

# **Mid-Domain Null Program: Help File**

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## 1. Program setup:

- a) Make sure your Excel security settings are at medium not high. (Go to Excel toolbar pull-down menu: Tools → Macro → Security: set to medium)
- b) Save Mid\_Domain\_Null Excel Add-in, sample data sheet and help file on your hard drive
- c) Loading: two ways to do this
  - (1) Double click on Mid\_Domain\_Null Add-in and it will automatically open Excel and put the add-in as an option on your Add-in menu. Go to Tools, Add-ins, and check Mid-Domain Null. This doesn't work for some people, so if it doesn't for you try number 2 below.
  - (2) Go to Tools, Add-ins, and Browse for the saved program. Then check the box by the add-in that appears.
- d) A push pin icon will appear on your toolbar
- e) Click on push pin icon and the program menu will appear

## 2. Data Input:

- a) Data must be entered in the active worksheet in Excel
- b) Data sheet setup (see sample data sheet for an example):
  1. Column A, Cell 1 type the heading "Range Size"
  2. Column B, Cell 1 type the heading "Range Midpoint"
  3. Column D, Cell 1 type the heading "Upper Limit"
  4. Column E, Cell 1 type the heading "Lower Limit"
  5. Depending on your data, put your species' range sizes and midpoints or upper and lower range limits in the appropriate columns starting in Cell 2
- c) The program will check if the range size and midpoint pair or upper and lower range limits are possible given the domain limits you specify in the menu, and will notify you if changes need to be made.

## 2. Program Menu:

### I. Data Input

#### a) Species number

1. Enter the number of species in the empirical species box for which you have entered range data
2. If you are running simulations **with** replacement, you have the option of simulating the same number of species as you have empirical data or any other number of species of interest

#### b) Domain Limits: enter the upper and lower limits of the domain

#### c) Bin Number: enter the number of divisions of the domain to depict the species richness pattern. Ideally, this should reflect the scale at which range sizes were assessed. Finer-scale range data--the greater number of bins

#### d) Data Type: check whether range size & midpoint data or range limit data were entered on data sheet

#### e) Title (optional): enter data title to appear on output sheets that will help the user keep track of the data used or the analysis run

#### f) Simulations: for all analyses other than empirical patterns, the user needs to specify the number of simulations for the program to run

### II. Mid-Domain Analysis

#### a) Display Empirical Pattern: computes the species richness curve between the domain limits specified and using the number of bins defined by the user. This analysis has two output options; the first is the default which displays the number of species in each bin ("Empirical Spp Richness Data"). The second output is a species richness graph.

#### b) Simulation without Replacement: computes simulated species richness patterns using (1) empirical range sizes sampled without replacement and randomly chosen range midpoints to produce ranges within the domain limits or (2) empirical midpoints sampled without replacement and randomly chosen range sizes that produce ranges within the domain limits. See McCain (2004) for a discussion of the pros and cons of sampling with or without replacement.

#### c) Simulation with Replacement: computes simulated species richness patterns using (1) empirical range sizes sampled with replacement and

randomly chosen range midpoints to produce ranges within the domain limits (*This analysis has a bug in the Excel Add-in code; see below in “Caveats” for a easy fix until a new version is available*) or (2) empirical midpoints sampled with replacement and randomly chosen range sizes that produce ranges within the domain limits. See McCain (2004) for a discussion of the pros and cons of sampling with or without replacement.

### III. Data Output

- a) **Empirical Species Richness Data:** list of empirical species number per bin of the domain
- b) **Empirical Species Richness Graph:** graph of empirical species richness curve
- c) **Simulated Richness Data—Sorted:** spreadsheet with each column containing the ascending species richness values for each bin in the domain from the simulated species richness curves
- d) **Simulated Richness Data—Raw:** spreadsheet with each row a simulated species richness curve by ascending bin number
- e) **95% Confidence Limits Graph:** graph of the 95% confidence limits based on the species richness simulations show in grey and the empirical diversity pattern displayed in black. The greater the number of simulations the less variable the confidence limits.
- f) **Simulated Range Sizes / Midpoints:** spreadsheets of the midpoint and range size for each simulated species. Each row is a simulation run and will have as many cells as species in the analysis.
- g) **Midpoint Frequency Histogram:** graph and data for the frequency of simulated midpoints in a particular bin (portion of the domain)
- h) **Range Size Frequency Histogram:** graph and data for the frequency of simulated range sizes in ascending order by multiples of the bin width
- i) **Random Number Checker:** With any analysis the user can check that the program is choosing random numbers in an unbiased manner across the domain. The menu will ask for the number of random numbers to generate after the user has checked the random number output option. A graph of the frequency of random numbers within each bin of the domain will be displayed.

**Caveats—**

Try not to change names of output spreadsheets, but save them to another file. Some name changes may cause the program to malfunction with subsequent runs.

Please do not give out additional copies, but have people contact me. Therefore, I will be able to send out updates to everyone using the program.

Please let me know of any problems you have and I will try to correct bugs as they occur.

**Bug Found** (Oct. 2006 by Oded from Israel): Randomizations WITH Replacement option for randomized midpoints. The bug involves only species ranges that occur across the entire domain. For example, if your domain is 0–5000 m then any species that have a range of 5000 m will cause the randomizations to fail. The easy fix is to change the species ranges that are the entire domain size to slightly less than the entire domain (e.g. 1–5000 or 0–4999). This will not influence the overall results as long as the bin size is >10m. This bug will be fixed in the future version of Mid-Domain Null. Cheers and thanks to Oded!