

# TURFtools: A Community-Based Tool for Designing TURF-Reserves

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Developed for Environmental Defense Fund by  
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In support of Fish Forever



## Preface

Territorial Use Rights for Fishing (TURFs) paired with no-take marine reserves (henceforth called “TURF-Reserves”) have been proposed as a viable management strategy to combat overfishing in many small-scale fisheries by combining the TURF benefits of exclusive access with the conservation, spillover, and resilience benefits of reserves. When appropriately designed and implemented, TURF-Reserves can encourage stewardship and empower fishers to better manage their resources. While tools that assist spatial design in marine nearshore contexts exist, they are data intensive, require expertise in software operation, and often need Internet connection.

We developed the TURF-Reserve design tool to assist spatial design in settings where these elements are not present, by providing an easy-to-use decision support tool for small-scale fisheries contexts. This tool consists of a spatial bioeconomic model that allows managers to analyze the relative performance of TURF-Reserve designs for a specific setting, by assessing the relative ecological and economic outcomes of each design.

The tool was developed in support of [Fish Forever](#), a global partnership between Environmental Defense Fund, Rare and the Sustainable Fisheries Group at the University of California, Santa Barbara. The tool developers appreciate the guidance and feedback provided by members of the Fish Forever team.

More information about the tool and its development is available at:

[http://www.bren.ucsb.edu/research/2015Group\\_Projects/documents/TURFtools.pdf](http://www.bren.ucsb.edu/research/2015Group_Projects/documents/TURFtools.pdf)

TURFtools is a new tool that is currently undergoing field testing. For questions about the tool or to provide feedback, contact [fisherysolutionscenter@edf.org](mailto:fisherysolutionscenter@edf.org).

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## Part 1: Understanding TURFtools & the TURFtools Model

### What is TURFtools?

TURFtools is a TURF-Reserve design tool that helps fishing communities anticipate tradeoffs between spatial TURF-Reserve design options by assessing the relative biological and economic performance of proposed designs. The tool is embedded in a Microsoft Excel-based model that uses biological, economic, social and spatial information provided primarily by fishery stakeholders.

### Significance of the Tool

TURF-Reserves may only be effective in meeting defined goals if they are designed thoughtfully, and appropriately to local biological, economic, and social contexts and goals. Stakeholders designing TURF-Reserves are faced with many technical decisions and need to consider complex biological, social and economic factors. Relative performance of TURF-Reserve designs depend on a variety of factors, including important fishing areas, movement patterns of target species, number of fishers, the location of key habitats, and complex social factors such as the way fishermen are organized<sup>1</sup>. In this design process, local site managers and stakeholders will need to weigh trade-offs and make design decisions based on available biological/ecological data and socioeconomic factors.

This TURF-Reserve design tool supports this decision-making process by providing a technologically simple, easy- to-use framework for site managers or stakeholders responsible for TURF-Reserve design decisions. The results and visualizations from the tool can facilitate informed design discussion with fishermen, fishery managers, scientists and other stakeholders when comparing different TURF-Reserve designs. Comparison will be measured in terms of: predicted species-specific performance in harvest, biomass and profit relative to a status quo scenario. Additionally, the tool permits evaluation of customizable design specific factors including % cover of the reserve, % cover of important habitats like nursery grounds or spawning areas, size of the TURF and Reserve, and other customized outputs.

### The Model

TURFtools uses Microsoft Excel as the primary platform for translating community information and TURF-Reserve design options into a visual and analytical output to help evaluate tradeoffs between design options. The model is designed to be used under

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<sup>1</sup> See Poon, S. E. and Bonzon, K. (2013). Catch Share Design Manual, Volume 3: Territorial Use Rights for Fishing. Environmental Defense Fund. Available at <http://fisherysolutionscenter.edf.org>.

data poor circumstances, though it can also be adapted to data-rich environments. The data inputs for the model are those that can be collected primarily from communities, fishermen, and local ecological knowledge. The model includes qualitative prompts for spatial and species-specific information that are translated into quantitative parameters via ‘behind the scenes’ tabs pre-populated with values. For every such input, a trained model user may manually adjust these values when local data is available.

### **How the Model Integrates into the Design Process**

While it is possible to design TURF-Reserves in the absence of this model, this design tool provides explicit and transparent technical guidance on the biological and economic tradeoffs associated with proposed TURF-Reserve design options. The model outputs show tradeoffs among designs—comparing total profit, harvest and abundance to a TURF-free (“status quo”) scenario. These outputs, however, must be interpreted in the context of community goals, constraints and other known tradeoffs that the model cannot address.

The design tool is intended to be used as part of a stakeholder-driven TURF-Reserve design process. Design processes vary from one context to another, but we recommend the following general steps for using the tool:

- **Collect and organize data**—Basic fishery data should be gathered through community consultations and other data collection methods. A detailed list of data required is located in Part 2 of this manual.
- **Develop TURF-Reserve design options with stakeholders**—Stakeholders develop up to 5 TURF-Reserve design options on a gridded map.
- **Input data into the tool**—Fishery data is entered into the Excel model.
- **Enter design options into the tool**—TURF-Reserve designs are entered into the model and saved one at a time.
- **Evaluate relative performance of design options**—The tool provides a comparison of the expected biological and economic performance of different design options relative to the current or status quo system to help users evaluate and communicate tradeoffs between design options.

These steps should be embedded in an appropriate participatory design process that includes clear and transparent processes for decision making. The outputs should be considered a complement (rather than an alternative) to other factors that support design decisions. We assume, for example, that the design options analyzed have been proposed by community members because they are considered to be reasonable and

appropriate. The outputs of the model can provide supplementary information about the expected performance of different design options. The tool provides feedback on relative biological and economic performance for species (through profit, harvest and abundance metrics) and certain design metrics (i.e. fishing grounds covered, spawning areas, TURF and Reserve size, etc.); however, it is up to the community and site managers to evaluate tradeoffs between designs based on these metrics and external social factors. TURFtools is meant to provide scientific insights into tradeoffs between design options to prompt a well-informed TURF-Reserve design decision-making process, but it cannot inform a community of the ‘best’ TURF-Reserve design option.

### **How to Use the Model**

A participant in the TURF-Reserve design process (a facilitator, scientific advisor, etc.) can follow the step-by-step instructions for the model as outlined in Parts 2 and 3 of this document to gather and input data into the Excel model. He/she will enter known site-specific information, or choose the best option from the pre-entered data already in the model.

Up to 5 pre-selected TURF-Reserve spatial design options (from participatory planning processes) are entered into the model. These are differentiated by their varying spatial placement of the open access area, TURF area, and reserve area. The output of the model will be visual representations of the tradeoffs between the design options, which will be used in the discussion of choosing a TURF-Reserve design.

### **Capabilities of the Model**

The TURFtools model is used within the design process to help facilitate data-driven, quantitative and qualitative discussions about various TURF-Reserve designs. Design teams can anticipate using the model to help:

- *Account for site-specific spatial, biological and economic information collected in the TURF-Reserve design process:* TURFtools utilizes available local data for target species, habitat type and quality within the potential TURF-Reserve range, as well as local prices and costs of fishing, and incorporates them into the model to give a more robust comparison between design options. The more accurate and specific the data, the more representative of the community conditions the trade-off analysis will be.
- *Assess tradeoffs between designs:* The model is used to evaluate the relative performance of TURF-Reserve design options by weighing trade-offs between varying spatial designs. These trade-off analyses will aid decision-makers by providing quantitative results for informed discussions.

- *Visualize design tradeoffs:* The trade-off analysis is depicted in various charts and graphs that can be used to visualize the outputs and to communicate these results to stakeholders.
- *Integrate into the design process:* TURFtools is not a stand-alone tool, but instead a tool that can be used as part of a comprehensive design process to weigh trade-offs between design options.

## **Limitations of the Model**

The outputs of the model are limited by both the type and the quality of data. Therefore, the model has some limitations as to its application and scope.

- *Comparison of Designs versus Optimal Design:* Spatial TURF-Reserve design maps are a data *input* into the model, resulting in a tradeoff analysis among designs. Therefore, the model's outputs compare relative design performance and do not provide an 'optimal' TURF-Reserve design. TURFtools will not act as a deciding factor to determine the 'best' TURF-Reserve design, as design suitability will also be dictated by the goals, objectives and constraints of each specific community.
- *Not an Enforcement and Regulation Tool:* TURFtools is not a management design tool, and will not provide information on how to enforce or regulate TURF-Reserve areas. While TURFtools does incorporate estimates of illegal fishing pressure and comparative harvest policies in managed and open access areas, it does not reflect actual local policies and any changes in management and use over time. Similarly, the tool does not incorporate the number of fishers, or the implication of designs on the number of fishers that should be licensed in a system.
- *Limited Spatial Variation:* Spatial variation (of both habitat and areas of importance) is limited to the resolution of the TURF-Reserve area and surrounding areas of importance. Each area will be mapped on a 10 x 10 grid, so the larger the area the coarser the resolution of the map. Since the model can only identify one habitat per square, or 'patch,' of the 10x10 gridded map, small-scale variation in habitats may not be reflected in a large scale system, lowering the overall precision of the outputs.
- *Discretionary Prioritization:* The model consists of three matrix maps, one for habitat, one for areas of interest (ex: spawning area, nursery ground, tourism zone, etc.), and one for designated use (reserve, TURF, open access). Patches with

multiple habitats, multiple areas of interest, or multiple management uses may have to be prioritized at the discretion of the data manager because the model only permits one value per patch. While the User Guide recommends ways to help manage these conflicting patches, certain designations will be a result of what the data manager chooses as the most important patch representation.

- *Social Limitations:* The social and practical constraints/ limitations that affect the size and space of the TURF will also be incorporated throughout the design process leading up to the use of this model and incorporated into the design options developed before using this tool. Some may be evaluated in TURFtools, such as the extent to which fishing grounds overlapped with proposed marine reserves. Others, such as acceptability of designs to different user groups, must be evaluated through facilitated community discussion and considered when creating the design options.
- *Static Parameters:* The model considers performance over time in order to assess the relative performance of design options. However, many of the inputs used to parameterize the inputs remain static (i.e. price, cost, MPA size, TURF harvest policies, etc.). While this may be unrealistic, since it is held consistent across designs it does not affect the overall outcomes of design performance relative to one another for a given metric.
- *Single versus multiple TURF-Reserves:* This tool is designed to consider alternative designs for a single TURF-Reserve. It was not designed to compare outcomes for a TURF area divided into multiple smaller TURFs over the same area. This is because TURF harvest policies, profits, and abundance outcomes are aggregated across all 'TURF' patches, and there is no way to differentiate within the TURF designation in the model.

TURFtools is best used as a supportive tool in a broader stakeholder driven design process. It is important to communicate the limitations of the tool to stakeholders to ensure appropriate interpretation of results.



## Part 2: Materials & Data Needed

The information required to run the TURFtools model can generally be collected from stakeholders, as described below. The materials required to use the model include:

- PC computer with Microsoft Excel
- Community-drawn maps featuring habitat characterization
  - Optional: habitat quality, areas of social, economic, and biological interest
- List of target species
- Biological and economic data for target species
- TURF-Reserve design options

### PC Computer with Microsoft Excel

TURFtools runs in Microsoft Excel and is formatted for a PC computer. The model does not run properly on Mac/Apple computers due to Microsoft Office compatibility issues. Excel must also be capable of installing the optimization tool “add-in” Solver. Instructions for installation can be found in Part 3 of this document.

### Community-Drawn Maps

Community-drawn maps of the fishing area provide the model with site-specific spatial variation that is integral for evaluating the projected performance of various design options. Therefore, the more detailed the maps the more comprehensive the trade-off analysis.

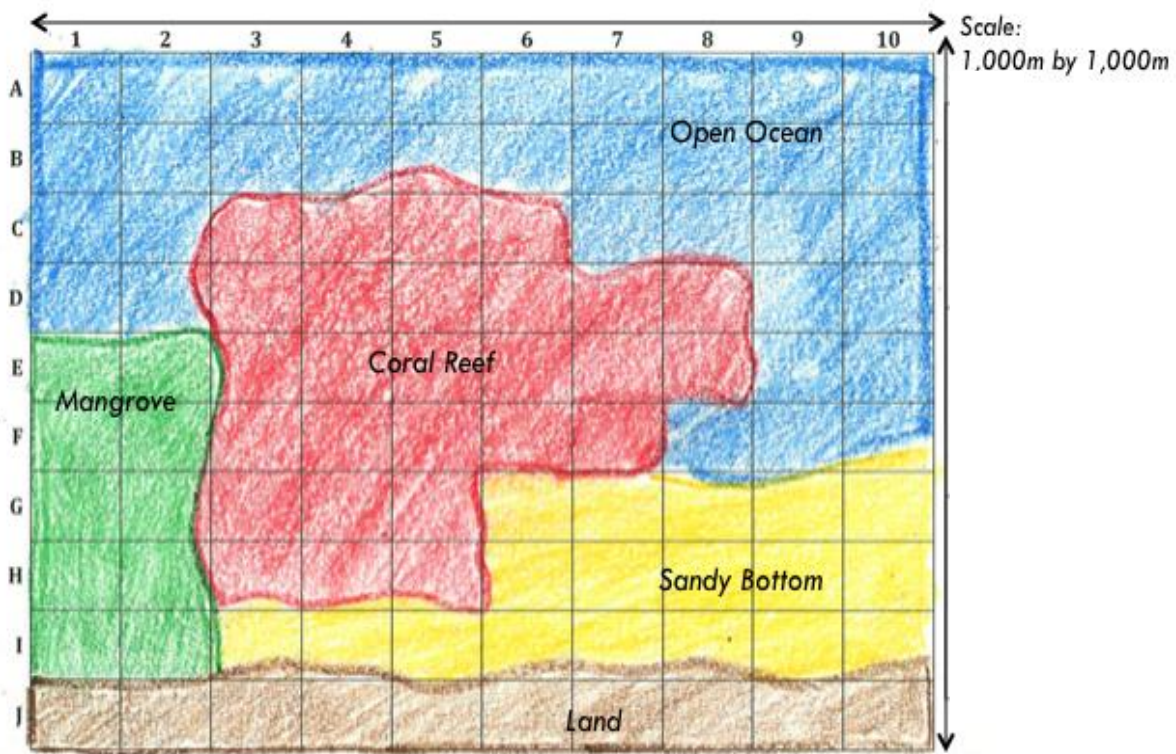
#### *Types of Maps*

- 1) Habitat map: These maps should include all critical habitats for the selected target species as well as surrounding habitat types. Up to 12 habitat characterizations can be input into the model.
  - a. Optional: Habitat Quality. The model may separately consider degraded habitats, so if there are community maps or other data showing spatial presence of degraded habitat this may be incorporated into the tool as well. Habitat quality information is most important when known to affect the total population of a target species that the habitat is able to maintain.
- 2) Areas of interest map: Three (3) categories of areas of interest can be mapped in the model to be used as metrics to compare across design options in terms of their overlap with TURF and Reserves. Depending on the goals of the community, these areas of interest can vary. Some examples include: spawning areas, nursery grounds, fishing areas, tourism zones, etc. These should be included spatially on the community-drawn habitat map, or a separate map that is on the same scale as the habitat map.

## Scale and Grid

Maps should be conducted on a 10x10 grid with the same scale across all maps for a given site. If a grid was not in place during the mapping workshops, a grid can be overlaid after mapping is complete.

The spatial resolution of the mapping area is extremely important for TURFtools. The model provides projected performance outcomes of various TURF-Reserve designs using the spatial information provided. The larger the mapping area, the “coarser” and less detailed the spatial data will be. The smaller the mapping area, the more detailed the outputs will be.



The size of the mapped area will change from site to site. However, maps should be scaled to include the largest potential TURF-Reserve site, as well as a portion of the unmanaged, open access areas. We suggest having one ‘row’ of grid cells beyond potential TURF waters as the perimeter of the grid.

The grid does not need to be square; it just needs to be a 10 x 10 grid. Each one of the cells of the grid can be tall or long rectangles, or squares. The most important part, however, is that the area of the map in linear kilometers be known so it can be entered into the model.

## **List of Target Species**

Before beginning to use TURFtools, communities should have selected the target species that will be prioritized in the TURF-Reserve design process. Up to five (5) target species can be entered into the model, though you can use as few as one (1) depending on desired outputs.

## **Supplementary Biological Data for Target Species**

The model has a database of life history and economic data for certain species. The current database is based on scientific literature and data relevant to the Philippines. It is meant to ease the input process and provide baseline data when appropriate from a national, or regional, scale. If, however, more specific biological information for the target species is available at your site, this information should be used in place of the prepopulated data.

Prepopulated data that should be modified when possible includes:

- Home range: The area in which a species lives and travels
- Intrinsic growth rate: Rate of population growth that determines how fast the population grows, influencing the number of new individuals entering the system
- Price of target species: Understanding the local market price for which the target species sells will help inform the relative changes in profits
- Cost of fishing: Cost of fishing related to basic needs (gear, bait, gasoline)

Price and cost information should be readily available at sites and should be changed to appropriate local values. Adult home range and growth rates, however, are more difficult to obtain on a local level. If these inputs are not available in the current database, a similar species may be selected for the specific input. In addition, research may be conducted to seek this information through literature review of scientific papers conducted in the region, from scientific studies at nearby universities, and online resources such as Fishbase.org.

## **TURF-Reserve Design Options**

Up to five TURF-Reserve spatial designs can be compared with one-another in the model. These potential TURF-Reserve designs have been pre-designed by the community on a map with the same scale as the habitat mapping. These design options should also be overlaid with the same 10 x 10 grid. Therefore when they are transferred into the model, the spatial data correlates to the same areas that are presented on the habitat maps.

## Part 3: Model Instructions

This section will guide *site managers (or model users)* through the process of using the TURF-Reserve Design Tool and its application.

### Materials and Data Needed for the Model

- Community-drawn maps on 10 x 10 grid, including:
  - Spatial habitat characterization on 10 x 10
  - Critical habitat (spawning areas, nursery grounds, etc.)
  - Other areas of interest (tourism areas, fishing grounds, mariculture, etc.)
- TURF-Reserve design options
  - Up to 5 design options of TURF, Reserve, and Open Access
- Up to 5 identified target species
  - Including any supplementary site-specific biological data for target species. For a specific list of data inputs, see Step 4.

#### *Definitions:*

- **Matrix:** synonymous to “grid” of the 10 x 10 maps
- **Tab:** Current worksheet that is being displayed within Excel. The worksheet, or tab, can be changed by selecting an alternate tab at the bottom of the Excel screen
- **Patch:** Each square of the 10 x 10 maps is characterized as a patch

#### *User Requirements:*

- **You must use a PC computer**—the model is formatted for a **PC**. Using an Apple/Mac will result in error messages
- **You must have “Solver” installed on Excel\***—Solver is an optimization tool that Excel offers as an “add-in” and must be installed before the model can run
- **You must “enable macros”\***—when prompted after opening the model, click “enable macros” so all features of the model can be run

\*This will be discussed below in Step 1

## **Step 1: Prepare the Model**

To successfully run the model, a few steps of preparation are required.

### **Instructions**

1. Open the Excel program on a PC computer. You may use a blank document or any other Excel file, but do not open the model just yet.
2. Install the “Solver” add-in.

#### *Installing Solver:*

1. Go to the File toolbar and select “Options”, and then “Add-ins”
2. In the pop-up Manage box, click “Excel Add-ins” and then select “Go”
3. An “Add-ins available” box will popup. Check the “Solver Add-in” box from the list and click “OK”. (if Solver is not listed, select “browse” and look for Solver.xlam)
4. Solver should now be listed in the “Analysis group” under the Data tab

3. Open the model. You will be directed to the home page. WELCOME!
4. Enable macros
  - A pop-up window will prompt you “This workbook contains macros. Do you want to disable macros before opening the file?”
  - Select “Enable Macros” to continue
5. Save the model. This model is read-only. By saving the model with your new site name, both your site-specific model and the original file will be easily accessible.
  - Go to File toolbar and select “Save As” from the pull down
  - Select the location on your computer where you wish to save your model
  - Save the model with your site name and date, using an underscore for spaces
    - a. Ex: *Inabanga\_Dec2015*
6. Familiarize yourself with the home dashboard and colored tabs along the bottom.

#### *Welcome Page Dashboard:*

This page is your home screen. When in doubt, come back here if you are lost. The dashboard offers:

1. Navigation: Each tab/ page within the Excel workbook can be navigated by the buttons on the right side of the homepage, or by the tabs along the bottom.
2. Checklists: Not sure what you need? Look back on the dashboard as a friendly reminder
3. Tracking: To keep track of what steps you have completed, write “YES” under the completed column on the home page. A check mark will automatically appear.

## Step 2: Input the Habitat Characterization of your TURF-Reserve site

This step will translate spatial habitat mapping information (seagrass, mangroves, coral reefs, etc.) to the computer model.

*Excel Tabs Needed:*

- Habitat Characterization (*GREEN*)

*Materials Required:*

- Community maps of the potential TURF-Reserve site’s habitat coverage and characterization, overlaid with a 10 x 10 matrix.
  - Optional: Habitat quality information included spatial information on where habitats are degraded.
- Dimensions of the TURF-Reserve system included in the 10x10 map.

**HABITAT TRANSLATION KEY:**

Habitat types are coded by both color and numbers. Mapping may vary per site, so double check mapping legends before translating data.

The default habitats and colors are:

- |                                  |                                   |
|----------------------------------|-----------------------------------|
| 1) Mangrove—DARK GREEN           | 7) Mudflats/ Estuary—PURPLE       |
| 2) Degraded Mangrove—LIGHT GREEN | 8) Open Ocean/ Channel/ Pass—BLUE |
| 3) Coral Reef—RED                | 9) Mariculture—LIGHT BLUE         |
| 4) Degraded Coral Reef—PINK      | 10) Rocky Shoreline—BROWN         |
| 5) Seagrass—ORANGE               | 11) Land—TAN                      |
| 6) Sandy Bottom—YELLOW           | 12) Other—LIGHT BLUE              |

<b>1. Mangrove</b>	<b>2. Degraded Mangrove</b>	<b>3. Coral</b>	<b>4. Degraded Coral</b>	<b>5. Seagrass</b>	<b>6. Sandy Bottom</b>
<b>7. Mudflats/ Estuaries</b>	<b>8. Open Ocean/ Channel</b>	<b>9. Mariculture</b>	<b>10. Rocky Shoreline</b>	<b>11. Other</b>	<b>0. Land</b>

**Instructions:**

- A. From the homepage, click on the Habitat tab (*GREEN*) on the bottom bar



- B. Make a list of up to 12 key habitats from the community mapping exercise. All important habitats for all target species should be included in this list (and corresponding maps. If the default habitats match the listed habitats from mapping, skip to Step D.
- C. To change the habitat name: simply click on the cell you would like to change and type in the more appropriate habitat types/name (i.e., local names for habitats).

Eg:

<b>Kelp Forest</b>	<b>Degraded Kelp Forest</b>	<b>Deep Rocky Reef</b>	<b>Tidal Rocky Reef</b>
<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>

Similarly, if different areas of the same habitat have significantly different characteristics that are relevant to the target species, those can be entered into the model as separate habitats.

Eg:

<b>Coarse Branching Coral</b>	<b>Fine Branching Coral</b>	<b>Deep Water Soft Coral</b>	<b>Mounding Coral</b>
<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>

*Fewer than 12 habitats?*

If your site has fewer than 12 habitats, click on the colored cells that are not being used and delete the habitats names. These cells can be left blank.

- D. Use your 10x10 gridded habitat map to guide you through translating habitat information into the model. Each square on your habitat map corresponds to one patch in the matrix.

*Multiple habitat types in one patch?*

For patches with multiple habitats choose the habitat that covers the largest percentage of that patch. No patch can be assigned two habitat types in the model. If multiple habitats are evenly distributed within one patch, select the habitat that is most important to your target species.

- E. For each patch in the matrix, assign the appropriate habitat number that corresponds to the habitat type from the community maps. Use the legend at the top of the page. To change the number, click on the cell, type the number, and press “enter”. Alternatively, numbers can be copied and pasted into the various cells, or ‘dragged’, by clicking on a cell, then on the bottom right corner of the cell and dragging it across other cells you wish to change to the same number.

	1	2	3	4	5	6	7	8	9	10
A	8	8	8	8	8	8	8	8	8	8
B	8	8	8	8	8	8	1	1	2	8
C	8	8	3	3	3	3	0	0	2	8
D	8	8	4	4	0	0	0	3	8	8
E	8	8	4	4	0	0	0	3	8	8
F	8	8	2	0	0	0	9	8	8	8
G	8	8	1	1	0	5	9	8	8	8
H	8	8	1	1	5	5	8	8	8	8
I	8	8	8	8	8	8	8	8	8	8
J	8	8	8	8	8	8	8	8	8	8

*What if the color of my cell does not change?*

As long as the number is correct the model will work. If, however, you would like to change the color for visual purposes, the colors will always update correctly if they are ‘dragged’ or copy/pasted from other cells. The colors work under an excel tool called ‘Conditional Formatting.’ For more detailed instructions on how to correct and change conditional formatting in this tool, see the Troubleshooting/ Customization Appendix.

- F. Scroll over to column O and column P to enter the “System Scale” in linear meters. This is the total height and width of the area mapped in the habitat characterization, and must also be the same as the scale used to map Areas of Interest and design options. It is important that the scale be accurate in order for the model to accurately calculate species movement and dispersal. The map does not have to be square! By entering the total system height and width, each patch size will be calculated and the total square meters and hectares will also auto-populate.



### **Step 3: Input Areas of Interest Maps**

**DEFINING AREAS OF INTEREST:** This tab is used to indicate areas of interest and/or importance to the community within the mapping area. These “Areas of Interest” are used in the comparison of designs and can include important zones (spawning areas, nursery grounds, etc.) or areas of use (fishing zones, tourism areas, etc.). Depending on these areas, it may be interesting for the community to see how various TURF-Reserve designs overlap with these regions. It can also be useful for identifying potential conflict areas.

In the tool, up to three areas of interest may be evaluated. Two are evaluated in terms of overlap with marine reserves, and one may be evaluated in terms of overlap with marine reserves and overlap with TURFs.

*Excel Tabs Needed:*

- Areas of Interest (BLUE)

*Materials Required:*

- Community maps areas of importance (spawning areas, nursery grounds, fishing grounds) gridded to 10 x 10 matrix

#### **Instructions:**

- A. Click on the Areas of Interest Tab (*BLUE*)

**Click Here**



- B. Select the three most influential and important areas of interest to your community from the drop-down menu.

*How to select from a built-in drop-down menu:*

- Select the menu by first clicking on the desired cell.
- Cells with drop-down menus will have a gray up/down arrow on the right of the cell.
- Click the arrows to display the drop-down menu and make your selection.

- C. If a given area of importance to your community is not listed, simply click on the colored cell and type in the appropriate name. Areas of interest 1 and 2 will show spatial overlap with the reserve area, whereas area of interest 3 will

be calculated to show overlap with both TURFs and reserves. These will be shown in the outputs, and should be strategically input depending on what conflicts are most important to communicate.

- D. Use your 10x10 gridded habitat map to guide you through translating “Areas of Interest” information into the model. Each square on your map corresponds to one patch in the matrix.
- E. For each patch in the matrix, assign the appropriate number that corresponds to the area of interest from the community maps. Use the legend at the top of the page. To change the number, click on the cell, type the number, and press “enter”. For troubleshooting if colors do not change correctly when entering numbers, see the call-out bubble in Step 2.

	1	2	3	4	5	6	7	8	9	10
A	3	3	3	3	3	3	3	3	3	3
B	3	3	3	3	3	3	3	3	3	3
C	3	3	3	3	3	3	0	0	3	3
D	3	3	3	1	0	0	0	3	3	3
E	3	3	3	2	0	0	0	3	3	3
F	3	3	3	0	0	0	3	3	3	3
G	3	3	3	1	0	3	3	3	3	3
H	3	3	3	3	3	3	3	3	3	3
I	3	3	3	3	3	3	3	3	3	3
J	3	3	3	3	3	3	3	3	3	3

*How to deal with overlapping “Areas of Interest”*

If more than one characterization applies (e.g. a single grid cell covers both nursery ground and spawning area), choose the characterization that is most important to the community when comparing designs. This is at the discretion of the inputter.

Ex: Coral trout spawns in 5 different areas, but the nursery ground is only found in one area that overlaps with one of the spawning areas. To ensure that nursery grounds are represented spatially, the data site manager may choose nursery ground over spawning area for that patch.

## **Step 4: Input Target Species Data**

Here, up to 5 target species for the TURF-Reserve site can be selected. When supplementary life history data is available in the model database (Life History Data tab), many inputs will ‘auto-populate.’ This may be helpful when local data for certain inputs is not available. For every species there are also certain inputs that require site-specific information. As the data manager, you should go through each input, one-by-one, applying local information whenever possible.

### *Excel Tabs Needed:*

- Species Inputs (RED)

### *Materials Required:*

- List of up to 5 target (priority) species at the site
- All local information available on target species and fishing trends. Specific inputs used with this information include:
  - Species’ preferred habitat types
  - Status of fish populations in important habitats
  - Primary Gear
  - Price and Cost Data
  - Illegal fishing and open access trend estimates
- *Optional\**: Life History Data collected from local studies, scientific literature, or Fishbase.com
  - Adult home range
  - Growth rate

\*Optional data is included in the life history database, but may be useful if the target species is not present in the current database.

## **Instructions:**

- A. Click on Species Inputs tab (*RED*)

Click Here



- B. Complete the information in each colored column by following steps 4.1 – 4.10 below
- C. Repeat for every selected target species (up to 5) in each subsequent column

**Step 4.1 – Species Selection (row 3):**

These are the pre-selected target species chosen by communities

- 1) In the first *DARK BLUE* column (A), choose the site's first target species from the drop-down list in row 3. Species are listed alphabetically.

*What if the drop-down list is blank?*

If the drop down list is blank, there is a quick fix through Excel's Data Validation tool. See the customization / trouble-shooting appendix.

- 2) If the species is not on the list, click on the cell (A4), and type the name of the target species in the column.

*Is your species listed in the drop-down menu?*

Have a list of the target species in your area available with their scientific names. If it is listed, picking a species from the drop-down menu will be helpful by automatically populating known biological data. A photographic list of local species may also be helpful when choosing species from the drop down.

- 3) The name of the target species will appear in several input categories, and for species for which there is stored life history data, values will auto-populate. (These categories include: home range, intrinsic growth rate, price, and cost).

**Step 4.2 – Adult Range (rows 7-8):**

**Definition:** Adult home range, or dispersal range, is the area in which a species lives and travels. This variable determines how much of species growth stays within a given patch versus disperses outward.

**Importance:** Home range impacts how effective the size of the TURF-Reserve is in capturing the target species scale of movement, important in evaluating potential spillover effects.

- 1) If you selected a species from the drop-down menu, this information will auto-populate for Step 4.2.
- 2) If the name of the target species was NOT on the list in Step 4.1, select the species with the most similar adult home range to the target species.
- 3) If local data is available regarding adult home range, manually enter this instead.

**Step 4.3 – Species Growth Rate (rows 10-12):**

**Definition:** The rate of population growth of the target species is indicated by the species' intrinsic growth rate.

**Importance:** In the model, the growth rate determines how fast the population grows, influencing the number of new individuals entering the system. Growth rates have been provided for some target species.

- 1) If there is life history data available for the target species this information will auto-populate.
- 2) If the value does not auto-populate, the intrinsic growth rate cell (row 11) reads 'NA', or contrary site information is available, there are two options:
  - 1- Use the drop-down menu to select the species with the most similar perceived growth rate (A11).
  - 2- If local data or literature-reviewed data provides a more accurate local intrinsic growth rate value, it can be manually entered by clicking on the cell (A12) and entering the value.

**Step 4.4 – Overall Stock Status (rows 14-15):**

**Definition:** This value indicates the overall condition of the stock as compared to a pristine stock.

**Importance:** Stock status helps determine the initial stock in year 1.

- 1) Choose a qualitative stock level from the dropdown menu in row 15 (pristine, high, average, low, depleted). To decide the status of the stock, consider how its current abundance and overall health compares to historical records. Potential impacts that may lower the stock status include overfishing, habitat degradation, and pollution, among others. Do not consider habitat preference at this point, but instead think about overall stock status in the entire mapped area.
  - a. Pristine—no fishing is present and fish stocks are high
  - b. High—fish populations are above average and may be increasing
  - c. Average—fish populations are neither increasing nor decreasing
  - d. Low—Fish populations are below average and may be decreasing
  - e. Depleted—fish populations are much lower

*Need help determining your stock status?*

See if your site has done any assessments of your target species over time such as catch records or trend diagrams of fish length, time on the water,

CPUE, etc. If no assessments are available, consider seeking input from local fishermen and/or scientists, and provide your best estimate.

#### **Step 4.5 – Habitat Use and Stock Status (rows 17-33):**

##### ***Habitat Use—***

**Definition:** Understanding which habitat types are occupied (and to what extent) by each target species helps determine the maximum population size of the target species that a habitat can sustain indefinitely, or, its carrying capacity.

**Importance:** This number will change for different habitat types. In the model, the habitat use helps determine the initial stock in a given habitat. It also affects how fast a population grows and limits its total growth.

##### ***Habitat Specific Stock Status (optional)—***

**Definition:** This value indicates the overall condition of the stock as compared to a pristine stock. Even though a species is living in its primary habitat, given fishing pressures or habitat health, the stock could lower than if it were in a pristine environment. This may vary significantly or not by habitat. Target species will have different stock status in different habitats given their biological characteristics.

**Importance:** Stock status helps determine the initial stock in year 1.

- 1) **HABITAT USE** (column B for species 1)— Habitat types from Step 2 will auto-populate in rows 22-33. For any habitats applicable, select from the drop down menu how each habitat serves the target species using the following definitions.
  - **Primary Habitat**—habitat where the species is most commonly found as an adult
  - **Secondary High**—habitat where the target species is often found, but is not considered its primary habitat
  - **Secondary Low**—habitat where the target species is occasionally found, but less than ‘Secondary High’
  - **Transient/ Low Density**—areas where species may travel through or reside temporarily or at low concentrations
  - **Not Present**—habitats where the target species is not found. Land, and any habitat not mapped should be categorized as ‘Not Present.’

*What if your species is found in multiple habitats?*  
More than one habitat type can serve as a species “primary habitat” or “secondary high”, etc.

- 2) **STOCK STATUS** (Optional, column C for species one)— The stock status determined in Step D will automatically fill the status for each habitat. If it is known that there is significant variation in the status of a stock in a given habitat, then users may choose a different status for any given habitat. If the stock is not present, then ensure that ‘Not Present’ was selected for the habitat in ‘Habitat Use’ (see above).
- Pristine—no fishing is present and fish stocks are high
  - High—fish populations are above average and may be increasing
  - Average—fish populations are neither increasing nor decreasing
  - Low—Fish populations are below average and may be decreasing
  - Depleted—fish populations are significantly lower or gone

#### **Step 4.6 – Illegal Fishing (rows 35-36):**

**Definition:** This categorization estimates the amount of total catch/harvest of a target species that is caught illegally (by gear type, size, location, etc.). In the model, this is calculated as a percentage of the total legal harvest in TURF areas (both in TURFS and reserves).

**Importance:** In the model, illegal fishing removes biomass from the stock in all management zones (TURF, Reserve, and Open Access) but does not contribute to profits.

For ‘Reserve’ (row 33) and ‘TURF’ (row 36) choose the estimated extent of current or future illegal fishing relative to perceived average amongst other communities.

- 1) Choose illegal fishing extent using the following definitions:
  - High— There is more illegal fishing than the average community. Much of the total harvest from the area is due to illegal fishing (gear, location, encroachment).
  - Average—Illegal fishing is occurring in the area but is believed to be similar to that seen in most communities.
  - Low—Illegal fishing is less than the average community (this may be due to effective enforcement and/or management, few number of fishers, etc.)

#### **Step 4.7 – Price (row 40):**

**Definition:** The average price in local currency per kilogram that the fishermen may sell the target species for.

**Importance:** Understanding the local market price for which the target species sells will help inform the relative changes in profits

- 1) If the target species was selected directly in the drop-down list in Step 4.1, an estimated price/kilogram (\$PHP) will automatically load.
- 2) If the target species was not in the dropdown list, choose the species from the dropdown list with the most similar price per kilogram.
- 3) Additionally, if local data suggests a different price/kilogram (PHP), the price may be changed manually directly in the cell.

#### **Step 4.8 – Cost (row 44):**

**Definition:** Cost of fishing related to basic needs (gear, bait, gasoline) given a fixed family income of \$300 PHP/day.

**Importance:** The relative price and cost of fishing determine profit per kilogram of biomass.

- 1) If the target species was selected directly in the drop-down list in Step 4.1, the cost/kilogram will automatically load.
- 2) If the target species was not in the dropdown list in Step 4.1, choose the species from the drop-down list with the most similar cost per kilogram.
- 3) If local data suggests a different cost/kilogram (PHP), the price may be changed manually directly in the cell.

#### **Step 4.9 – Primary Gear Used (Catch Coefficient) (row 46-47):**

**Definition:** Primary gear refers to the most commonly used gear for the target species.

**Importance:** The gear type is used to calculate the ‘catch coefficient,’ which is a parameter used to calculate the efficiency of effort and impacts profits per kilogram.

- 1) Select the most commonly used gear for the target species from the drop-down menu. A value for the catch coefficient will then automatically load in the parameter tab based on the selection.
- 2) If the primary gear is not present in the drop-down list, choose the most commonly used gear in the list, or the gear type most similar in efficiency.

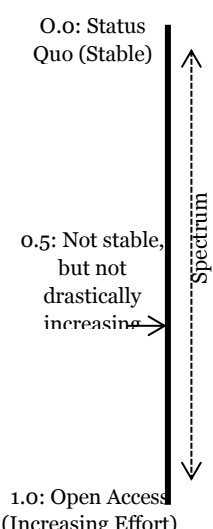
#### **Step 4.10 – Open Access Dynamics (row 49):**

**Definition:** This value explains the harvest dynamics of a target species in unmanaged (open access) areas. Fishing pressure in these areas may be increasing as profits decrease; or, if the fishery is stable it may continue at status quo. A stable fishery does



not mean that it is a healthy fishery, but rather that stock levels are not changing. Where in this spectrum the fishery stands depends on an input from 0-1.

**Importance:** It is important to understand what fishing is like outside of managed TURF and Reserve areas because this affects the abundance of stocks within TURFs and Reserves. This is because fish move, or disperse, between areas. For example, while stocks may be recovering in a reserve with no fishing, if the areas nearby are being heavily fished without regulation the fish that leave the reserve may be immediately fished out, minimizing the positive impact of the reserve on total abundance.

- 
- **0:** Enter zero if the fishery is well established and stock levels are stable, even if they are low or depleted. One way to determine this is to look at catch per unit effort (CPUE) trends if this data is available. If the trend is stable, it is a sign the fishery is in status quo. Another option is to consider the length of fish caught in the last ten years. If fishery landings are consistent in length this is also a sign that the fishery is in status quo. A value of 0 means the fishery is in perfect status quo and that stock levels are constant.
  - **1:** Enter 1 if the fishery is newly emerging and increasing in pressure. A value of 1 will result in an open access situation, in which stocks are harvested until profits equal zero. If fishing pressure is increasing (CPUE is decreasing and/or length of fish caught is declining); or, if the species is determined to be highly susceptible to overfishing, this is a sign that the fishery should be considered open access.
  - **Between 0 and 1:** If the fishery is somewhere in between, choose an appropriate relative value between 0.0-1.0.

Repeat Steps 4.1 – 4.10 for up to 5 species. If there are less than 5 target species, for the additional species choose ‘Not Present’ from the dropdown menu.

## **Step 5: Input Your TURF-Reserve Design Options**

### *Excel Tabs Needed:*

- Designs (ORANGE)

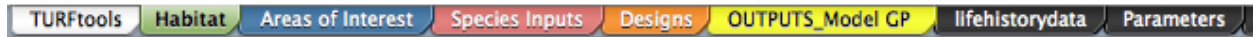
### *Materials Required:*

- Up to 5 community-drawn TURF-Reserve designs on a 10x10 grid of the same dimensions as the habitat characterization.

**Instructions:**

- A. Click on “Designs” tab at the bottom of the page (*ORANGE*)

Click Here

- B. Insert the current management occurring at your site on the 10 x 10 grid. This status quo management design should be on the same spatial scale as the habitat maps.
- Assign each patch a number according to the desired design, where 1 is open access, 2 is reserve, and 3 is TURF.
    - ***For most areas, this will be just “open access”, or no management zones, and maybe a marine reserve if it already exists in the area.***
    - *If colors do not update correctly, see the troubleshooting bubble in Step 2.*
  - After the “Status Quo” scenario has been entered, save the design by clicking on the “STATUS QUO” button to the right of the map.
  - The model will save the design and return you to the design tab after running through the model equations.

*Consider saving images of each design*

It may be helpful to save images of each design in the tool to refer back to later on. Each design image must be saved as an image and copy/pasted on the “outputs” tab template area before the next design is entered.

To do this:

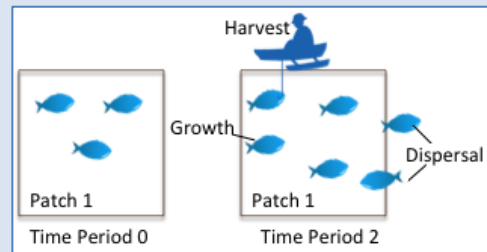
- Enter the status quo or TURF-Reserve design.
- Highlight all the cells in the 10x10 grid, and copy by write clicking on the highlighted cells or through the “edit” menu bar.
- Click on a cell where you want to place the image.
- Right click or go through the edit bar and select “paste special,” then choose to paste ‘as image.’
- Resize the image as desired.

- C. Insert up to 5 pre-determined TURF-Reserve designs into the 10x10 grid. These designs should also be on the same spatial scale and map as the habitat mapping

- Assign each patch a number according to the desired design, where 1 is open access, 2 is reserve, and 3 is TURF.
- After the first design has been entered, save the design by pressing the ‘Save Design 1’ button. This will cause the model to run.
- Repeat the process for up to 5 designs, each time saving by pressing ‘Save Design 2,’ ‘Save Design 3,’ ‘Save Design 4,’ and ‘Save Design 5’

*What happens when you run the model by saving a design?*

When a design is saved, the model evaluates each design by calculating species dynamics based on the species growth, movement in and out of patches, and harvest.



The amount of harvest in a time period depends on whether a patch is designated as a TURF, Reserve, or open access. The TURF policy is determined based on the design, and requires Excel to use a function called “Solver.”

When you press ‘Save,’ you will be redirected to the parameter page where you will be prompted in a pop-up box that “Solver has found a solution.” Click ‘Okay.’ This will happen 4 more times (5 times total, once for each species).

*What if my patch has more than one management use?*

For patches with multiple management designations (reserve, TURF, open access) on a map, select the management type that covers the largest percentage of that patch.

## **Step 6: Compare Designs and Communicate Outputs**

*Excel Tabs Needed:*

- Outputs (YELLOW)

*Materials Required:*

- Projector (if possible to show outputs)
- Printer (suggested to take-home some of the results)

**REMEMBER!**

*Think carefully what you want to communicate. As with any communication tool, it is important to select the appropriate information and/or visuals for your community. TURFtools provides more than one option to compare between species, designs, or both. These combinations of outputs can be used to support the decision-making process.*

**Instructions:**

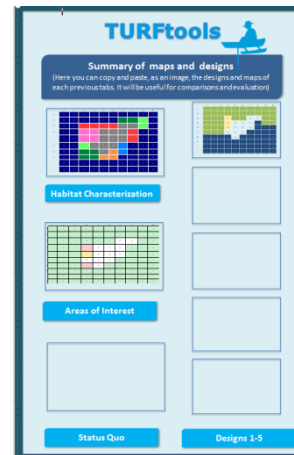
- A. Select the Outputs tab at the bottom of the page (**YELLOW**)



- B. Familiarize yourself and your external audiences with the icons key that is provided in the dashboard.



- C. Locate the “**Summary of maps and designs**” area. Users are encouraged to copy and paste the maps and designs that were input in the previous tabs.













Having maps and designs on the output tab will be convenient for future discussions and evaluations. It allows the users to remember the designs and maps they input without going back and forth between the other tabs.

- D. The charts can display different output metrics (such as abundance, harvest and profits) in different ways. Each has different “levels”, or complexities, of information. We suggest using the framework described below to guide the outputs’ evaluation.

The goal of TURFtools is to provide outputs that may help stakeholders in the decision-making process of selecting a TURF-Reserve that best fits the community goals. To achieve this, TURFtools contains charts that can be used to spark discussions, compare designs and evaluate tradeoffs. To select the most effective chart to communicate tradeoffs between designs, it is important to remember the community goals that have been defined previously.

Users must consider that there is a strong link between harvest, abundance and profit. Therefore, focusing only one output metric will not be sufficient to make a robust decision. The following table shows some examples of how the goals may be evaluated in the multiple outputs options that the tool provides. It suggests charts that may help facilitate discussion of the pros and cons of each design. This is by no means a complete list, but it can help users familiarize themselves with interesting and important tradeoffs for community consideration.

Goal	Description	Output Metric(s) to look at	Additional element to consider	Chart (s)
1	Livelihoods improved			1a (upper left)
2	Catch yields/ Harvest improved or sustained			1a (upper right), 1c
3	Population of target species maintained or increased		 % MPA Area (km <sup>2</sup> )	1b and 1c
4	Individual species protected/ sustained		 *	1c and 2
5	Potential social conflict minimized	 % Fishing area/reserve overlap		1b and 1c
6	Marine reserve covers % of TURF	 % MPA / (MPA + TURF)		1b
7	Livelihoods improved and Harvest sustained		 % Fishing grounds covered by TURFs (km <sup>2</sup> )**	SCORE TABLE

\*Remember that users can select a single species or all species for these output metrics.

\*\* Remember that some of these factors are customizable depending on the areas of interest that the community prioritized (see Step 3).

The following table provides detailed guidance to help site managers choose between the multiple output visualization options based on the analysis or tradeoffs they hope to communicate. The table describes the types of analysis that the charts available facilitate, describes the charts available, suggests guiding questions, and provides pros and cons of the chart as a communication tool.

Analysis or Tradeoff Targeted	Recommended Chart	Guiding Questions	PROS / CONS
Performance of all designs for all species and all output metrics	<p><b>SCORE TABLE</b></p> <p>The score table shows the performance of each design for all species. The color scale ranges from light to dark, with darker values representing higher percentages or values.</p>	<ul style="list-style-type: none"> <li>- Which design has a larger amount of darker values?</li> <li>- Do designs perform differently for each species (i.e. does a design have a lot of darker cells for one species but not for another?)</li> </ul>	<p><b>PROS:</b> It is helpful to see all the outputs at once and to get an idea of which design performs better across many metrics.</p> <p><b>CONS:</b> It may be difficult to see the tradeoffs between specific parameters because there is too much information to display.</p>
Values of each output metric for each design	<p><b>CHART 1.a</b></p> <p>The spider webs, or radar charts, show the values of each output metric (i.e. harvest) for each one of the designs along a separate axis. This is a simple way to focus on only one output metric. (The values increase as they reach the outer ring.)</p>	<ul style="list-style-type: none"> <li>- Which design has a better performance in term of profits/abundance/ harvest?</li> <li>- Which design has a larger reserve area (km<sup>2</sup>)?</li> </ul>	<p><b>PROS:</b> It is easy to see the differences between designs when considering one output metric</p> <p><b>CONS:</b> The charts are limited to one output metric per chart, and do not consider tradeoffs between metrics.</p>
What are the tradeoffs between two output metrics?	<p><b>CHART 1.b</b></p> <p>The graph shows the tradeoff between the two output metrics. The size of the circle reflects the size or amount of an area of interest that may be a priority for the community</p>	<ul style="list-style-type: none"> <li>- Which design has better performance in terms of :                             <ul style="list-style-type: none"> <li>...profits and abundance?</li> <li>...profits and harvest?</li> <li>...harvest and abundance?</li> </ul> </li> <li>- How does the “area of interest” influence the output?</li> <li>- Is the design with the better performance feasible?</li> </ul>	<p><b>PROS:</b> It is easy to see the performance between all designs when considering two output metrics. The area of interest represented in the size of the marker adds additional relevant information.</p> <p><b>CONS:</b> One primary output metric will always be excluded.</p>

Analysis or Tradeoff Targeted	Recommended Chart	Guiding Questions	PROS / CONS
Comparison between all designs and how do they perform in terms of harvest, abundance, profit and one area of interest	<p><b>CHART 1.c</b></p> <p>The bubble graph allows you to compare different output metrics across designs (Similar to Chart 1b). The difference is that this chart displays all three main output metrics at once.</p>	<p>-Which design has bigger bubbles?</p> <p>- What makes the design have bigger bubbles for the given metrics? Is it the TURF/reserve size/location?</p>	<p><b>PROS:</b> The bubble graph allows user to quickly see the design that has larger values in terms of harvest, abundance, or profit.</p> <p><b>CONS:</b> When values are similar, it may be hard to see differences between the size of the different bubbles.</p>
<p>How do designs perform in terms of one output metric?</p> <p>*Species analysis</p>	<p><b>CHART 1.a</b></p> <p>The chart shows how the output metric selected (y-axis) perform for each design across all species. An output metric may perform similarly, or not, across different species.</p>	<p>- Which design has a better performance in term of profits /abundance/ harvest for (name of species)?</p> <p>- Why do you think design (#) perform better for (name of species)?</p>	<p><b>PROS:</b> This chart is useful when users are interested in considering tradeoffs between design performances per species.</p> <p><b>CONS:</b> When designs perform similarly, it may be hard to see the ranking of the different designs for a given metric.</p>

### **Output Communication to Communities**

Site coordinators, as well as stakeholder participants, may find it useful to share or display the outputs in a variety of ways, including print-outs and PowerPoint presentations. The outputs are arranged in Excel to facilitate easy printing for handouts and pasting into PowerPoint for presentations.

If you click on “VIEW” and then “Page Layout” you will see that the outputs are arranged such that charts can be selected (by page) in the printer preferences and shared.

*\*\*\* Note: When sharing print-outs, be sure to clearly communicate that the printed material does reflect a final decision and is just information that was used to discuss the different options of designs. \*\*\**

## Appendix 1: Customization of the Workbook Interface

### How to create and fix drop-down lists

Drop-down lists allow model users to select an input from a list stored in the workbook (on any worksheet). In this tool, drop-down lists appear in the ‘Areas of Interest,’ ‘Species Inputs,’ and ‘Model Outputs’ tabs. These lists make the user process much similar, and permit auto-population from the life history tab. Future users may need to troubleshoot an error, a user may want to change the contents of the list, or create a new list. For example, if local names for species with life history database values are available a user may change the target species drop-down list to select local species names.

#### To Create a Dropdown List in Excel:

1) Create a list in any worksheet.

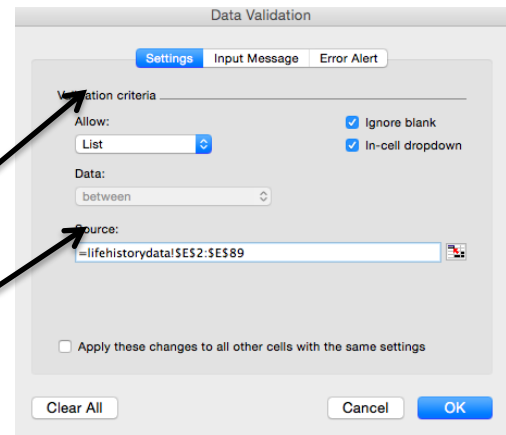
In the workbook, several such lists have already been created. There are drop down lists in the Areas of Interest and Species Inputs tabs, the lists for which are all kept in the Life History Tab.

2) Select the cell you wish to turn into a dropdown menu.

3) From the Data menu, click on the ‘Data Validation’ button.

4) From the settings tab on the pop-up window, choose to Allow ‘List.’ A Source box should appear.

5) Click in the source box then select the list you want to appear in the drop down.



#### Extras:

The ‘Error Alert’ tab in the Data Validation pop-up allows you to stop or warn a user before manually entering information into the cell with the drop-down list available. For this model this is important because the drop-down menu selections are associated with key data.

### How to create and fix auto-population of species inputs

Autopopulation of inputs is achieved through a vlookup function in Excel. This function allows the tool to look-up a value associated with another value. In the Life History tab, there are lists of species, habitat use categories, stock level categories, illegal fishing, and gear types, each with parameter values associated. By using this function, the model is



able to populate the value associated with the species, gear, or categorical value selected in the drop-down menus.

#### To create a vlookup function in Excel:

- 1) Click in the cell that you wish to autopopulate
- 2) Click on the 'fx' button and search for the vlookup function. The window will contain prompts for the key inputs for the function.
- 3) The first input is the 'lookup value.' This should be the value you wish Excel to 'look up' to find the target input value. For example, in order to autopopulate species input values, the vlookup 'lookup value' is set to row '4,' where the target species is selected.
- 4) The next input is the 'table array.' For this, select the area that contains both the 'lookup value' and the target associated value. In the current tool, these areas are in the Life History Tab. Begin with the column that contains the lookup value and end at the column that contains the target value. For instance, for the home range autopopulation the vlookup table array begins with the 'Common, Scientific' name column and extends through to the home range column.
- 5) The next input is the 'column index number.' For this, count the number of columns away from the lookup column where the target input value resides. For example, the target value is immediately adjacent to the lookup value, the index number would be 2.
- 6) The final input is 'range\_lookup.' This should be 'True' or 'False.' Choose false in order to prevent Excel from using a similar lookup value.

The final function will look something like:

```
=VLOOKUP(A$7,lifehistorydata!$E$2:$F$89, 2, FALSE)
```

### **How to create and fix conditional formatting (automatic color-coding)**

Conditional formatting permits automatic color-coding of cells that facilitates a user-friendly interface and process. It does not affect the values or the functionality of the model. Rather, it is meant to provide consistent aesthetics. In this tool it is used in the Habitat Characterization and Areas of Interest tabs.

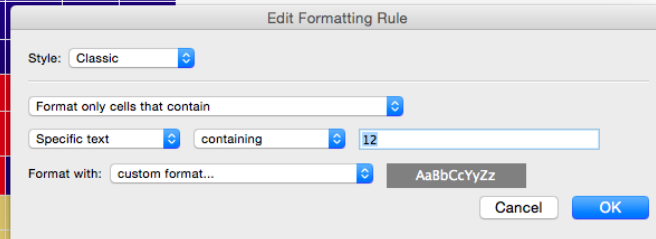
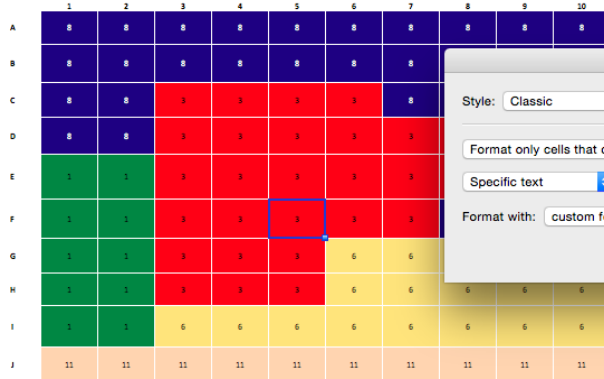
How to create conditional formatting in Excel

- 1) Click on the 'conditional formatting' button on the home toolbar.
- 2) Either choose 'new rule' or 'manage rules'
- 3) The formatting rule style should be 'classic,' and 'format only cells that contain' 'cell value' 'equal to' "#". Format with 'custom format.' This allows you to choose a cell fill, text color, etc.

Habitat Characterization

Mangrove	Degraded Mangrove	Coral	Degraded Coral	Seagrass	Sandy Bottom	Mudflats/ Estuaries	Open Ocean/ Channel	Mariculture	Rocky Shoreline	Land	Other
1	2	3	4	5	6	7	8	9	10	11	12

System Scale (meters)	
Length (Distance from 1-10)	1000
Height (Distance from A-J)	1000
Square meters	1000000
Hectares	100.00



**Troubleshooting Note:**

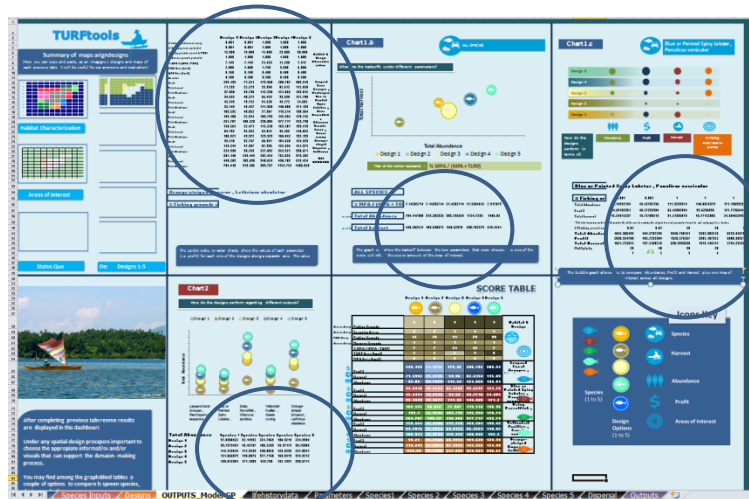
There are quirks in the conditional formatting commands that may cause colors not to change, particularly in the Habitat Characterization tab. By copy/pasting or dragging cell values, proper conditional formatting should restore. Once again, whether the colors update correctly does not affect the functionality of the model.

**How to find the values with which the charts were built**

If future versions of the tool require an improvement, or a change to charts, the values are hidden in the dashboard using two key methods:

- 1.- In the SCORE TABLE, we select the numbers below the brown area and we did the following:
  - a) Right-click on the mouse
  - b) Select "Format cells..."
  - c) In the "Number" tab select: CUSTOM
  - d) Under TYPE, there is a box where you need to enter: ;;; (This makes the numbers invisible)

- 2.- In all the other tables, numbers simply match the background color. You can make them appear by highlighting the cells and selecting a darker color.



Circles show the location of the tables that feed the charts. The SCORE TABLE is linked to the values of the first table (next to the summary of maps and designs)

## Appendix 2: Preparing the Model for Use in the Field

In order to facilitate efficient, user-friendly experience with TURFtools in a field setting- particularly when the model user is less familiar with modeling and/or Excel- it is important that the model be prepped appropriately. TURFtools should be provided to a site for use in the design process only after completing the following steps:

1. Reset Habitat and Areas of Interest maps on their respective tabs. This includes deciding on a primary list of 12 habitat opens and 3 Areas of Interest (from the drop-down menu list). We recommend choosing the habitat and area of interest most commonly seen (such as open oceans habitat and fishing grounds area of interest).
2. Prep Species Inputs
  - a. Check Life History Database (LifeHistoryData tab) and make sure the species lists are relevant, in an appropriate sorting order, and the associated data looks accurate. Update as needed and possible with local data.
  - b. Check that all data validation lists (dropdown menus) are working correctly (see Appendix (1)).
  - c. Change species data validation lists to refer to whichever name type best suits the locale (i.e. common name, species name, family name, etc).
    - i. Be sure to sort the species list database appropriately first because it will appear in the dropdown menu in the same order it appears in the database.
    - ii. To combine cell contents into a single column, use “=A1&”, "&B1” function format.
  - d. Set all species to ‘not present’ (drop down menu row 4) and habitat use as ‘not present’ (rows 22-33).
3. Prep Design Tab with Status Quo
  - a. Make the design grid set to all open access and run once as status quo to clear the model baseline
4. Check Parameters Tab
  - a. Ensure that N/A does not appear in any parameter.
  - b. Change all TURF polices to 0.2. (The exact value does not matter, but Solver tends to work better when beginning with a moderate value for the fishing policy).