Lower Colorado River
Multi-Species Conservation Program

Balancing Resource Use and Conservation

Alternatives to Program DS for Double Sampling Population Estimates

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Objectives

- Program DS review
- Why not DS?
- Current alternatives: Excel, SAS
- Caveats
Program DS

- Jon Bart (Conceptual, MSCP)
- Dana Hartley (Software)
- Accommodates different sampling designs (3).
- Estimates with or without detection ratio
- GUI
- Input data validation
Welcome To DS

A program for analyzing data collected using double sampling

(This program can also be used to analyze simple plot data – see User’s Manual)

DS requires 7-11 input files depending on the design of the study. Preparation of these files is described in the User’s Manual, available here. You cannot modify the input files from within DS. See the Appendix of the User’s Manual for instructions on installing DS.

The steps in using DS are:

1. Describe the study design
2. Identify the input files
3. Select the desired output

\[ d = \frac{\hat{X}}{\hat{R}} \quad \hat{V}(d) = d^2 \left( \frac{\hat{V}(\hat{X})}{\hat{X}^2} + \frac{\hat{V}(\hat{R})}{\hat{R}^2} \right) \]

(Photos by Stephen Brown)

Advanced Sql Options
Next
Study Sampling Plan

1. Choose the sampling plan (see User’s Manual)
   - Simple random sampling within strata (no clusters or zones)
   - Cluster sampling with strata (but no zones)
   - Both clusters and zones

   ![Simple Random Sampling](image1)
   ![Cluster Sampling](image2)
   ![Both Clusters and Zones](image3)

2. Were intensive plots included?
   - Yes
   - No. Enter value for detection ratio: 1
Problems with DS?

• Installation difficult (requires SQL Server or Server Express)
• Not actively supported by USGS
• No adjustment to variance for $fpc$ (finite population correction = $1 - n/N$)
Commercial Software

• Duplicate results in Excel
• SAS macros for ‘automation’
  --DS input files
  --Macros for SW & HCAs
• Another option is R (Not there yet)
Detection ratio (DR)

\[
\hat{R} = \frac{\bar{x}}{\bar{y}}
\]

\[
\hat{V}(\hat{R}) = \hat{R}^2 \left( \frac{\hat{V}(\bar{x})}{\bar{x}^2} + \frac{\hat{V}(\bar{y})}{\bar{y}^2} - \frac{2\text{Cov} (\bar{x}, \bar{y})}{\bar{x}\bar{y}} \right)
\]

Rapid Counts

\[
\hat{V}(\hat{X}) = \left( \frac{\hat{Z}}{a} \right)^2 \left( \frac{\hat{V}(\hat{Z})}{\hat{Z}^2} + \frac{\hat{V}(a)}{a^2} - \frac{2\text{Cov}(\hat{Z}, a)}{\hat{Z}a} \right)
\]

Corrected density & variance

\[
d = \frac{\hat{X}}{\hat{R}}
\]

\[
\hat{V}(d) = d^2 \left( \frac{\hat{V}(\hat{X})}{\hat{X}^2} + \frac{\hat{V}(\hat{R})}{\hat{R}^2} \right)
\]
DS Input files for SAS macros

- Intensive plot data (2 files, Rapid, Intensive)
- Rapid counts (All plots)
- Plot area
- Strata (Names, Total Plots, Total Area)
- Species List (Which spp. used for DR)
SAS macros

- Read data files, insert missing 0’s
- Calculate DR & SE(DR) -- output overall & by species
- Calculate density & totals by and over strata (output for all species)
- Tables for covered and 10 most common species
%include "RawSys_mac.sas"; *Reads raw data;
%include "dr_sys_mac.sas"; *Calculating detection ratio;
%include "Stat_sys_mac.sas"; *Calculating Pop Estimates and SE;
%include "Tables_sys_mac.sas"; *Tables for covered and common species;

*Insert correct filenames, assume they all end with "_year";
*for 2015;
%let yr=2015;

%RawSys_mac(Intact=IntAct_&yr,
            Intcts=IntCts_&yr,
            Rapid=RpdCts_&yr,
            Species=Species_&yr,
            Plotarea=CIArea_&yr,
            Strata=GBBO_Strata_2012,
            Omitreg=&str(1,2,3,4,9,13,14))

%dr_sys_mac(outsysdr=sys_dr_&yr, outsysdr2=sys_bysppdr_&yr)
%stat_sys_mac(fpcor=0, outstat=SYS__stspp_&yr)

%Tables_sys_mac(prefix=SYS,covlist=&str(if species2="Yellow Warbler" then spcode="1YW";
else if species2="Bell's Vireo" then spcode ="2BV";
else if species2="Gila Woodpecker" then spcode="3GW";
else if species2="Summer Tanager" then spcode="4ST";
Caveats

- Only Stratified Random Design
- Inflexible: limited macro variables
- Essentially no data validation
- No documentation
Questions?

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