilled in writing and editing.

If reports are written to update findings only and they do not deviate significantly from previously reviewed and distributed reports then the review process may stop here. However, review by park staff and subsequent external reviews must be sought for new reports or those that deviate significantly from previously reviewed and distributed reports. Also, if management activities within a park are not clearly understood than park review should be sought for a report to clarify results and management implications.

Park Review

Park staff, generally the Resource Managers are in a unique position since they can supply details about management activities that may influence findings presented in a report. Also, they will most likely be directly involved in applying management recommendations to their respective parks. Therefore, review by park staff is vital to the interpretation of findings and the assessment of proposed management implications. Review by park staff should be conducted before a report is submitted for external review.

External Review

External review by two or more experts in water landbird monitoring should be sought for the first report in a series of annual reports. In addition, analytical methods employed on data presented in the report need to be reviewed by one or more statisticians. If a report updates a previously reviewed and distributed report than external review is not required. However, external reviews must be sought for new reports including the analysis and synthesis reports or those that deviate significantly from previously reviewed and distributed reports. In order to conserve reviewer time, external reviews must follow the internal and park review process.

Report Distribution Procedure

Identifying Stakeholders

The primary stakeholders in our landbird monitoring efforts are park staff. Additional stakeholders include the SFAN I&M program and other partnering agencies.

Distributing the Report

The main mechanism for distribution of the landbird monitoring reports will be the Internet. All reports will be made available for download at the SFAN website:

<http://science.nature.nps.gov/im/units/sfan/>

In addition, the NPS I&M Program maintains an on-line natural resource bibliographic database known as NatureBib. NatureBib records will be created for all of the monitoring documents, including the reports. The public version of NatureBib is in development by the NPS I&M program.

All reports will be published in the Natural Resource Technical Report (NRTR) Series following guidance from the NPS Natural Resource Program Center in Fort Collins, CO. The Natural

Resource Publications Management home page hosts a list of and links to all documents published in the NRTR Series. The home page can be found at:

<http://www.nature.nps.gov/publications/NRPM/>

Progress Reports

Progress reports refer to simple summary reports and should be completed every third year in line with point count survey schedule. Several standard summary tables should be included in the progress report. The recommended structures for standard tables to include in the progress report are presented below, with fabricated data included for illustrative purposes.

Observers Who Conducted Point Counts and / or Mist-netting

Table 1 of the progress report (Table 17) should provide the names and roles of all observers who conducted point counts during the current year and mist-netting during the last three years.

Table 17. Sample Table 1 of the Progress Report.

Observer	Role	Method*	Year(s)
Diana Humple	Field Lead	PC, MN	2010, 11,12
Scott Jennings	Technician	PC, MN	2010, 11,12
Renée Cormier	Field Lead	PC, MN	2010, 11,12
Tom Gardali	Project Lead	PC, MN	2010, 11,12
Elizabeth Porzig	Technician	MN	2010
Borja Mila	Technician	MN	2011
Gregor Yanega	Technician	MN	2012

*PC = point count and MN = mist-netting

Number of Hours Mist-nets were Operated by Season and Year

Table 2 of the progress report (Table 18) should provide the names of the mist net stations and the total number of net hours (effort) summarized by season and year.

Table 18. Sample Table 2 of the Progress Report.

Station	2011 Net hours			2012 Net hours			2013 Net hours		
	Summer	Fall	Winter	Summer	Fall	Winter	Summer	Fall	Winter
Muddy Hollow	1200	1800	800	1150	1780	820	1090	1690	790
Redwood Creek	1100	1780	750	1080	1700	800	1110	1710	850

Dates that Point Count stations were Surveyed by Visit and Year

Table 3 of the progress report (Table 19) should provide the site names and the survey dates by visit and year.

Table 19. Sample Table 3 of the Progress Report.

Point count Site	2011 dates		2012 dates		2013 dates	
	Visit 1	Visit 2	Visit 1	Visit 2	Visit 1	Visit 2
Muddy Hollow	9 May	1 Jun	10 May	2 Jun	12 May	1 Jun
Upper Olema	7 May	5 Jun	7 May	9 Jun	9 May	9 Jun
Tennessee Valley	16 May	11 Jun	12 May	8 Jun	11 May	8 Jun

All Species Recorded During the Field Seasons

Table 4 in the progress report (Table 20) should list all species detected by point count and mist-netting. In the abbreviated table below, a single asterisk (*) indicates that the species is a California Partners in Flight Focal Species and two asterisks (**) are species with special management status according to the California Bird Species of Special Concern list.

Table 20. Sample Table 4 of the Progress Report.

Common name	Latin name	Detection method
Olive-sided Flycatcher*, **	<i>Contopus borealis</i>	PC, MN
Western Wood-Pewee	<i>Contopus sordidulus</i>	PC
Willow Flycatcher	<i>Empidonax traillii</i>	MN
Pacific-slope Flycatcher	<i>Empidonax difficilis</i>	PC, MN

PC = point count and MN = mist-netting

Number of Individuals of Each Species Detected During Point Counts

Table 5 in the progress report (Table 21) should indicate the number of individuals of each species detected during point counts.

Table 21. Sample Table 5 of the Progress Report.

Species	2011	2012	2013
Song Sparrow	30	39	29
Spotted Towhee	26	20	19
California Towhee	2	0	5

Number of Individuals of Each Species Captured During Mist-Netting

Table 6 in the progress report (Table 22) should indicate the number of individuals of each species captured during mist-netting.

Table 22. Sample Table 6 of the Progress Report.

Species	<u>2011</u>			<u>2012</u>			<u>2013</u>		
	Summer	Fall	Winter	Summer	Fall	Winter	Summer	Fall	Winter
Song Sparrow	105	95	50	99	100	55	140	120	70
Spotted Towhee	55	60	36	60	49	30	70	62	50

Other Components of Progress Reports

In addition to the tables described above, progress reports should include:

- A brief Narrative section describing logistical problems (if any) and details changes to methods (if any).
- Graphs showing trends in the raw count of at least the most common species detected and / or California Partners in Flight focal species. These graphical presentations of trends in raw data will not be analyzed quantitatively because they represent interim data that has not accounted for effort and detectability.
- A Results section that describes the content of the tables and graphs.
- A brief Discussion section that highlights unusual events such as atypical weather patterns that might have affected results.
- An Acknowledgements section.

Six-Year Analysis and Synthesis Reports

In addition to the material recommended for the progress reports, the 6-year reports should include the following.

Trends for Species with Adequate Data for Density Estimation from Point Count Data

The primary goal of the 6-year report is to provide information on population trends. Hence, these figures represent the meat of the report. An example figure using data from a subset of riparian sites for six species is provided as Figure 17.

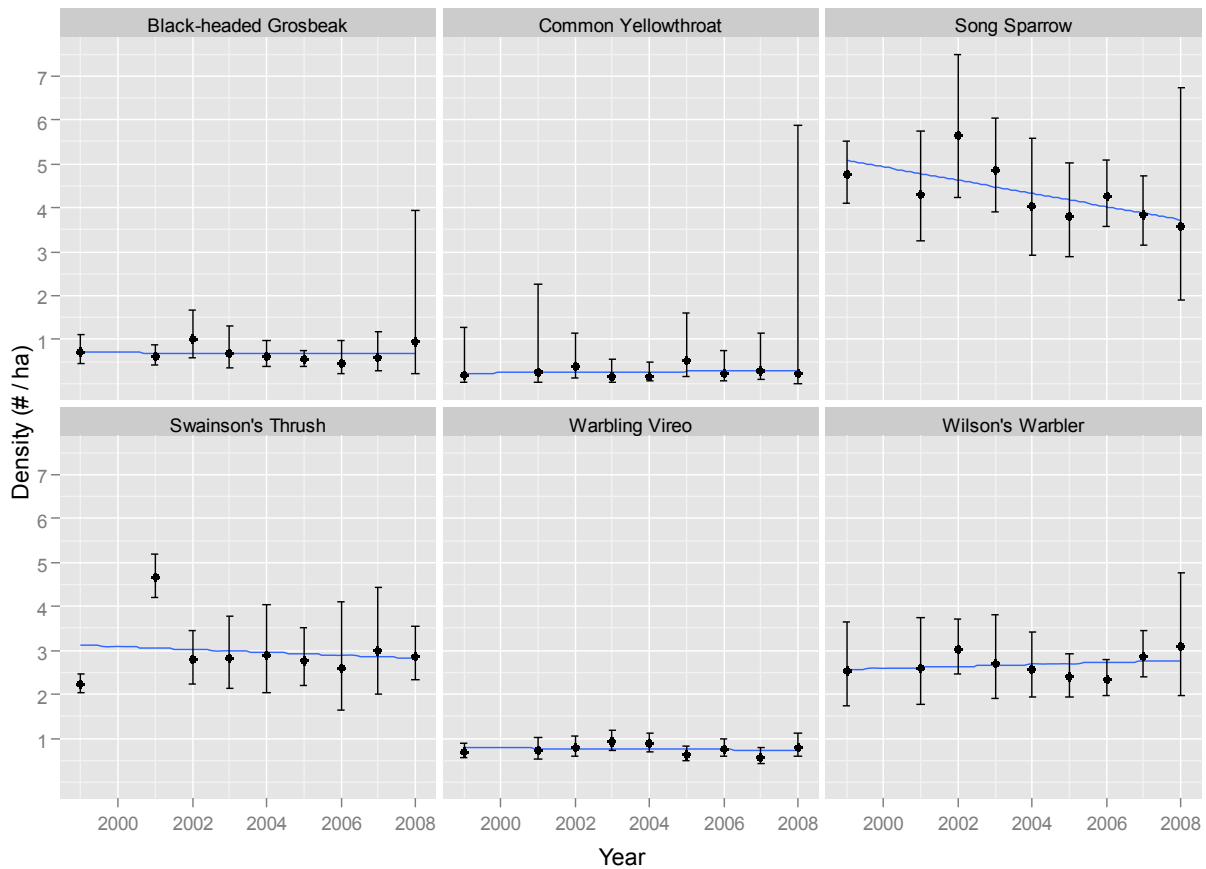


Figure 17. Sample figure depicting trends.

The 6-year report should also include a table (Table 23) with summary statistics for each species that will supplement the trend figures.

Table 23. Sample table with summary statistics for the Progress Report.

Species	Trend in λ	Standard Error (λ)	Trend
Black-headed Grosbeak	-0.010	0.032	No trend
Common Yellowthroat	-0.025	0.048	No trend
Song Sparrow	-0.035	0.013	Negative trend
Swainson's Thrush	-0.0037	0.025	No trend
Warbling Vireo	-0.0095	0.019	No trend
Wilson's Warbler	0.0077	0.012	No trend

The 6-year report should also provide the estimated density (birds/ha) of each species during each year (Table 24).

Table 24. Sample table with estimated density (birds/ha).

YEAR	Black-headed Grosbeak		Common Yellowthroat		Song Sparrow		Swainson's Thrush		Warbling Vireo		Wilson's Warbler	
	Density	Variance	Density	Variance	Density	Variance	Density	Variance	Density	Variance	Density	Variance
<i>Arroyo Hondo</i>												
1999	0.47	0.03	0.00	0.00	4.09	0.28	2.41	0.24	0.58	0.03	4.81	1.11
2001	0.00	0.00	0.00	0.00	1.82	0.56	4.83	0.16	0.55	0.04	3.48	0.47
2002	0.17	0.01	0.00	0.00	1.76	0.23	2.36	0.11	0.44	0.05	1.47	0.29
2003	0.34	0.06	0.00	0.00	3.19	0.73	4.40	0.51	1.11	0.12	5.01	0.26
2004	0.17	0.01	0.00	0.00	2.20	0.32	2.79	0.09	0.44	0.05	4.28	1.28
2005	0.25	0.03	0.00	0.00	1.82	0.23	2.73	0.91	0.44	0.08	3.67	1.30
2006	0.25	0.06	0.00	0.00	4.30	2.76	5.15	0.71	1.11	0.17	2.93	1.85
2007	0.00	0.00	0.00	0.00	2.70	0.73	1.40	0.44	0.48	0.05	3.80	0.31
2008	0.38	0.07	0.00	0.00	2.97	0.14	2.41	0.37	1.11	0.14	2.38	0.37
<i>Coast Trail Laguna</i>												
2002	0.52	0.05	0.93	0.09	5.03	0.53	2.60	0.27	0.56	0.04	1.95	0.21
<i>Gerbode Valley</i>												
2005	0.29	0.03	2.01	0.16	3.03	0.13	3.11	0.25	0.00	0.00	2.38	0.21
<i>Lagunitas Creek</i>												
1999	1.01	0.03	0.00	0.00	4.37	0.10	2.22	0.08	1.45	0.02	2.53	0.13
2001	0.70	0.02	0.00	0.00	3.49	0.17	4.22	0.16	1.82	0.05	2.73	0.23
2002	1.63	0.06	0.03	0.00	5.18	0.28	2.57	0.09	2.28	0.08	3.26	0.21
2003	1.35	0.03	0.00	0.00	4.96	0.22	2.47	0.10	2.01	0.05	3.22	0.22
2004	0.67	0.01	0.00	0.00	2.64	0.10	2.39	0.13	1.45	0.03	2.32	0.10
2005	0.84	0.04	0.00	0.00	2.86	0.24	1.39	0.04	1.51	0.04	2.99	0.14
2006	0.93	0.05	0.00	0.00	3.53	0.15	2.04	0.08	1.03	0.04	2.32	0.09
2007	0.72	0.01	0.00	0.00	3.53	0.21	2.20	0.07	0.81	0.02	2.51	0.14
<i>Lower Olema Creek</i>												
2002	0.34	0.02	0.31	0.02	4.24	0.53	1.75	0.15	0.12	0.01	3.50	0.47
2003	0.28	0.03	0.31	0.03	4.06	0.26	2.98	0.41	0.24	0.01	2.60	0.13
2004	0.28	0.02	0.24	0.03	4.24	0.39	2.46	0.19	0.90	0.04	2.90	0.18
2005	0.41	0.05	0.39	0.02	4.96	0.34	2.90	0.25	0.30	0.04	1.90	0.08
2006	0.07	0.00	0.31	0.03	3.97	0.33	1.93	0.07	0.24	0.02	2.20	0.30
<i>Muddy Hollow</i>												
1999	0.44	0.01	0.69	0.05	4.67	0.09	2.32	0.10	0.27	0.01	1.91	0.11
2001	0.57	0.03	0.50	0.05	4.67	0.18	4.85	0.23	0.09	0.00	1.56	0.12
2002	0.71	0.07	0.84	0.10	6.12	0.25	3.77	0.15	0.21	0.01	2.54	0.13
2003	0.71	0.04	0.38	0.02	5.16	0.16	3.09	0.12	0.27	0.01	1.66	0.08
2004	0.47	0.03	0.42	0.03	4.10	0.23	2.70	0.16	0.24	0.01	1.81	0.11
2005	0.61	0.03	0.52	0.05	4.03	0.13	3.54	0.18	0.22	0.02	2.05	0.09
2006	0.35	0.03	0.63	0.05	4.36	0.24	2.32	0.10	0.22	0.01	2.05	0.21
2007	0.35	0.03	0.63	0.03	4.43	0.21	3.80	0.17	0.13	0.01	2.79	0.13
<i>Pine Gulch</i>												
1999	0.40	0.04	0.46	0.08	4.10	0.30	2.44	0.40	0.62	0.01	2.20	0.39
2001	0.61	0.08	2.07	0.81	4.56	2.55	5.02	2.78	1.06	0.16	1.76	0.32

Table 24. Sample table with estimated density (birds/ha). (continued)

YEAR	Black-headed Grosbeak		Common Yellowthroat		Song Sparrow		Swainson's Thrush		Warbling Vireo		Wilson's Warbler	
	Density	Variance	Density	Variance	Density	Variance	Density	Variance	Density	Variance	Density	Variance
2002	0.51	0.03	1.38	0.49	4.36	0.14	3.73	1.28	0.44	0.02	2.64	0.21
2003	0.20	0.04	0.57	0.07	7.67	0.24	4.25	0.39	1.50	0.17	3.23	0.81
2004	1.11	0.14	0.46	0.05	6.21	0.30	6.05	0.25	2.65	0.17	3.08	0.32
2005	0.45	0.09	0.69	0.11	7.54	1.91	3.86	0.30	1.86	0.16	2.86	0.22
2006	0.00	0.00	0.52	0.12	6.35	0.71	5.21	0.29	0.80	0.15	1.98	0.42
2007	0.15	0.02	1.03	0.41	5.16	0.86	4.83	0.51	0.80	0.15	3.30	0.27
2008	0.30	0.09	0.86	0.15	5.35	0.10	2.70	0.52	0.93	0.12	4.18	0.94
<i>Redwood Creek</i>												
1999	0.79	0.02	0.00	0.00	5.39	0.19	2.12	0.08	0.47	0.01	2.73	0.11
2001	0.65	0.03	0.07	0.00	5.09	0.30	4.85	0.24	0.31	0.01	3.36	0.13
2002	1.41	0.05	0.05	0.00	7.60	0.41	2.58	0.07	0.45	0.02	3.35	0.18
2003	0.49	0.01	0.05	0.00	4.66	0.21	2.23	0.08	0.52	0.02	2.63	0.11
2004	0.80	0.03	0.12	0.01	4.98	0.12	2.84	0.07	0.61	0.02	2.93	0.17
2005	0.69	0.03	0.11	0.01	4.46	0.14	3.06	0.10	0.64	0.02	2.75	0.14
2006	0.54	0.01	0.07	0.01	4.42	0.11	2.33	0.12	1.02	0.04	2.84	0.13
2007	0.88	0.06	0.25	0.03	3.72	0.18	3.06	0.12	0.64	0.04	3.21	0.12
2008	1.32	0.06	0.14	0.02	3.29	0.10	3.05	0.16	0.66	0.02	3.18	0.16
<i>Upper Olema Creek</i>												
2005	0.41	0.03	0.13	0.02	3.28	0.12	2.30	0.19	0.71	0.05	1.69	0.14

Trends in Captures for Species from Mist-Netting

The 6-year report should include a table that shows the estimated linear trends for species or subspecies by season (summer, fall, winter) from mist-netting data (Table 25). An abbreviated example from Palomarin (Ballard et al. 2003) is provided below; the actual table will contain many more species.

Table 25. Sample table depicting estimated linear trends.

Species (mean/yr, yrs w/ 0 caps)	Winter location	Nest height	Nest type	Winter food	Cowbird host	Human tolerant	Linear trend (% change)	Adj. R ²	P-value
Pacific-slope Flycatcher (180, 0)	Tropics	High	Other	Insects	Common	Yes	- 0.5 ± 14.6	- 0.05	0.76
Hutton's Vireo (12, 0)	Resident	High	Cup	Insects	Common	No	- 7.7 ± 1.7	0.47	<0.001
Warbling Vireo (47, 0)	Tropics	High	Cup	Insects	Common	Yes	- 9.4 ± 2.2	0.43	<0.001

Trends in Number of Young Birds Captured from Mist-Netting

The 6-year report should include a table that shows the estimated linear trends for young birds captured in mist-nets during the summer and fall. The table will look like the one for adults above.

Trends in Annual Apparent Survival of Adults

A table presenting annual survival of adults should also be presented in the report (see Table 26 taken from Gardali et al. 2003). The actual report will contain many more species.

Table 26 . Sample data with estimated density (birds/ha)

Species	Survival Probability (SE, 95% CI)	Recapture Probability (SE, 95% CI)
Swainson's Thrush	0.564 (0.025, 0.515–0.612)	0.598 (0.040, 0.518–0.674)

Other Components of the 6-Year Analysis and Synthesis Reports

In addition to the extra analyses and tables described above, the 6-year report also should:

- Provide public interest highlights. This section has significant potential to create interest and support for this and other resource management projects. Provide a bulleted list of highlights from this project. Resource managers may use these as talking points with other park staff including management. Interpretation staff may use these to highlight aspects of interest to the general public.
- Make management recommendations. If management recommendations are warranted, highlight them here. If the study was initiated due to specific park management needs, management implications should be emphasized and discussed
- Make research recommendations. Summarize additional research needs. This section may serve as a way to develop priority research projects for the parks and to support future funding.

- Attempt to place network results within the larger context of bird population changes as measured by the Breeding Bird Survey for example.
- Evaluate operational aspects of the monitoring program

Literature Cited

Ballard, G., G. R. Geupel, N. Nur, and T. Gardali. 2003. Long term declines and decadal patterns in population trends of songbirds in Western North America, 1979 – 1999. *Condor* 105:737-755.

Gardali, T., D. C. Barton, J. D. White, and G. R. Geupel. 2003. Juvenile and adult survival of Swainson's Thrush in coastal California: annual estimates using capture-recapture analyses. *Auk* 120:1188-1194.

Standard Operating Procedure (SOP) 11: Revising the Protocol V1.1

Revision History Log:

Prev. Version #	Revision Date	Author	Changes Made	Reason for Change	New Version #
1.0	June 2009	T. Gardali, M. Koenen	Added May 2007 peer review comments	To document rational for changes to protocol	1.1

Scope and Application

This Standard Operating Procedure explains how to make changes to the Riparian Landbird Monitoring Protocol and accompanying SOPs, and explains procedures for tracking these changes. SFAN or park staff editing the Protocol Narrative or any SOP need to follow this procedure to eliminate confusion in data collection and analysis methods. All SFAN landbird monitoring staff should be familiar with this SOP in order to identify and use the most current methodologies.

This SOP also contains a table listing the most current version of the protocol narrative and each of the SOP's. This will provide a single reference for ensuring that the most current documents are being used. Also included is a section containing comments from protocol review, responses to those comments and approvals.

Protocol Revision Procedures

1. The Riparian Landbird Monitoring Protocol Narrative and accompanying SOP's are a living document, designed to capture current best-laid plans in a readily disseminated and followed format. Changes and revisions will inevitably be made, and documented as soon as they are deemed necessary and appropriate reviews conducted.
2. All edits will be reviewed for grammatical and technical accuracy and overall clarity. Minor changes or additions to existing methods will be reviewed "in-house" by the GOGA wildlife ecologist, PORE Science Advisor and other appropriate network staff. However, if a complete change in methods is anticipated, then an outside review is required. Subject matter experts familiar with landbirds monitoring and data analysis will be utilized as reviewers.
3. Edits and protocol revisions will be documented in the Revision History Log that accompanies the Protocol Narrative and each SOP. Only changes in the Protocol Narrative or specific SOP that has been edited will be logged. Minor changes, such as an alteration of species lists, will be recorded as decimal increases in version number (*e.g.*,

Version 1.1 to 1.2). Major changes, such as an alteration in objectives or update after five-year analysis, will be recorded as integer increases in version number (*e.g.*, Version 1.2 to 2.0). “Record the previous version number, date of revision, author of the revision, identify paragraphs and pages where changes are made, and the reason for making the changes along with the new version number” (Peitz *et al.* 2002). Changes to conform to the most recent formatting required by NPS “Instructions to Authors” (see <http://www.nature.nps.gov/publications/nrpm/>) are generally done as part of protocol revision and not noted separately as changes.

4. Notify the SFAN Lead Data Manager or Project Manager of any changes to the Protocol Narrative or SOP so that the new version number can be incorporated in the Metadata. The Data Manager or Project Manager will then edit the database per any changes to the Protocol Narrative and SOPs.
5. Post new versions on the internet and notify all individuals known to have a previous version of the Protocol Narrative or SOP.
6. When any significant changes in the data collection protocols occur, such as changes in sample collection techniques or equipment, a change in database, or changes in staff, there should be an “overlap” of methods and personnel (Oakley *et al.* 2003). This requires using both the old and new techniques on a given survey as well as having both the outgoing and new staff survey concurrently.

Table 27. Current SFAN Riparian Landbird Monitoring Protocol documents.

Document Name	Current Version	Version Date	Author
San Francisco Bay Area Network Riparian Landbird Monitoring Protocol	4.4	3/1/10	T. Gardali et al.
Standard Operating Procedure (SOP) 1: Preparations and Equipment Set up	2.0	6/22/09	T. Gardali et al.
Standard Operating Procedure (SOP) 3: Training Observers	2.0	6/22/09	T. Gardali et al.
Standard Operating Procedure (SOP) 4: Marking and Relocating Sampling Plots	2.0	6/22/09	T. Gardali et al.
Standard Operating Procedure (SOP) 5: Using the GPS Unit	1.0	6/22/09	T. Gardali et al.
Standard Operating Procedure (SOP) 6: Conducting Variable Circular Plot (VCP) Point Count Surveys	1.0	6/22/09	T. Gardali et al.
Standard Operating Procedure (SOP) 7: Conducting Mist-netting and Banding	2.0	6/22/09	T. Gardali et al.
Standard Operating Procedure (SOP) 8: Data Management	3.0	6/22/09	T. Gardali et al.
Standard Operating Procedure (SOP) 9: Data Analysis	2.0	6/22/09	T. Gardali et al.
Standard Operating Procedure (SOP) 10: Data Reporting	2.0	6/22/09	T. Gardali et al.
Standard Operating Procedure (SOP) 11: Revising the Protocol	1.1	6/22/09	T. Gardali et al.

Protocol Review

Peer reviewers provided comments to the draft protocol using a template developed for the NPS protocol peer review process in the Pacific West Region (Table 28).

Table 28. Template used by protocol reviewers

Section	Section Content
Section 1	Overall Organization and Presentation of Protocol Narrative 1. Is the overall monitoring protocol well-organized with sections clearly delineated? 2. Does the protocol have a title page with authors' names, protocol version number and date? (Protocol version numbers should be constructed to allow for both major and minor changes.) Is there a Table of Contents, abstract, and the three basic sections: 1-Narrative, 2-Standard Operating Procedures (SOPs), and 3-Supplementary Materials or Appendices recommended in the NPS standards published by Oakley et al. 2003 (http://science.nature.nps.gov/im/monitor/protocols/ProtocolGuidelines.pdf). 3. Is there a complete and accurate table of contents with page numbers? (Chapters should be paginated consecutively, i.e. Chap. 1 (pp. 1-20), Chap. 2 (pp. 21-28), Chap. 3 (pp. 29-44), etc. to allow for modular updates.) 4. Are the tables and figures clearly labeled and understandable? 5. Is the protocol bound so that it lies flat, preferably in a 3-ring binder?
Section 2	A. Background and Objectives (Chapter 1) 1. Does the protocol narrative provide a rationale or justification for why a particular resource or resource issue was selected for monitoring? Is the history and background for this resource issue well-referenced with supporting literature cited? 2. Does the protocol narrative discuss the linkages between this and other monitoring projects? 3. Does the protocol narrative describe how monitoring results will inform management decisions? 4. Does the protocol narrative contain careful documentation of the monitoring objectives or monitoring questions being asked? 5. Does the protocol narrative identify specific measurable objectives such as thresholds or trigger points for management actions?
Section 3	B. Sampling Design (Chapter 2) 1. Is there a clear and logical rationale for selecting the sampling design over others? 2a. Were the criteria for site selection clearly discussed including stratification, spatial design, and whether this monitoring will be co-located and/or integrated with other VS monitoring protocols? (See Checklist, Section 1A2.) 2b. Has the target population or "sampling frame", and the sampling units, been identified? In other words, is the desired level of inference clear? 3. Is the sampling frequency and replication identified? 4. Is the timing of sampling defined? 5. Are the location of sampling sites clearly identified? 6. Is the level of change that can be detected for the amount or type of sampling being instituted identified? (See Checklist, Section 1A5.)
Section 4	C. Field Methods (Chapter 3) 1. Are preparations for the field season and equipment setup included? Are requirements for permitting and compliance discussed? 2. Does the protocol include clear and detailed information on taking measurements with example survey forms included? (Protocol variables and measurements may be discussed in detail in a SOP. A complete set of forms should be included in either the supplementary materials or a SOP.) 3. Is the method of access for sampling sites provided? 4. Is there an overview of procedures for establishing, monumenting, and maintenance of plots discussed in one or more SOPs? 5. Does the protocol include details for the post-collection processing of samples or vouchers? 6. Does the protocol include procedures to be followed at the end of the field season?
Section 5	D. Data Handling, Analysis and Reporting (Chapter 4) 1. Does the protocol provide an overview of the process for entering, editing, and storing data, identification of database software, and whether the database is consistent with the recommended I&M database template structure? (For water quality protocols, see specific water quality guidance in Part B or WRD's General Comments 15, and checklist items in Section 2, items 8-10, below.)

	2. Are quality assurance (QA) and quality control (QC) procedures presented for the various levels of data collection and analysis? (See water quality Part B guidance or General Comments 15 as appropriate.)
	3. Is the data structure clearly presented and sufficient to capture the required information to meet the stated goal? Is there an overview of the database design?
	4. Are there recommendations for routine data summaries and statistical analysis to detect change?
	5. Is there a recommended reporting schedule?
	6. Is there a recommended report format with examples of summary tables and figures?
	7. Is there a recommendation for long-term trend analysis (e.g. every 5 or 10 years)?
	8. Does the protocol narrative include an adequate description of metadata and data archival procedures?
	9. Does the protocol narrative describe the frequency of testing and review of protocol effectiveness?
Section 6	E. Personnel Requirements and Training (Chapter 5)
	1. Does the narrative include a listing of the personnel and describe their roles and responsibilities, and qualifications?
	2. Does the protocol include a discussion of training procedures for personnel?
Section 7	F. Operational Requirements (Chapter 6)
	1. Are facility, vehicle and equipment needs identified?
	2. Is there a summary of key partnerships with agencies, organizations and individuals that are part of the monitoring program and a description of their contribution? Is there a list of relevant cooperative agreements and other partnership agreements, if applicable?
	3. Is a schedule for the annual fieldwork and administrative needs required to implement this protocol included?
	4. Is there an overall budget that summarizes the annual and periodic costs of implementation of the protocol? Does it seem reasonable?
	5. Does the staffing plan and budget demonstrate that adequate resources have been allocated to data management, analysis, and reporting activities (ca. 30% are recommended)?
Section 8	G. Literature Cited (Chapter 7)
	1. Are the literature citations relevant, sufficient and consistently formatted?
Section 9	Standard Operating Procedures (Selected essential SOPs in addition to those mentioned in the narrative outline are identified in the checklist below. For Water Quality protocols, Part B Guidance or WRD's General Comments 15 should be consulted when developing SOPs.)
	1. Is there a table of contents for the SOPs?
	2. Are changes to each SOP clearly identified with a title, version number or revision date, and page numbers? Changes to protocol modules (Chapters or SOPs) should be reflected in the overall protocol version number and protocol revision history log either through a minor or major revision; however, you may also wish to develop a numbering scheme for SOPs, e.g. SOP 1.00, 1.01...
	3. Is there a SOP with instructions for revising the protocol and a revision history log?
	4. Is there a SOP with instructions for preparation before the field season? Is there a SOP with instructions for procedures and equipment storage during and after the field season? (Also see numbers 10 and 11 below.)
	5. Is there a SOP for training field personnel?
	6. Is there a SOP that clearly defines protocol variables and how to measure them? (See Checklist, Section 1C2.)
	7. Are there clear and detailed driving and other navigational instructions to sampling sites?
	8. Are the details of Data Management identified in one or more SOPs? Topics to be included are at minimum identified in Section 1D and may include customized data management routines. Specifically for water quality monitoring data, does the SOP specify how data will be reported to WRD for entry into the Environmental Protection Agency's STORET database?
NA	9. For water quality monitoring and other monitoring as appropriate, is there a quality control SOP associated with each protocol that adequately documents QC objectives for measurement sensitivity (detection limits), measurement precision, measurement systematic error (bias as percent recovery), data completeness (including adequacy of planned sample sizes and statistical power – this topic may be in the SOP on Sampling Design), and (if applicable for lab measurements only) blank control? Are instrument calibration details included either in the QC SOP or in a separate calibration SOP?
NA	10. For water quality protocols, is there a SOP that includes an explanation of how data comparability (a quality assurance basic) was considered in choosing which protocols and chemical labs to utilize? Do protocol SOPs contain enough field and lab method details to allow others to determine if data produced is comparable enough to other regional data sets to be considered

NA	credible by regulatory agencies interested in the data?
	11. Do aquatic protocol SOPs adequately describe the details of all Sampling Protocols (Field and Laboratory), as well as equipment needs and operation, sampling techniques, sample preservation and handling and logistics?
	12. Are all major procedures required for the protocol sufficiently explained? Are any SOPs missing?
	13. Are the literature citations with the SOP relevant, sufficient and consistently formatted?
Section 10	Supplementary Materials or Appendices
	1. Is there a table of contents with Section 3 – Supplementary Materials that clearly identifies the materials provided in this section of the protocol?
	2. Are the supplementary materials relevant, sufficient and consistently presented? Consistent formatting is desirable, but not always possible.
	3. Are data collection forms provided either in this section or in an SOP?
	4. Is there a section for the Administrative Record that provides the history of protocol development and refinement? (The published protocol may be presented either in Section 2 or Section 3 depending upon its contribution to the current protocol.)

Reviewer Comments

Below are the consolidated comments and responses from the writing team from the round of reviews in May 2007.

Review Approval and Distribution

Key personnel involved with the development, implementation, and review of this monitoring protocol will be on the electronic mailing list for receipt of this document and subsequent major revisions. These include the following personnel:

- | | |
|---|--------------------------------------|
| • Marcus Koenen, I&M Program Manager | San Francisco Area Network |
| • Dave Press, I&M Data Manager | San Francisco Area Network |
| • Sarah Allen, PWR and PORE Science Advisor | Point Reyes National Seashore |
| • Bill Merkle, Wildlife Ecologist | Golden Gate National Recreation Area |
| • Daphne Hatch, Chief of Natural Resources | Golden Gate National Recreation Area |
| • Tom Gardali, Lead Investigator | PRBO Conservation Science |
| • Diane Humple, Co-Investigator | PRBO Conservation Science |

PWR Protocol Review

Peer reviewers used a standard template to review this protocol and standard operating procedures. In addition, reviewers provided narrative comments.

Response to Peer Review Comments Received May 2007.

Penelope Latham comments with Tom Gardali (TG) and Marcus Koenen (MK) responses and clarifications:

General:

- “Unable to locate an updated PDS. (This should have been submitted prior to submitting the protocol.) It would be helpful to provide one prior to re-review.” **MK:** *The PDS has been updated based on the changes in this revised protocol.*
- “See NRTR guidance for formatting of text and tables. Substitute “Tables” and “Figures” for “list of Tables”, etc.” **MK:** *The protocol has been updated to meet the most recent NRTR guidelines.*
- “Pg. 5 refers to Natural Resource Reports. The paragraph to be retained on this page should reference the technical report series for protocols.” **MK:** *The most recent guidance has been that protocols follow the NRR formatting. Annual reports follow the NRTR guidelines.*
- Changing order of SOPs. **TG:** *good suggestion; order revised.*

- “It would be more helpful to the reader if the SOPs were listed in the TOC rather than the Executive Summary. The TOC should provide an overview of everything that is in the document. You will need to figure out a way to identify your standard SOPs, e.g. Site Visits (well done) and Field Safety. While these are standard SOPs I can’t think of any reason why you can’t also assign them an appropriate number for this protocol.” **TG:** *I added all SOPs to the document instead of as separate files – this makes the document massive but that is the only way to address this. I made Site Visits an SOP with an assigned number. MK: The formatting for the document including the SOP follows the most recent guidance. Also, a field safety SOP was added.*
- “Executive Summary, pg. 10: the first sentence says the purpose of this document is to describe the National Park Service’s monitoring program for landbirds of the SFAN... That suggests there is a national protocol that is being used in SFAN but that isn’t the case. This Protocol is specific to SFAN. I’d change this wording and look for other places where this occurs. There are at least a few if not several.” **TG:** *Changed in the executive summary and throughout.*
- “Protocol presented in very draft form; however, it is modular and can be bound to make it easy to use.” **MK:** *Formatting will be finalized after peer review is approved.*
- No schedule. **MK:** *There is a schedule in the narrative.*
- No SOP for after the field season. **TG:** *That is correct. There is no end of the season for mist netting since we band year-round. And there are already SOPs for data management, reporting, etc. It does not seem necessary then to provide an SOP for cleaning and inventorying the minimal gear etc.*
- Capture a copy of the MAPS protocol on CD. **TG:** *The MAPS manual is now provided.*

SECTION 1. Narrative.

Section 1A. Background and Objectives:

Q2. The discussion regarding the use of data from the Palomarin Field Station is very confusing, both here and in subsequent parts of this protocol. You state in several places that the field station data is not part of this protocol, yet it is fairly clear that the data will be integrated during analysis with data collected as part of this protocol and that other monitoring at the FS will complement the monitoring proposed here. I think it would be a lot clearer if you took the approach that you are integrating with other existing monitoring rather than trying to draw lines between them that don’t seem accurate. This adds value to the protocol not detracts from it. **TG:** *We acknowledge that we unnecessarily overstated that Palomarin would not be part of this protocol and that this distracted from the clear “value added” Palomarin provides. We have now made an attempt to acknowledge the linkages between Palo and the protocol without going into the actual details. We do not wish to fully develop how the two monitoring programs could be integrated because (1) we want this protocol to stand on its own (2) we cannot promise the integration will happen due to funding constraints, etc. and (3) doing so would add a level of complexity and hence general confusion to the protocol. Regarding the full question here: Does the protocol discuss linkages between this and other monitoring projects? We think we have done a great job pointing out how our data will become part of and can be informed by several other monitoring programs.*

Q3. Objectives say that the protocol is designed to evaluate ecosystem health not management actions. Agree that this seems particularly appropriate for landbirds, but if you find a decline in landbirds, what will you do? Are there management implications? The discussion of pg. 19-20 seems to partly address this question. On the other hand, it is somewhat contradictory as pg. 20 says that monitoring focuses primarily on the local scale of a park or network in order to inform park managers to (replace with “about”) park-specific changes. **TG:** *It is true that we won’t be evaluating management actions; that would be an entirely different beast and assumes there are management actions in place to evaluate. We made it very clear that a decline in riparian landbirds will “inform managers when management actions are warranted and research is needed” – this in our mind is the management implication. What those management actions will be will depend on what we find and hence we know of no way of answering “what will you do?” within this protocol. Finally, we searched the approved NCCN protocol and could not locate anything that answers the question “what will you do?”*

Section 1C. Field Methods:

Q1. There is no reference to equipment needed or field season preparations in the narrative although there is an SOP (1). There should at least be some statement directing the reader to this section. Permitting and compliance is mentioned in the generic Site Visit SOP but not in the narrative. Readers should also be directed to this SOP. **TG:** *We made reference to these and all SOPs in the narrative. We added info on permitting and compliance to the narrative.*

SOP 3: While there is an SOP titled Establishing, Marking and Relocating Sampling Plots, the SOP only describes how to relocate pre-existing stations not how to establish new stations. **TG:** *We are not going to be establishing new stations and changed the SOP title to reflect this. Note that this is now SOP 4.*

Section 1D. Data Handling, Analysis and Reporting:

Q5. Table 4 in the narrative shows that analysis and synthesis will occur every 4 years. However, the analysis proposed occurs in the middle of the three yr. sequence of data collection for point counts. Seems like it would be more effective if you got through an entire sequence rather than always analyzing your data mid-stream. **TG:** *Good point. We have now modified this by doing analyses once every 6th year during the year following the point count surveys. While six years seems like a long time between analysis reports, we point out that for long-term data collection, it is not (NCCN is every 5 years for example). Further, this frees up funds that can be used for other monitoring projects in SFAN.*

SOP 11: It is not clear whether the format described in the data management plan is different than that described for the NRR series. I suspect it is as the DM plan was written prior to the development of guidance for the series. It is now recommended that all reports written for protocols (annual or otherwise) be formatted and published in the NRR series either as a NRR report or a NRTR report. The checklist is a good tool. **TG:** *We have now modified SOP 10: Data Reporting to reflect that we will follow the NRR series format guidelines.*

The final responsibility for review approval of these reports lies with the Regional I&M Coordinator who is the Key Official. Guidance is provided on the NRPM website and approval submittal forms are available there to submit documents for approval before obtaining series numbers, constructing metadata records, and uploading the documents to NRBib and TIC. Review procedures for protocol reports are currently under development at the regional level but will at a minimum include thorough internal network and park review. **MK:** *These steps will be followed to publish the final protocol.*

Q6. There is a good example in the SOP of what a report format should like although it is not clear which guidance is followed for the format presented (Data Management plan or NRTR). There does not seem to have been much consideration of the content that would go into the report and more attention should be directed to this topic. **TG:** *We have fully revised the reporting SOP to more clearly define content for the Progress Report and the Analysis and Synthesis Report. And we have clarified that we will use the NRR format.*

Section 1E. Personnel Requirements and Training:

Q1. Who is responsible for internal oversight of the review process and coordinating with the Regional Key Official (Regional I&M Coordinator) for review procedures, submission of the report review approval form, constructing the metadata record, obtaining a TIC number and uploading the report?

The Network Coordinator and probably the Data Manager should also be key contacts in ensuring the quality of reports and completion of the process for publication and distribution of reports. **TG:** *These responsibilities have now been added to this section.*

Section 1F. Operational Requirements:

Q1. There is very little discussion of field needs, schedules, vehicles, equipment or other operational details at PINN. **TG:** *PINN is no longer included.*

Q3. The information provided on field and product deliverable scheduling is minimal. I would suggest reviewing a copy of the NCCN Landbird protocol and SOPs for some good examples.

TG: *We reviewed Appendix 2 of the NCCN proposal and judged that that level of detail would be difficult to attain for the year-round mist-netting part of the protocol. Much of the general information on scheduling is already present throughout the document.*

Q5. Several different tables are provided that present different views of the budget and are all useful information. However, it is still very difficult to tell how much actual attention is being paid to management of data. The figures presented suggest that around \$6,000 is dedicated to data management in annual budgets that range from \$93,000 to \$158,000. This hardly seems adequate. **TG:** *These budgets don't entirely tell the whole data management story. In other words, data management is done at several levels and at PRBO most staff are involved in some aspect. For example the project field leader has responsibilities to make sure data are managed on the day to day level as well as with daily, monthly, and annual proofing. PRBO's data management is somewhat automated by the California Avian Data Center. Finally, the NPS Data Manager's time is not accounted for in any of the budgets. In sum, you are correct, \$6k is*

*hardly adequate but the real number – difficult to assess – is much higher. We made notes within each budget that the responsibilities of data management also fall under project leaders, etc. **MK:** We also added some language showing that between the different people working on the program including project leaders, supervisory bander, Lead Field Biologist, statistician, data manager, intern, and field staff, about 1/3 of the budget goes to data management and reporting.*

OTHER Comments:

Sampling Design and Field Methods:

Pg. 18. You state that you will collect data for all birds encountered not just the target species (not identified) but that you will exclude non-target species from analyses because they are not appropriately sampled by the methods employed. What will happen to these data? How will you be able to use it in the future if it wasn't collected with an appropriate method? Is it worth the time and money to collect unusable data? **TG:** *First, to be clear, it does not cost any more money to collect these data. During point counts, every bird detected is simply recorded. All of these data will be entered. They are not useless data as they let us know that a species was present/absent at a general location on a particular date. These types of data can be quite useful over the long term. However, these data are not useful within the confines of this protocol.*

Sampling design, stratification, judgmental vs. probabilistic designs, “n” for various combinations of data is unclear. Additional tables would help. **TG:** *I am not sure what is specifically being requested here.*

Pg. 21. You provide justification for not using a probabilistic design on pg. 21 and state that replicating sites is more important than if they are chosen randomly. You then state that productivity indices from the judgmentally selected mist-net stations provide a landscape-level measure of productivity. Given that there are only six stations listed in Table 2, only three are in the parks and they are judgmentally selected, I'm not sure how you can make that statement. **TG:** *All mist-net stations are relevant to the parks. Only one is outside of the park boundary. That statement (landscape-level measure) is based on the fact that mist-nets tend to sample from a much larger area than the area immediately surrounding the nets. We have shown this directly and indirectly from several of our validation studies cited in the narrative.*

Pg. 27. Last paragraph. Table 1 is a species list. Is this the table you mean? Also you state that the monitoring program is not only for breeders but also for other wildlife using the park. What other wildlife? This seems too broad a term when the focus is on birds. **TG:** *We fixed the mislabeled table. We corrected this statement to by deleting wildlife and inserting “other landbirds species” which was our original intent.*

EDITORIAL (Typos or words that need adding or deleted):

Please cite websites with date last accessed. **TG:** *All websites cited in the narrative, SOPs, and Appendices now have last date accessed.*

Literature Cited section needs editing. There are several small typos. **TG:** *I believe I found all of these.*

The entire document could use another editing as there are many places where the sentence structure doesn't work well or words are left out or sentences are awkward. **MK:** *We worked with a technical editor and hope that all issues have been remedied.*

Pg.10: (add "the" after summarizes", lowercase for Parks in 2nd paragraph, PRBO not identified) **TG:** *We made these changes.*

Pg. 16: Sentence about monitoring with GOGA is repetitious. Discussion in 2nd paragraph could be tightened up. Insert "conducting" before point counts in second paragraph, sentence starting with PRBO. **TG:** *We made these changes and this section has been slightly modified.*

Pg. 27: Line 3 typos. **TG:** *I believe we took care of all of these.*

Pg. 29: Replace "forth" with "fourth". **TG:** *No longer relevant since we are on 6-year cycles.*

Pg. 32. There is a font change in the right hand column. There may be other areas of the document where this also occurs. **TG:** *We corrected this and attempted to find and correct similar problems elsewhere in the document.*

Pg. 35. Blank page. **TG:** *Blank page removed.*

Figures 2 and 3. It is not easy to go from the table that describes the various sites to the figures that presumably portray them. I couldn't come up with the correct number of monitoring sites in most instances. It would help to label them or identify them more clearly in some other way. Identify which is PORE and which is GOGA. **TG:** *The table and the figure have now been completely revised.*

SECTION 2. SOPs

1. No. Not required but useful for larger SOPs. **TG:** *We opted not to add a table of contents for any of the SOPS. This is consistent with NCCN protocol and NRR formatting.*

4. There is no SOP with instructions for procedures and equipment storage after the field season. Probably most of this is handled by PRBO but what happens at PINN. **TG:** *PINN is no longer part of this protocol. See second to last bullet under General above for discussion of end of season equipment storage, etc.*

7. The directions for access to sites is missing. I presume this is what is under development in Appendix A. of SOP 3. Please complete. **TG:** *We have added an entirely new section that provides not only directions to sites but also directions to individual survey points, lat/longs, etc. However, for several sites, the information is incomplete. This is unavoidable but will be completed during the 2010 field season – i.e., impossible to write narratives without visiting the survey points.*

SUPPLEMENTAL MATERIALS

All supplemental documents, e.g. MAPS manuals and other PRBO SOPs used for this protocol should be captured and archived on a CD. **TG:** *Supplementary materials are now provided.*

James Agee comments with Tom Gardali's (TG) responses and clarifications:

Major Concerns:

There are no study sites identified by park. **TG:** *This concern is unclear to me. Table 2 shows study sites by park unit.*

The target species to be considered are not identified. **TG:** *In considering the idea of target species more fully, we decided not to pursue developing them, and instead followed the lead of the NCCN protocol: “. . . detect trends for as many species as possible.”*

No sample sizes are identified and linked to a power analysis. **TG:** *We have now provided a power analysis for a subset of species at all sites where we had sufficient data. It is likely that power will be improved beyond what we report through the addition of more study sites as is now recommended.*

Long-term analysis is not included. **TG:** *We have added a relatively detailed analysis plan that is complemented by the fully revised Data Reporting SOP.*

No habitat measurements are included. **TG:** *It is true that a lack of habitat measurements will make it difficult to interpret abundance patterns over time. There are several factors beyond habitat that could also influence landbird abundance patterns the most notable of which are weather, climate, and landscape. Hence we did not include protocols for habitat, weather, etc. We will explore developing protocols for veg change, weather, etc. in future versions of the protocol. We anticipate that doing so will add substantially to this protocol – not so much in terms of cost – but in analyses protocols for example. Further, we judged it wise to test drive the bird survey only protocol, and especially the reporting demands, before we committed to anything more. We will of course use all available information for interpreting our results. **MK:** *The network is also developing vegetation monitoring protocols that can support future analyses.**

Other comments:

I did not find it easy to tease out which of the “legacy” sites at each park are to be part of the continuing protocol. **TG:** *We have now made it clear in Table 2 and Figure one – all sites listed will be surveyed with point counts, mist-nets, or both.*

What is the difference between a “legacy” transect and an existing transect. **TG:** *There is no difference and we added a sentence to make this clear.*

At PINN, it appears that nine “legacy” transects will be the sample to be measured annually, with no “random” transects used at all. At PORE and GOGA, “legacy” transects (all of those in Table 1?) will be mixed with “random” transects (which for riparian areas really aren’t random anyway, are they?). In figure 2, a number of “random” transects are identified - are these (a) past transects, (b) the ones to be used the first year of the this new protocol, or (c) the entire set of transects, some of which may be measured each year? As suggested by R1, a table would be useful indicating for all points where, in what type, and by season. **TG:** *No longer relevant as we are not sampling PINN and have dropped the random component and instead opted to cover a significant amount of all riparian habitat in PORE and GOGA. We believe our new Table 2 makes our site information more clear.*

With the long history of monitoring and the extensive databases available, the lack of any power analysis (page 19 and R2) in this protocol is puzzling. There are protocols that have been approved without an a priori power analysis, because no data yet existed on the vital sign being monitored. In those cases there was no choice, and a commitment to conduct a power analysis was made. In this case it was very feasible to do a power analysis prior to submitting the protocol. **TG:** *As stated above, we now include a power analysis.*

Additionally, longer-term analysis (SOP #10, p. 3) procedures “will be developed during FY07-FY08” - this should have been completed before the protocol was submitted. **TG:** *As stated above, analysis procedure are now included.*

SOP #3 (Site Descriptions) is listed as “under development”. This makes the protocol incomplete. There is very detailed description of the history of landbird monitoring at SFAN parks, but it is not clear how these data will be integrated into the protocol under review here. **TG:** *I addressed this above and my comments are repeated here: We have added an entirely new section that provides not only directions to sites but also directions to individual survey points, lat/longs, etc. However, for several sites, the information is incomplete. This is unavoidable but will be completed during the 2010 field season – i.e., impossible to write narratives without visiting the survey points.*

Target species (page 45) have not yet been identified, and “future analyses” will determine them. Aren’t all the species potential target species? If not, what criteria will be used to identify them? Surely this is known now. **TG:** *As stated above, we are no longer taking the target species approach.*

The lack of any habitat measurement will make it impossible to associate landbird trends with habitat. On page 20, the last paragraph states “All of our sites were ground-truthed long ago”, implying but not fully stating that vegetation parameters are known. What if a fire or flood hits either scrub or riparian area in the future? Some attention to habitat measurement, particularly if disturbance occurs, would appear essential to analyzing trend. **TG:** *See above.*

Within the text, there are numerous references to “attached SOP” (e.g., p 27 par. 1, 2, and 3). Please identify the specific SOP at each reference. **TG:** *We have attempted to identify specific SOPs at each reference.*

P 10. Please identify PRBO Conservation Science at first mention. **TG:** *done.*

P 18, l. 10. Bart et al. (2004) is not in the literature cited. **TG:** *done*

P 27, l 3. A typo? “..within the interior eight ha 8of a 20-ha....” **TG:** *It was a typo.*

P 28 (R1): Are the “X”s in Table 3 showing a range of time rather than a specific action to be taken in a given month? The text says two point counts per year, but the table (with four X’s) implies four. Maybe just a line (-----) across those months would be clearer. **TG:** *We attempted to clarify by using shaded cells and adding some more text.*

SOP #2 (R1). Training for rangefinder use (and what kind) needs to be specified. **TG:** *We opted not to add training for rangefinders because we currently have 3 different kinds of rangefinders and they are all extremely easy to use and hence require almost no training – can be “trained” in less than one minute!*

A SOP for “End of Season” procedures is required. **TG:** *See discussion above with respect to why we opted not to develop an end of season SOP.*

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National Park Service
U.S. Department of the Interior



Natural Resource Program Center
1201 Oakridge Drive, Suite 150
Fort Collins, CO 80525

www.nature.nps.gov

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