

# The SPatial Analysis and Resource Characterization (SPARC) Tool

## Instruction Manual

### Overview

The SPatial Analysis and Resource Characterization (SPARC) tool was developed by NOAA's Biogeography Branch and the Marine Protected Areas Center. The tool is part of a larger partnership between the two groups to develop integrated products that meet the goals of both the national coastal and marine spatial planning (CMSP) initiative, and continued development of the National System of Marine Protected Areas.

SPARC was built to assimilate spatial data, including newly compiled management and resource information from the MPA inventory, and provide a comprehensive analysis of resources protected within and outside MPA boundaries. Its focus is regional, on the identification of ecologically important areas, on resource characterization, and to be able to better characterize MPAs.

Note: The current version of the tool was developed for evaluation and to be used internally only by the MPA Center and NCCOS staff. It is expected that users are already familiar with the tool and datasets.

Note: The tool was built and is being evaluated using datasets in California, but is able to accept data and boundaries from anywhere. The tool can handle datasets collected at various spatial scales and spatial extents, and in point or polygon formats.

This instruction manual identifies how to install and use the tool.

## Installation

The Spatial Analysis and Resource Characterization (SPARC) Tool is an ArcMap Add-In. Install the Add-In by copying the file MPA\_SPARC.esriAddIn to the “My Documents\ArcGIS\AddIns\Desktop10.0” folder.

See

[http://help.arcgis.com/en/sdk/10.0/arcobjects\\_net/conceptualhelp/index.html#/Sharing\\_add\\_ins/0001000009tm000000/](http://help.arcgis.com/en/sdk/10.0/arcobjects_net/conceptualhelp/index.html#/Sharing_add_ins/0001000009tm000000/) for more information about add-ins and distributing add-ins within a private network. Information about the add-in can be found by clicking on Customize|Add-in Manager.

Add the MPA SPARC toolbar to ArcMap by clicking on Customize|Toolbars and checking MPA SPARC.

## Requirements

SPARC was built for ArcMAP version 10. Two files are required for SPARC to work. A polygon layer with MPA boundary shapes is needed to identify the location, shape and size of MPAs in analysis. A lookup table (LUT) is needed to identify datasets (points or polygons) used as resources in analysis.

The base data polygon dataset is required to contain three text fields:

- “SITE\_NAME” – the name of the MPA
- “GOV\_LEVEL” – the jurisdictional authority
- “SITE\_ID” – the ID of the MPA

The lookup table contains the list of spatial resource data layers that will be used in analysis. The lookup table requires six fields:

- “Name” – the name (but not the path) of the dataset (“seamounts.shp”)
- “Location” – the path where the dataset is stored (“C:\MPA\_Data\GIS\analysis layers”)
- “Alias” – a user friendly name of the dataset (“Seamounts and Banks”)
- “Contents” – a longer description of the dataset (“Derived benthic features from ETOPO-1 and 200m bathymetry surfaces”)
- “Extent” – a description of the spatial coverage (“Offshore depths on West Coast”)
- “Type” – the geometry of the dataset (“Polygon”)

## SPARC Toolbar

The SPARC toolbar (Figure 1) is the primary interface between normal ArcMap operations and SPARC.



Figure 1: MPA SPARC Toolbar

This toolbar contains three tools: Analyze, Settings, and LUT Editor. The first time SPARC is started, the Analyze tool will be disabled until the Settings tool is run and the Base Data, the Resource Lookup Table, and the Output Data locations are set. These locations are saved to the computer's registry, so the Settings tool only needs to be run again if the locations change.

## Settings Tool

The Settings tool (Figure 2) is used to set the framework for analysis by storing the location of important files used by SPARC.

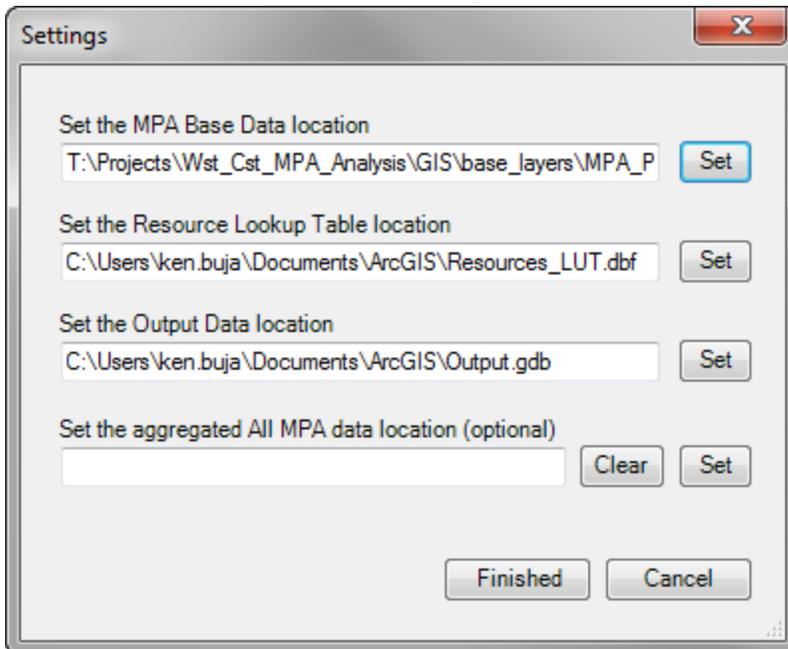


Figure 2: Settings Tool

The tool saves the Base Data, the Resource Lookup Table, the Output Data, and (optionally) the aggregated MPA features locations to the computer's registry. Since SPARC reads the registry settings on subsequent runs, this tool only needs to be run again if the locations change. The text boxes for each of the locations are not editable and can be changed only by clicking on the "Set" buttons. Once all three locations are set, the "Finished" button will activate and, when clicked, saves the locations to the registry.

The aggregated MPA data set is a feature class containing a single polygon representing a footprint of all the MPA features. If the location is left empty, it will automatically be filled using the Output Data location during the Analysis process if the "Compare with all MPAs" option is selected. If the MPA Base Data data set is edited (features added, changed, or removed), click the "Clear" button to create a new All MPA data set.

## LUT Editor

The LUT Editor (Figure 3) is used to locate resource layer datasets and modify dataset metadata used in spatial analysis.

To add, remove, or change the location of any of the resource layers in the lookup table, open the LUT Editor. Each individual resource layer can be edited or removed. The Alias, Information, and Extent fields in the data grid can be edited by typing in the row's cell, while the "Type" field is automatically populated. The Dataset field can be changed by using the "Edit Path" button at the right end of the row (see Figure 4). The "Remove" button deletes the dataset from the lookup table.

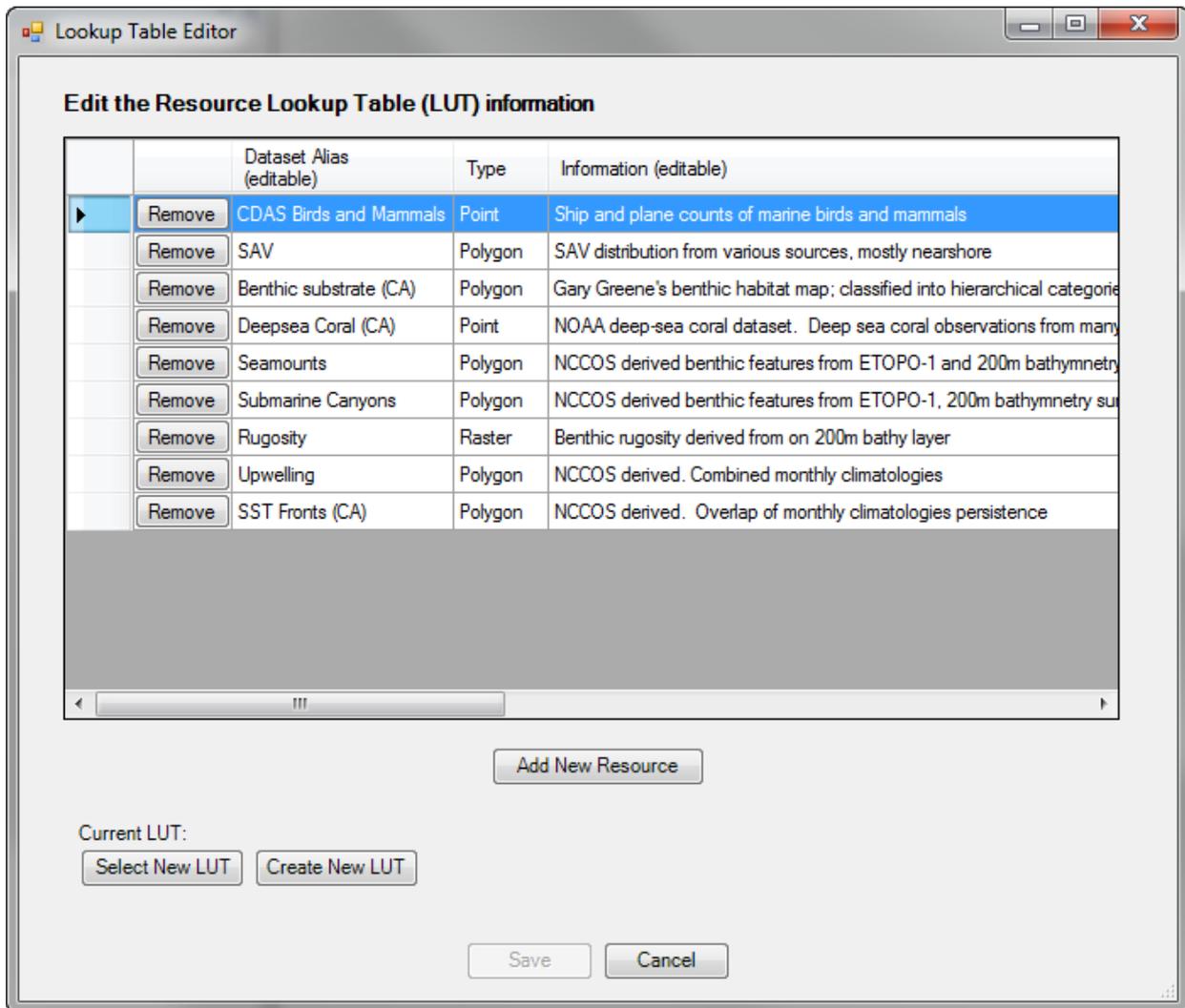


Figure 3: Lookup Table Editor

The "Add New Resource" button opens the Add Data dialog where multiple datasets can be added. The Dataset Name and Type fields will be automatically populated. The Dataset Alias field will be automatically populated with the dataset's name, which can be changed to a more descriptive name. The Information and Extent fields must be manually added.

The “Select New LUT” button opens a different lookup table and populates the data grid with the information from that table.

The “Create New LUT” button will create a new look up table that contains the six required fields and clears the data grid.

The “Save” button will write the information to the LUT and change the location in the registry, if necessary. The Cancel button discards any of the changes made in the table and the original lookup table is retained.

If the locations of all of the resource files are changed, it may be easier to edit the table in ArcMap, using the Field Calculator to change many rows at once.

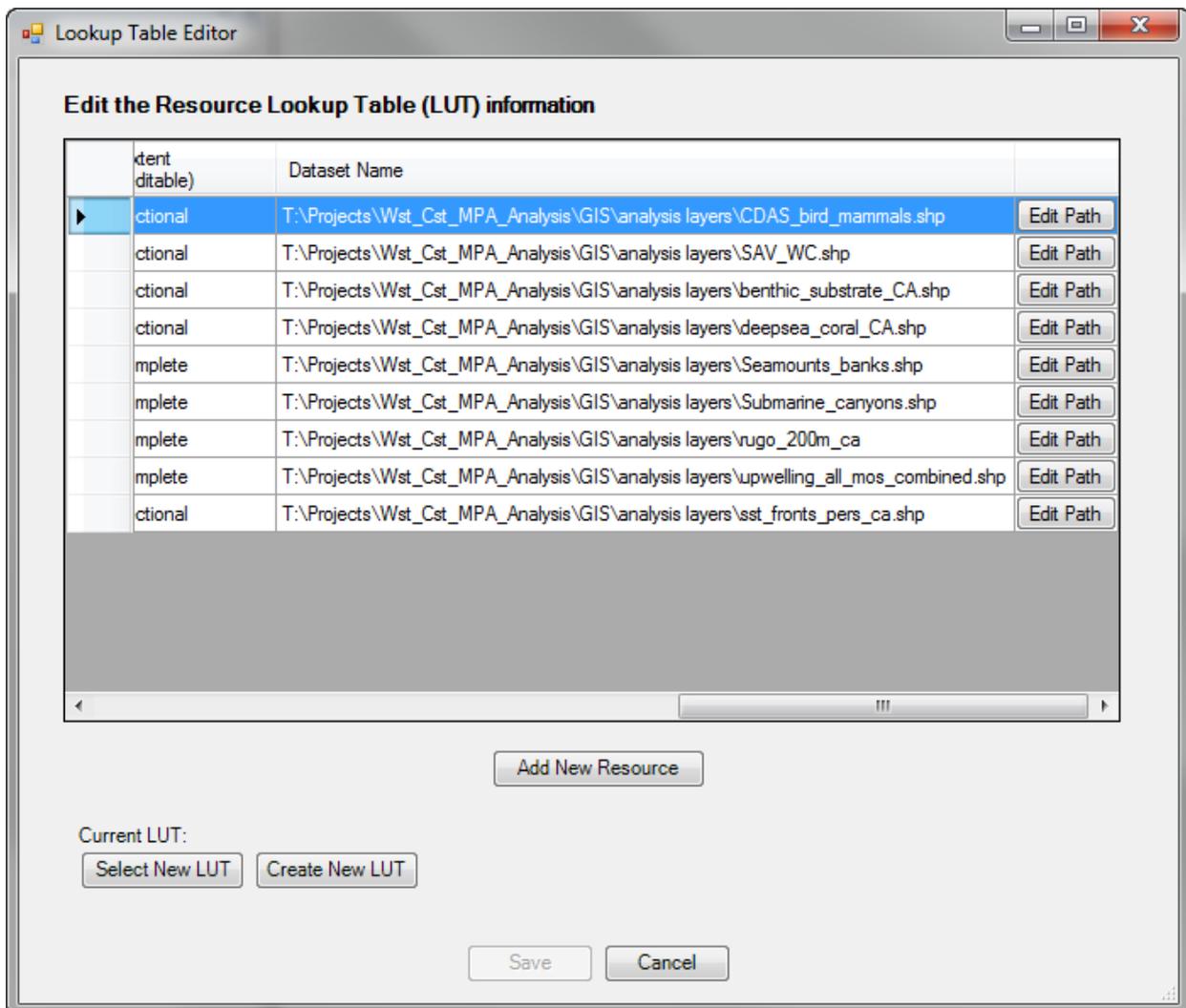


Figure 4: Lookup Table Editor (right side)

## Analyze Tool

The Analyze Tool is used to identify the area of interest (AOI), identify resources of interest and calculate the area of resources inside the AOI and to make comparisons among different AOIs.

### Select the Area of Interest

The first page of the Analyze tool is where the area of interest (AOI) is set (Figure 5).

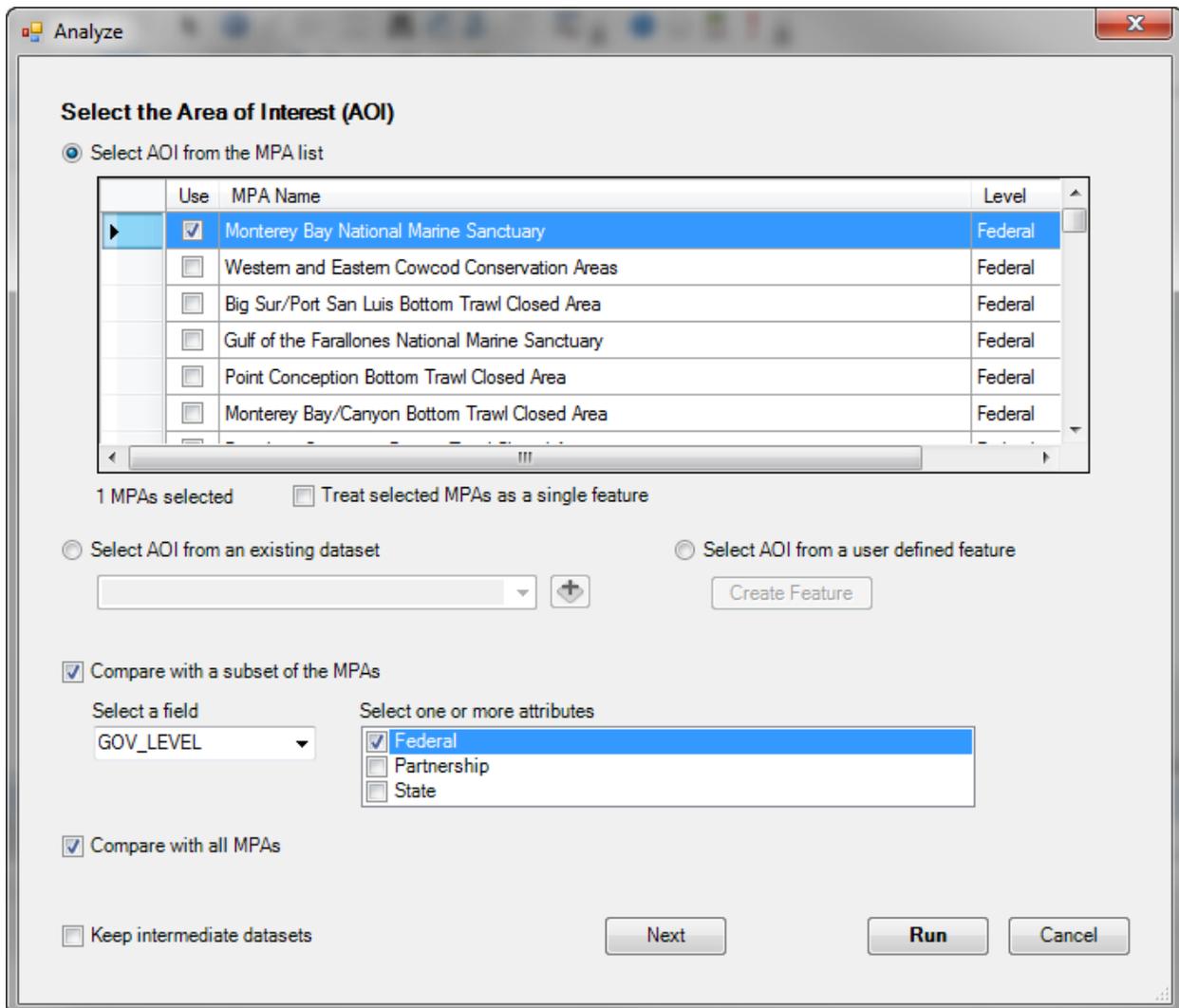


Figure 5: Analyze Tool - Selecting the area of interest

The AOI can be set by using three different methods:

1. The AOI can be set by selecting one or more of the MPAs listed in the data grid. Check off the MPAs individually or click on the “Use” column to select or unselect all MPAs. Clicking on the other columns will sort the columns alphabetically or numerically. Each MPA will be analyzed separately with the selected resources. If the “Treat selected MPAs as a single feature” option is selected, the selected MPAs will be merged into a single polygon for analysis.

2. The AOI can be set from an existing polygon dataset. Each of the individual polygons in the selected dataset will be analyzed with the selected resources.
3. The AOI can be selected from a user defined feature. Click the “Create Feature” button and select the type of feature to draw: a point, a buffered point, a polygon, or a rectangle. (*not currently available*)

#### Comparing resources among different AOIs

In addition to analyzing the resources for a single AOI, the resources can be analyzed and compared with a larger grouping of the MPAs, such as all of the MPAs under Federal jurisdiction. Select the “Compare with a subset of the MPAs” option and select a field containing the attributes of the grouping. Select one or more of the attributes. The polygons with the selected attributes will be merged into a single polygon and analyzed with the selected resources.

Select the “Compare with all MPAs” option to analyze the selected resources with all of the MPA polygons merged into a single polygon.

If the “Keep intermediate datasets” option is selected, the data set created during analysis will be saved to the Output Data location. The process may overwrite data sets created in previous runs currently in that location. Otherwise, the intermediate data sets will be saved to a temporary directory that will be deleted when ArcMap is closed.

Click the “Next” button to proceed to the next page.

## Select the Resource

The second page of the Analyze tool is where the resource layers are selected for inclusion in the analysis (Figure 6).

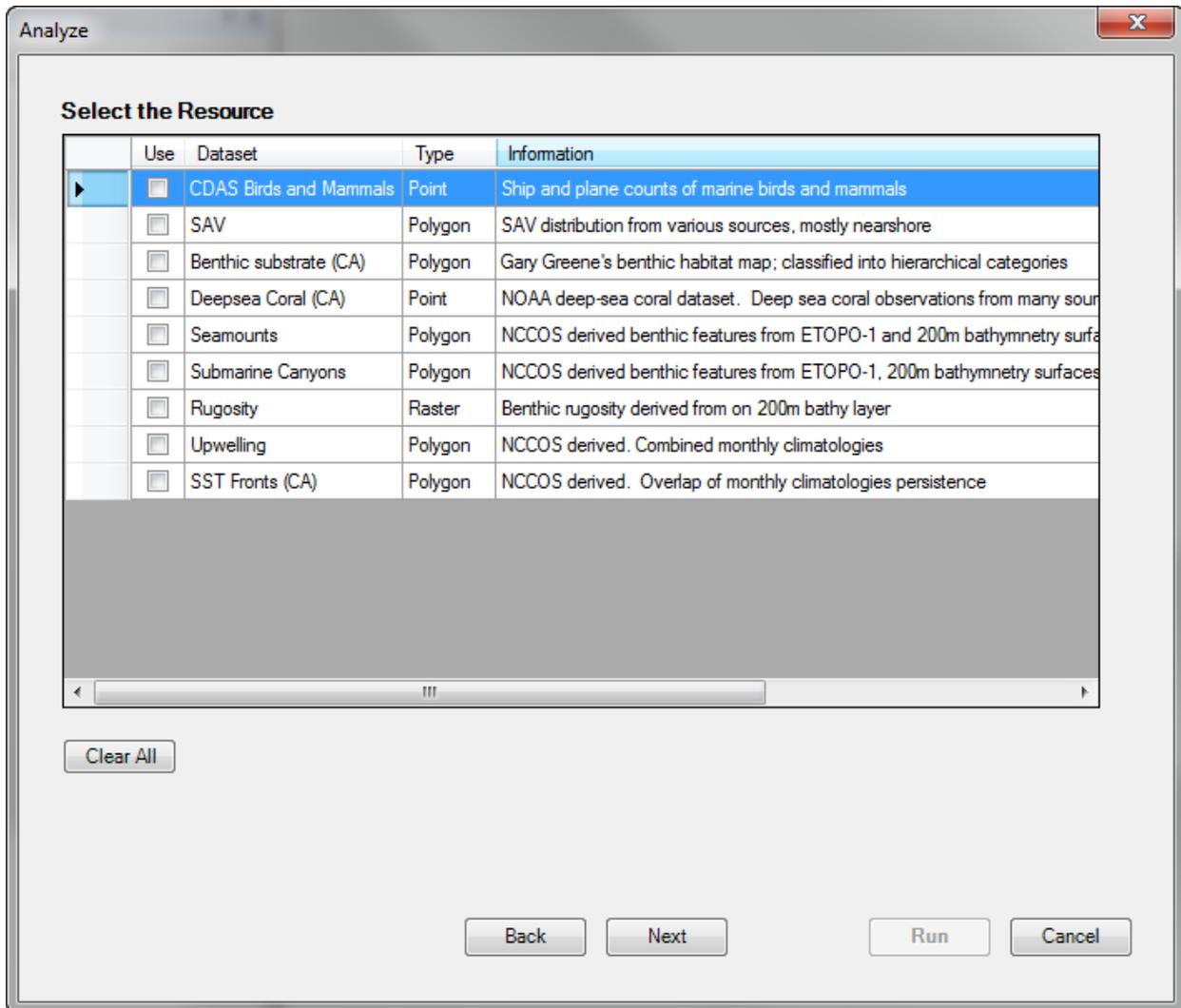


Figure 6: Analysis Tool - Selecting the resources

When a resource is selected for use, the tool first verifies that the dataset is valid. If the name or path in the resource lookup table is incorrect or the dataset is invalid, an error message will appear. If valid, the resource will be added to the data grid on the next page (Figure 7). If the resource is unchecked, it will be removed from the next page.

Although the Run button will be activated when at least one resource is selected, click "Next" to open the next page to set the analysis type and extent.

### Select the Analysis Type and Extent

The third page of the Analyze tool is where the resources are selected to be included in the analysis (Figure 6).

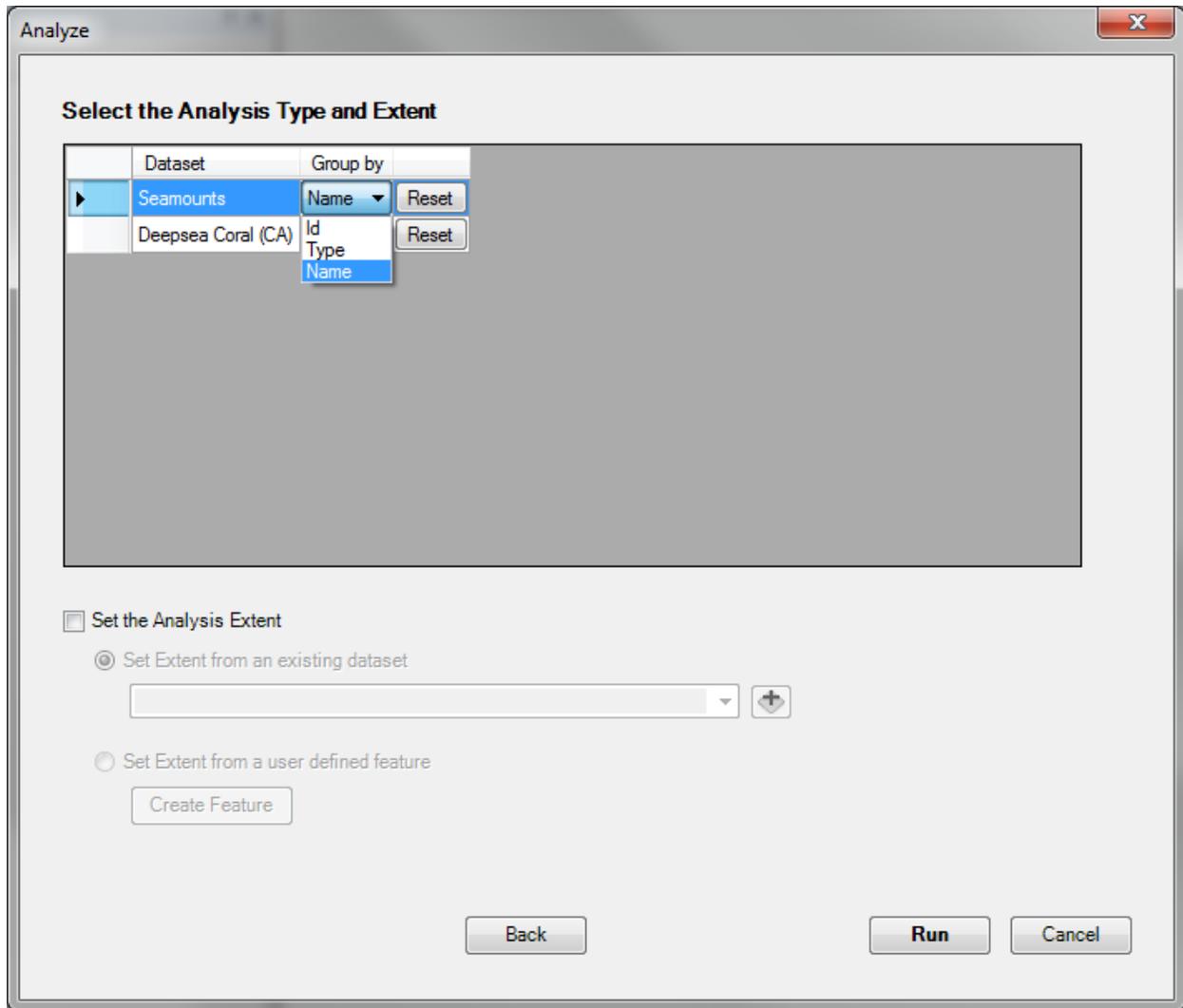


Figure 7: Analysis Tool - Selecting the analysis type and extent

Each resource selected in the preceding will be added to the data grid on this page. The “Group By” column lists the fields in the dataset. If no fields are selected and the resource is a polygon dataset, the resource will be aggregated (i.e. dissolved) into a single polygon. If a field is selected, the resource will be aggregated (i.e. stratified) by the attributes of that field. To clear the field selection, click the “Reset” button.

Select the “Set the Analysis Extent” option to constrain the analysis area. Without an analysis extent SPARC will analyze resources within the combined footprints of the AOI and each individual resource layer. If an analysis extent is selected, the AOI and the resources will be clipped to this extent and the analyses will be run with these clipped features, not the entire dataset. The extent can be set to an

existing dataset or a user defined polygon (*not currently available*), such as a buffered point, a polygon, or a rectangle.

For example, use the “Set the Analysis Extent” option when only areas within state jurisdiction are of interest. By setting the analysis extent to a polygon representing only a 3nm buffer of the shoreline, only MPAs and resources within the buffer will be analyzed.

Clicking the “Run” button will start the analysis. While the analysis is running, a message on the bottom of the window will show what process is currently happening. The analysis will loop over each resource data set, and for each resource, there will be a process for each AOI selected. When finished, the Results window will open.

## Results

The results window contains a data grid that lists every AOI and the area or point count of each resource chosen (Figure 8). In addition to the AOI name and the resource name, the grid contains the following columns:

“AOI Area” – the area of the AOI in the spatial units of the resource

“Units” – the spatial units of the resource

“Grouping attribute” – the “Group By” resource attributes selected in the Analysis tool with the following exceptions

- “Resource Summary” - the “Group By” field is empty or a summary of all the attributes (**blue**)
- “Resource No Data” – the area of the polygonal resources that are outside of resource polygon extent (**red**)

“Resource Type” – the geometry type of the resource

“Resource Inside AOI” – the total area in the spatial units of the resource (for polygons) or the number of points for the attribute of the resource that falls inside the AOI

“Resource Total” – the total area in the spatial units of the resource (for polygons) or the number of points of the resource

Area of Interest (AOI)	AOI Area	Units	Resource	Grouping Attribute	Resource Type	Resource Inside AOI	Resource Total	Units
Monterey Bay National Marine Sanctuary	1.38813	deg <sup>2</sup>	Deepsea Coral (CA)	Resource Summary	Point	144	1,913	
Gulf of the Farallones National Marine Sanctuary	0.33951	deg <sup>2</sup>	Deepsea Coral (CA)	Resource Summary	Point	27	1,913	
Monterey Bay National Marine Sanctuary	1.38813	deg <sup>2</sup>	Seamounts	Bank	Polygon	0	0.29048	deg <sup>2</sup>
Monterey Bay National Marine Sanctuary	1.38813	deg <sup>2</sup>	Seamounts	Mound	Polygon	0.00588	1.02631	deg <sup>2</sup>
Monterey Bay National Marine Sanctuary	1.38813	deg <sup>2</sup>	Seamounts	Ridge	Polygon	0	0.52797	deg <sup>2</sup>
Monterey Bay National Marine Sanctuary	1.38813	deg <sup>2</sup>	Seamounts	Seamount	Polygon	0	0.92602	deg <sup>2</sup>
Monterey Bay National Marine Sanctuary	1.38813	deg <sup>2</sup>	Seamounts	Resource Summary	Polygon	0.00588	2.77079	deg <sup>2</sup>
Monterey Bay National Marine Sanctuary	1.38813	deg <sup>2</sup>	Seamounts	Resource No Data	Polygon	1.38225	2.77079	deg <sup>2</sup>
Gulf of the Farallones National Marine Sanctuary	0.33951	deg <sup>2</sup>	Seamounts	Bank	Polygon	0.00031	0.29048	deg <sup>2</sup>
Gulf of the Farallones National Marine Sanctuary	0.33951	deg <sup>2</sup>	Seamounts	Mound	Polygon	0	1.02631	deg <sup>2</sup>
Gulf of the Farallones National Marine Sanctuary	0.33951	deg <sup>2</sup>	Seamounts	Ridge	Polygon	0	0.52797	deg <sup>2</sup>
Gulf of the Farallones National Marine Sanctuary	0.33951	deg <sup>2</sup>	Seamounts	Seamount	Polygon	0	0.92602	deg <sup>2</sup>

Show Numeric Values     Show Percentages  
 Export    Report    Map  
 Close

Figure 8: Results - Numeric Values

If the option “Compare with a subset of the MPAs” was selected, an additional column will be added:

“Resource Inside MPA Subset” – the total area in the spatial units of the resource (for polygons) or the number of points for the attribute of the resource that falls inside the MPA subset

If the option “Compare with all MPAs” was selected, an additional column will be added:

“Resource Inside All MPAs” – the total area in the spatial units of the resource (for polygons) or the number of points for the attribute of the resource that falls inside all of the MPA polygons.

If the “Show Percentages” option is selected (Figure 9), each of the “Resource Inside” columns will show the percentage of the resource total (either area or point count) that is inside the AOI. The exception to this is for the “Resource No Data” rows, which shows the percentage of the AOI that is not covered by the resource polygons.

Area of Interest (AOI)	AOI Area	Units	Resource	Grouping Attribute	Resource Type	Resource Inside AOI	Resource Total	Units
Monterey Bay National Marine Sanctuary	1.38813	deg <sup>2</sup>	Deepsea Coral (CA)	Resource Summary	Point	7.53%	1,913	
Gulf of the Farallones National Marine Sanctuary	0.33951	deg <sup>2</sup>	Deepsea Coral (CA)	Resource Summary	Point	1.41%	1,913	
Monterey Bay National Marine Sanctuary	1.38813	deg <sup>2</sup>	Seamounts	Bank	Polygon	0	0.29048	deg <sup>2</sup>
Monterey Bay National Marine Sanctuary	1.38813	deg <sup>2</sup>	Seamounts	Mound	Polygon	0.57%	1.02631	deg <sup>2</sup>
Monterey Bay National Marine Sanctuary	1.38813	deg <sup>2</sup>	Seamounts	Ridge	Polygon	0	0.52797	deg <sup>2</sup>
Monterey Bay National Marine Sanctuary	1.38813	deg <sup>2</sup>	Seamounts	Seamount	Polygon	0	0.92602	deg <sup>2</sup>
Monterey Bay National Marine Sanctuary	1.38813	deg <sup>2</sup>	Seamounts	Resource Summary	Polygon	0.42%	2.77079	deg <sup>2</sup>
Monterey Bay National Marine Sanctuary	1.38813	deg <sup>2</sup>	Seamounts	Resource No Data	Polygon	99.58%	2.77079	deg <sup>2</sup>
Gulf of the Farallones National Marine Sanctuary	0.33951	deg <sup>2</sup>	Seamounts	Bank	Polygon	0.11%	0.29048	deg <sup>2</sup>
Gulf of the Farallones National Marine Sanctuary	0.33951	deg <sup>2</sup>	Seamounts	Mound	Polygon	0	1.02631	deg <sup>2</sup>
Gulf of the Farallones National Marine Sanctuary	0.33951	deg <sup>2</sup>	Seamounts	Ridge	Polygon	0	0.52797	deg <sup>2</sup>
Gulf of the Farallones National Marine Sanctuary	0.33951	deg <sup>2</sup>	Seamounts	Seamount	Polygon	0	0.92602	deg <sup>2</sup>

Show Numeric Values     Show Percentages  
 Export    Report    Map  
 Close

Figure 9: Results - Percentages

The “Export” button will export the table to a tab-delimited file that can be imported into Excel.

The “Report” button is not yet available.

The “Map” button is not yet available.

### **Contact Information**

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