



Standard Operating Procedure (SOP) 9: *Data Analysis V2.0*

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Revision History Log

Prev. Version #	Revision Date	Author	Changes Made	Reason for Change	New Version #
	June 2009	T. Gardali, M. Herzog	Added content to document for first time		1.0
1.0	Dec 2018	M. Dettling, D. Humple	Attempted to make document more timeless by removing references to software and focusing more on objectives	Durability of the document	2.0

This Standard Operating Procedure is available in digital format from [San Francisco Bay Area Network website](#) and the [NPS Data Store](#).

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

Querying from the Databases

All point count data can be retrieved from the California Avian Data Center (www.prbo.org/cadc; Accessed: December 3, 2018). Detectability modeling, density estimation, and temporal trend analysis currently require exporting data to other software applications, but those capabilities may become available in the future via the California Avian Data Center. The Data Analysis SOP (#9) will be updated as these features become available. Mist-netting data is not yet supported by the California Avian Data Center, so to obtain that data a request must be sent to Point Blue staff.

Developing Parameters for Trend Analysis in Abundance

An annual estimate of abundance from point count data will be produced for trend analyses. This generally involves generating an index of abundance per year for each species by averaging the number of detections per point per visit. It may include computing a detectability parameter in order to produce a more specific density estimate, which is generally done using the most recently available version of the free software program *Distance* (Thomas et al. 2006), available at <http://www.distancesampling.org> <http://www.rupa.st-and.ac.uk/distance/> (Accessed: October 30, 2018). There are numerous resources available on using program *Distance* (e.g., Buckland et al. 2001, Buckland et al. 2004). Since new software, statistical approaches and code are continuously developed, the data analyst may vary the tools used in a given analysis cycle to model trends in abundance of landbirds, and detectability if that is being included. When performing the analysis, each year will be considered a stratum, and each point count station within transects a substratum that will be considered replicate samples 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).

Mist-net Data Analysis Time Windows (note that “Summer” and “Fall” includes dates outside calendar seasons)

Season	Analysis Dates*
Summer (breeding season)	1 May – 10 August
Fall (migration)	18 August – 31 October
Winter	1 November – 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. Again, as new software, statistical approaches and code are developed, a new method might be chosen to conduct the analysis. But in the past, data analysts have used Program MARK (White and Burnham 1999). The package RMark (Laake and Rexstad 2008) provides a very rich and simple R interface to Program MARK. 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 or relative abundance (point count), abundance (mist-net), and survival estimates are available, trend analyses will be performed on these data. Trend analysis for survival rates will be conducted using an appropriate statistical program (e.g. Program R), by incorporating additional models where year is analyzed as a continuous variable. For trend analysis in density and abundance, the analyst will calculate simple trends 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

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