SIGHTMOD

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SIGHTMOD is an R function that uses aerial survey data and a logistic regression sightability model to estimate wildlife population sizes according to methods described by Udevitz et al. (2006). These methods are applicable to situations where (1) the survey completely covers the study area so that every individual has some probability of being detected and (2) individuals occur in various sized groups, with probabilities of detection that depend on group size. Detection probabilities are estimated from preliminary or concurrent surveys of marked animals. SIGHTMOD provides estimates of the number of groups, number of individuals, mean group size, proportion of the total number of individuals that were detected, and bootstrap estimates of standard errors and 95% confidence limits for each estimated parameter. It does not assess the suitability of the logistic regression sightability model for any particular application. Appropriateness of the sightability model should be determined with a more extensive analysis of the marked animal data, such as that conducted by Udevitz et al. (2006). Once it has been determined that this estimation approach is appropriate, SIGHTMOD is intended to provided a quick and convenient way to obtain routine estimates from these types of surveys. This might be useful, for example, when this type of survey is used for routine monitoring of a population. If data on marked animals are not obtained concurrently with each survey, follow up studies should be conducted at least periodically to verify that the sightability model is still appropriate.

PREPARING THE DATA

The function requires two Excel (Microsoft Corporation) worksheets as input. The worksheets may be in the same or different workbooks. The names of the workbooks and worksheets must not contain apostrophes. The first worksheet should provide data for estimating the logistic regression parameters based on surveys of marked animals in which the size of each marked group and whether or not it was detected was recorded. This worksheet must include one row for each marked group, with a column labeled “total” indicating the group size and a column labeled "resight" indicating whether the group was detected (resight=1) or not detected (resight=0). Any additional columns will be ignored.

The second worksheet should provide data from the particular survey from which population estimates are desired. It must contain one row for each detected group and a column labeled "total" indicating the group size. Again, additional columns will be ignored.

PREPARING THE SOFTWARE

The function requires R software (R Development Core Team 2006). This software can be obtained, free of charge, at http://www.r-project.org/. The R software should be downloaded and installed according to the directions at that site.

The function also uses the RODBC library (Ripley 2007) to read the Excel input files. This library must be installed before using the function for the first time. To download and install this library, start R and at the prompt in the R Console, type install.packages(“RODBC”). Alternatively, select <u>Install package(s)</u> from the Packages menu and follow the prompts.

USING THE FUNCTION

The function itself is contained in the text file sightmod.R. To use the function, first load it into R by typing source(“*path*/sigtmod.R”) at the prompt in the R Console. Here, *path* is the

directory path to the folder where sightmod.R was saved. Alternatively, you can select Source R code… from the File menu and browse to the location of sightmod.R.

Next, type *objname* <- sightmod(), where *objname* is the name of a data object where you will store the results. You will then be prompted to browse to the Excel files and to select the worksheets containing your input data. After selecting these worksheets, there will be a pause while the estimates are computed. By default, when the computations are complete, a graphics window will pop up showing the cumulative averages of the estimated total number of individuals and the standard error of this total as functions of the number of bootstrap samples (Figure 1). These plots are diagnostics that should be examined to ensure that the bootstrap sample size was large enough for the estimates to converge.

To see the estimates, type *objname* at the next prompt. The listing will include (1) the number of groups and individuals detected in the survey (2) estimates of the total number of groups, total number of individuals, mean group size, and proportion of the total number of individuals that were detected in the survey, (3) bootstrap estimates of standard errors and lower and upper 95% confidence limits for each estimated parameter, and (4) the identities of input data sets, number of bootstrap samples, and date of analysis (Figure 2).

SIGHTMOD has two optional arguments that can be specified when the function is called. Typing sightmod(N=*n*, diagnostic.plots=F), changes the number of bootstrap samples to *n* and prevents generation of the diagnostic plots. Defaults are N=2000 and diagnostic.plots=T. You can also type sightmod(help=T) at the R prompt to list an abbreviated version of this documentation.

ACKNOWLEDGEMENTS

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REFERENCES

R Development Core Team. 2006. R: A language and environment for statistical computing. R Foundation for Statistical Computing, Vienna, Austria. URL http://www.R-project.org.

Ripley, B. D. 2007. RODBC: ODBC database access. R package version 1.1-9.

Udevitz, M. S., B. S. Shults, L. G. Adams, and C. Kleckner. 2006. Evaluation of aerial survey methods for Dall's sheep. Wildlife Society Bulletin 34(3):732-740.

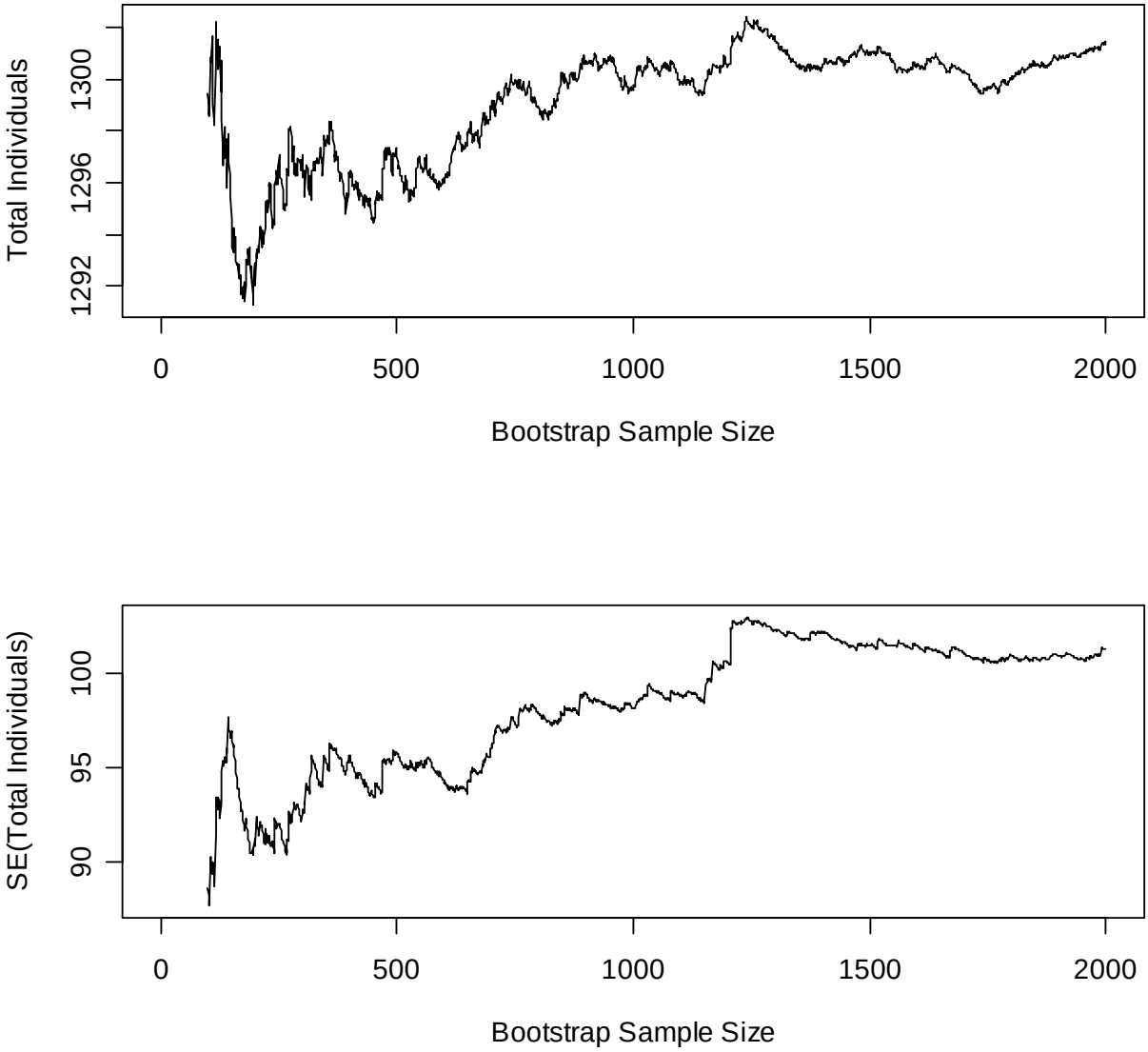

Figure 1. Example diagnostic plots showing estimates of standard errors that have converged after about 1300 bootstrap samples.

```
$Observations
  Detected Groups    Detected Individuals
              157                     908

$Estimates
                Total Groups   Total Individuals   Mean Group Size   Proportion Detected
Estimate          321.03443          1276.4562         3.9760726            0.71134442
SE                 76.16244           101.3315         0.5949974            0.05200621
Lower            229.65921          1143.8936         2.8538595            0.59068819
Upper            525.12986          1537.8882         5.2432982            0.79353193

$Survey_Data
[1] "C:\\ example_survey_data.xls (Sheet1$)"

$Marked_Data
[1] "C:\\ example_marked_data.xls (Sheet1$)"

$Bootstrap_Samples
[1] 2000

$Date
[1] "Thu Jan 24 10:42:12 2008"
```

Figure 2. Example listing of output.