QuickStart Guide

Donut Tool

A General Selectivity Model for
Fish Feeding

v0.9.0 (beta)

NOAA – National Marine Fisheries Service

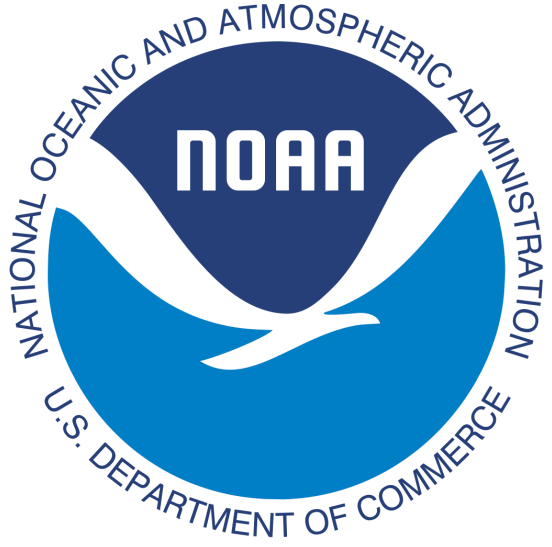

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Table of Contents

(click on heading to jump)

1. Introduction

The Donut Tool model is to predict fish prey preference and diet composition. It uses a Rank Proportion Algorithm (RPA). Prey preference and diet composition are calculated using user input of relative abundance and prey preference attribute rankings.

The Donut Tool derives its name from the observed "foraging" pattern of donuts at a conference. Generally, the donuts with icing and elaborate sprinkles are consumed first, followed by plain icing, those that are sugared, and finally plain ones. This pattern differs only if the abundance of a particular type of donut is altered (i.e., there are lots of plain donuts and a few with sprinkles).

This tool assumes an "icing-on-the-donut" general selectivity theory for fish feeding. It is based on the physiological or anatomical constraints of predator preference coupled with the available prey items in a given environment. The hypothesis is that there is a set of general criteria (based on the past 40 or so years of empirical evidence) whereby one can determine a priori the prey preference of fish species given their characteristics and environmental conditions. Additionally, if estimates of ambient prey concentrations exist, one can predict the prey utilization (diet composition) of fish.

More detailed information regarding the algorithm may be found here:

Jason S. Link (2004) A General Model of Selectivity for Fish Feeding: A Rank Proportion Algorithm, Transactions of the American Fisheries Society, 133:3, 655-673, DOI: 10.1577/T02-142.1

The RPA is defined as follows:

1. Assess general characteristics of a predator j
2. Determine all possible prey N
3. If feasible, determine relative abundance A (numerical or mass, ranging from 0-1) of all prey
4. If feasible, determine spatio-temporal (x, y, z, & t) overlap O_{ij} between the predator j and each prey i (scaled from 0-1)
    a. If steps 3 & 4 possible, then can do diet composition
    b. If not possible, then can only do prey selectivity, set all abundance and overlaps to 1
5. Determine number of factors M to evaluate
    a. Usually four steps of the predation process plus an “icing” factor
6. Rank each prey i for each factor m, ranging from 1 to N (1 being the highest and so forth), R_{ijm}

7. Calculate an adjusted (inverse) rank R'_{ijm} to account for ranking highest prey as #1

   $R'_{ijm} = | (N+1) - R_{ijm} |$

8. Generate rank proportions for each prey and factor, P_{ijm}

   $P_{ijm} = R'_{ijm} / \sum_{i=1}^{N} R'_{ijm}$

9. Multiply rank proportions across all M factors for each prey i to develop a preference proxy, S_{ij}

   $S_{ij} = \prod_{m=1}^{M} P_{ijm}$

10. Calculate diet composition proxy D_{ij} if abundance and overlap are available (S_{ij}* A_i* O_{ij})

11. Calculate RPA estimate of diet composition (or, using just S's, for preference), D'_{ij}

    $D'_{ij} = D_{ij} / \sum_{i=1}^{N} D_{ij}$

2. Setup

The Donut Tool uses only flat CSV data files, no database setup is needed. Simply run the executable.

3. Program Execution

Windows:

1. Create a directory for the release and copy the zip file into it.
2. Unzip the zip file containing the executable and required auxiliary files.
3. Double click the executable file and the application should start up.

Linux:

1. Create a directory for the release and copy the tar file into it.
2. Untar the tar file containing the executable and required auxiliary files with:
   tar xvf *nameOfFile.tar*

3. Double click the **Donut** file and the application should start up.

Clicking **Help -> About** should raise a window with application information and is a good way to test that the application is functioning properly.

4. Online Help

Online help is available in two formats:

1) Hover Help

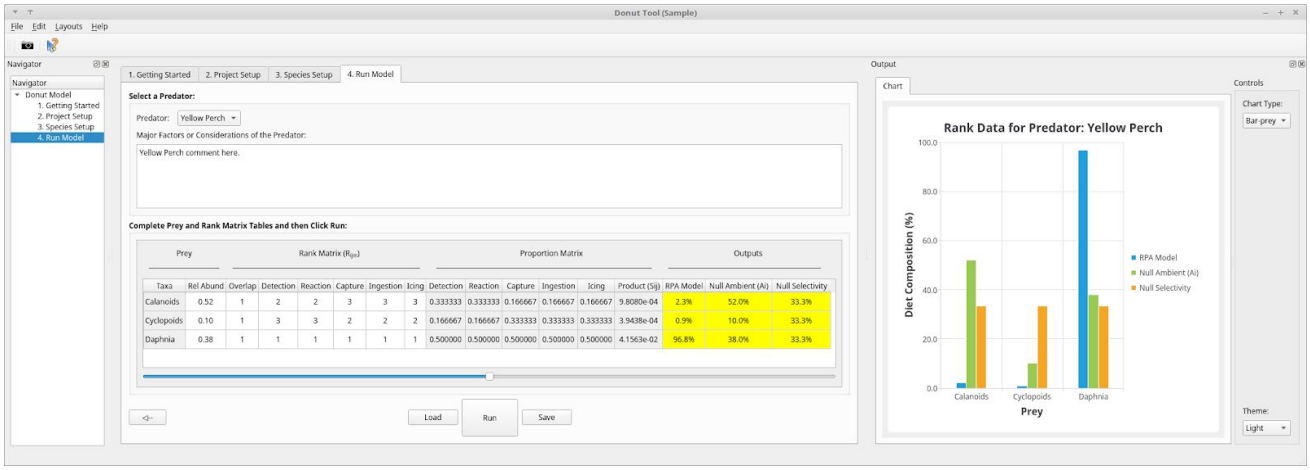
Hover Help is available by holding the cursor over a GUI element. If Hover Help has been implemented for the element, a short textual tooltip will briefly appear.

2) WhatsThis? Help

WhatsThis? Help is typically more detailed information than what's available in Hover Help. It's available by first clicking on the arrow/question mark icon  in the application toolbar and then hovering over a GUI element. If WhatsThis? help has been implemented for a GUI element, the cursor will change from a circle with a diagonal line to a question mark with an arrow at the bottom. Clicking on the element with the changed cursor will cause more detailed information to pop up on the screen, where it will remain until the user clicks the cursor.

5. GUI Layout

The Donut Tool's user interface is set up as a collection of movable and resizable windows. From left to right they are: **Navigator**, **Data Input,** and **Output** windows. An optional window is the **Log** window which shows the running log (by clicking Refresh) of the current application run. The Log window can be raised by right clicking on the top window border and checking the box next to Log.



6. Toolbar icons

There are 2 toolbar icons: screen shot and whatsThis? help,

1. Chart Capturing: 

   The  icon will cause the currently visible chart to be saved into the outputImages project directory. Additionally, the complete Rank matrix will be saved as a CSV file in the outputData directory.

2. WhatsThis? Help: 

   This has been described in the Online Help section above. (You may do WhatsThis? Help on the WhatsThis? Icon itself!)

7. Project Setup Tab

Prior to running a model in the Donut Tool the user must create a Project. In the Setup group in the Navigator, the user sets up various Project parameters (i.e., name, directory, description). The user must be sure to click Save prior to moving to another tabbed window.

The recommended workflow is for the user to create a separate project directory for each project file. Creating a new project directory for each project will help prevent data files from being mixed with different projects.

1) Sample Project

The tool is shipped with a sample project. It's located in the sample_data/SampleProject directory. Open the project name, Sample.prj, from Tab 2 (Project Setup). You'll then need to select the project directory that the project was in (it's different for everyone since it depends on where you installed the tool).

The sample project has 1 predator and 3 prey species. To test that the tool is functioning properly, after loading the project, go to Tab 4 (Run Model) and click Run. The Output window should appear to the left of the GUI (you may need to resize it wider the first time you run the tool). After confirming that the tool is functioning properly you may add more species and prey.

8. Species Setup Tab

After setting up the Project, the user then moves to the Species Setup tab. There are two sub-tabs here: Species and Interaction. The Species tab is used to enter the Species name and the type of species it is (i.e., predator, prey, both). After these data are entered and the user clicks Save, the user then moves to the Interaction tab.

The Interaction tab allows the user to assign prey to predators. When the user clicks Save here, the appropriate tables are generated in the next tab, Run Model.

9. Run Model Tab

The basic operation of the Run Model Tab is as follows:

1. The user selects a predator
2. The user completes the data in the white input cells of the Rank table.
3. The user clicks Save to save the data.

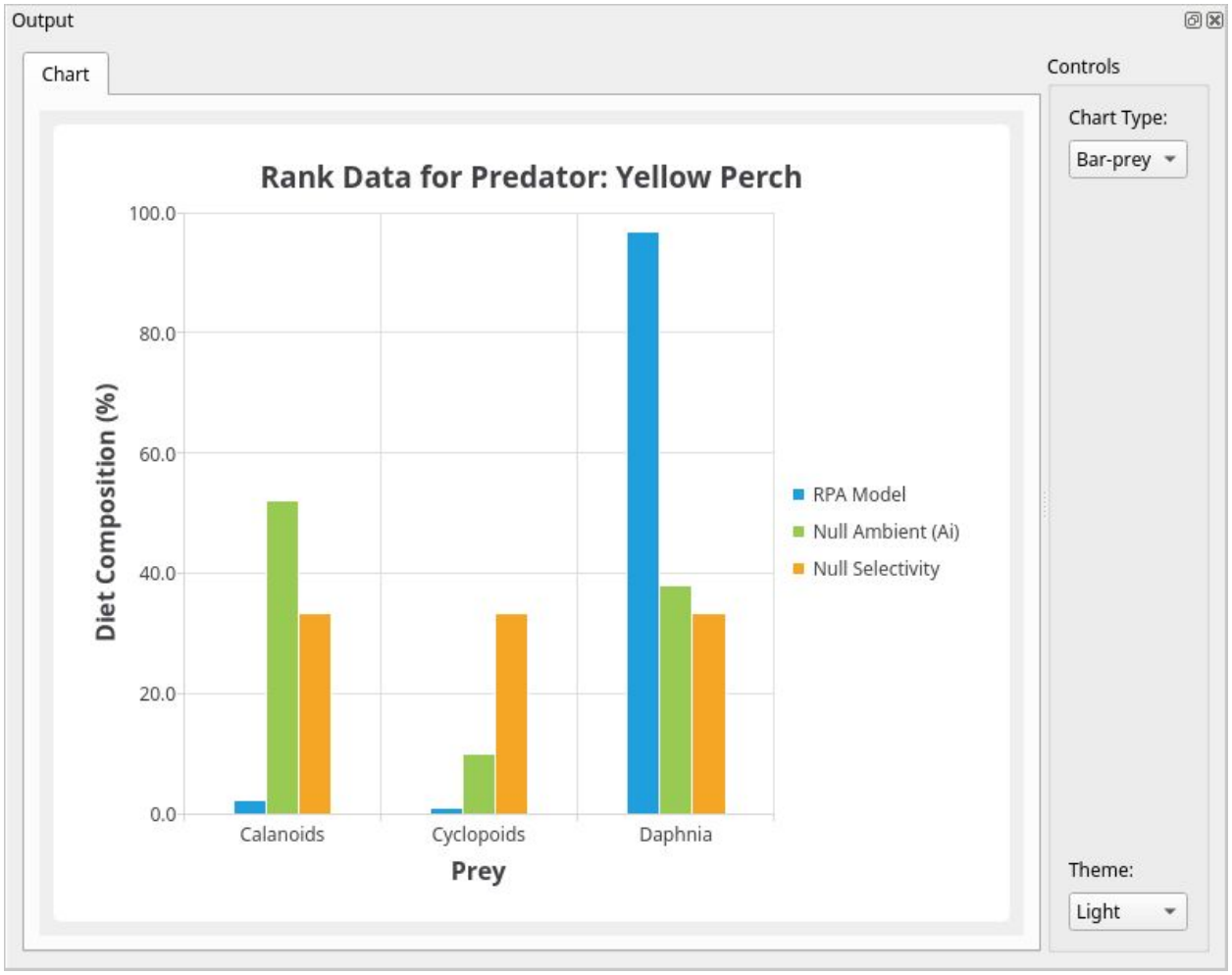
4. A save also does a run and the user will notice that the Output chart has appeared. It may be resized and inspected. What's depicted in the output charts are the last 3 columns of data (with the yellow background) from the Rank data table.

10. Workflow

1. Create Project
    a. Projects are setup in Tab 2 (Project Setup)
    b. Make sure to save your Project
2. Create Species (names and types)
    a. Species (names and types) are defined in Tab 3 (Species Setup) in the Species sub-tab
    b. Make sure to save your Species definitions
3. Create Species Interactions
    a. Species interactions are set in Tab 3 (Species Setup) in the Interaction sub-tab
    b. Make sure to save your Species interactions
4. Complete Rank table
    a. Ranks are set in Tab 4 (Run Model)
    b. Additional help is found by clicking the WhatsThis  toolbar icon over the column group name
    c. User must complete the cells with the white background (i.e., Rel Abund thru Icing)
    d. When data input is complete, hit Save or Run
    e. Be sure to hit Save prior to exiting tool

11. Output

As the user runs the Donut Tool various output graphics will appear in the Output window. The appearance of these graphics may be modified by the GUI controls to the right of the drawing area in the Output window.



12. Troubleshooting

1) **An application feature not working correctly**

The application has a log system where status messages are periodically saved to an output file. The contents of these log files may be viewed by the user from within the application by enabling the Log window.

To enable the Log window, right click anywhere on the toolbar and check the Log item. The Log window will appear in the application. You may click and drag it by its title to relocate it if desired. To view the most recent Log file, click the **Refresh** button in the Log window. The user may view a previous Log file by clicking the **Browse** button and selecting the desired Log file. After 50 Log files have been created, the user will be prompted to delete the current Log files.

Log files are time-stamped and color-coded. Colors are defined as follows:

- Black - Informational text
- Blue - New section of messages
- Red - Warning
- **Red Bold** - Error