Flathead VPM Software Help

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Basics

Viable population monitoring (VPM) makes yearly predictions of probabilities of short-term persistence for a population in order to monitor population viability. Further information can be found in Staples et al 2005 and Taper et al 2009 located in the literature subfolder of the VPM file directory. This software uses VPM to analyze the status of the migratory bull trout population in the upper Flathead River drainage of Montana using a corrected measure of redd counts. Further information on the redd count analysis can be found in Muhlfeld et al 2006. The software is available at http://taper-linux.msu.montana.edu/VPM/VPMfiles.zip. This VPM software is designed for users with minimal expertise in the R statistical computing environment. The software is designed so that double clicking the file *VPMrun.bat* will run the R software in the background with user defined settings.

R is available from http://cran.r-project.org/. The version tested with this software is http://cran.r-project.org/bin/windows/base/R-2.9.2-win32.exe. This is the most current version of the software as of the writing of this document. Installation is simple and requires double clicking the downloaded file and following the installation procedure. Be sure to check the box to insert version number in the registry when installing. The software requires the package 'Hmisc' to be installed in R (necessary to have administrator privilege to install in Vista). To install open R and type:

```
install.packages('Hmisc',dep=T)
```

into the R console and the package will be automatically installed. You can then close R.

Input is in the form of a *.csv* file structured with the first column as year and subsequent columns having counts of index streams corresponding to sampling from each year. The first row of the file is a header and should have the label YEAR, then all of the stream names. Microsoft Excel files can be saved as *.csv* files by going to File $->$ Save as.... then changing the file type to *.csv*. An example file is given in **AllRedds.csv**. All csv files can be opened and edited in Microsoft Excel.

The file that has parameters which control the software is **controlfile.txt**. This and the data file are the only files which should be edited by the user and the name of **controlfile.txt** can not be changed. The order of parameters must also be preserved.

To run the program double click **VPMrun.bat**. A DOS window will appear and will close when the program is done. This program may take a very long time so you may choose to run it over a weekend or on a computer that will

not be used much. The default configuration does not estimate the amount of time that the program will take but it can with the flag time.estimate. For more information on this see the controlfile parameters section. To cancel the program hit `Ctrl-c` or close the DOS window while the program is running. If the program is stopped prematurely the error will appear at the bottom of the file **readControl.Rout**. Alternatively, if you prefer to run the script in the R environment you may run the file readControl.R from the console.

controlfile parameters

redd.file File should be a *.csv* file. If the file is not in the same directory as **VPMrun.bat** then you can put in the full path, as in C:/Work/Reddcounts/AllRedds.csv. Description of the file structure is given in the Basics section and AllRedds.csv is given as an example file.

out.dir directory into which all output files will be written.**MUST NOT** be blank and **MUST** already exist. Default directory is called 'output' and is automatically created when software is initially installed by extracting VPMfiles.zip. All output files are stored in this directory.

B Iteration size for redd error calculation described in Muhlfeld et al 2006. This bootstrap calculates the confidence intervals on the corrected redd counts. Output of corrected counts is written to Correctedcounts.csv while confidence intervals are written to REDDSCI.csv.

B.par Iteration size for parameter confidence interval calulations. Output for each stream is given in STREAM.Bootmles.csv. Setting $B.par = 1$ turn off calculation of parameter confidence intervals and will be removed from plots as well.

B.extinct Bootstrap size for calculating probability of extinction. Setting $B.extinct = 1$ will turn off VPM calculation and persistence probability will be removed from plots.

B.pboot Bootstrap size for calculating confidence intervals on the probability of extinction. Setting $B.pboot = 1$ will turn off VPM confidence interval calculation and they will be removed from plots.

project Years projected ahead for the VPM.

threshold VPM threshold value, below this the species is considered unable to persist.

project.coal Years projected ahead for Coal Creek VPM. This is customizable due to the lower amount of data available for Coal Creek.

threshold.coal VPM threshold value for Coal Creek, below this the species is considered unable to persist.

mle.confidence.level two sided confidence level for parameter bootstrap confidence intervals. This includes the parameters estimated in the redd count correction procedure.

vpm.confidence.level two sided confidence level for vpm confidence intervals.

ic.flag Tells program which information criterion to use for model selection. This is the model used for the VPM. Choices are SIC or AICc

graphics.file Output file for graphs. Choices are to be of type .pdf or .tiff

plot.all Do all plots in one file as well as individually? 0=false, 1=true, output file is named AllCreeks.graphics.file.

time.estimate Estimate the time needed to run with the current set of parameters. Can be 0 (off) or 1 (on). If this is turned on then a text file will pop up with the estimated time. To continue running the software you **must** close the text file. The time estimate takes several minutes to run so it will be awhile before the text file pops up.

overwrite.stop Can be 1 (on) or 0 (off). Program will automatically stop if any files will be overwritten if this is turned on.

Output Files

Correctedcounts.csv These are the counts corrected to include observer error as described in Muhlfeld et al 2006.

REDDSCI.csv These are the confidence intervals calculated for the corrected redd counts as described in Muhlfeld et al 2006.

STREAM.ModelSummary.csv This file has the maximum likelihood estimates for each model in the stream, as well as the negative log-likelihood (neglnLhat), number of transitions in time series (q), number of model parameters including the variance (k) and the information criterion value (AICc or SIC).

STREAM.Bootmles.csv Has the raw parameter bootstrap values for each creek. Useful for diagnostics and if you would like to recalculate confidence intervals at a different confidence level after you have already run the software.

STREAM.graphic.file This file has the plot for the streams corrected redd counts (red line), as well as the carrying capacity of the stream and its corresponding 95 confidence interval (solid vertical line and the surrounding grey rectangle), the switch point and its confidence interval if one exists (solid vertical line and dotted vertical lines), and the persistance probability of the population is given by the blue line and its confidence interval is the surrounding dotted black lines. File must be of the type *.pdf* or *.tiff*.

AllCreeks.graphic.file Only given if plot.all=1. This plot lays out all creeks into one file for easy comparison. Same as plot in Taper et al 2009. If this option is turned on, individual creek plots are still outputed as well.

All.BestSummary.csv Has the ML parameter estimates and confidence intervals for each streams best model. Also has the short-term persistance probability and associated confidence intervals for the last observed year.

ThatPhatLamhat.csv Has the ML parameter estimates for each streams corrected counts. Rows correspond to years and columns to a streams corresponding $\hat{t}$, $\hat{p}$ and $\hat{\lambda}$ values.

REDDSCI.csv Has the estimated number of corrected counts for each stream along with the associated confidence interval. Rows correspond to years.

Troubleshooting

We have had some issues with R in Windows Vista. If you receive the message "Error: R not in registry", you need to either reinstall R with the checkbox "Include version information in registry" checked. It is recommended to reinstall the software if you have never edited registry entries before but you can also fix the problem in the following way. For 32-bit versions of Vista, open regedit and go to

`HKEY_LOCAL_MACHINE->software->R-core->R`

and add the subkey with the name "InstallPath" with the the data field being the path to your most current installation of R, e.g. "C:\Program Files\R"

For Vista 64, open regedit and go to

`HKEY_LOCAL_MACHINE->software->Wow6432Node->R-core->R`

and add the subkey with the name "InstallPath" with the the data field being the path to your most current installation of R, e.g. "C:\Program Files\R"

for further help contact Mark Taper at mltaper@msn.com, (406)-451-9542 or Jake Ferguson ferguson@math.montana.edu.