Documentation for the NERRS SWMP Annual Reserve-Level Reporting Template

Prepared for:
NOAA and the NERRS Science Collaborative

May 9, 2018

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TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

1 Introduction

The annual reserve-level reporting template is intended to provide all reserves within the National Estuarine Research Reserve System (NERRS) a uniform, yet flexible, template for generating reports that can be used to answer the frequently asked question, "How is my estuary water quality doing?" on an annual basis. This documentation provides a guide on how to use R, Excel, and PowerPoint to generate a reserve-level annual report as a PDF that can be distributed electronically or printed.

There are two sets of automated scripts, written in R, involved in producing an annual reserve-level report. The first set of scripts use reserve-specific System-wide Monitoring Program (SWMP) data to conduct twelve data analyses and produce plots that can then be used in the final reserve report. The analyses are intended to familiarize the user with monitoring results from the year of interest and to provide historical context that allows the user to evaluate whether or not water quality trends are changing over time. The second set of scripts are used to populate a pre-formatted, empty PowerPoint template with reserve-specific plots, text, and imagery. The plotting scripts produce many more analysis results and plots than could be reasonably included in a single report. However, by producing a large number of plots, each reserve can select parameters that are of particular interest to their stakeholders, while keeping the overarching theme of the report consistent in tone and style across reserves.

Both the plots and the reserve-level template are highly customizable. To limit user interaction with the R programming language, and ease the report generation process, two Excel templates have been included to help users set reserve-specific settings: 1. Reserve_Level_Plotting_Variables.xlsx and 2. Reserve_Level_Template_Text_Entry.xlsx. Instead of having the user modify the R scripts directly, the user can simply update these two templates from year to year and re-run the plot and report generation scripts.

This documentation outlines all of the steps necessary to generate reserve-specific plots, create an unformatted (raw) reserve-level template, and format the raw template into a final reserve-level report suitable for distribution. It also provides reference information that users may find helpful, including:

- Descriptions of all files within a reserve-level report folder
- Methodologies for each type of data analysis
- Detailed information on working with Reserve_Level_Plotting_Variables.xlsx and Reserve_Level_Template_Text_Entry.xlsx

2 Quick Start Guides,Workflow Diagrams and System Requirements

The quick start guides and workflow diagrams are intended to give the user a brief introduction to and overview of the steps necessary to create a reserve-level annual report. This section includes two "quick start" guides that outline the minimum number of steps the user must take to create a reserve-level report. Two workflow diagrams that outline the relationships between the automated scripts are included, and a brief summary of system requirements is also provided.

2.1 Quick Start Guides

There are two major tasks associated with generating an annual reserve-level report: 1. producing reserve-specific figures and 2. generating a raw reserve-level report. There are two quick start guides that break these two tasks down into sub-steps:

- Generating reserve-level plots
- Generating a raw reserve-level report

2.1.1 Generating Reserve-Level Plots

1. Populate reserve-specific variables and settings in Reserve_Level_Plotting_Variables.xlsx (Figure 1). Additional details on modifying this file can be found in section 5.

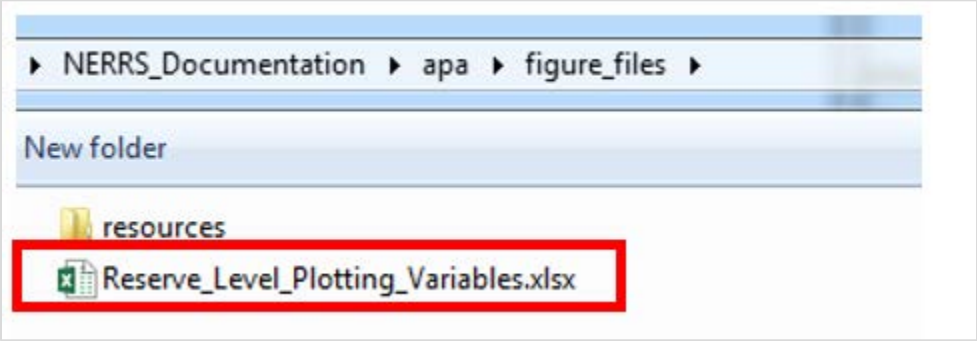


Figure 1. Screenshot of the Reserve-Level_Plotting_Variables.xlsx File within the Apalachicola Bay Folder

2. Put reserve-specific data into the data folder (Figure 2).

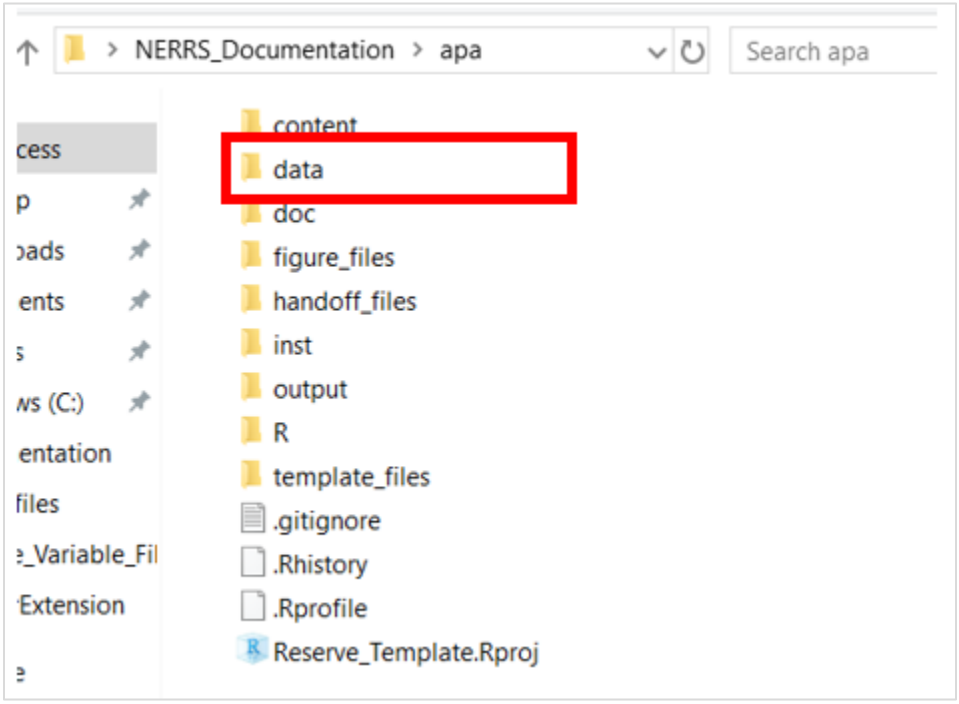


Figure 2. Screenshot of the data Subfolder within the Apalachicola Bay Folder

3. Double click on Reserve_Template.Rproj to launch RStudio (Figure 3).

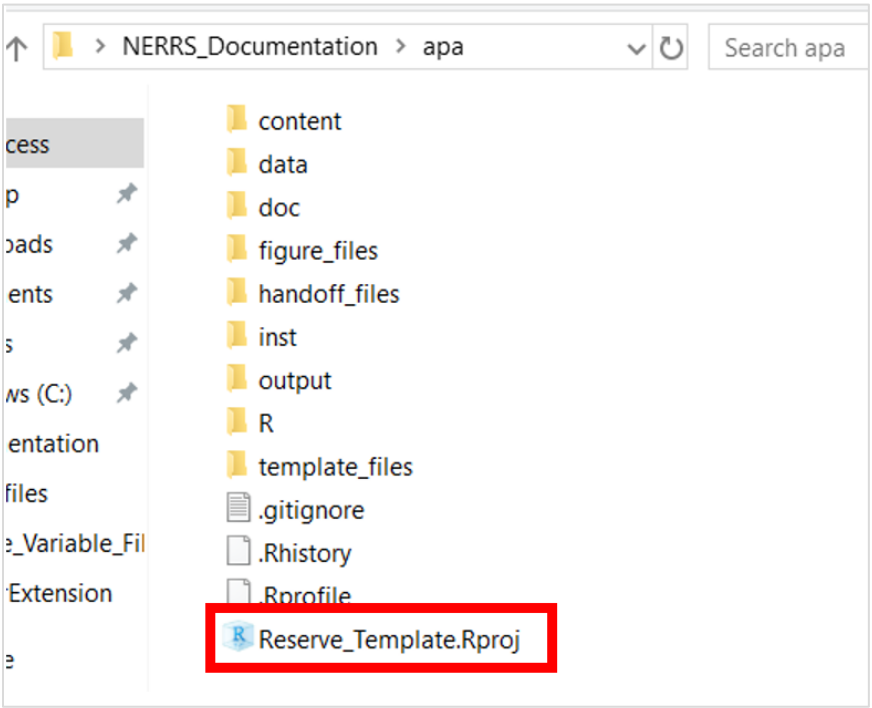


Figure 3. Screenshot of the Reserve_Template.Rproj File within the Apalachicola Bay Folder

4. Open 01_Load_Wrangle_Run.R from the "Files" window (Figure 4).

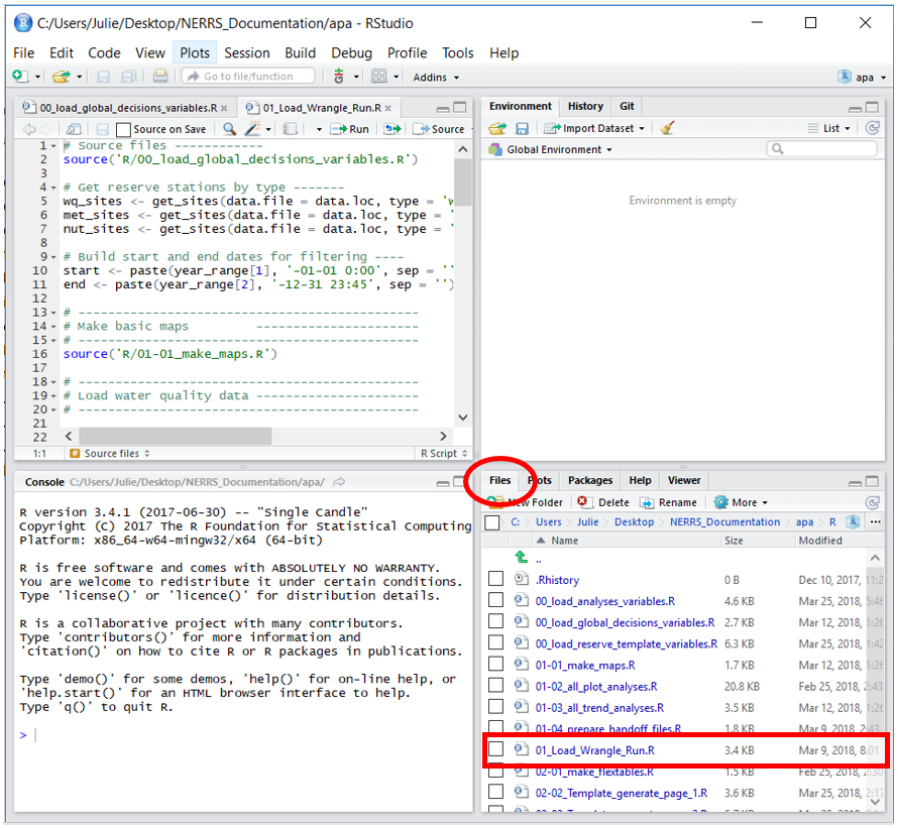


Figure 4. Screenshot of the RStudio User Interface, the Location of the File Window, and the Location of the 01_Load_Wrangle_Run.R Script

5. Select all of the text within the editor window by clicking in the window and then using crtl+a on the keyboard (Figure 5).

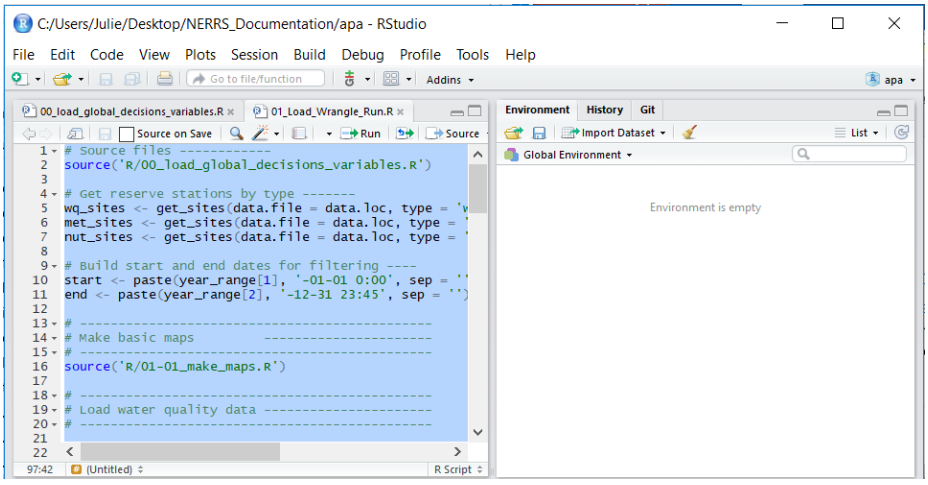


Figure 5. Screenshot of Selected Text in 01_Load_Wrangle_Run.R

6. With all of the text selected, click on “Run” button in the upper right-hand corner of the editor window (Figure 6).

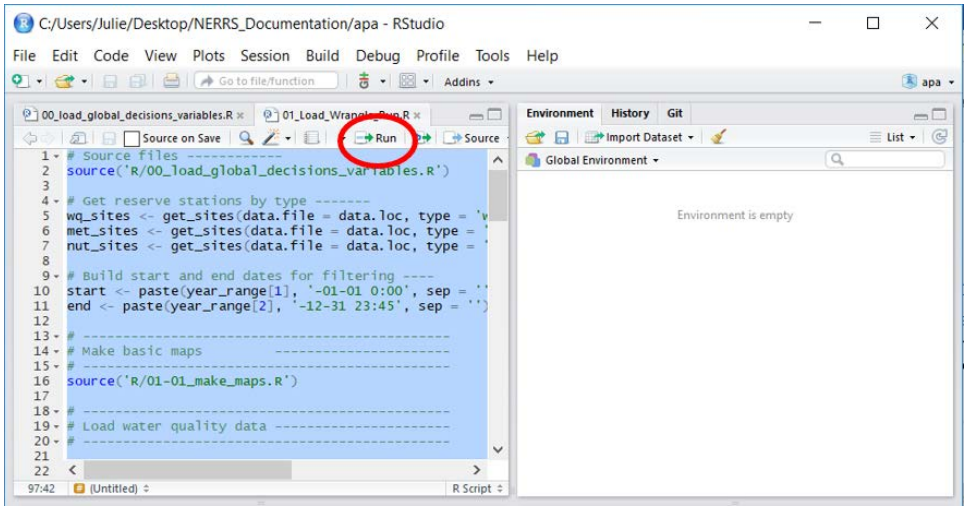


Figure 6. Screenshot of Selected Text in 01_Load_Wrangle_Run. R and the Location of the Run Button in the RStudio Editor Window

7. Verify that figures were produced in the output folder.

2.1.2 Generating a Raw Reserve-Level Report

Generating a raw reserve-level report assumes that all analyses associated with 01_Load_Wrangle_Run.R have been run and there are plots in the output folder.

1. Review plots in the output folder (Figure 7).

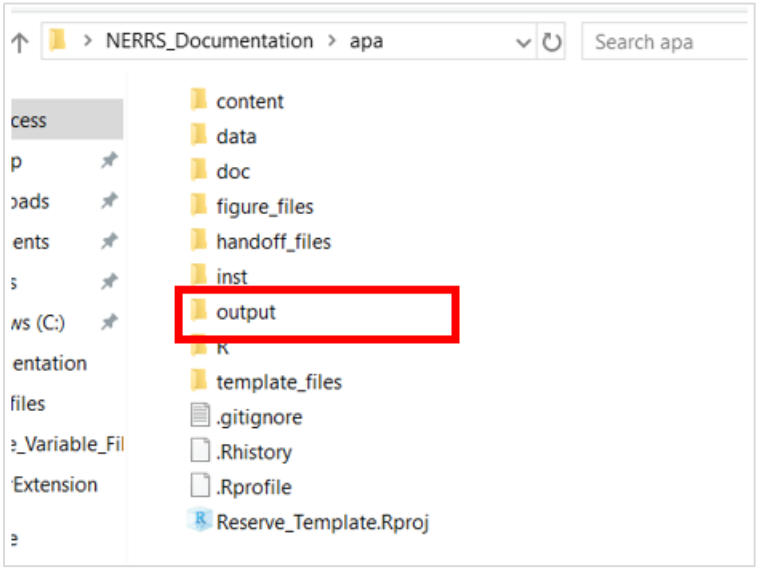


Figure 7. Screenshot of the output Subfolder within the Apalachicola Bay Folder

2. Place images in template_files > output folder (Figure 8).

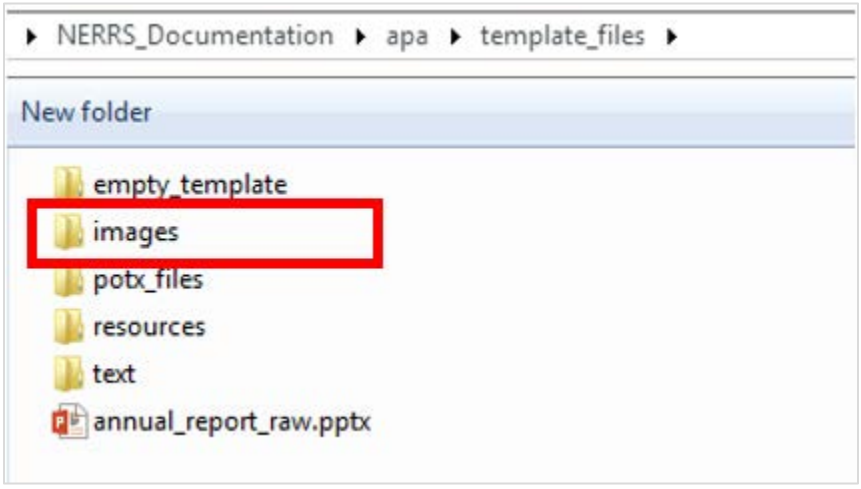


Figure 8. Screenshot of the images Subfolder within the Apalachicola Bay Folder

3. Populate reserve-specific text, images, and R figures in Reserve_Level_Template_Text_Entry.xlsx (Figure 9). Additional details on modifying this file can be found in section 6.

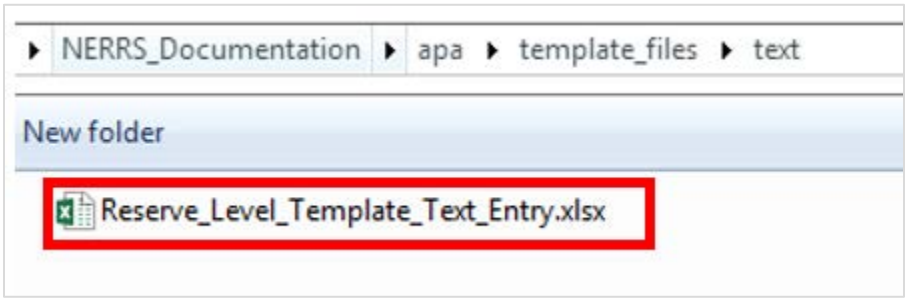


Figure 9. Screenshot of Reserve_Level_Template_Text_Entry.xlsx File for Apalachicola Bay

4. Double click on Reserve_Template.Rproj to launch RStudio (Figure 10).

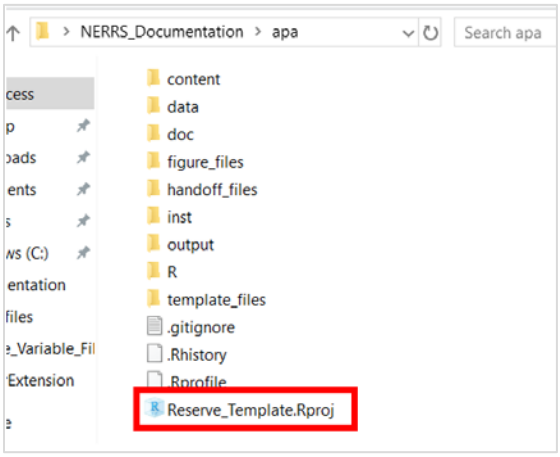


Figure 10. Screenshot of the Reserve_Template.Rproj File within the Apalachicola Bay Folder

5. Open 02_Generate_Reserve_Template.R from the "Files" window (Figure 11).

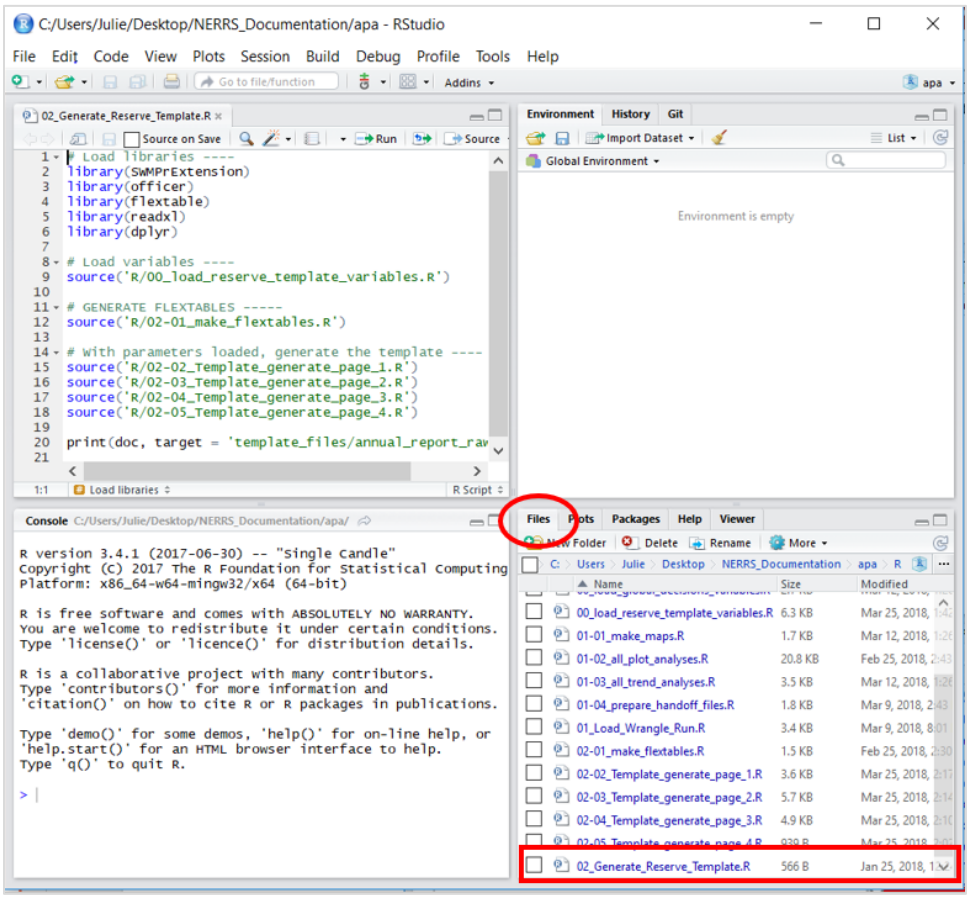


Figure 11. Screenshot of the RStudio User Interface, the Location of the File Window, and the Location of the 02_Generate_Reserve_Template.R Script

6. Select all of the text within the editor window by clicking in the window and then using crtl+a on the keyboard (Figure 12).

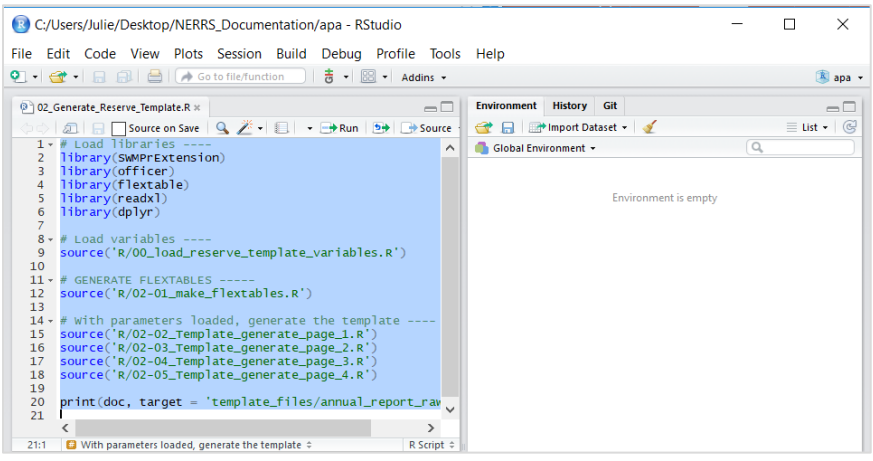


Figure 12. Screenshot of Selected Text in 02_Generate_Reserve_Level_Template. R

7. With all of the text selected, click on the "Run" button in the upper right-hand corner of the editor window (Figure 13).

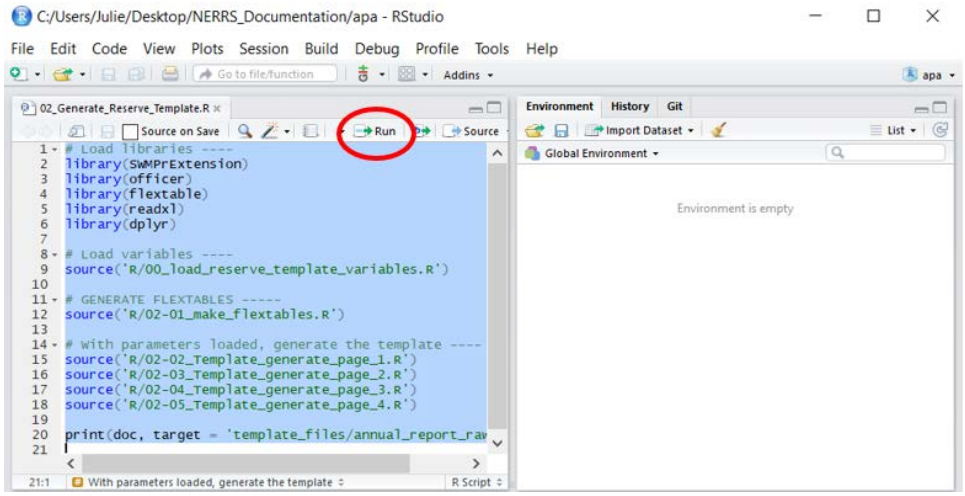


Figure 13. Screenshot of Selected Text in 02_Generate_Reserve_Level_Template. R and the Location of the Run Button in the RStudio Editor Window

8. Verify that a raw reserve-level report was produced (Figure 14).

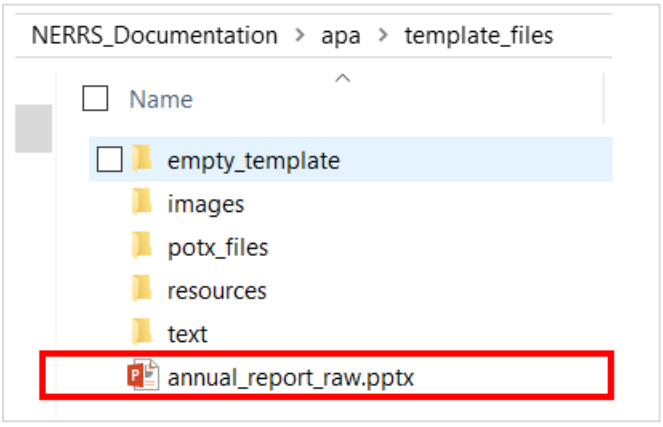


Figure 14. Screenshot of a Raw Reserve-Level Report for Apalachicola Bay

9. Complete manual formatting steps outlined in section 7.

2.2 Workflow Diagrams

There are two separate workflows that must be implemented to produce a raw reserve-level report: the plot generation workflow and the template generation workflow. The plot generation workflow produces all figures and conducts all analyses outlined in section 3. Due to the volume of plots that are created, producing plots can be time consuming from a computational standpoint (> 30 min). The user

only needs to run this workflow if they wish to modify input variables to produce plots different from the ones provided by the Centralized Data Management Office (CDMO). The template generation workflow depends on the results from the plot generation workflow. As part of executing the report generation workflow, the user must review the plots produced by the plot generation workflow, and then produce text that appropriately describes the results of the analyses. Producing the raw reserve-level report is much less time consuming than producing the plots (< 1 min). After executing both workflows, the user can then format the raw reserve-level report into the final reserve-level report by using the formatting steps outlined in section 7.

The workflow diagrams are intended to help the user understand the relationships between the two user Excel templates (Reserve_Level_Plotting_Variables.xlsx and Reserve_Level_Template_Text_Entry.xlsx), R scripts, the data plots that are produced, and the raw reserve-level report that is populated with these data plots. Each workflow contains four different types of colored shapes (Figure 15):

- The red rectangle—steps that require a user action.
- The blue oval—automated loading of variables.
- The blue rectangle—an analysis and the generation of a plot.
- The green rectangle—production of an output (i.e., a plot or a summary table).

Figure 15. The Four Types of Unique Actions with the Plot Generation and Template Generation Workflows

Two versions of the workflow are provided (Figures 16 and 17): one version describes each step in user-friendly terms (narrative-based workflow) and one highlights the files and R scripts used at each step of the process (script-based workflow).

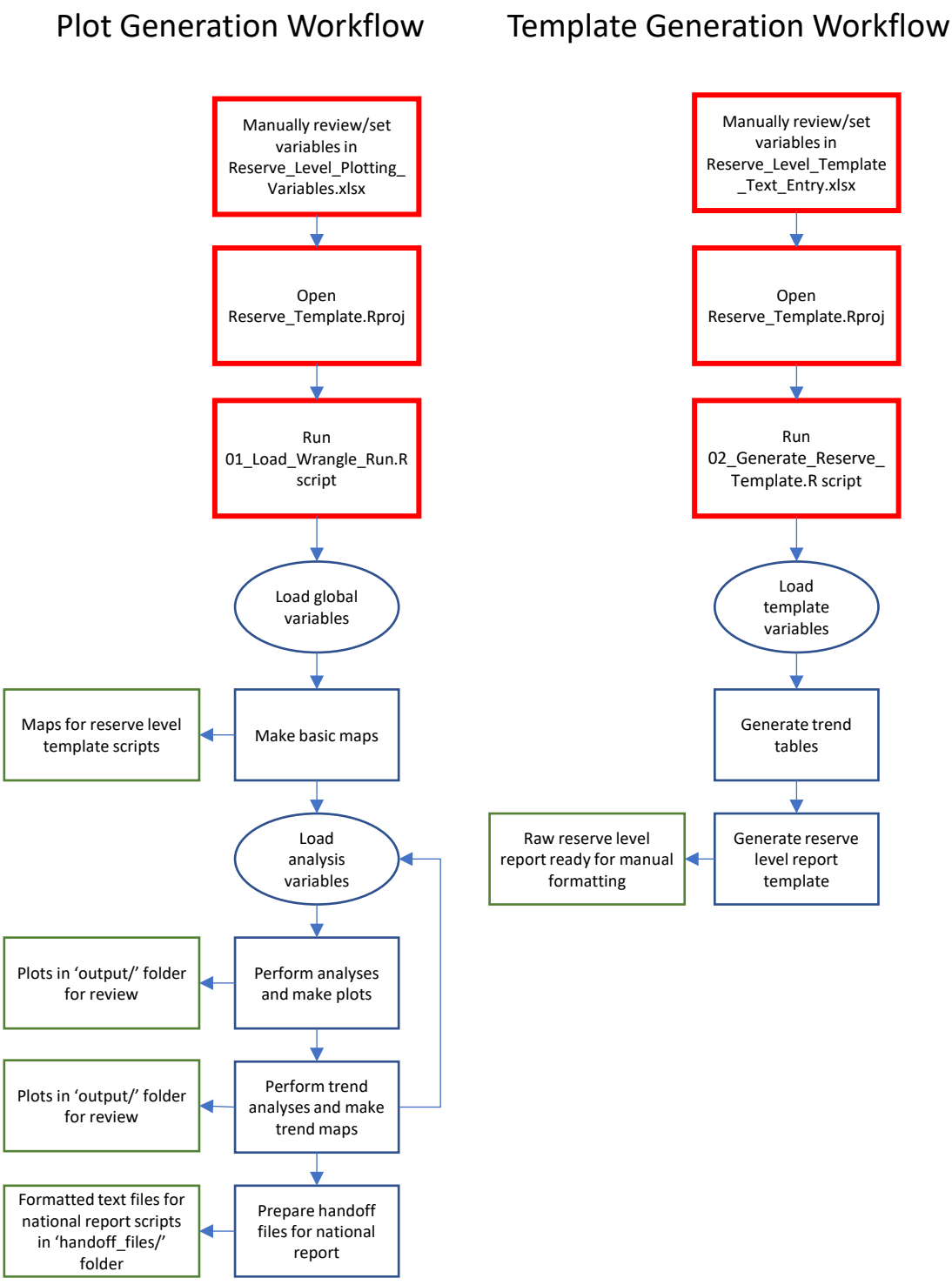


Figure 16. Narrative Workflow for the NERRS SWMP Annual Reserve-Level Reporting Template Scripts

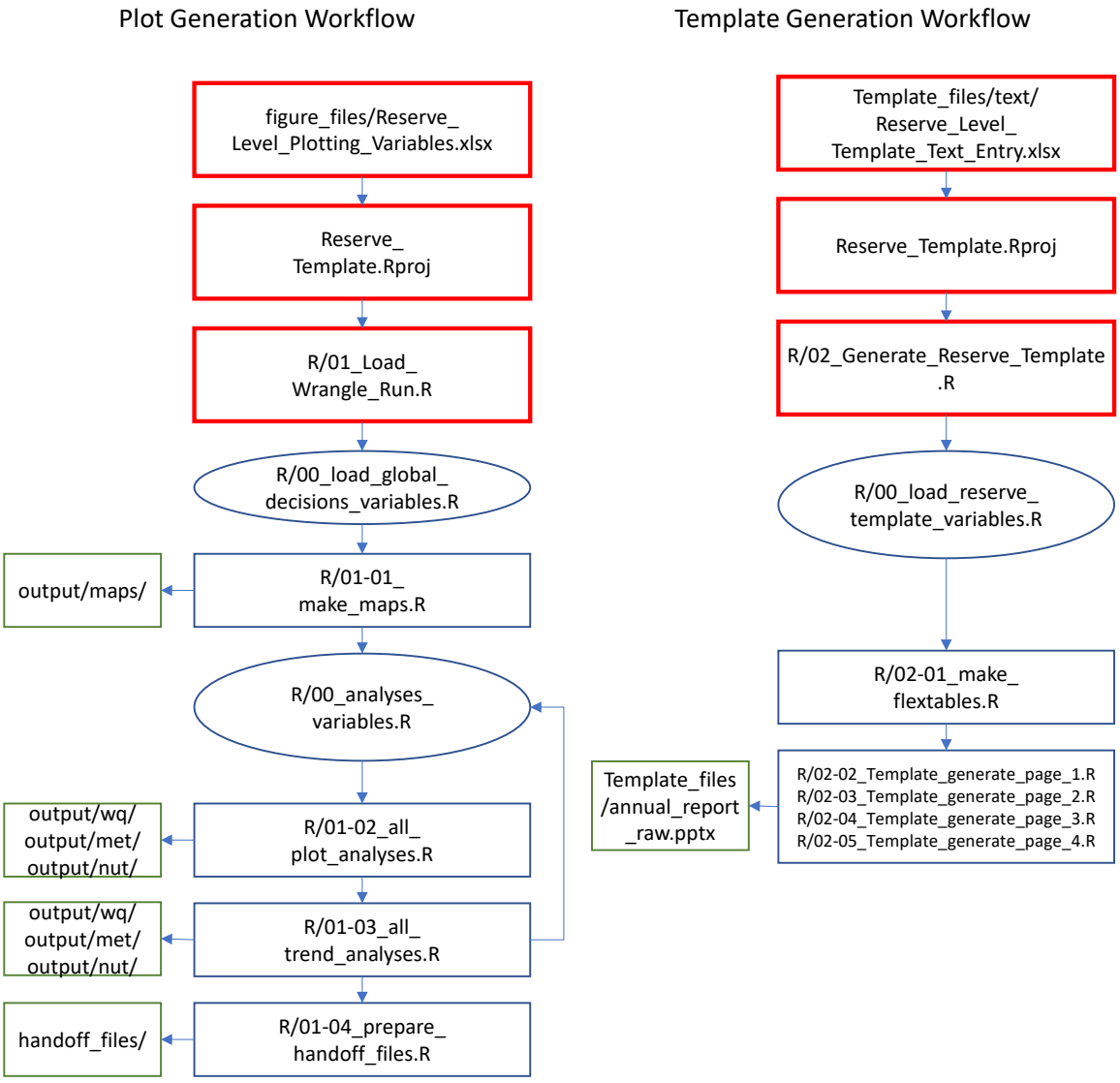


Figure 17. Script-Based Workflow for the NERRS SWMP Annual Reserve-Level Reporting Template Scripts

2.3 System Requirements

To run the NERRS SWMP Reporting Scripts the user must have R and R studio as well as several additional R packages. After installing R and RStudio, the user can automatically install all necessary R packages by running the "00_initial_installation.R" script located in the R folder. The system requirements are outlined below.

Computer

- Windows
- Mac OSX

Microsoft Office

- 2007 and greater

Note: Microsoft office is not required to successfully run the reserve-level scripts, but it is recommended.

R

- R 3.4.1 or greater
- Rstudio 1.0.153 or greater

R Packages

- broom
- dplyr
- EnvStats
- flextable
- ggplot2
- ggthemes
- grDevices
- leaflet
- lubridate
- magrittr
- maptools
- methods
- officer
- tidyr
- scales
- RColorBrewer
- rgdal
- rgeos
- rlang
- stringr
- sp

3 Core Analyses

The core analyses available within the SWMPrExtension R package used to create the reserve-level annual report fall into four general categories: boxplots and barplots, range plots, threshold plots, and trend plots. There is also an additional category called "mapping" that contains functions to generate the maps associated with the reserve-level reports. The analyses, methods, and maps in this section were selected by and approved by a technical advisory committee composed of NERR research coordinators, SWMP technicians, and CDMO staff.

The "Core Analyses" section outlines the basic methodologies associated with each analysis. Detailed information on how to modify parameters and customize plots can be found in the documentation for Reserve_Level_Plotting_Variables.xlsx in section 5 and within the R documentation for the SWMPrExtension R package.

3.1 Boxplots/Barplots

Boxplots and barplots are used to visualize continuously monitored data and monthly nutrient sampling data using simple aggregation methods. The plots are meant to provide a first look at the data and to give the user a sense of basic trends.

There are four types of boxplots/barplots:

- Raw_boxplot
- Seasonal_boxplot
- Seasonal_boxplot (with a target year)
- Seasonal_barplot

3.1.1 Boxplots of Raw Data for a Target Year (SWMPrExtension function: raw_boxplot)

Output subfolder: met/nut/wq > boxplot_raw

Boxplots of raw data include all observed data that are not excluded during the QA/QC process. Data are grouped on a seasonal basis. If the user does not specify seasons, then each month will be considered a single season (Figures 18 and 19). Since the nutrient data being used for the reserve-level report are only sampled monthly, it is recommended to group months into seasons (e.g., winter, spring, summer, fall) (Figure 20).

The lower and upper hinges of the boxplot correspond to the 25th and 75th percentiles, respectively. The bar in the middle is the median. The whiskers of the boxplot extend to the value that is 1.5 * interquartile range. Points that plot above or below the whiskers represent values that are outside of 1.5 * interquartile range.

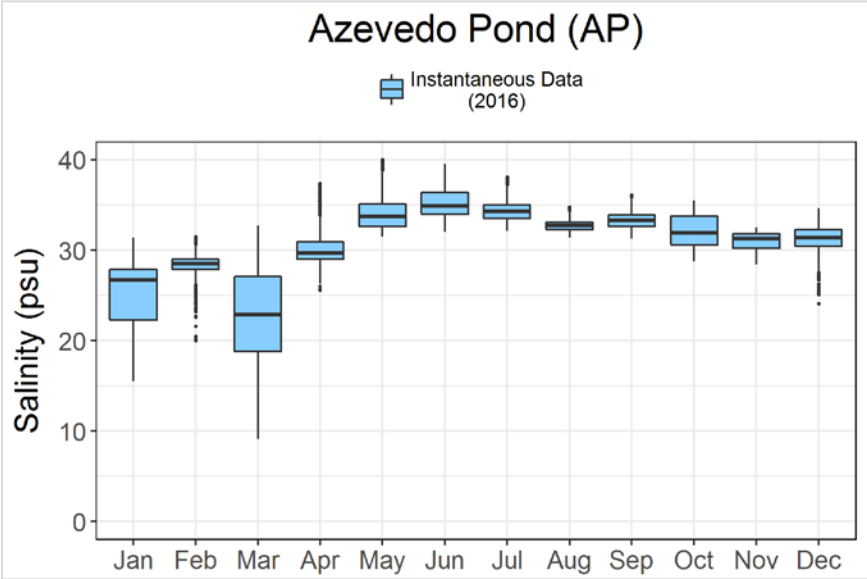


Figure 18. Boxplot of 2016 Raw Water Quality Data at Azevedo Pond Station, Elkhorn Slough NERR

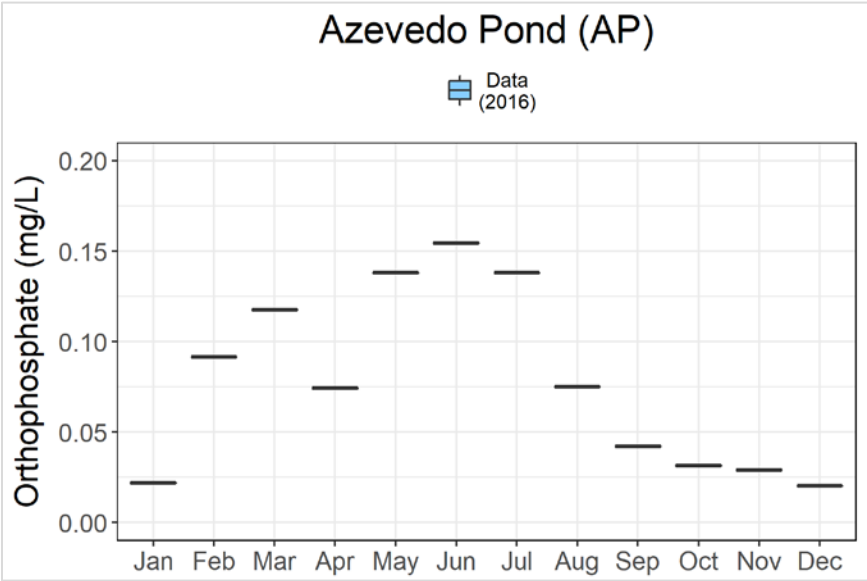


Figure 19. Boxplot of 2016 Raw Nutrient Data at Azevedo Pond Station, Elkhorn Slough NERR

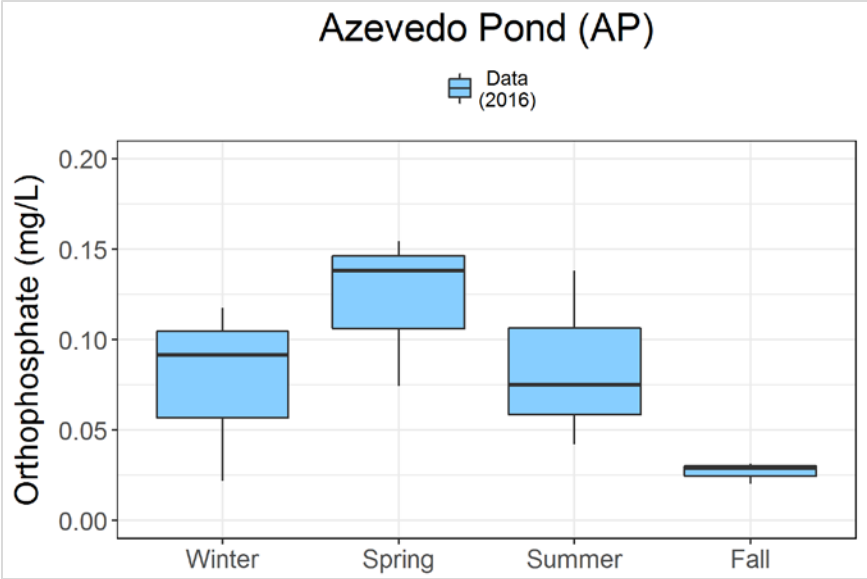


Figure 20. Boxplot of 2016 Raw Nutrient Data at Azevedo Pond Station, Elkhorn Slough NERR with Months Grouped into Four Seasons

3.1.2 Boxplots of Daily Average Data Grouped by Season (SWMPrExtension function: seasonal_boxplot)

Output subfolder: met/nut/wq > boxplot_seasonal

For continuously monitored data, this analysis uses boxplots to summarize statistics calculated on a daily basis across-user defined seasons for all years within a time period of interest (Figure 21). Similar to the raw boxplot, the default is for each month to be considered a season. The default summary statistic is the average. However, the user can specify a different summary statistic for the daily summary. For nutrient data, no aggregation is performed before plotting the data (Figure 22).

The lower and upper hinges of the boxplot correspond to the 25th and 75th percentiles, respectively. The bar in the middle is the median. The whiskers of the boxplot extend to the value that is 1.5 * interquartile range. Points that plot above or below the whiskers represent values that are outside of 1.5 * interquartile range.

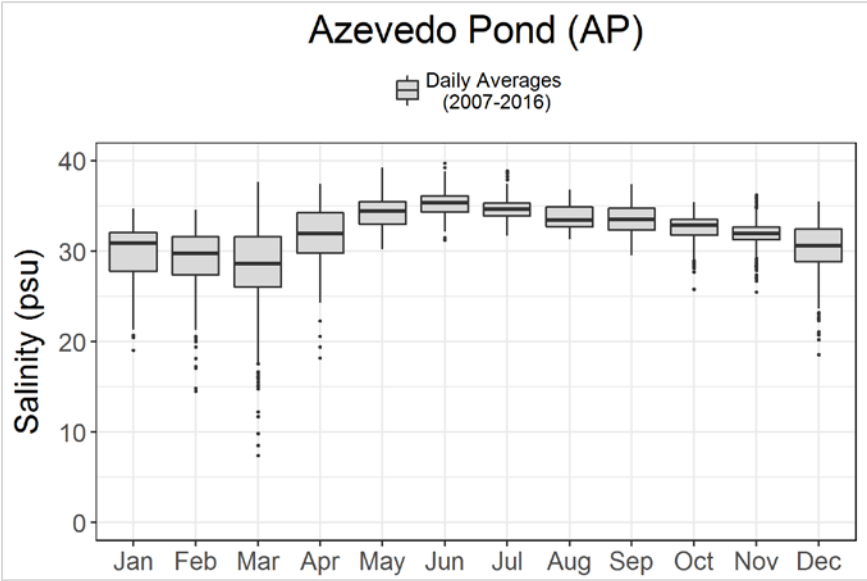


Figure 21. Water Quality Daily Averages from 2007-2016 at Azevedo Pond, Elkhorn Slough NERR

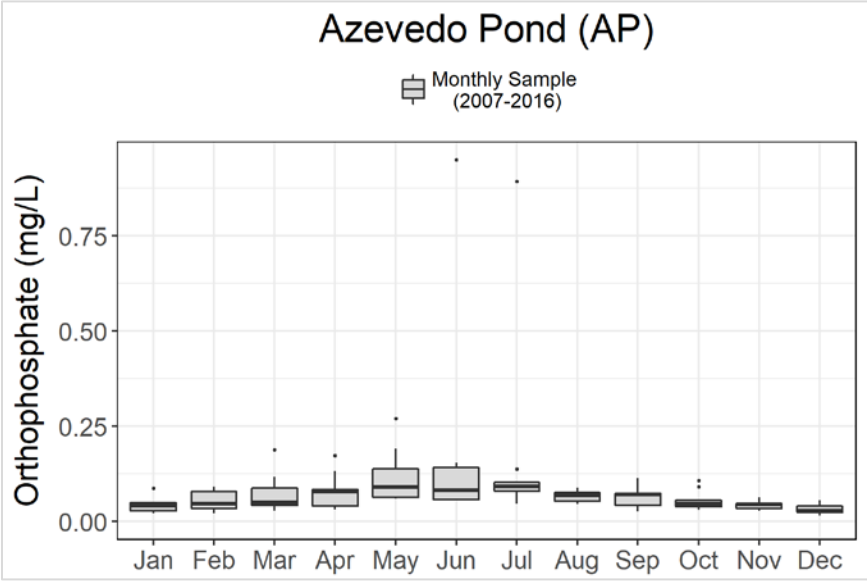


Figure 22. Monthly Nutrient Sampling Data from 2007-2016 at Azevedo Pond, Elkhorn Slough NERR

3.1.3 Boxplots of Daily Average Data Grouped by Season Compared Against a Target Year (SWMPrExtension function: seasonal_boxplot)

Output subfolder: met/nut/wq > boxplot_seasonal_w_target_yr

This analysis is almost identical to the previous analysis (boxplots of daily average data grouped by season) with one additional calculation. After calculating a summary statistic on the entire range of data for the boxplots, a median value of the daily summary statistic for one target year of interest is calculated and plotted on top of the boxplots. This allows the median of the target year of interest to be compared to the boxplot median (Figure 23). For nutrient data, no aggregation is performed. The boxplots represent all sampled data for the time period of interest while the blue dot represents the sampling data from the target year of interest (Figure 24).

The lower and upper hinges of the boxplot correspond to the 25th and 75th percentiles, respectively. The bar in the middle is the median. The whiskers of the boxplot extend to the value that is 1.5 * interquartile range. Points that plot above or below the whiskers represent values that are outside of 1.5 * interquartile range.

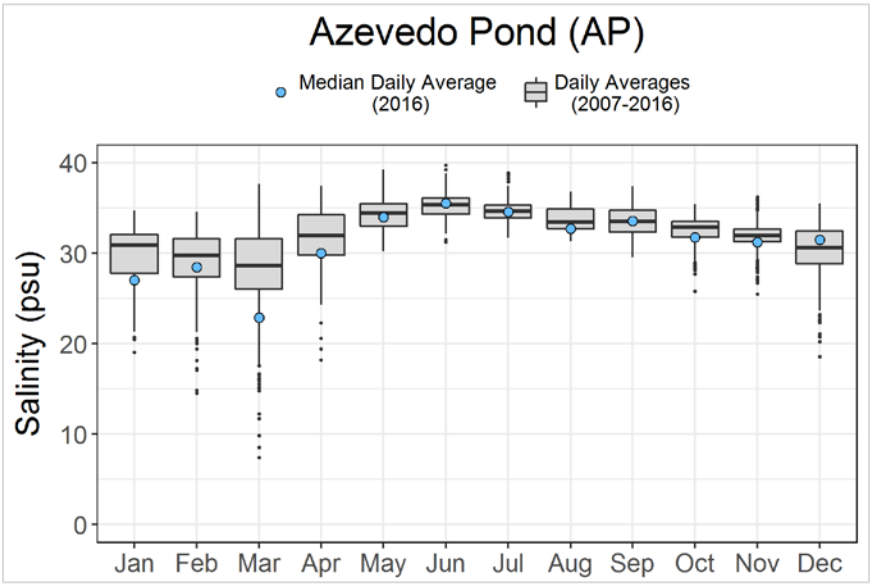


Figure 23. Water Quality Daily Averages from 2007-2016 at Azevedo Pond, Elkhorn Slough NERR Compared Against the Median Daily Average for 2016

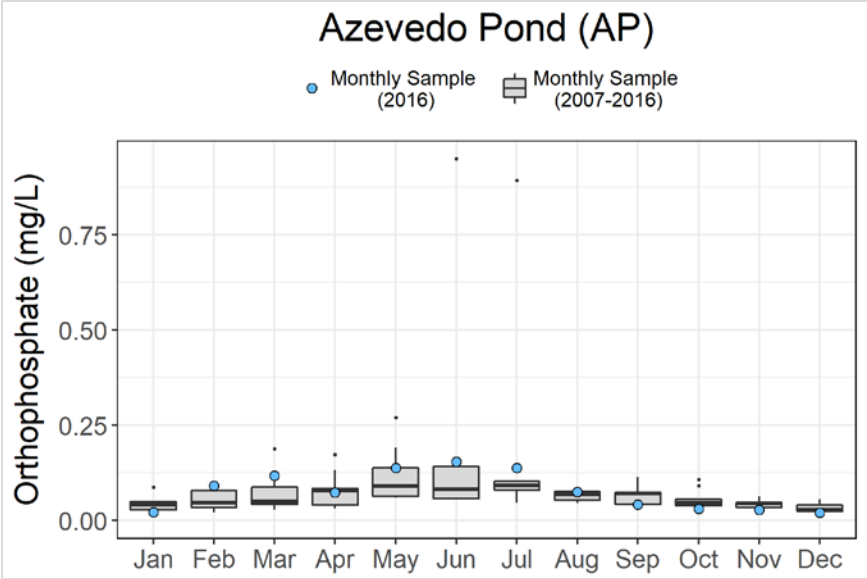


Figure 24. Monthly Nutrient Sampling Data from 2007-2016 at Azevedo Pond, Elkhorn Slough NERR Compared Against Monthly Sampling Data from 2016

3.1.4 Barplots of Cumulative Data Grouped by Season (SWMPrExtension function: seasonal_barplot)

Output subfolder: met/nut/wq > barplot_seasonal

This analysis uses barplots, instead of boxplots, to summarize data that are best viewed on a cumulative basis, such as precipitation (Figure 25). Data are summed on both an annual and seasonal basis.

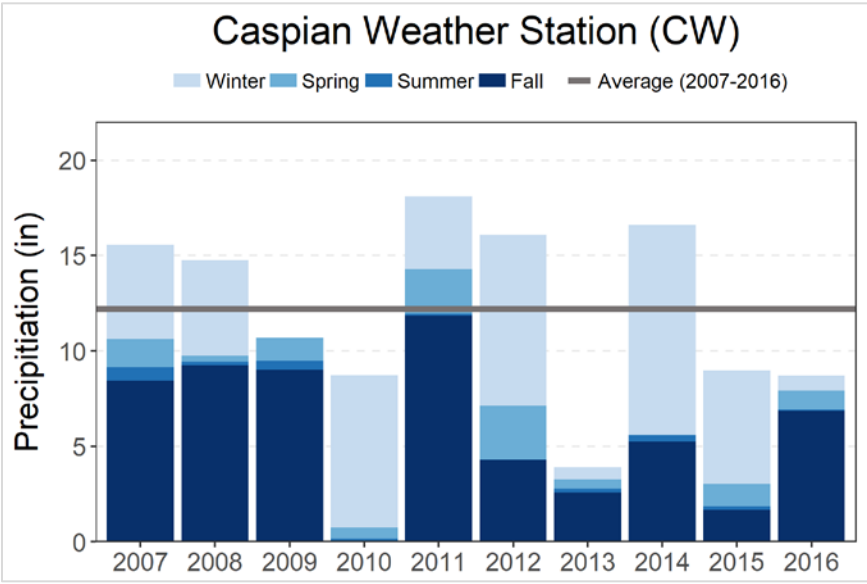


Figure 25. Meteorological Annual Totals Grouped by Season at Caspian Weather Station, Elkhorn Slough NERR

3.2 Range Plots

Range plots allow to user to evaluate daily average data on a seasonal-basis and an associated range around that average. These plots were developed because an average value alone may not convey the variability that one can observe between seasons within an estuary.

There are two types of ranges that are possible for range plots: the range and the average range. The term "range" refers to an absolute maximum and minimum value. For example, a daily range refers to an absolute daily maximum and daily minimum value observed for all the days in a season. While average daily range refers to the average daily maximum and daily minimum for all the days in a season.

There are three types of range plots:

- Annual_range
- Historical_range
- Historical_daily_range

3.2.1 Range Plot of Daily Average Data Grouped by Season (SWMPrExtension function: annual_range)

Output subfolder: met/nut/wq > range_annual

For continuously monitored parameters, the annual range plot calculates several summaries on a seasonal basis: the average daily average, the average daily range, and the maximum daily range observed within a target year of interest (Figure 26). For monthly nutrient data, the monthly sample is plotted as a time series, without calculating a daily average range or maximum daily range (Figure 27).

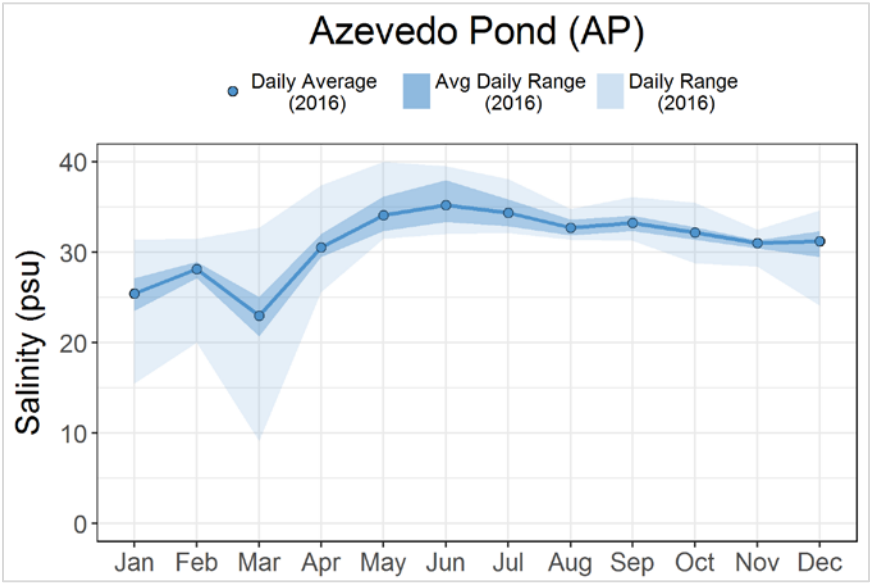


Figure 26. Annual Range Plot for Water Quality Data from Azevedo Pond, Elkhorn Slough NERR

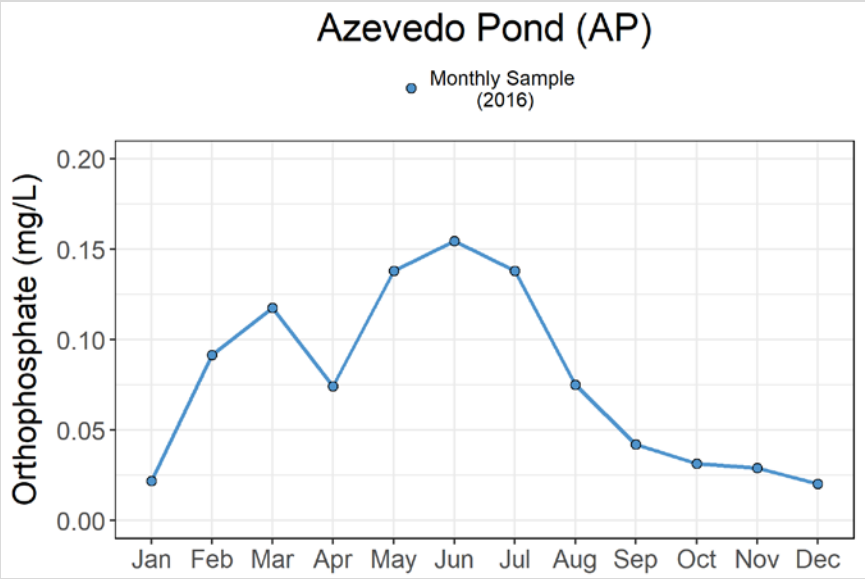


Figure 27. Annual Range Plot for Nutrient Data from Azevedo Pond, Elkhorn Slough NERR

3.2.2 Range Plot for a Target Year Compared (SWMPrExtension function: historical_range)

Output subfolder: met/nut/wq > range_historical_seasonal

The historical range plot compares summary statistics for a target year of interest to the summary statistics of a larger time period. For continuously monitored parameters, a daily average value is calculated as well as a ribbon that represents the daily average range observed within a season (all in blue). These statistics can then be compared against the same statistics for the larger time period (in gray) (Figure 28). For monthly nutrient data, a seasonal average can be calculated for the target year of interest, but a seasonal range can only be calculated if the user defines seasons that are longer than one month (Figure29).

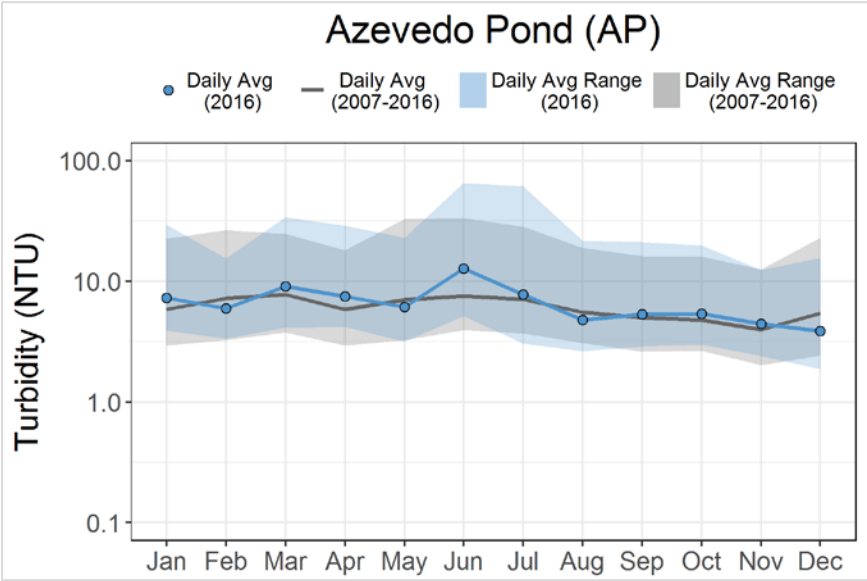


Figure 28. Historical Range Plot for Water Quality Data at Azevedo Pond, Elkhorn Slough NERR

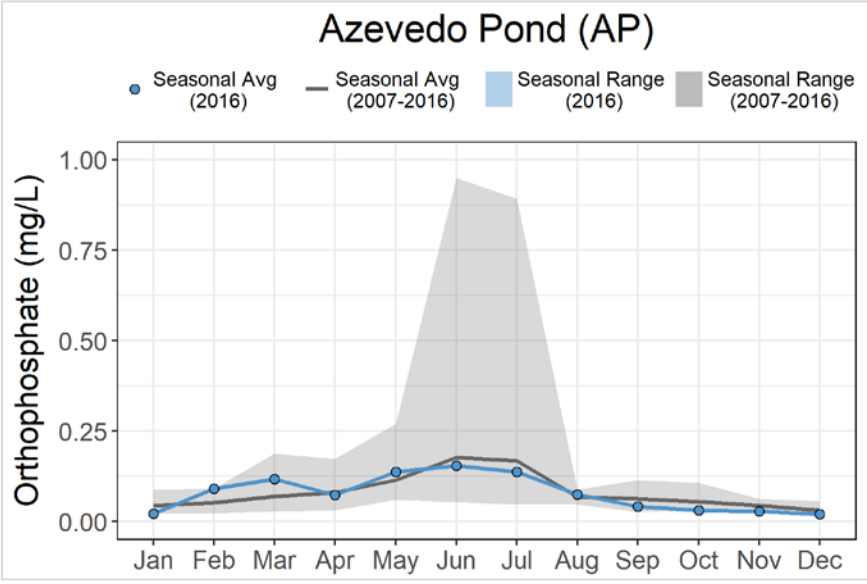


Figure 29. Historical Range Plot of Nutrient Data at Azevedo Pond, Elkhorn Slough NERR

3.2.3 Range Plot of Daily Average Data Compared Against a Historical Range (SWMPrExtension function: historical_daily_range)

Output subfolder: met/nut/wq > range_historical_daily

For continuously monitored parameters, the historical daily range plot compares the daily averages for a target year of interest to the average daily range and the maximum daily range. This allows the target year to be compared to typical highs/lows and maximum highs/lows (Figure 30). A historical daily range plot is not available for nutrient data.

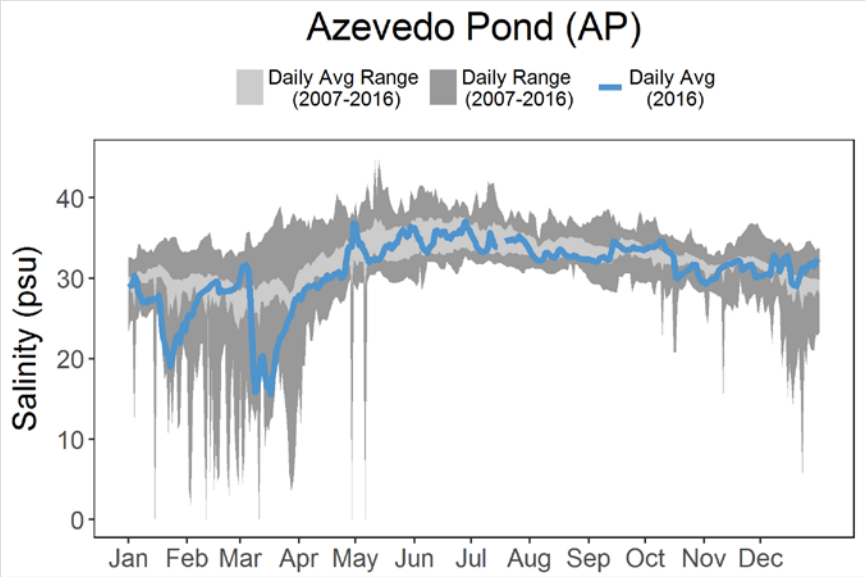


Figure 30. Historical Daily Range Plot of Water Quality Data at Azevedo Pond, Elkhorn Slough NERR

3.3 Threshold Plots and Evaluations

The threshold plots and evaluations allow the user to compare data against user-specified numeric criteria or statistical criteria and to evaluate the frequency with which data violate user-specified numeric criteria. There are four types of threshold evaluations:

- threshold_criteria_plot
- threshold_percentile_plot
- threshold_identification
- threshold_summary

3.3.1 Comparison of Data Against Numeric Criteria (SWMPrExtension function: threshold_criteria_plot)

Output subfolder: met/nut/wq > threshold_criteria

For all data types, the threshold criteria plot compares all observed data that passes QA/QC against user-specified numeric criteria. Plots that contain more than one year of data will automatically appear in gray and plots with only one year of data will appear in blue (Figures 31 and 32). The user has the

option to set the criteria thresholds and decide what threshold labels are appropriate (e.g., “Good”, “Fair”, and “Poor”) in Reserve_Level_Plotting_Variables.xlsx. See section 5 for more details.

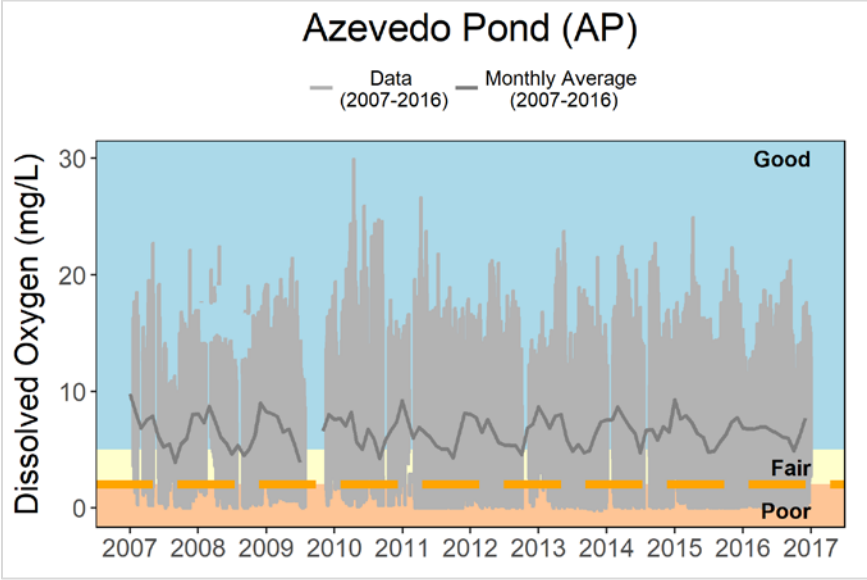


Figure 31. Threshold Criteria Plot for Multiple Years of Water Quality Data (2007-2016) for Azevedo Pond, Elkhorn Slough NERR

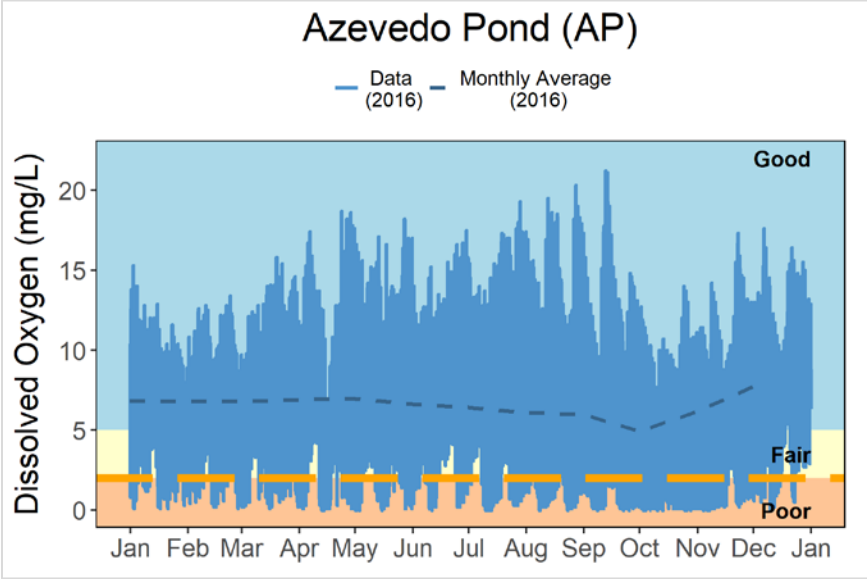


Figure 32. Threshold Criteria Plot for One Year of Water Quality Data (2016) for Azevedo Pond, Elkhorn Slough NERR

3.3.2 Comparison of Data Against Statistical Thresholds (SWMPrExtension function: threshold_percentile_plot)

Output subfolder: met/nut/wq > threshold_percentile

The threshold percentile plot was developed as an alternative to the threshold criteria plot because not all parameters have appropriate numeric criteria for evaluation. Similar to the threshold criteria plot, all data that passes the QA/QC process will be plotted. If there are multiple years of data, the plot will be gray (Figure 33). If there is only one year of data, the plot will be blue (Figure 34). The user has the option to specify the percentiles used. If no percentiles are specified the 5th and 95th percentiles will be plotted as a default. The user can also decide whether or not percentiles should be calculated on a seasonal basis. These values are set in Reserve_Level_Plotting_Variables.xlsx. See section 5 for more details.

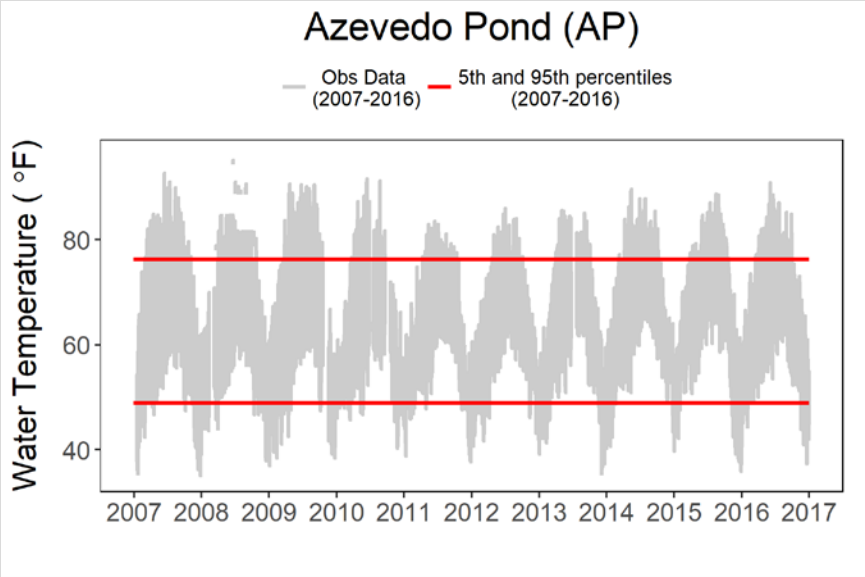


Figure 33. Threshold Percentile Plot for Multiple Years of Water Quality Data (2007-2016) for Azevedo Pond, Elkhorn Slough NERR

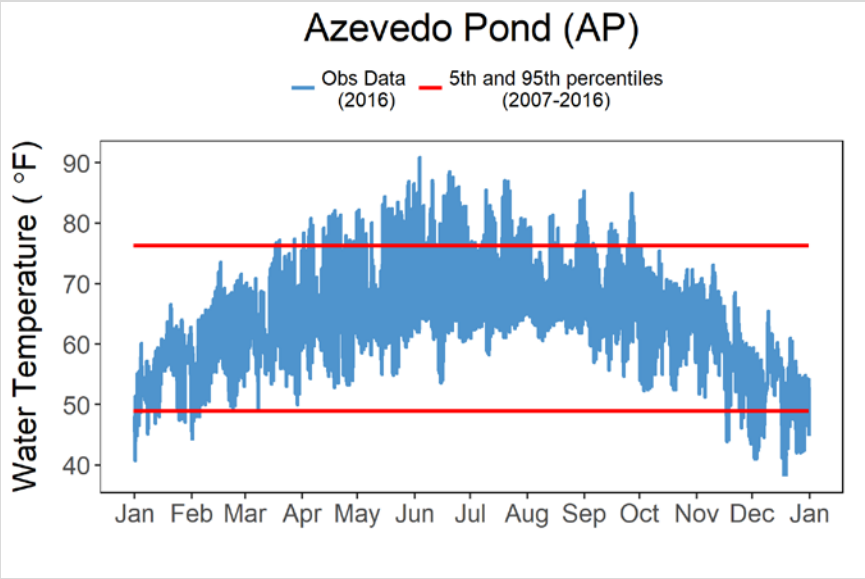


Figure 34. Threshold Percentile Plot for One Year of Water Quality Data (2016) for Azevedo Pond, Elkhorn Slough NERR

3.3.3 Identification of Threshold Violations (SWMPrExtension function: threshold_ identification)

Output subfolder: met/nut/wq > threshold_identification

The identification of threshold violations allows the user to quantify violations of a numeric threshold displayed in the threshold criteria plots. For continuously monitored parameters, the user must specify a numeric criteria (e.g., "<2") and a time threshold. The time threshold allows the user to identify criteria thresholds that may be out of the ordinary for their reserve. For example, a user may not be concerned about a low dissolved oxygen event (< 2 mg/L) unless it lasts for more than two hours. By specifying a time threshold, a user can then ignore all low dissolved oxygen events that are less than two hours (Table 1). For nutrient data, a time threshold is not necessary. All nutrient data that violate the user-specified criteria are tabulated. See section 5 for more details on how to specify a parameter threshold and a time threshold.

Table 1. Summary of Threshold Exceedances for Cat Point, Apalachicola Bay NERR

parameter	starttime	endtime	Duration_hr	thr_violation	statement
do_mgl	7/2/2013 1:15	7/2/2013 4:15	3.25	TRUE	do_mgl < 2
do_mgl	7/30/2013 8:00	7/30/2013 12:30	4.75	TRUE	do_mgl < 2
do_mgl	8/1/2013 6:30	8/1/2013 8:30	2.25	TRUE	do_mgl < 2
do_mgl	8/2/2013 4:30	8/2/2013 8:30	4.25	TRUE	do_mgl < 2

3.3.4 Graphical Summary of Results from Threshold Identification (SWMPrExtension function: threshold_summary)

Output subfolder: met/nut/wq > threshold_identification

The graphical summary of the results from the threshold identification provides a visual representation of the tabular results produced in the threshold violations tabular analysis in section 3.3.3. Results can be summarized on a monthly or seasonal basis (Figures 35 and 36). See section 5 for more details.

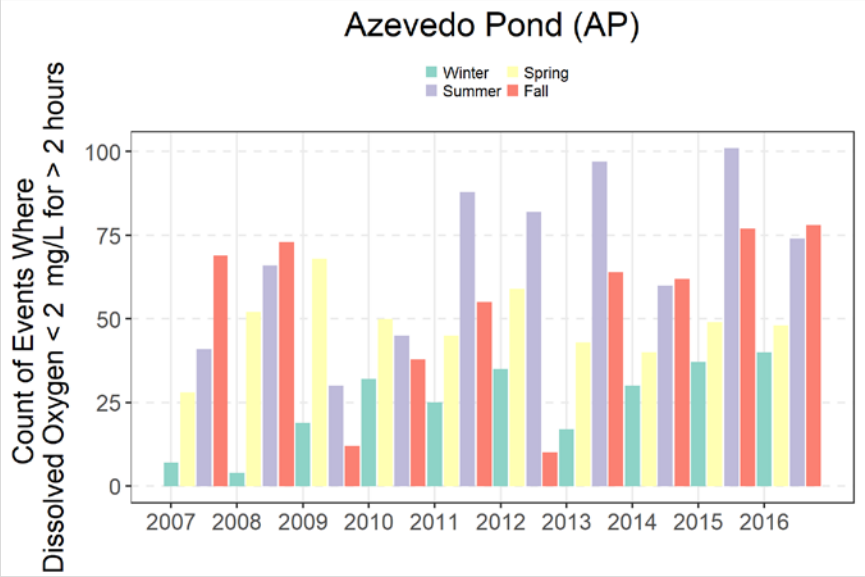


Figure 35. Results from the Threshold Identification Analysis for Azevedo Pond, Elkhorn Slough NERR summarized on a Seasonal Basis

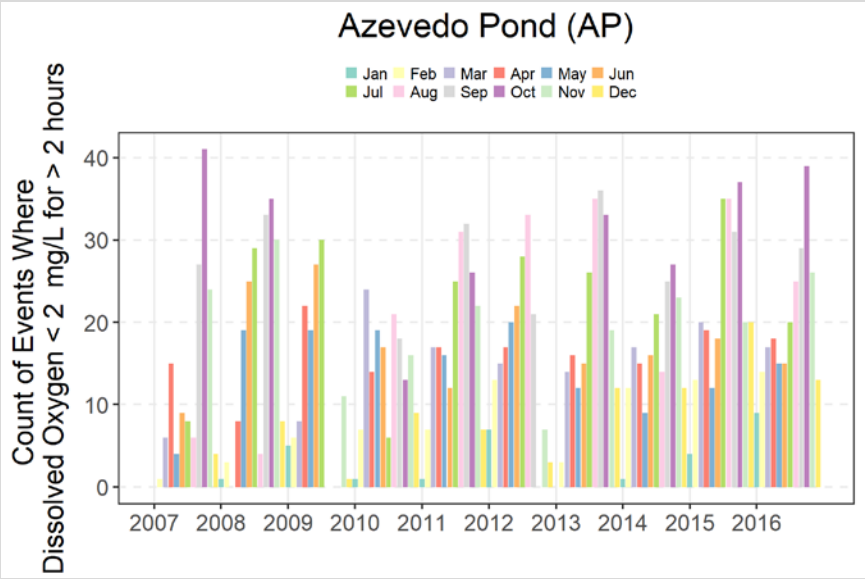


Figure 36. Results from the Threshold Identification Analysis for Azevedo Pond, Elkhorn Slough NERR summarized on a Monthly Basis

3.4 Trend Analysis

The trend analyses are used to help the user evaluate long-term trends for each station within their reserve. There are two types of trend analyses and one trend map:

- sk_seasonal
- sk_map
- seasonal_dot

3.4.1 Seasonal Kendall Test for Monotonic Trends (SWMPrExtension function: sk_seasonal)

Output subfolder: met/nut/wq > trend_sk

This analysis performs a seasonal kendall test for monotonic trends on seasonally aggregated data. It returns a table that reports the reserve station, the type of aggregation parameter, the parameter, tau, slope, p-value for the chi-squared test for heterogeneity (Van Belle-Hughes test), the p-value for the seasonal kendall test, and two columns that indicate whether or not the p-values are significant (Table 2). A reserve must have at least five years of data for this analysis to be performed.

Table 2. Seasonal Kendall Results for Water Quality Parameters at Azevedo Pond, Elkhorn Slough NERR

station	type	parameter	tau	slope	pval.chisq	pval.trend	sig.chi	sig.trend
elkapwq	Average	temp	0.32	0.29	0.98	0.00	insig	inc
elkapwq	Average	sal	0.13	0.10	0.93	0.08	insig	insig
elkapwq	Average	do_mgl	0.07	0.03	0.08	0.39	insig	insig
elkapwq	Average	ph	-0.31	-0.03	0.70	0.00	insig	dec
elkapwq	Average	turb	0.14	0.11	0.36	0.05	insig	inc
elkapwq	Average	depth	0.66	0.16	0.99	0.00	insig	inc

3.4.2 Mapping Seasonal Kendall Results (SWMPrExtension function: res_sk_map)

Output subfolder: met/nut/wq > trend_sk_maps

The seasonal kendall trend map allows the user to visually communicate the tabular results from the seasonal kendall trend test (section 3.4.1). The user can modify the bounding box associate with the reserve-level seasonal-kendall map in Reserve_Level_Plotting_Variables.xlsx (Figure 37). See section 5 for more details.

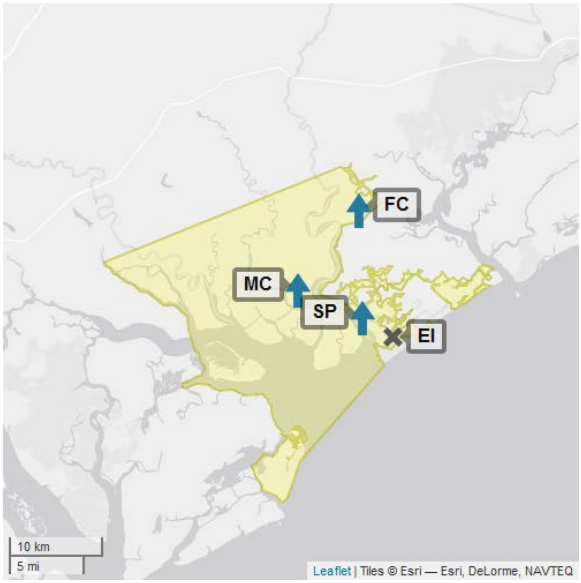


Figure 37. Trend Map Displaying Seasonal Kendall Trend Results for Turbidity at ACE Basin NERR

3.4.3 Seasonal Comparisons of Minimum/Average/Maximum Values Across Years (SWMPrExtension function: seasonal_dot)

Output subfolder: met/nut/wq > trend_dot_plot

The seasonal comparison dot plot allows the user to aggregate data seasonally and then evaluate the seasonal average, seasonal minimum, and seasonal maximum across multiple years (Figure 38). This

analysis also provides the option to perform linear regressions on a seasonal-basis and to report p-values from the regression.

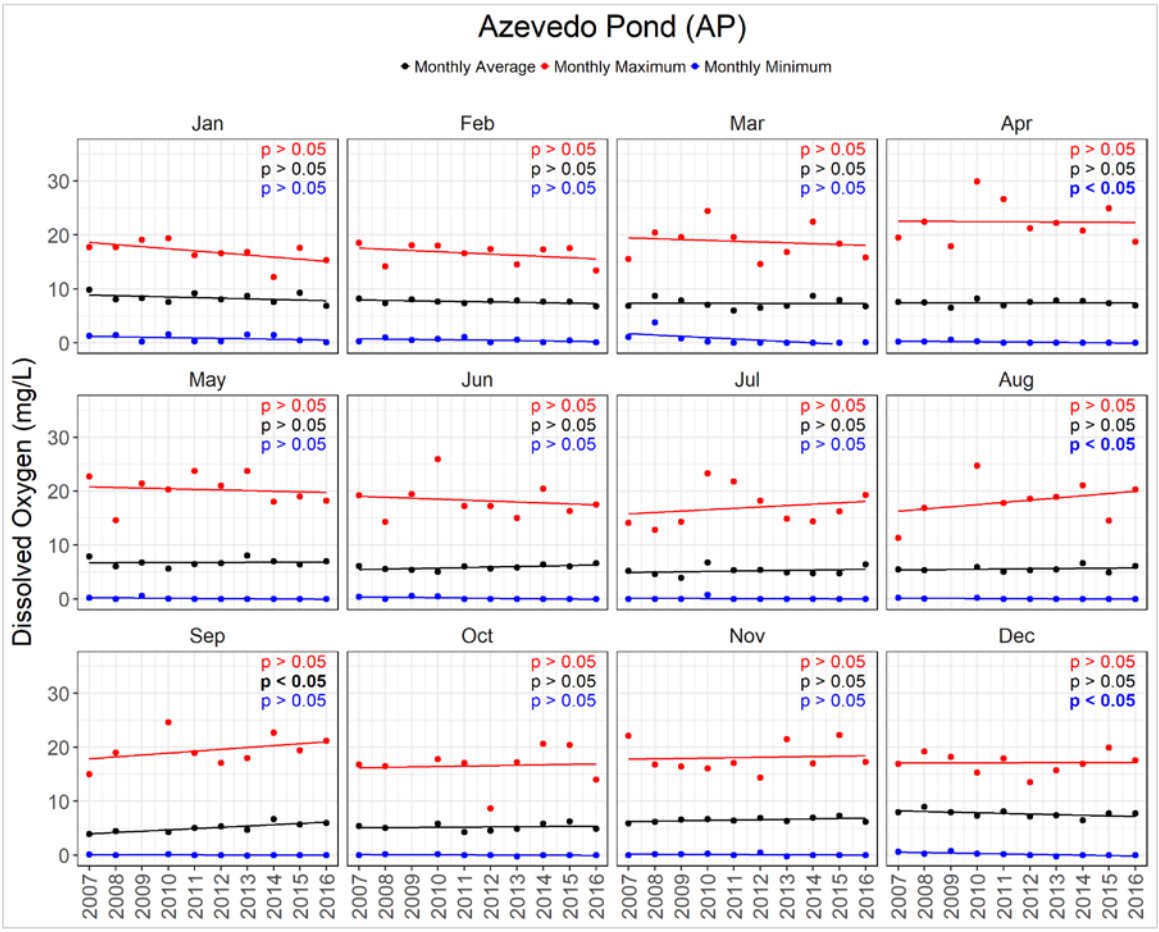


Figure 38. Seasonal Dot Plot of Water Quality Data for Azevedo Pond, Elkhorn Slough NERR

3.5 Mapping

There are two general mapping functions, one that produces a system-wide NERRS map, and one that produces a reserve-level map:

- res_national_map
- res_local_map

3.5.1 National Map (SWMPrExtension function: res_national_map)

Output subfolder: maps

The national map function highlights a user-specified reserve within the NERRS (Figure 39).

Figure 39. NERRS National Map Highlighting Apalachicola Bay NERR

3.5.2 Reserve Map (SWMPrExtension function: res_local_map)

Output subfolder: maps

The reserve map function produces a map of a user-specified reserve and the active, primary SWMP stations (Figure 40). The user can modify the bounding box associate with the reserve-level map in Reserve_Level_Plotting_Variables.xlsx. See section 5 for more details.

Figure 40. Reserve-level Map of Apalachicola Bay NERR

4 Folder Contents and Additional File Descriptions

This section provides a reference of all of the subfolders and files within the reserve-level directory. Each folder and its contents, within a reserve-level template folder, are described below.

4.1 data

The **data** folder contains all of the data that will be used by the R scripts to generate data plots.

4.2 doc

The **doc** folder contains user documentation for running the R scripts and creating the reserve-level report.

4.3 figure_files

The **figure_files** folder contains the **Reserve_Level_Plotting_Variables.xlsx** Excel workbook and the **resources** subfolder.

4.3.1 Reserve_Level_Plotting_Variables.xlsx

The **Reserve_Level_Plotting_Variables.xlsx** Excel workbook is used to feed reserve-specific variable settings into the R scripts in order to generate data plots. This workbook is one of the main products in the folder that the user will interact with. For detailed information on the content within the Reserve_Level_Plotting_Variables.xlsx workbook see section 5. For the plot generation scripts to work properly, the user should not change the name or location of this file.

4.3.2 Resources

The **resources** subfolder contains another subfolder called **empty_output_folders**. The empty_template_output_folders subdirectory can be used to help the user quickly regenerate an empty version of the **output** folder.

If the user would like to delete all of the figures in the reserve directory and create a fresh output directory, the user can perform the following steps:

- delete the output folder
- create a copy of **empty_output_folders** and copy it into the main directory
- rename empty_output_folders to output

4.4 handoff_files

In addition to reserve-level reports for each reserve, a national-level report, that summarized trends across reserves, will also be produced annually. The **handoff_files** folder contains handoff files that will be used by the national-level reporting R scripts. These files are reformatted versions of the seasonal kendall results that can be found in the *output > met/nut/wq > trend_sk* folder.

4.5 inst

The **inst** folder contains additional data sources that are used by various R scripts to produce figures for the reserve-level report. Currently, there is one subfolder in this directory, called **GIS**. This folder contains spatial data for each NERRS reserve. The reserve spatial data were downloaded from CDMO.

4.6 output

The **output** folder contains all of the figures produced by the R scripts for the reserve level report. There are four subfolders in this directory: **maps**, **met**, **nut**, and **wq**. The maps subfolder contains two maps: one that shows the reserve boundary and sampling stations, and another that shows the location of the reserve in relation to all of the other reserves in the system. The met, nut, and wq subfolders contain the figures for meteorological parameters, nutrient parameters, and water quality parameters, respectively.

Within each parameter subfolder (met, nut, and wq), there are 13 subfolders:

- barplot_seasonal
- boxplot_seasonal
- boxplot_seasonal_w_target_yr
- range_annual
- range_historical_daily
- threshold_criteria
- threshold_identification
- threshold_percentile
- trend_dot_plot
- trend_sk
- trend_sk_maps

Each one of these subfolders contains the plots from a different analysis. If a subfolder is empty, then no plots were produced for that analysis. For details on each analysis, see section 3.

4.7 R

The **R** folder contains all of the R scripts used to generate data plots and the raw reserve-level report. The function of each individual file is described below. Scripts in this folder fall into one of two categories: scripts used to generate data plots and scripts used to generate the reserve-level report. The workflow diagram in section 2.2 provides a visual summary of this information.

4.7.1 Initial Install

4.7.1.a 00_initial_installation

The **00_initial_installation.R** script will install all of the R packages necessary to run the reserve-level template scripts. This script will also install Phantom JS on the user's system, which is required for

reserve-level mapping. This script only needs to be run if the user does not have all of the relevant R packages and Phantom JS on their system.

4.7.2 Plot Generation Scripts

The plot generation scripts are used to generate reserve-specific plots based on the user's settings in the Reserve_Level_Plotting_Variables.xlsx workbook. To run these scripts and generate a complete set of plots, the user should first open the Reserve_Template.Rproj file in the main directory, and then run the 01_Load_Wrangle_Run.R script.

4.7.2.a 00_load_analyses_variables.R

The **00_load_analyses_variables.R** script loads variables from Reserve_Level_Plotting_Variables.xlsx into R that are specific to a parameter. This script is called three times from within the 01_Load_Wrangle_Run.R script: one time for each parameter category (met, nut, and wq). Complete details on the variables within Reserve_Level_Plotting_Variables.xlsx can be found in section 5.

4.7.2.b 00_load_global_decisions_variables.R

The **00_load_global_decisions_variables.R** script loads variables from Reserve_Level_Plotting_Variables.xlsx into R that are common across all analyses. Complete details on the variables within Reserve_Level_Plotting_Variables.xlsx can be found in section 5.

4.7.2.c 01_Load_Wrangle_Run.R

01_Load_Wrangle_Run.R is the primary script that the user will interact with to generate reserve-specific data plots. Running this script will call all of the other scripts necessary to load variables, clean data, and generate all plots in the output folder.

4.7.2.d 01-01_make_maps.R

The **01-01_make_maps.R** script produces the maps that are in the output > maps folder. It produces a reserve map that includes sampling stations and a system-wide map that includes the other reserves in the system.

4.7.2.e 01-02_all_plot_analyses.R

The **01-02_all_plot_analyses.R** script produces most of the plots in the output folder by calling the analyses functions from the SWMPrExtension R package. This script is called three times from within the 01_Load_Wrangle_Run.R script: once for each parameter category (met, nut, and wq). This script uses variables that are assigned in 00_load_global_descisions_variables. R and 00_load_analyses_variables.R.

Results from this script are saved in the following subfolders within the output folder:

- barplot_seasonal
- boxplot_seasonal
- boxplot_seasonal_w_target_yr
- range_annual

- range_historical_daily
- threshold_criteria
- threshold_identification
- threshold_percentile
- trend_dot_plot

4.7.2.f 01-03_all_trend_analyses.R

The **01-03_all_trend_analyses.R** script produces all of the seasonal kendall trend analyses by calling analyses functions from the SWMPrExtension R package. Similar to 01-02_all_plot_analyses.R, this script is called three times: once for each parameter category. This script also uses variables that are assigned in 00_load_global_descisions_variables. R and 00_load_analyses_variables.R.

Results from this script are saved in the following subfolders within the output folder:

- trend_sk
- trend_sk_maps

4.7.2.g 01-04_prepare_handoff_files.R

The **01-04_prepare_handoff_files.R** script reformats results from the trend analysis and places a copy of the reformatted results into the *handoff_files* folder. The resulting files will be used by the national-level template report generation scripts.

4.7.3 Report Generation Scripts

The report generation scripts are used to generate a raw version of the reserve-level report based on user-specified settings in Reserve_Level_Template_Text_Entry.R. To run these scripts and generate a raw version of the reserve-level report, the user should first open the Reserve_Template.Rproj file in the main directory, and then, run the 02_Generate_Reserve_Template.R script. After generating a raw version of the reserve-level report, the user can then complete the formatting steps outlined in section 7 to produce a final version of the reserve-level report.

4.7.3.a 00_load_reserve_template_variables.R

The **00_load_reserve_template_variables.R** script loads variables from Reserve_Level_Template_Text_Entry.xlsx into R that will be used to add text, images, and R figures into the raw reserve-level report. Complete details on the variables within Reserve_Level_Template_Text_Entry.xlsx can be found in section 6.

4.7.3.b 02_Generate_Reserve_Template.R

The **02_Generate_Reserve_Template.R** script is the primary script that the user will interact with to generate the raw reserve-level report. Running this script will call all of the other scripts necessary to load variables, create trend tables, and generate a complete raw reserve-level report.

4.7.3.c 02-01_make_flextables.R

The **02-01_make_flextables.R** script generates properly formatted trend tables for page two of the reserve-level report.

4.7.3.d 02-02_Template_generate_page_1.R

The **02-02_Template_generate_page_1.R** script is used to create a copy of the empty reserve-level template, add a first page, and to populate it with text and images.

4.7.3.e 02-03_Template_generate_page_2.R

The **02-03_Template_generate_page_2.R** script is used to add a second page to the reserve-level template and to populate it with text and images.

4.7.3.f 02-04_Template_generate_page_3.R

The **02-04_Template_generate_page_3.R** script is used to add a third page to the reserve-level template and to populate the text, images, and plots to it.

4.7.3.g 02-05_Template_generate_page_4.R

The **02-05_Template_generate_page_4.R** script is used to add a fourth page to the reserve-level template and to populate it with text and images.

4.8 template_files

The **template_files** folder contains all of the material necessary to generate a raw reserve-level report. There are four subfolders within this folder: **empty_template**, **images**, **resources**, and **text**. In addition to these subfolders, there may be a file called **annual_report_raw.pptx**.

4.8.1 empty_template

The **empty_template** folder contains one file: **Reserve_Level_Template.pptx**. This PowerPoint file is a blank version of the reserve-level report that will be used by the R scripts to generate a reserve-specific report based on user-specified settings in the Reserve_Level_Template_Text_Entry.xlsx workbook. The user does not need to modify this file or folder.

4.8.2 images

The **images** folder contains all images that the user would like to use in the reserve-level report.

4.8.3 resources

The **resources** folder contains a file called **Template_Resources.pptx**. This file contains preformatted shapes, legends, and labels that the user will find helpful when formatting annual_report_raw.pptx into a final reserve-level report. Template_Resources.pptx contains four slides, one for each page of the final report. For detailed information on Template_Resources.pptx and the formatting of the final reserve-level report, see section 7.

4.8.4 text

The **text** folder contains the **Reserve_Level_Template_Text_Entry.xlsx** Excel workbook. This Excel workbook is used to feed reserve-specific text, images, and R figures into the R scripts that populate the raw reserve-level report. This workbook is one of the main products in the folder that the user will interact with. For detailed information on the content within the Reserve_Level_Template_Text_Entry.xlsx workbook see section 6. For the reserve-level template generation scripts to work properly, the user should not change the name or location of this file.

4.8.5 annual_report_raw.pptx (may not be present)

The **annual_report_raw.pptx** file is a raw version of the reserve-level report. If this file exists within *template_files* folder it means that the 02_Generate_Reserve_Template.R script has been run based on the text settings in Reserve_Level_Template_Text_Entry.xlsx workbook.

4.9 .gitignore

Git is a version control system that tracks changes in a folder over time. The .**gitignore** file tells git what files within a folder can be ignored when tracking changes. This file is not critical to the production of the reserve-level report.

4.10 .Rhistory

The .**Rhistory** file saves the history of a previous R session. It is not critical to the production of the reserve-level report.

4.11 .Rprofile

The .**Rprofile** file is a file that can be used to run R scripts that are run when R/RStudio is launched. Currently, there are no R files that are necessary to run at launch. The user does not need to modify this file.

4.12 Reserve_Template.Rproj

The **Reserve_Template.Rproj** file is an R project file. This is a file format used by RStudio to make project organization easier for users. When the user double clicks on this file, RStudio will launch and the working directory will automatically be set to the folder where the R project file exists. Working with R via an R project, all file path references can be relative instead of absolute. If file references are relative, then the R project can be easily transferred between computers without having to modify any R scripts.

The user should first open Reserve_Template.Rproj if they want to produce data plots or a raw reserve-level report.

5 Plotting Variables Guide

The **Reserve_Level_Plotting_Variables.xlsx** workbook has been developed to facilitate the production of the reserve-level annual report and to help the user organize reserve-specific settings. The workbook is also intended to minimize user interaction with the R scripts that produce the data plots.

Within the workbook, user decisions fall into one of two categories:

- Global_Decisions
- Analyses

`Global_Decisions` are settings that affect a large number of plots while **`Analyses`** settings affect specific parameters within the context of a specific data analysis. Each section below `Global_Decisions` and `Analyses` refers to a different sheet in the Reserve_Level_Plotting_Variables.xlsx workbook.

It is important to note that columns should not be inserted between the existing columns and existing columns should not be deleted.

5.1 Global_Decisions

Global decisions are variables that are used to either filter QA/QC data (e.g., Flags) or affect a large number of analyses.

5.1.1 Flags

Every dataset from the CDMO contains data flags. CDMO QA/QC flags can contain a numeric value or a combination of a numeric value and a three-letter code. In the **Flag** sheet, the user can specify all of the data flags that should be kept during the QA/QC process. If the user would like to include a numeric flag then including the number (e.g., "5") is sufficient. If the user would like to include a numeric flag and a three-letter code, then the user must enter the code as it is formatted in the CDMO data set (e.g., "<-4> \[SBL\]"). The backslashes are known as escape characters, and they are necessary for the R scripts to properly interpret the "[" character. Currently, the default flags are 0, 3, 5 and 4 [SBL]. Definitions for these flags can be found in Table 3. Complete definitions for QA/QC flags can be found at the following CDMO website: http://cdmo.baruch.sc.edu/data/qaqc.cfm. At the time of thisreport, data flagged with the CDMO flag of 4 (historical: pre-auto QA/QC) are excluded because of unknown data quality.

Table 3. Subset of QA/QC Fkags frin CDMO

CDMO QAQC Flag	Excel Formatted QAQC Entry	CDMO Definition
0	0	Passed initial QA/QC checks
3	3	Calculated data: non-vented depth/level sensor correction for changes in barometric pressure
5	5	Corrected data
-4 [SBL]	<-4> \[SBL\]	Outside low sensor range [value below minimum limit of method detection]

Possible Values:

- Any valid CDMO data flag

Formatting requirements:

- Integer (if only using a numeric flag)
- Alpha-numeric string with escape characters (e.g., "<4> \[SBL\]")

Potential resources:

- CDMO Quality Assurance and Quality Control (QAQC) Website: http://cdmo.baruch.sc.edu/data/qaqc.cfm

5.1.2 Years_of_Interest

The **Years_of_Interest** sheet is where the user defines the range and target year.

5.1.2.a Range

The range is the minimum and maximum year the user wants to use for plotting and statistical analysis.

Possible Values:

- Any two years in YYYY format

Formatting requirements:

- integer

5.1.2.b Target_Year

The target year is the year the user wants to highlight in the annual reserve-level report.

Possible Values:

- Any year in YYYY format

Formatting requirements:

- Integer

5.1.3 Seasons

Seasons are used to group data together for plotting and statistical analyses. The default method for assigning seasons is for each month to represent one season and for January to be the first season plotted. The user can either use the default grouping of seasons (Monthly Default), or they can assign their own seasons (e.g., Winter/Spring/Summer/Fall, Wet/Dry, etc.). If the user leaves a season definition blank, then the default season assignment will be used. If the user wants to use custom seasons, then they will need to assign a custom season name to each month of the year. The user also has the option to specify the season that should be first by using an argument called season_start. If season_start is not specified, then the first season in the column will be used as season_start. Currently, season assignment does not cross over calendar years. For example, it is not possible to group data into a hydrologic year that starts in one calendar year and then ends in another.

In Table 4, the season **"WQ_Seasons"** has been assigned in three different ways: first, using the default monthly seasons (i.e., left blank); then using a Winter/Spring/Summer/Fall format; and finally using a Wet/Dry season format. Figures 41 through 43 summarize the results of the different season assignments.

Table 4. Three Season Definitions for WQ_Seasons: Monthly Default, Winter/Spring/Summer/Fall, and Wet/Dry

Month	WQ_Seasons	WQ_Seasons	WQ_Seasons
January		Winter	Wet
February		Winter	Wet
March		Winter	Wet
April		Spring	Dry
May		Spring	Dry
June		Spring	Dry
July		Summer	Dry
August		Summer	Dry
September		Summer	Dry
October		Fall	Wet
November		Fall	Wet
December		Fall	Wet
Season_Start		Spring	

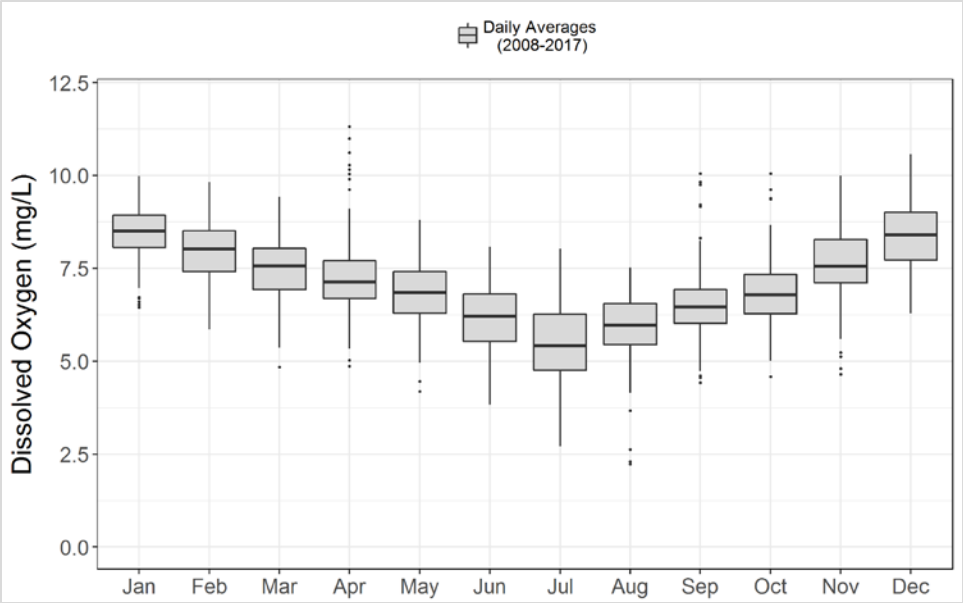


Figure 41. Seasonal_Boxplot Results for the Default Monthly Season Assignment and the Default Season Start (January)

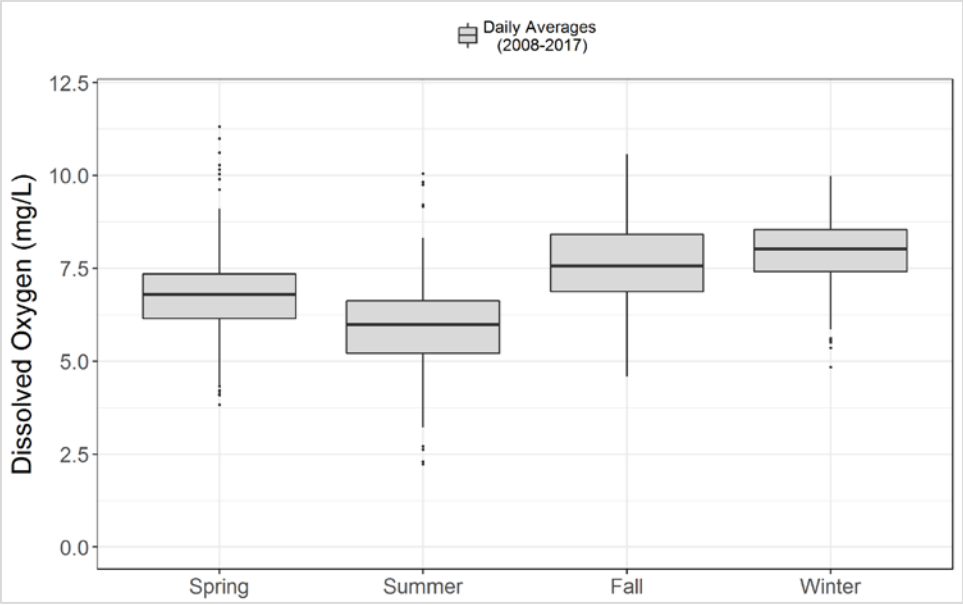


Figure 42. Seasonal_Boxplot Results for Winter/Spring/Summer/Fall Season Assignment with Spring as Season_Start

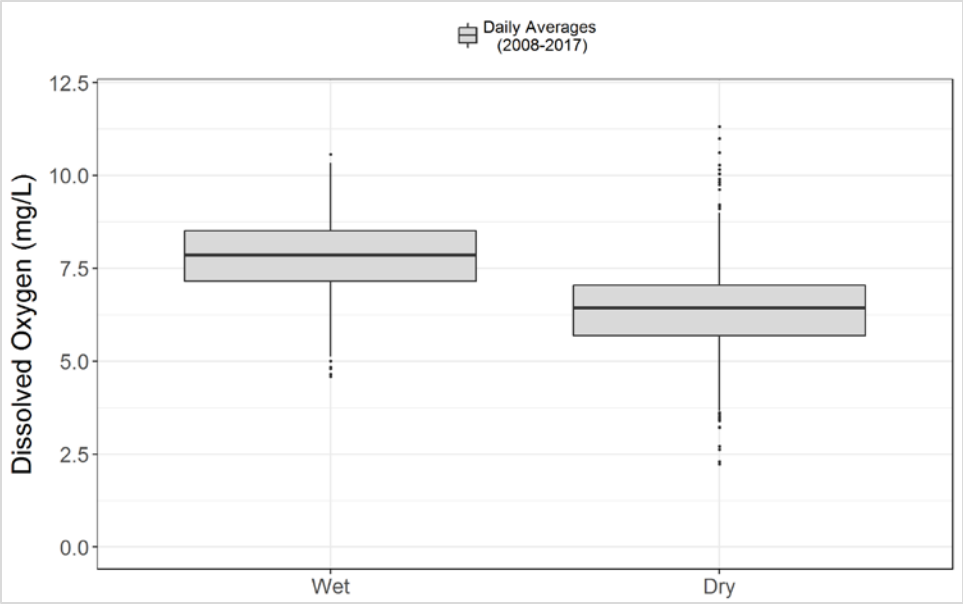


Figure 43. Seasonal_Boxplot Results for Wet/Dry Season Assignment Using the Default Season Start (Wet)

5.1.3.a Season_Definition

For the current version of the reserve-level template scripts, five different seasons need to be defined. The user can either accept the default assignments or they can specify their own seasons.

WQ_Seasons, MET_Seasons & NUT_Seasons

The user has the option to assign custom seasons to each SWMP data type. **WQ_Seasons** corresponds to water quality data, **MET_Seasons** corresponds to meteorological data and **NUT_Seasons** corresponds to nutrient data. The season assignments determine the x-axis for all water quality, meteorological, and nutrient box plots, bar plots and most range plots.

Barplot_Seasons

Cumulative parameters, such as precipitation and photosynthetically active radiation can be plotted using a custom set of seasons that differs from the definitions used for WQ_Seasons, MET_Seasons, and NUT_Seasons. This option is available because while monthly season assignments might be desirable for parameters that plot as box plots, it can be difficult to view the same results in a bar plot (Figures 44 and 45).

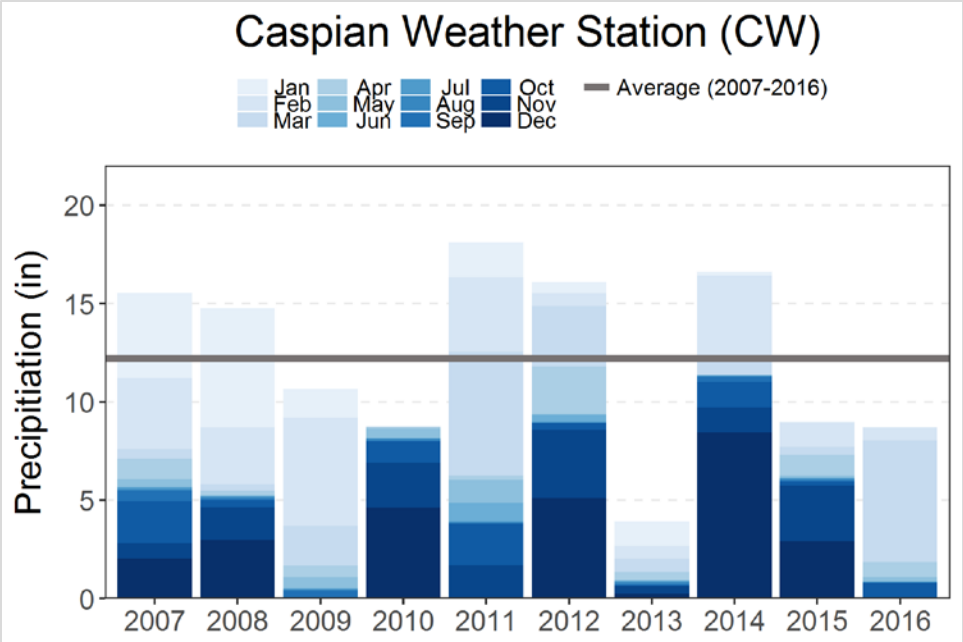


Figure 44. Seasonal_Barplot with Default Monthly Season Assignment

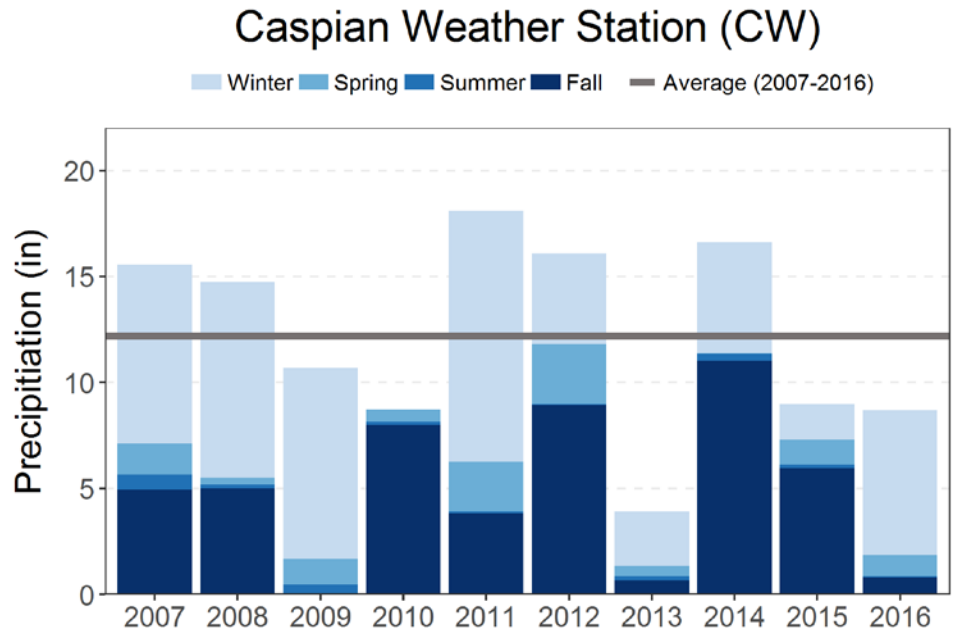


Figure 45. Seasonal_Barplot with Winter/Spring/Summer/Fall Season Assignment

SK_NUT_Seasons

For water quality and meteorological sampling data, the default season for the Seasonal Kendall test for monotonic trends is monthly. Due to the sampling frequency of nutrient data, a monthly Seasonal Kendall trend test may not be appropriate. To account for this, the user has the option to assign custom seasons to nutrient data.

5.1.4 Mapping

Two types of maps are produced by the NERRS reserve-level reporting scripts: a station map and Seasonal Kendall results maps (Figures 46 and 47). The station map displays all primary reserve sampling stations and two-letter station code labels. The Seasonal Kendall results map displays all of the primary stations for a specific dataset and the associated monotonic trend.

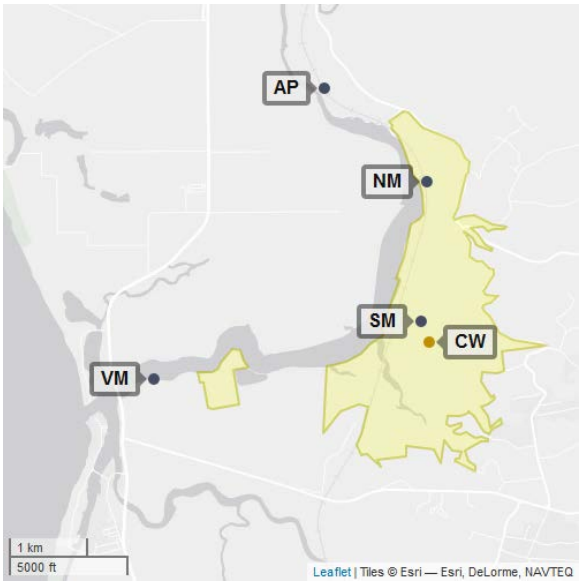


Figure 46. A Station Map for Elkhorn Slough NERR

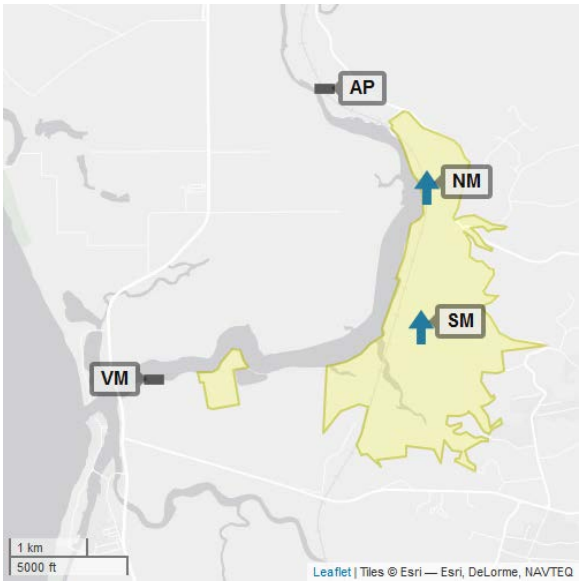


Figure 47. A Seasonal Kendall Results Map for Dissolved Oxygen Concentrations at Elkhorn Slough NERR

5.1.4.a Bounding_Box

A bounding box is a set of geographic coordinates (two longitude/latitude pairs) that are used to define the visible area of a map (Figure 48). The user-defined bounding box should be big enough to include

the reserve boundary and all stations of interest. Default bounding boxes have been selected for each reserve.

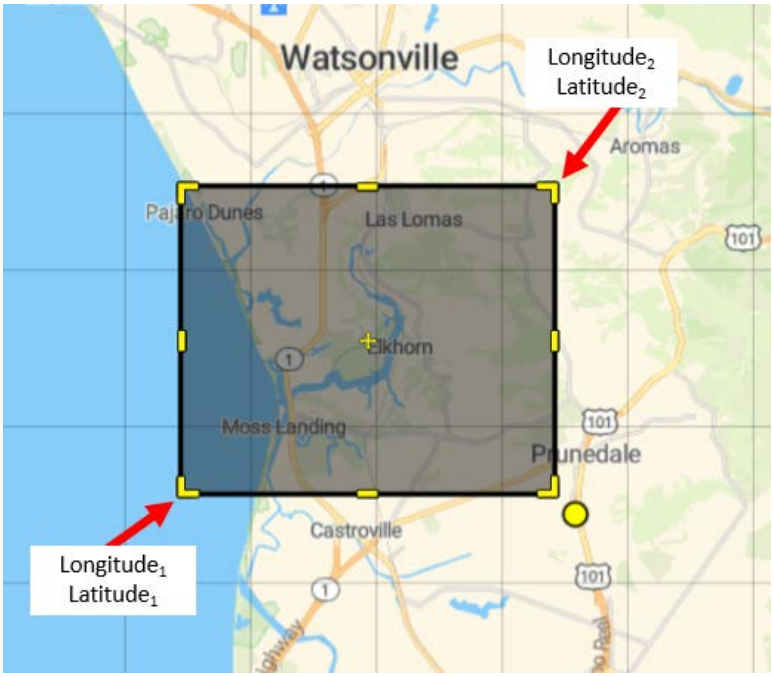


Figure 48. A Sample Bounding Box for Elkhorn Slough NERR

Possible values:

- Two sets of Longitude/Latitude values

Formatting requirements:

- Four (4) numeric values in the format longitude$_1$, latitude$_1$, longitude$_2$, latitude$_2$ (i.e., X_1, Y_1, X_2, Y_2)
- Decimal degree format

Potential resources:

- Online bounding box tool: https://boundingbox.klokantech.com/

5.1.4.b Station Labels

The user has the option to specify whether station labels appear on the right-hand side or the left-hand side of a station. If the user leaves this column blank, then all values will default to left-hand side. If the user assigns values to a station label column then there must be one value for each station or the mapping function will return an error.

Station_Map_Label

Assign a station label to the right-hand side or left-hand side of a sampling location. The labels are applied to the station names alphabetically.

Possible values:

- L (for a left-hand side label)
- R (for a right-hand side label)

Additional formatting requirements:

- Case sensitive
- Uppercase letter required
- Labels assigned alphabetically

SK_WQ_Map_Label, SK_MET_Map_Label & SK_NUT_Map_Label

For each data type, assign a station label to the right-hand side or left-hand side of a sampling location. The labels are applied to the station names alphabetically.

Possible values:

- L (for a left-hand side label)
- R (for a right-hand side label)

Additional formatting requirements:

- Case sensitive
- Uppercase letter required
- Labels assigned alphabetically

5.1.5 Bonus_Settings

This sheet contains additional options that do not easily fit into any of the other `Global_Decisions` worksheets

5.1.5.a Options

There are six additional options that the user can specify for plotting. All six options are set up in a true/false format:

- Convert temperature units from celsius to fahrenheit?
- Convert precipitation units from mm to in.?
- Include station name as a plot title?
- Include the historical average on cumulative barplot?
- Calculate dissolved inorganic phosphorus
- Calculate dissolved inorganic nitrogen
- Calculate DIN using NO23?
- Include station labels on reserve map?
- Include station labels on trend maps?

The first four decisions are related to plot formatting and appearance. The next two are related to the calculation of additional nutrient parameters. The next three questions relate to the calculation of dissolved inorganic phosphorus and dissolved inorganic nitrogen. For the reserve-level report, the

calculation of dissolved inorganic phosphorus (DIP) and dissolved inorganic nitrogen (DIN) is necessary for the data analyses that evaluate nutrient thresholds. The National Coastal Condition Assessment (NCCA) (USEPA 2016) was used to establish reasonable water quality thresholds for all reserves. However, NCCA only provides water quality thresholds for DIN and DIP and not the individual components. For DIP, it was assumed that *`dip = po4f`*. For DIN, it was assumed that *`din = no2f + no3f + nh4f`* or *`din = no23f + nh4f`*. The final two questions are related to plot labels on reserve maps. Some station locations are close geographically and some reserves may want to manually specify station labels for their maps. Specifying either of these questions as F (or FALSE) will result in maps without station labels.

5.1.5.b Setting

The `Setting` column answers the questions posed in the `Options` column.

Possible values:

- T (or TRUE)
- F (of FALSE)

Additional formatting requirements:

- Case sensitive
- Uppercase letter required

5.2 Analyses

5.2.1 Basic_Plotting

Basic plotting refers to analyses that either plot raw data or perform simple summaries. All box plots, bar plots and range plots are included in this category. After defining the variables on the `Seasons`, `Years_of_Interest`, and `Bonus_Settings` sheets, there are a few remaining variables that must be defined on a parameter basis.

5.2.1.a Parameter

This column contains a list of parameters to be analyzed. The format of each parameter name matches the column headings of a `swmpr` object.

Possible values:

- Any parameter name listed in the `parameters` attribute of a `swmpr` object

Additional formatting requirements:

- Case sensitive

5.2.1.b Parameter_Category

Values in this column are used internally by the annual reporting scripts. If a new parameter is added to the Parameter field then `Parameter_Category` must also be specified.

Possible values:

- wq
- met
- nut

Additional formatting requirements:

- Case sensitive
- Lowercase abbreviation required

5.2.1.c Parameter_Type

Values in this column determine whether or not a parameter should be evaluated on a cumulative basis. Currently, only two parameters are viewed cumulatively: precipitation and photosynthetically active radiation. A parameter that is specified as “cumulative” will produce cumulative barplots instead of boxplots.

Possible values:

- instantaneous
- cumulative

Additional formatting requirements:

- Case sensitive
- Lowercase term required

5.2.1.d Log_Scale

Values in this column determine whether or not the y-axis will be plotted on a log-scale. If this parameter is set to “T” then a log-scale will be used (Figure 49).

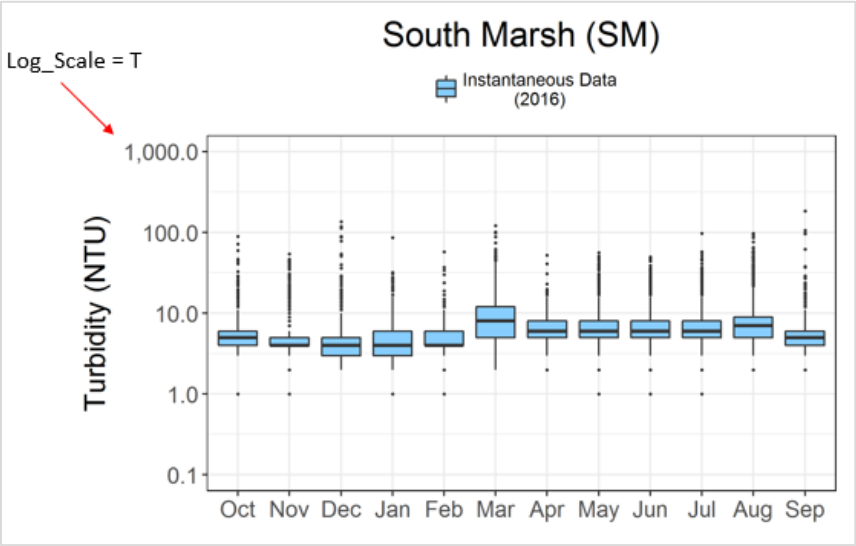


Figure 49. Seasonal_Boxplot with Annotations Highlighting the Impact of Specifying Log_Scale = T

Possible values:

- T (or TRUE)
- F (of FALSE)

Additional formatting requirements:

- Case sensitive
- Uppercase letter required

5.2.1.e WQ_Threshold

Values in this column determine whether or not a water quality threshold line will be plotted on boxplots and range plots (Figure 50). If no value is provided then no line will be plotted.

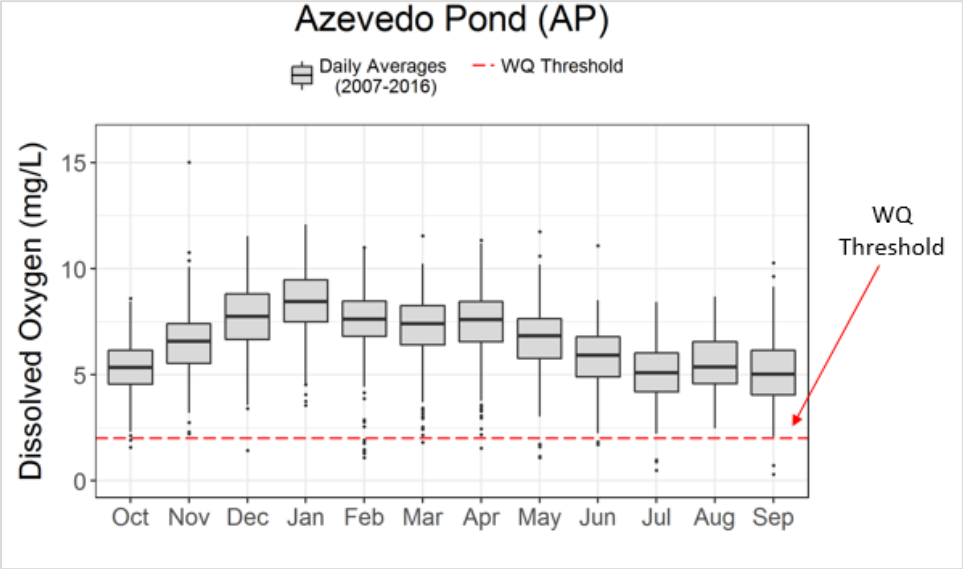


Figure 50. Seasonal_Boxplot with Annotations Highlighting the Impact of Specifying WQ_Treshold

Possible values:

- Any numeric value

Additional formatting requirements:

- Numeric

5.2.2 Threshold_Plots

Threshold plotsrequire more detailed information than box plots, bar plots, and range plots.

5.2.2.a Parameter

This column contains a list of parameters to be analyzed. The format of each parameter name matches the column headings of a `swmpr` object.

Possible values:

- Any parameter name listed in the parameters attribute of a `swmpr` object

Additional formatting requirements:

- Case sensitive

5.2.2.b Parameter_Category

This parameter is used internally by the annual reporting scripts. If a new parameter is added to the Parameter field then `Parameter_Category` must be specified.

Possible values:

- wq
- met
- nut

Additional formatting requirements:

- Case sensitive
- Lowercase abbreviation required

5.2.2.c Threshold_Type

Values in this column define which type of threshold plot should be produced for a given parameter. There are two types of threshold plots available: a criteria threshold plot and a percentile threshold plot (Figures 51 and 52). For a given parameter, the user can generate a criteria threshold plot by specifying `Threshold_Type = criteria` and a percentile threshold plot by specifying `Threshold_Type = percentile`. A criteria threshold plot should be used when the user wants to compare observed data to known, numeric criteria. The percentile threshold plot is more appropriate when the user does not have specific criterion in mind. Currently, threshold plots do not work with cumulative variables such as precipitation and photosynthetically active radiation.

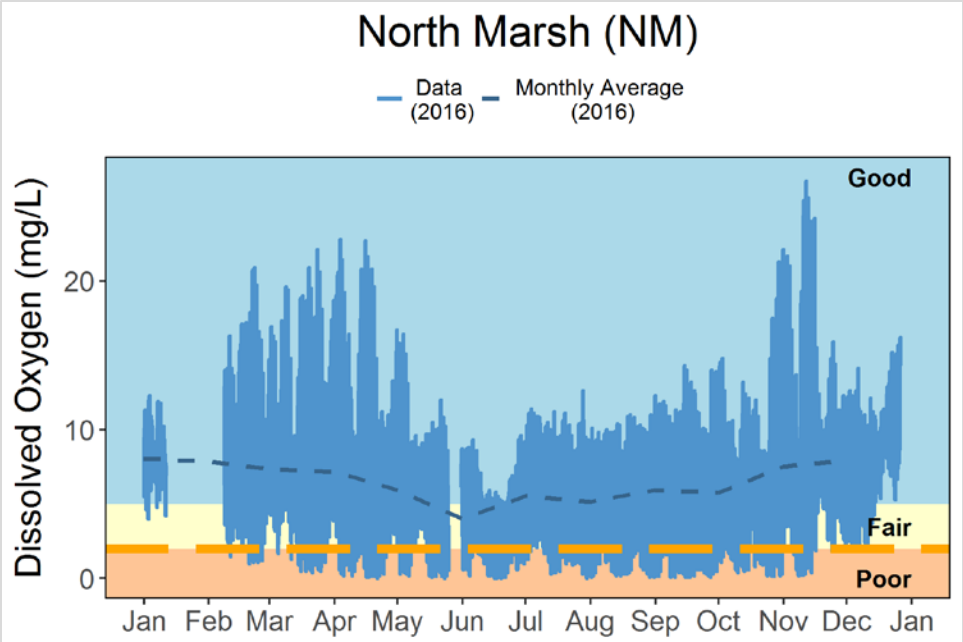


Figure 51. Threshold_Criteria_Plot for North Marsh Station at Elkhorn Slough NERR

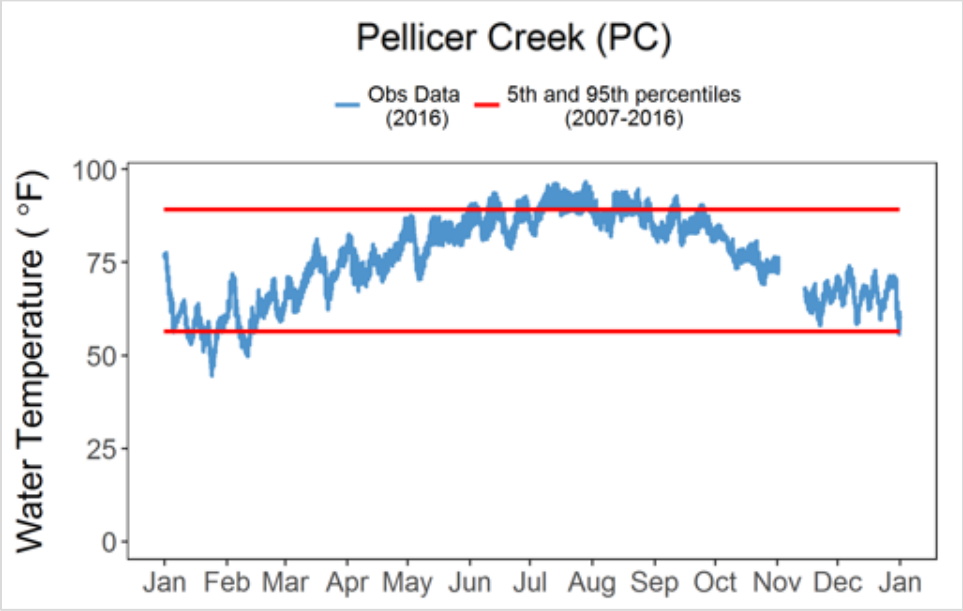


Figure 52. Threshold_Percentile_Plot for Pellicer Creek Station at Guana Tolomato Matanzas NERR

Possible values:

- percentile
- criteria

Additional formatting requirements:

- Case sensitive

- Lowercase term required

5.2.2.d Bound_1 & Bound_2

Values in these columns are relevant for both `Threshold_Type = criteria` and `Threshold_Type = percentile`.

When `Threshold_Type = criteria`, any two numeric values can be used to establish three regions on the criteria plot. There are no default values for **Bound_1** and **Bound_2**; the user must specify them (Figure 53). If the user intends to have three threshold categories (Figure 54) then **Bound_1** must be lower than **Bound_2**. The default values that currently populate each reserve template were selected according thresholds listed in the National Coastal Condition Assessment 2010 (USEPA 2016) (Table 5).

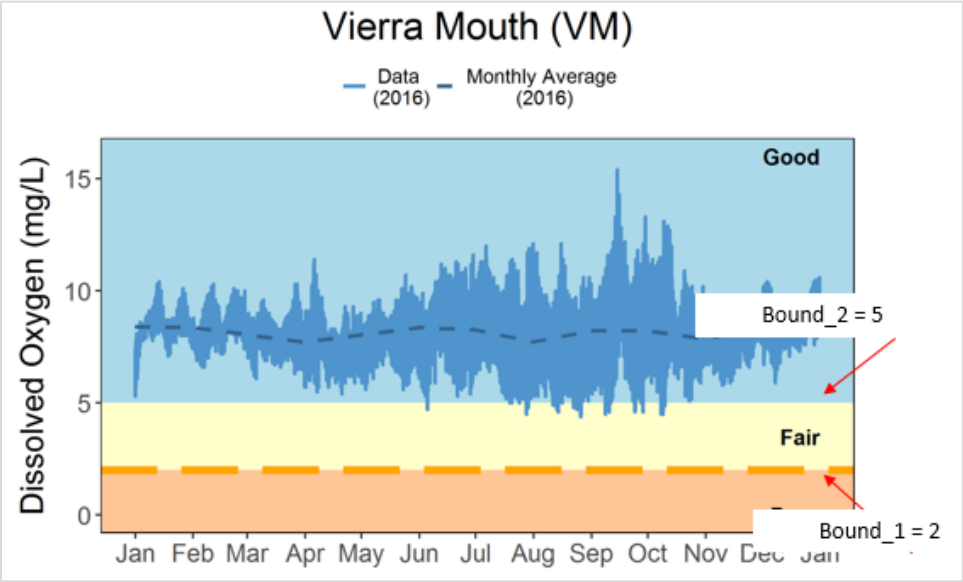


Figure 53. Threshold_Criteria_Plot with Annotations Highlighting the Impact of Specifying Bound_1 and Bound_2

Table 5. Water Quality Threshold Values from the National Coastal Condition Assessment 2010 (USEPA 2016)

NCCR Region	CDMO Region	NERR	Chlorophyll-a (ug/L)			Dissolved Inorganic Nitrogen (mg/L)			Dissolved Inorganic Phosphorus (mg/L)			Dissolved Oxygen (mg/L)		
			Good	Fair	Poor	Good	Fair	Poor	Good	Fair	Poor	Good	Fair	Poor
Gulf	Gulf Coast	Apalachicola Bay	< 5	5-20	> 20	< 0.1	0.1-0.5	> 0.5	< 0.01	0.01-0.05	> 0.05	> 5	2-5	< 2
		Grand Bay												
		Mission Aransas												
		Rookery Bay												
		Weeks Bay												
Northeast	Mid-Atlantic	Chesapeake Bay-MD	< 5	5-20	> 20	< 0.1	0.1-0.5	> 0.5	< 0.01	0.01-0.05	> 0.05	> 5	2-5	< 2
		Chesapeake Bay-VA												
		Delaware												
		Jacques Cousteau												
	Northeast	Great Bay	< 5	5-20	> 20	< 0.1	0.1-0.5	> 0.5	< 0.01	0.01-0.05	> 0.05	> 5	2-5	< 2
		Narragansett Bay												
		Waquoit Bay												
		Wells												
Southeast	Southeast	ACE Basin	< 5	5-20	> 20	< 0.1	0.1-0.5	> 0.5	< 0.01	0.01-0.05	> 0.05	> 5	2-5	< 2
		GTM												
		North Carolina												
		North Inlet-Winyah Bay												
		Sapelo Island												
West	West	Elkhorn Slough	< 5	5-20	> 20	< 0.35	0.35-0.5	> 0.5	< 0.07	0.07-0.1	> 0.1	> 5	2-5	< 2
		Kachemak Bay												
		Padilla Bay												
		San Francisco Bay												
		South Slough												
		Tijuana River												
Tropical	Caribbean	Jobos Bay	< 0.5	0.5-1	> 1	< 0.05	0.05-0.1	> 0.1	< 0.005	0.005-0.01	> 0.01	> 5	2-5	< 2
Great Lakes (Superior)	Great Lakes	Lake Superior	< 1.3	1.3-2.6	> 2.6	n/a	n/a	n/a	< 0.005	0.005-0.01	> 0.01	> 5	2-5	< 2
Great Lakes (Erie/West)	Great Lakes	Old Woman Creek	< 2.6	2.6-3.6	> 3.6	n/a	n/a	n/a	< 0.015	0.015-0.032	> 0.032	> 5	2-5	< 2
	Northeast	Hudson River												

When `Threshold_Type = percentile`, the user can specify up to two percentiles (Figure 53). If only one percentile is specified, then only one percentile will be plotted. If the user does not specify any percentiles for **Bound_1** and **Bound_2**, then the default will be the 5th and 95th percentiles.

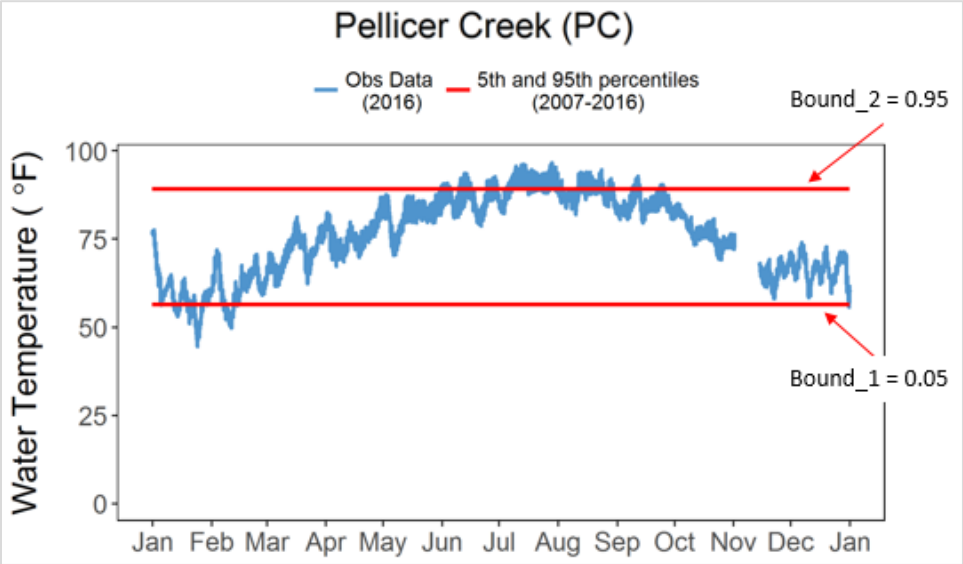


Figure 54. Threshold_Percentile_Plot with Annotations Highlighting the Impact of Specifying Bound_1 and Bound_2

Possible values:

- Numeric
  - Any value for criteria plots
  - Values between 0 and 1 for percentile plots

Additional formatting requirements:

- Numeric
- Lowercase required

5.2.2.e Threshold_Label and Threshold_Color

These parameters are relevant when `Threshold_Type = criteria`. `Threshold_Label` and `Threshold_Color` determine the labels and background colors associated with the three zones created by specifying `Bound_1` and `Bound_2` (Figure 55).

It is possible to create a threshold criteria plot that has two zones instead of three. To do this set `Bound_1 = Bound_2`, `Threshold_Color_1 = Threshold_Color_2` and add a blank space in the cell for `Threshold_Label_2` (Figure 56).

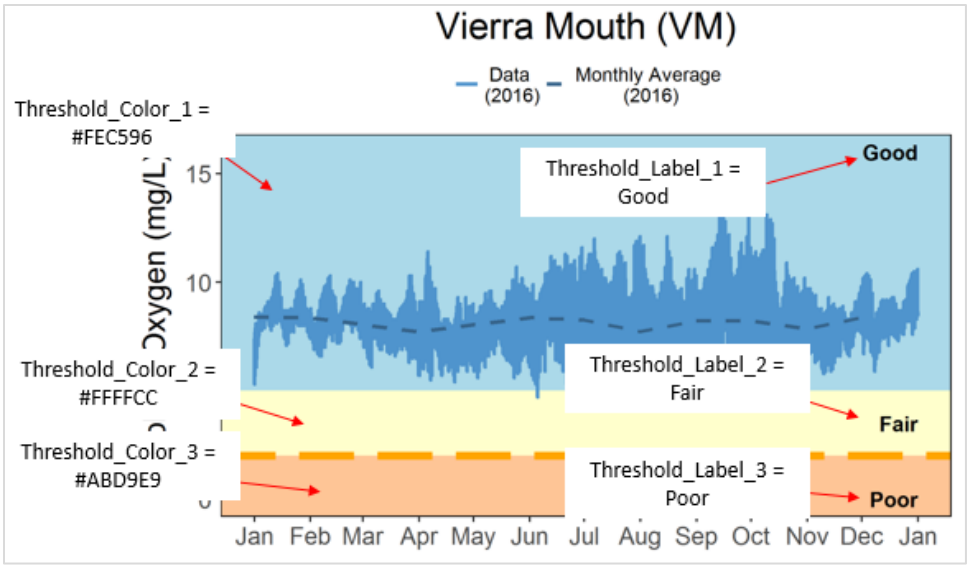


Figure 55. Threshold_Criteria_Plot with Annotations Highlighting the Impact of Threshold_Color and Threshold_Label Values

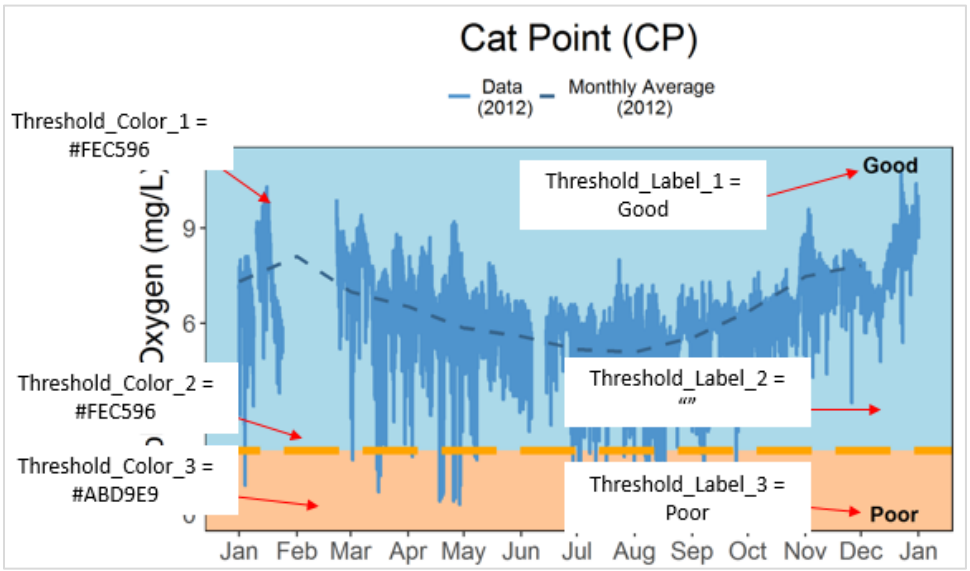


Figure 56. Modified Threshold_Criteria_Plot with Only Two Regions

5.2.2.f Monthly_Smooth

This parameter is relevant when `Threshold_Type = criteria`. By specifying `Monthly_Smooth = T`, the user can add a dashed line of monthly averages (Figure 57). `Monthly_Smooth` is not available for nutrient parameters.

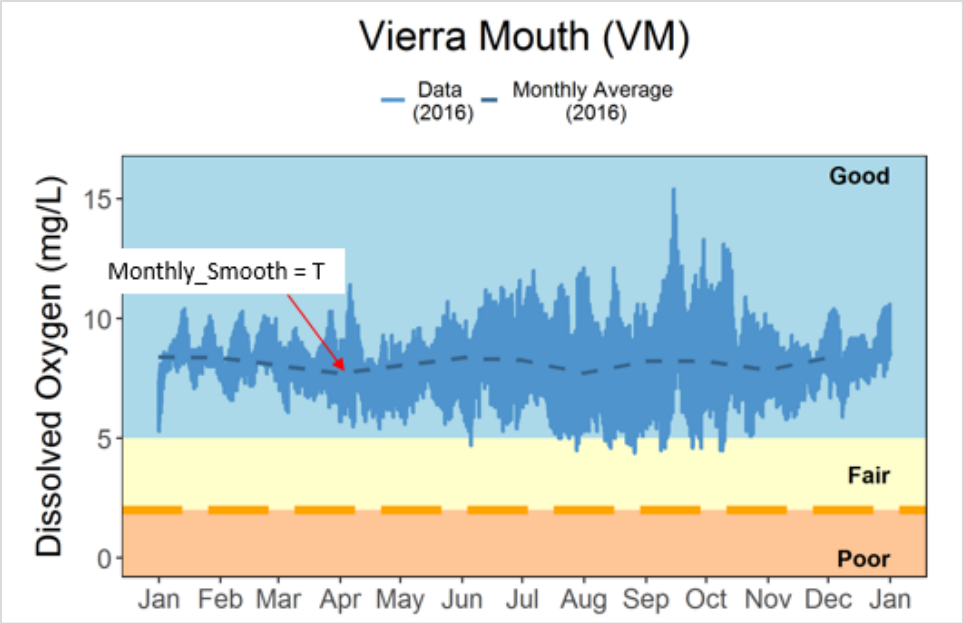


Figure 57. Threshold_Criteria_Plot with Annotations Highlighting the Impact of Monthly_Smooth = T

Possible values:

- T (or TRUE)
- F (of FALSE)

Additional formatting requirements:

- Case sensitive
- Uppercase letter required

5.2.2.g Critical_Threshold

This parameter is relevant when `Threshold_Type = criteria`. By setting the `Critical_Threshold` the user can add a dashed line to emphasize a threshold value (Figure 58).

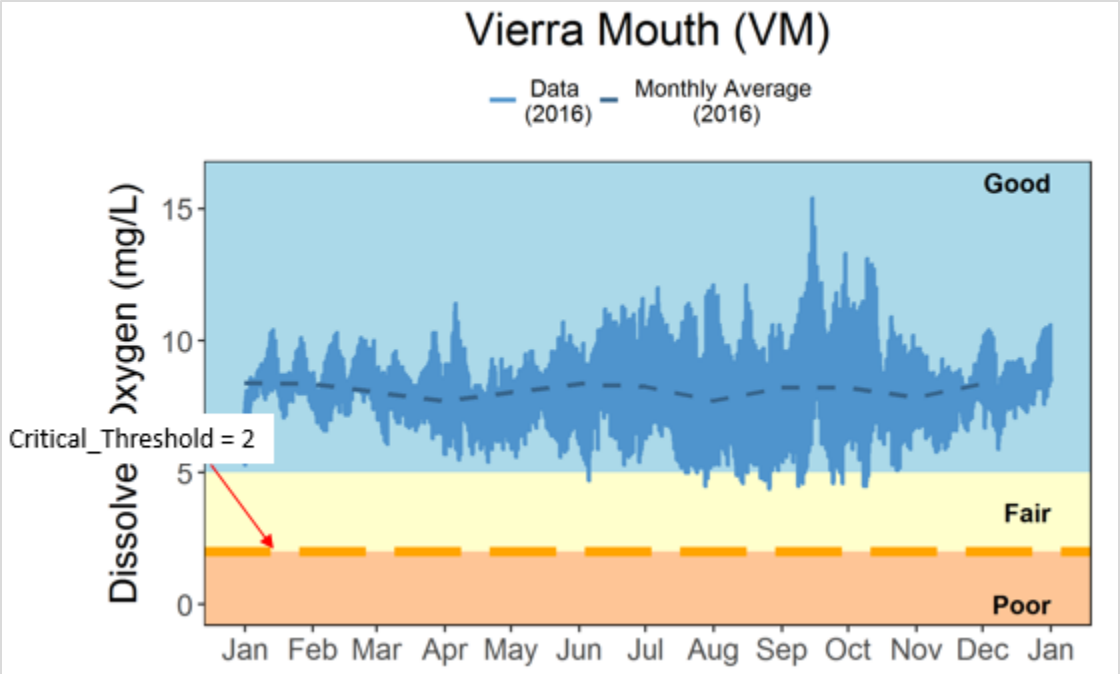


Figure 58. Threshold_Criteria_Plot with Annotations Highlighting the Impact of Critical_Threshold = T

Possible values:

- Any numeric criteria

Additional formatting requirements:

- numeric

5.2.2.h By_Month

This parameter is relevant when `Threshold_Type = percentile`. If `By_Month = T`, then the percentile thresholds will be calculated on a monthly basis (Figure 59).

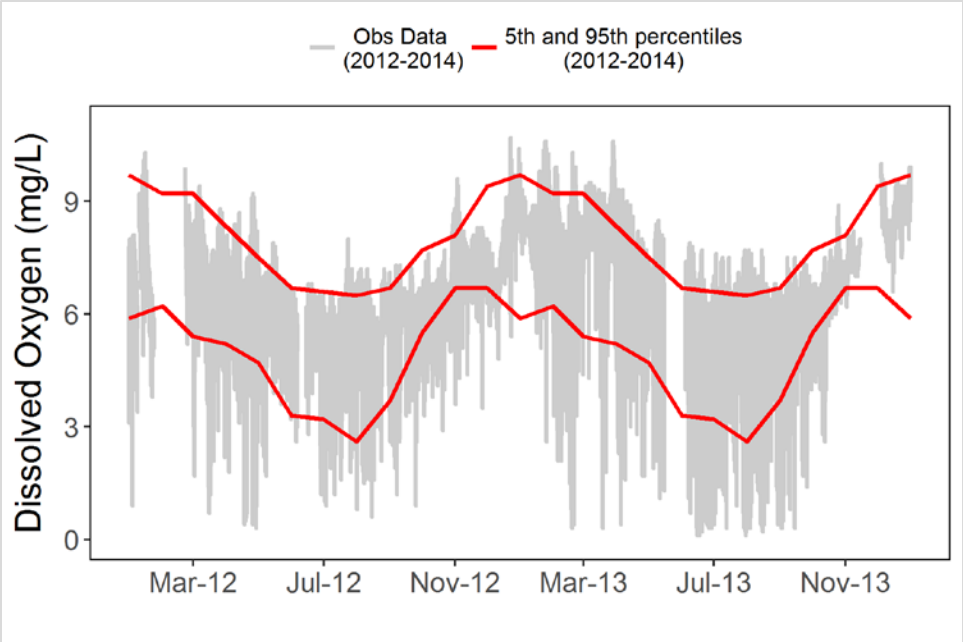


Figure 59. Threshold_Percentile_Plot with Annotations Highlighting the Impact of By_Month = T

Possible values:

- T (or TRUE)
- F (of FALSE)

Additional formatting requirements:

- Case sensitive
- Uppercase letter required

5.2.3 Threshold_Identification

The `Threshold_Identification` analysis is used to create a table of time periods when a given parameter violates a user-specified water quality standard.

5.2.3.a Parameter

This column contains a list of parameters to be analyzed. The format of each parameter name matches the column headings of a `swmpr` object.

Possible values:

- Any parameter name listed in the `parameters` attribute of a `swmpr` object

Formatting requirements:

- Case sensitive

5.2.3.b Parameter_Category

This parameter is used internally by the annual reporting scripts. If a new parameter is added to the Parameter field then `Parameter_Category` must be specified.

Possible values:

- wq
- met
- nut

Additional formatting requirements:

- Case sensitive
- Lowercase abbreviation required

5.2.3.c Qualifier and Value

These two parameters are used to define the threshold value that is used in the `Threshold_Identification` analysis. For example, if `Value = 2` and `Qualifier = <` then the `Threshold_Identification` analysis will identify events where dissolved oxygen is less than 2 mg/L.

Possible values:

- Qualifier
  - <
  - >
  - <=
  - >=
  - ==
  - !=
- Value
  - Numeric

5.2.3.d Time_Hrs

For water quality and meteorological parameters, a time threshold must be specified in hours. By using a time threshold, the `Threshold_Identification` analysis will ignore events that violate the water quality threshold for less than the specified time threshold. For example, if the user-specified water quality threshold for dissolved oxygen is <2 mg/L and the time threshold is 2 hours, then the `Threshold_Identification` analysis will only include events where dissolved oxygen is <2 mg/L for more than two hours.

For nutrient parameters, every time the user-defined threshold is exceeded is counted as an event.

Possible values:

- Any numeric value

5.2.3.e Threshold_Aggregation

This parameter is used during the `Threshold_Summary` analysis. The `Threshold_Summary` analysis simply creates a graphical summary of the results from the `Threshold_Identification`. `Threshold_Identification` results can be aggregated on a monthly, seasonal, or annual basis by specifying `Threshold_Aggregation` = `month`, `season`, **or** `year` (Figures 60 through 62).

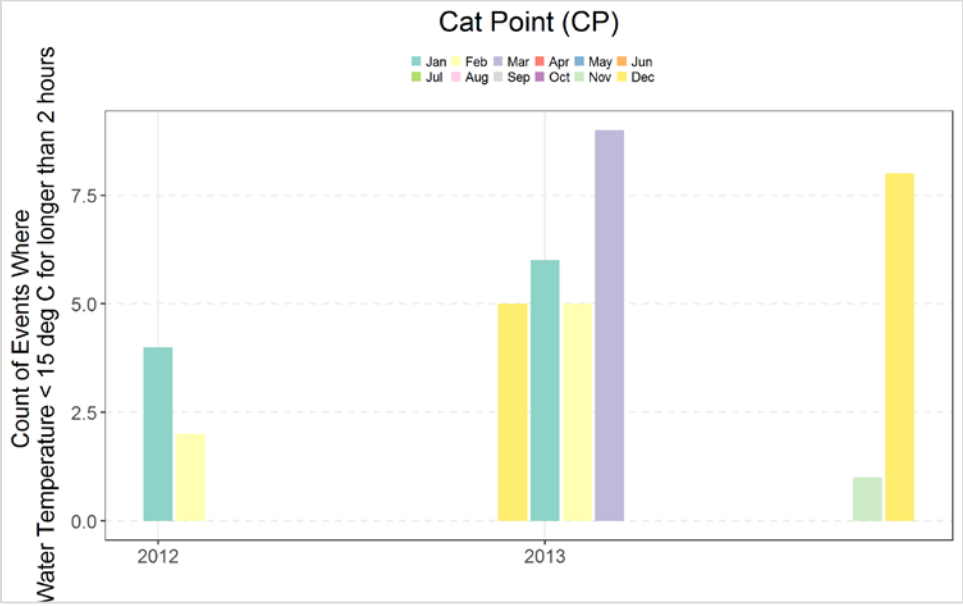


Figure 60. Threshold_Summary Plot Results When Threshold_Aggregation = Month

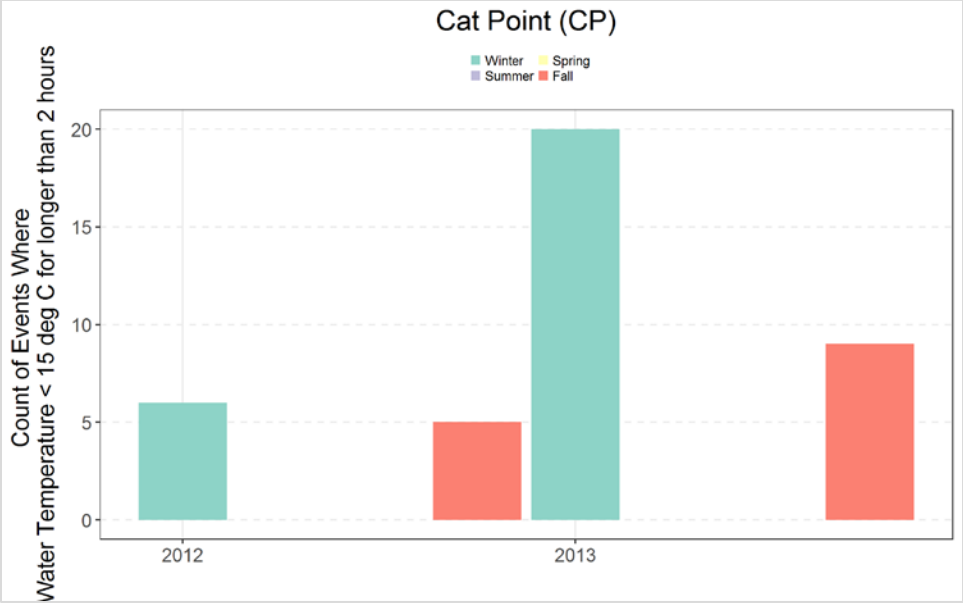


Figure 61. Threshold_Summary Plot Results When Threshold_Aggregation = Season

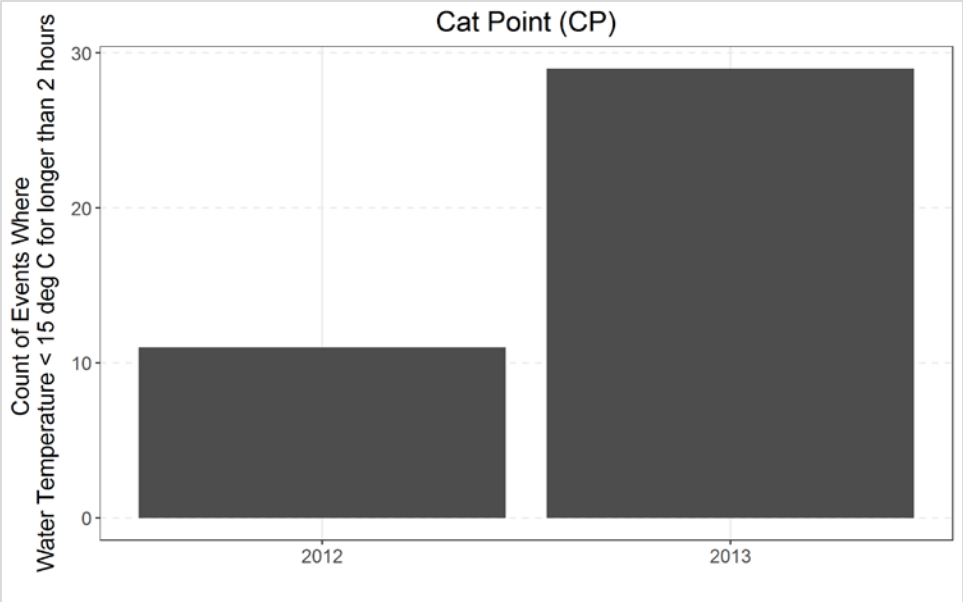


Figure 62. Threshold_Summary Plot Results When Threshold_Aggregation = Year

Possible values:

- month
- season
- year

Formatting requirements:

- Case Sensitive
- Lowercase term required

5.3 References

U.S. Environmental Protection Agency (USEPA). 2016. National Coastal Condition Assessment Report 2010. Washington, D.C. EPA 841-R-15-006. URL: https://cfpub.epa.gov/si/si_public_record_Report.cfm?dirEntryId=327030

6 Text Entry Guide

The **Reserve_Level_Template_Text.xlsx** workbook has been developed to facilitate the production of the reserve-level annual report and to help the user organize reserve-specific text, images, and plots. The workbook is also intended to minimize user interaction with the R scripts that produce the reserve-level annual report.

It is important to note that columns should not be inserted between the existing columns and existing columns should not be deleted.

6.1 Worksheets

There are five worksheets within this workbook: Page_One, Page_Two, Page_Three, Page_Four, and Trend_Table. The first four worksheets correspond to one page in the reserve-level report. The final worksheet, Trend_Table, is where the user defines the parameters that will populate the color-coded trend table on page two of the reserve-level template.

6.2 Column Descriptions

6.2.1 Report Text (Worksheets Page_One, Page_Two, Page_Three, Page_Four)

Within the first four worksheets there are six columns that are common to all worksheets: Variable_Name, Type, Descriptions, Change, Text, and File_Name. There is one column that is only used in the Page_Two worksheet: Parameter.

6.2.1.a Variable_Name

The **Variable_Name** column contains a list of variables that are used in the R scripts to filter each worksheet table. This column must be correctly populated for the R scripts to successfully run.

The user should not modify this column.

6.2.1.b Type

The **Type** column is used let the user know what type of variable Variable_Name represents. It is not necessary to successfully run the R scripts. There are three potential variable types: text, image, and R figure. If a Variable_Name is text then the corresponding variable is used to populate text in the raw reserve-level report. If the type is R figure then the variable is used to populate an R figure into the template. Finally, if the Variable_Name type is image then the variable is used to add a picture to the report.

The user should not modify this column. It is merely informative.

6.2.1.c Description

The **Description** column provides a user-friendly text description to clarify the meaning of the variable listed in the Variable_Name column.

The user should not modify this column. It is meant to help the user interpret the Variable_Name column.

6.2.1.d Change

The **Change** column lets the user know whether they should modify the Text or File_Name columns.

The user should not modify this column. It is meant to help the user determine if they should modify the Text or File_Name columns.

6.2.1.e Parameter

This column only exists on the Page_Two worksheet. It is necessary to populate this column for the following parameters: text_trend_1, text_trend_2, text_trend_3, text_trend_4, and text_trend_5. Each value in the Parameter column is used to populate the trend summary table in the upper left-hand corner of page two in the reserve-level report (Figure 63).

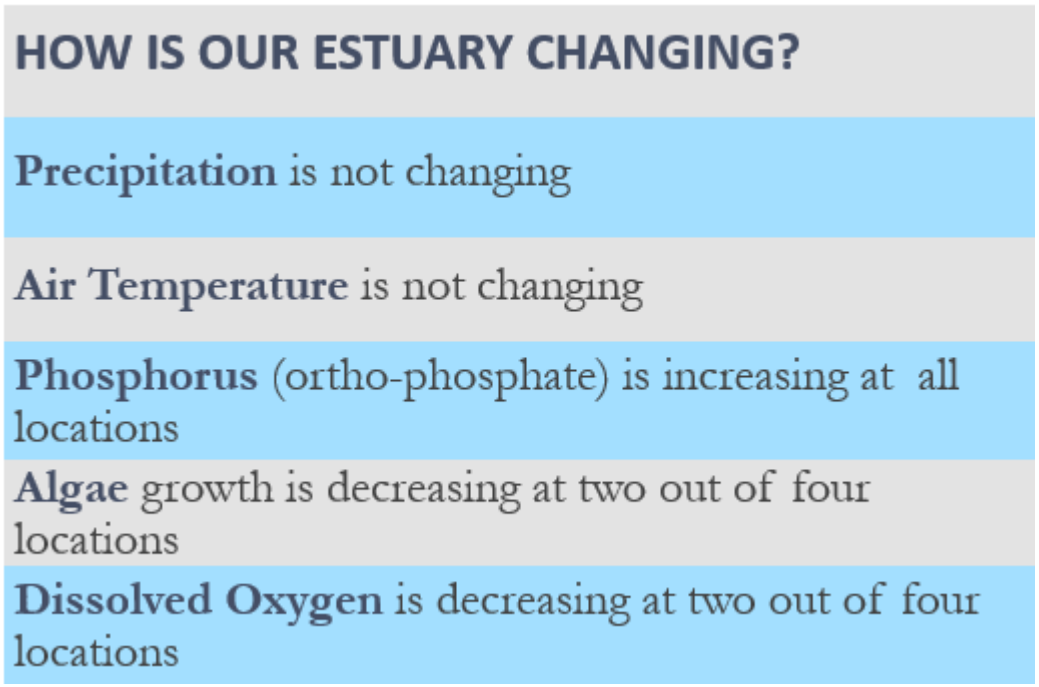


Figure 63. Screenshot of the Trend Summary from the Apalachicola Bay Reserve-level Report

6.2.1.f Text

The **Text** column is where the user should enter text that will be used to populate the reserve-level report. The Text column should be populated by the user if *Type = Text* and *Change = Yes*. If *Type = Text* and *Change = No*, then the cell has already been populated with text that should be consistent across all

reserve-level reports within the system. Figures 64 and 65 illustrate the correspondence between the Text column on the Page_Two worksheet and the resulting text in the reserve-level report.

	A	F	G	H
	Variable_Name	Text	File_Name	
	img_plot_1		output/met/barplot_seasonal/seas_bar_stack_apaebmet_totprcp_yr.png	
	txt_plot_caption_1	Rainfall was ~2 inches greater than the long-term historical average in 2016		

Figure 64. Screenshot of Page_Two Worksheet for Apalachicola Bay (Several Columns and Rows Have Been Hidden)

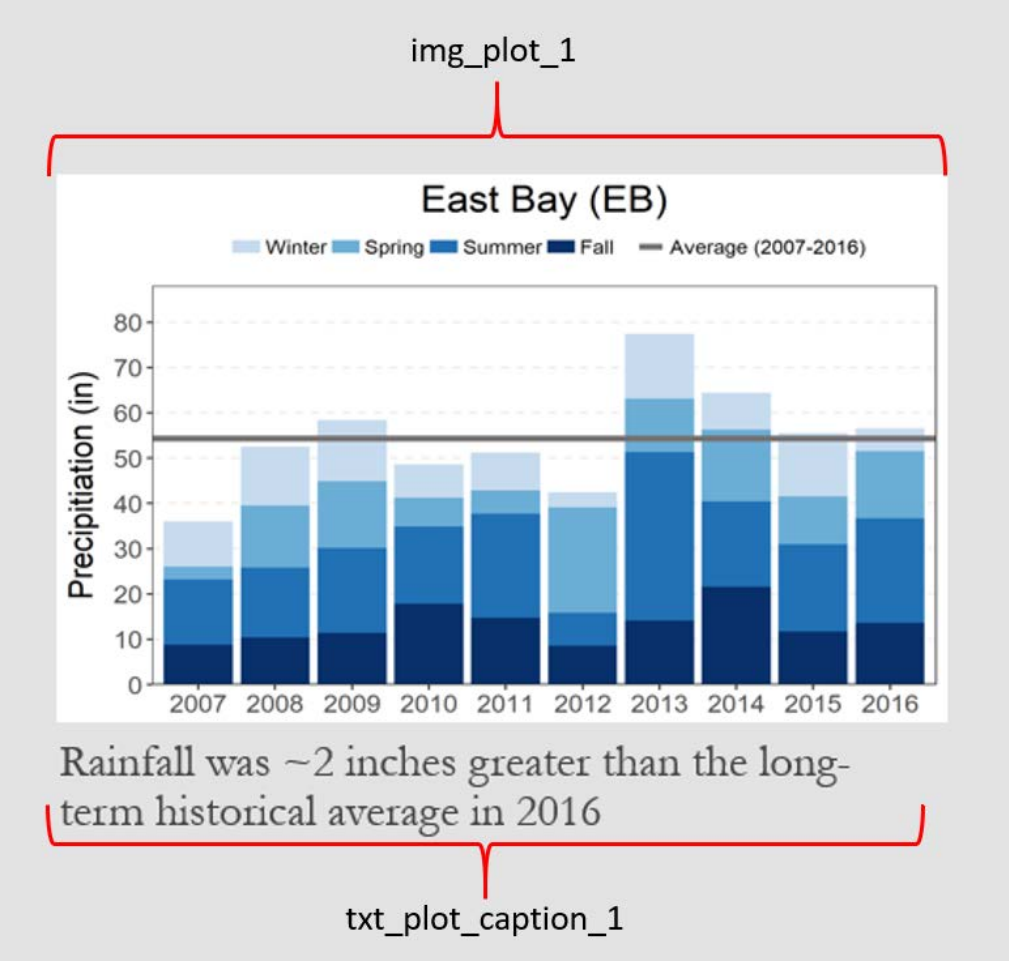


Figure 65. Screenshot of the Apalachicola Bay Reserve-Level Report Txt_plot_caption_1.

6.2.1.g File_Name

The **File** column is where the user should enter the file name that will be used to populate images in the reserve-level report. There are two possible ways to populate this field, first if *Type = Image*, and second, if *Type = R figure*. If *Type = Image* then the user can simply enter the name of the file within the

template_files > images directory. Currently, each reserve-level template folder contains two images, one for Page One (Page1.jpg) and one Page Two (Page3.jpg) (Figure 66). If *Type = R figure* then the user must enter the file path and the figure name in order for the reserve-level report to populate correctly (Figure 67).

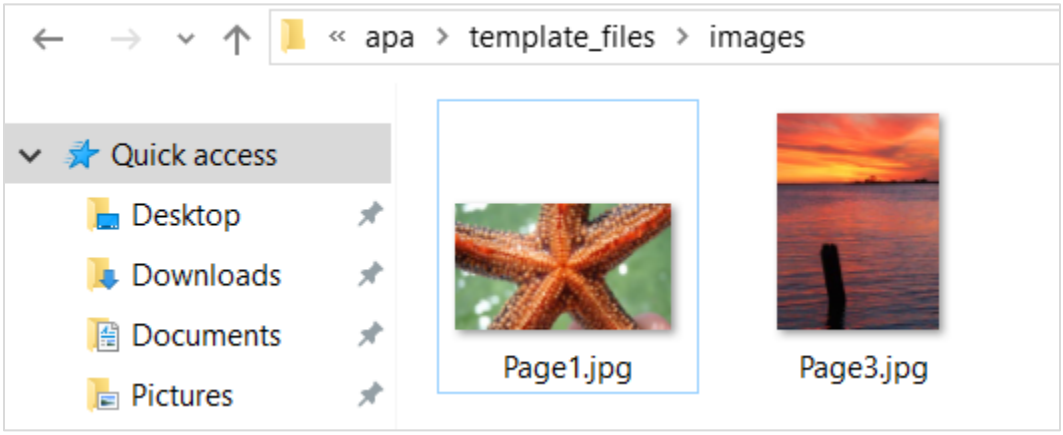


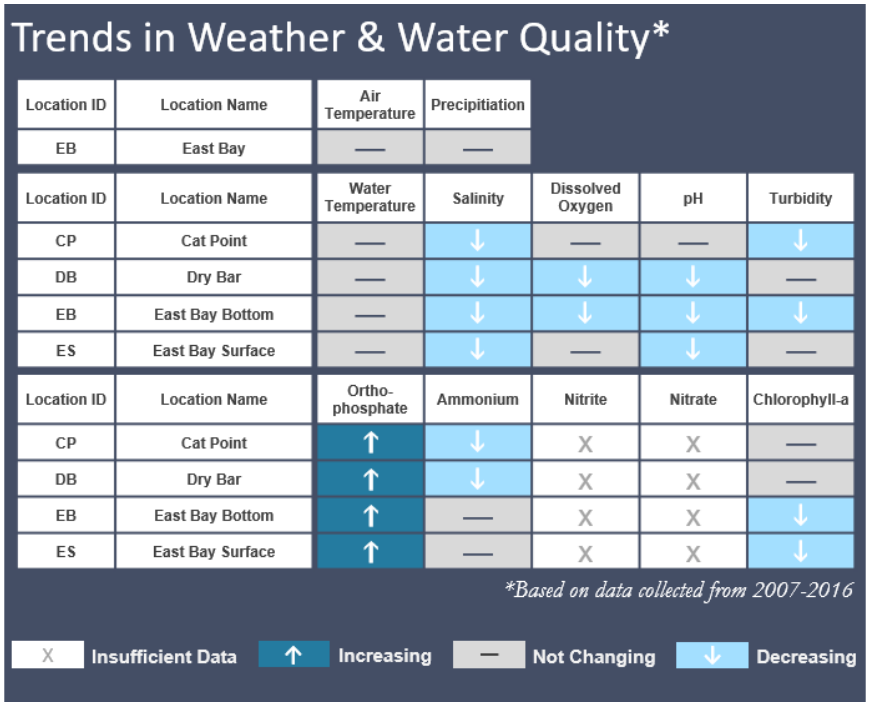
Figure 66. Screenshot of the template_files > images Directory for Apalachicola Bay

	A	B	C	D	G	H	I	J	K
1	Variable_Name	Type	Description	Change	File_Name				
11	img_plot_1	R figure	Figure name for plot on left hand side	Yes	output/met/barplot_seasonal/seas_bar_stack_apaebmet_totprcp_yr.png				
12	txt_plot_caption_1	text	Caption for plot on left hand side	Yes					

Figure 67. Screenshot of Page_Two worksheet for Apalachicola Bay (Several Columns and Rows Have Been Hidden)

6.2.2 Trend Table (Worksheet: Trend_Table)

The **Trend_Table** worksheet is used to populate the trend table on page two of the reserve-level report (Figure 68). Within the Trend_Table worksheet there are two columns that must be defined in order for the template to populate correctly: **Parameter** and **Parameter_Category**.



Trends in Weather & Water Quality*

Location ID	Location Name	Air Temperature	Precipitiation
EB	East Bay	—	—

Location ID	Location Name	Water Temperature	Salinity	Dissolved Oxygen	pH	Turbidity
CP	Cat Point	—	↓	—	—	↓
DB	Dry Bar	—	↓	↓	↓	—
EB	East Bay Bottom	—	↓	↓	↓	↓
ES	East Bay Surface	—	↓	—	↓	—

Location ID	Location Name	Ortho-phosphate	Ammonium	Nitrite	Nitrate	Chlorophyll-a
CP	Cat Point	↑	↓	X	X	—
DB	Dry Bar	↑	↓	X	X	—
EB	East Bay Bottom	↑	—	X	X	↓
ES	East Bay Surface	↑	—	X	X	↓

*Based on data collected from 2007-2016

X Insufficient Data ↑ Increasing — Not Changing ↓ Decreasing

Figure 68. Screenshot of the Trend Table On Page Two of the Apalachicola Bay Reserve-Level Report

6.2.2.a Parameter

The **Parameter** column is where the user specifies the parameters that will appear in the trend table. The format of each parameter name matches the column headings of a **swmpr** object.

Possible values:

- Any parameter name listed in the parameters attribute of a swmpr object

Additional formatting requirements:

- Case sensitive

6.2.2.b Parameter_Category

Values in the **Parameter_Category** column are used to sort the parameters into the three different trend tables: meteorology, water quality, and nutrients.

Possible values:

- wq
- met
- nut

Additional formatting requirements:

- Case sensitive
- Lowercase abbreviation required

7 Report Formatting Guide

This section provides a guide on how to format an unformatted (raw) reserve-level template to create the final annual reserve-level report. Additional formatting information and guidance is provided in the "Report Style Guide" in Appendix A.

7.1 Opening the Raw Template File

The unformatted (raw) reserve-level report will be in the "templates_files" folder and will be named "annual_report_raw" (Figure 69).

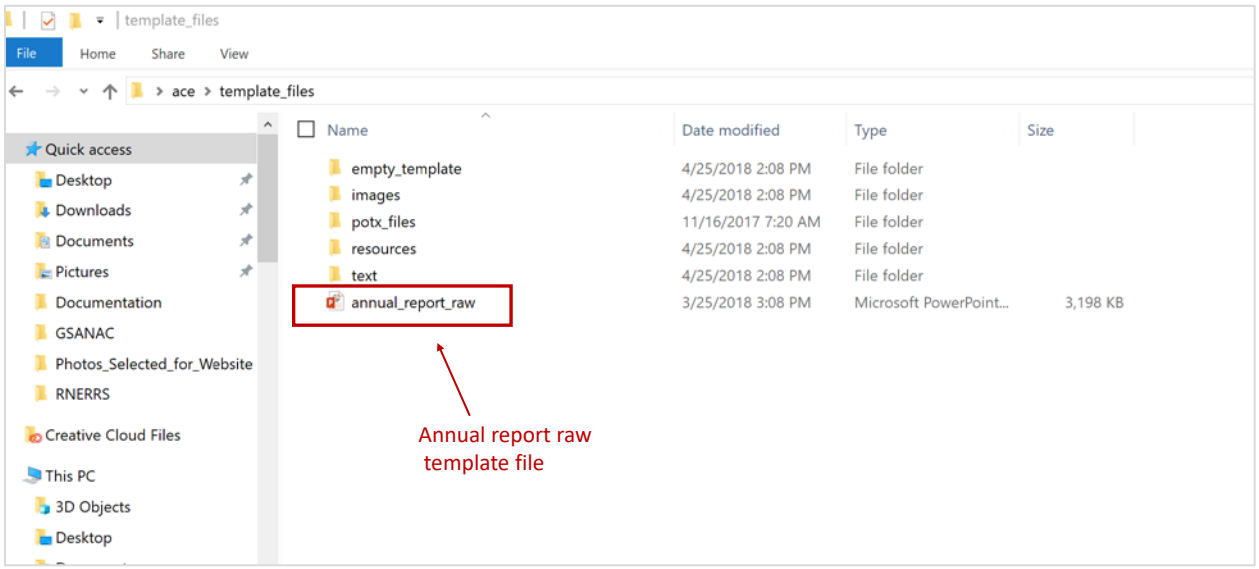


Figure 69. Screenshot of the Annual Report Raw Template file in in the "template_files" Folder

When the unformatted (raw) reserve-level report file is first opened, it may open in "Normal" view mode or "Slide Master" view mode (Figure 70). If the template file opens in "Slide Master" view mode, complete the following steps to switch the view mode to "Normal" (Figure 71). Go to the "View" section and the "Presentation Views" tab. Click on the "Normal" option to switch the view mode to "Normal."

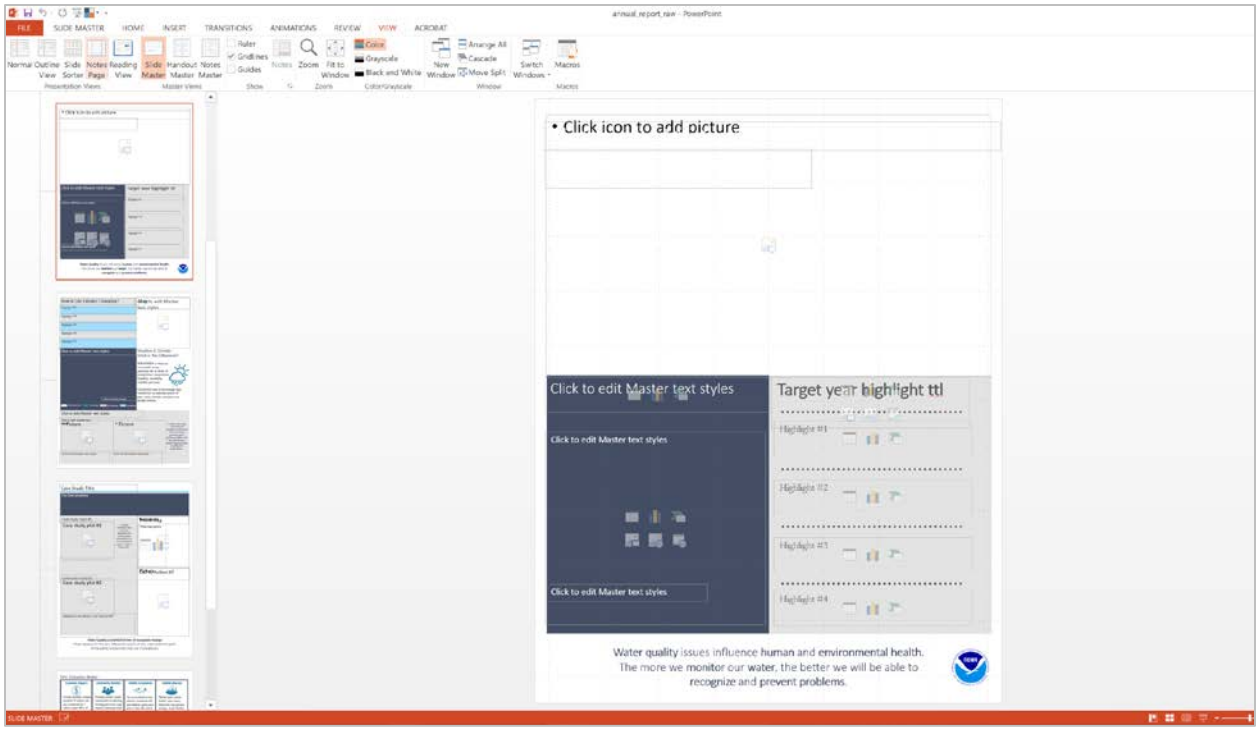


Figure 70. Example of "Slide Master" View Mode

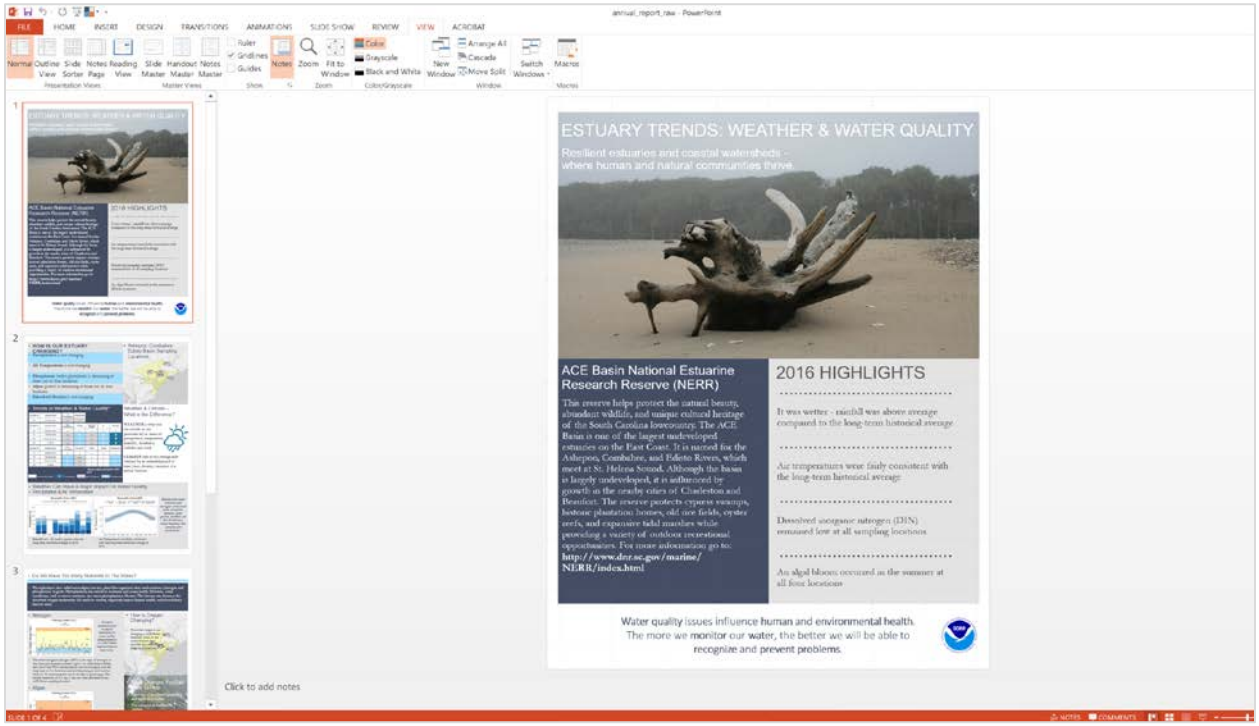


Figure 71. Example of "Normal" View Mode

7.2 Page One Formatting Steps

Step 1. Cover image

- The generation of the raw annual report results in a slight misalignment of the cover image and the box elements below. Adjust the cover image to left align with the "reserve background information box" below. Click on the image to select it and then move the image eight (8) spaces to the right by using the right arrow on the keyboard. An example of a misaligned (top) and aligned (bottom) cover image is provided below (Figure 72).

Figure 72. Example of a Misaligned (top) and Aligned Cover Image

- *Optional* - If the report title (in white font) does not have enough contrast with the cover photo, add the **Report Title Background** (see Template_Resources.pptx, Page 1) element to create contrast and improve readability. Go to the "Template_Resources.pptx" file and select element, copy and paste into the report pptx file. Align the element to top of the page but don't move over to left yet. Select the report title and subtitle text boxes, go to the "Format" section and the "Arrange" tab, click on the "Bring Forward" down arrow, and select "Bring to Front." Next, move the **Report Title Background** element to the left so that is aligned to the left side of the page and the element is completely aligned with the top of the page. A screenshot of the Page 1 Template_Resources.pptx elements is provided below (Figure 73).

Figure 73. Screenshot of the Page 1 Template_Resources.pptx Elements

- *Optional* - Add the **Cover Photo Credit Label** (see Template_Resources.pptx, Page 1) if a photo credit is required. Go to the "Template_Resources.pptx" file, select the element and copy and paste into the report pptx file. Fill-in the photo credit information. Align the text box to the bottom, right side of the cover image. A screenshot of cover photo without (left) and with (right) the **Report Title Background** and **Cover Photo Credit Label** is provided below (Figure 74).

Figure 74. Screenshot of Cover Photo Without (left) and With (right) "Report Title Background" and "Cover Photo Credit Label"

Step 2. Reserve background information box

- *Optional* - Adjust the reserve background information in the text box to improve the layout. Adjustments can be made by adjusting (increasing or decreasing) the text box width.
- Adjust the web link text box to improve the text layout by adjusting the text box width and/or adding a space(s) to move text to the next line. Align the web link text with the "For more information go to:" statement. The text box may be placed on same line or a line below as shown in Figure 75.

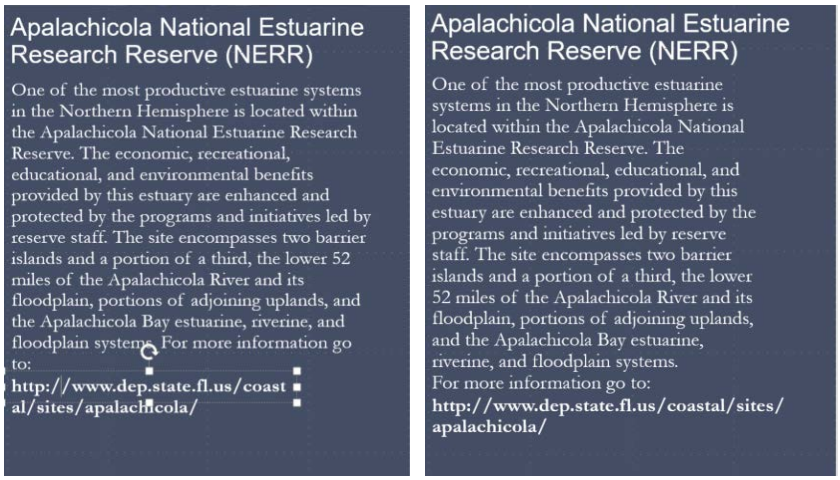


Figure 75. Screenshot of the Reserve Background Information Text and Web Link Unformatted (left) and Formatted (right)

Step 3. 20XX Highlights box

- Select words to emphasize in the "20XX Highlight" box. Change the font to bold and dark blue (RGB 68,78,101) (Appendix A). Adjust each highlight statement text box to the middle vertical position between each dotted line as illustrated in Figure 76.

Figure 76. Screenshot of Annual Highlight Box Unformatted (left) and Formatted (right)

7.3 Page Two Formatting Steps

Step 1. Remove bullets

- Remove the bullets on the entire page. Go to the "Home" section and the "Editing" tab, click on the "Select" down arrow and click on "Select All." Go to the "Paragraph" tab and click on the "Bullets" down arrow and select "None" (Figure 77).

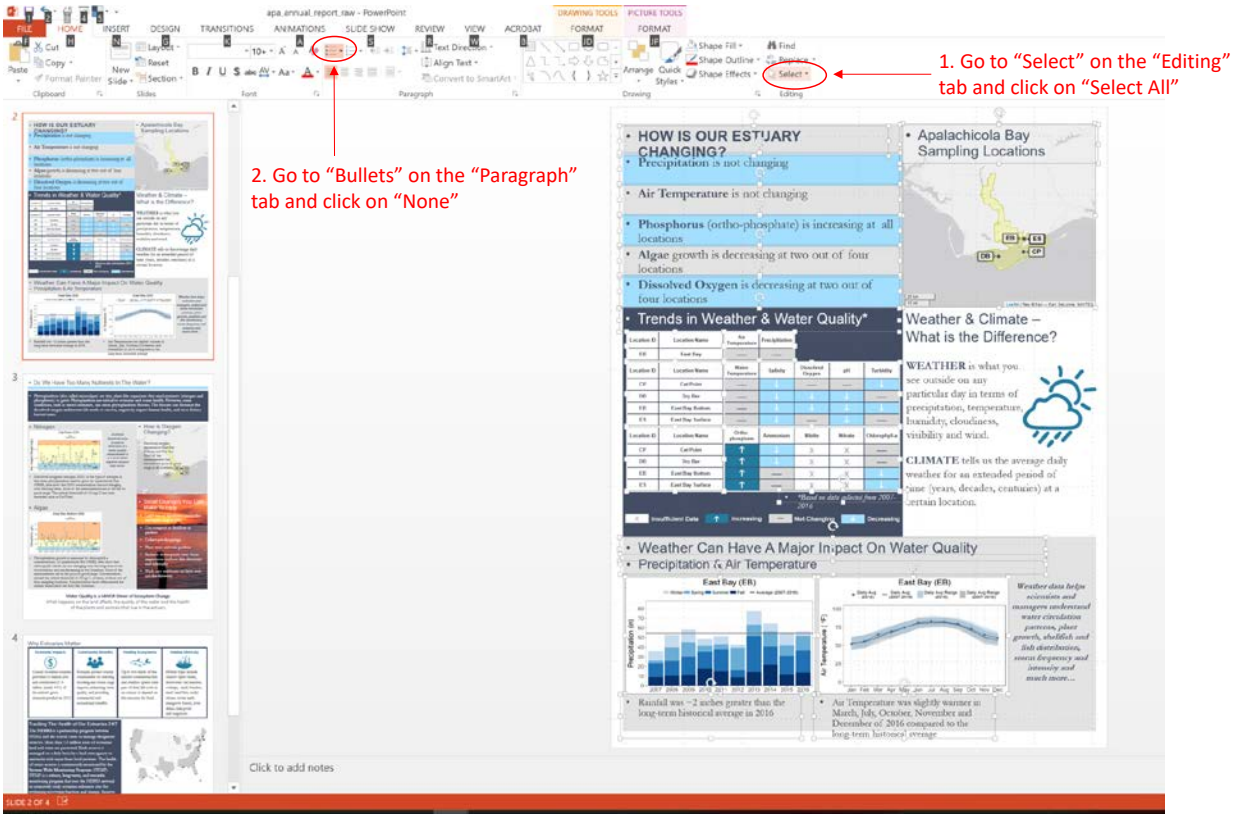


Figure 77. Screenshot of Steps to Remove Bullets on an Entire Page

Step 2. HOW IS OUR ESTUARY CHANGING box

- Adjust the title to the middle vertical position of the first row.
- Adjust each highlight statement text box to the middle vertical position in each row (Figure 78).
- Fix orphans (i.e., a single word on a line) by adding a space(s) until the desired text moves to the next line (Figure 78).

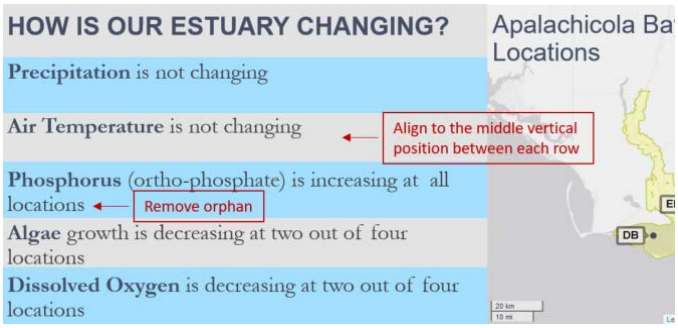


Figure 78. Illustration of Unformatted Highlight Statements and Orphans

Step 3. Sampling location map box

- Add the **Legend for Reserve Map** (see Template_Resources.pptx, Page 2) element to the map. Adjust the placement of the element on the map so that the legend is readable and does not interfere with the other map elements.
- *Optional* - Add a **Customizable Map Label** (see Template_Resources.pptx, Page 2) element to the map. See section 5, 5.1.5a Options for more detail on the customizable map label.

A screenshot of the Page 2 Template_Resources.pptx elements is provided below (Figure 79).

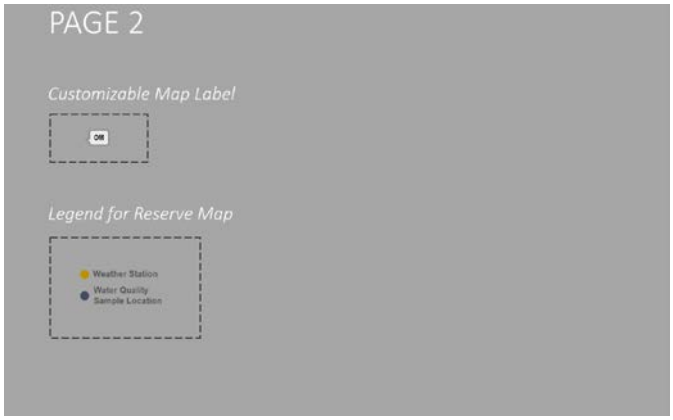


Figure 79. Screenshot of the Page 2 Template_Resources.pptx elements

An example of a formatted sampling location map box is provided below (Figure 80).

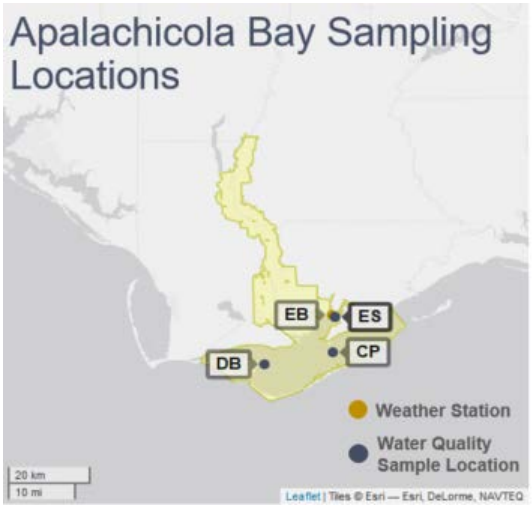


Figure 80. Screenshot of a Formatted Sampling Location Map

Step 4. Trends in Weather & Water Quality box

- *Optional* - If the table footnote and legend are behind the table, go to the "View" section and then select "Slide Master" in the "Master Views" tab to move the footnote and legend down to the bottom of the table. The table footnote and the legend should look like the example below (Figure 81).

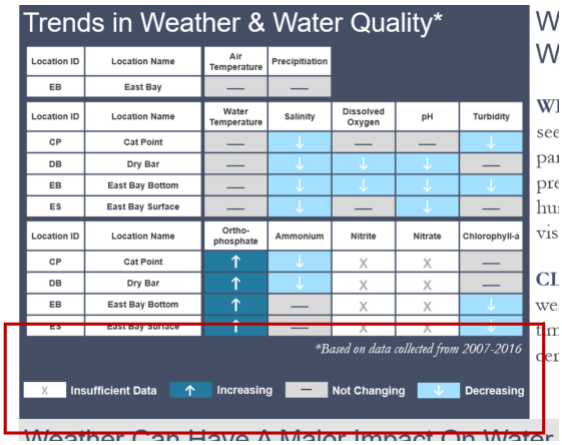


Figure 81. Example of a Formatted Table Footnote and Legend

Step 5. Weather Can Have A Major Impact On Water Quality box

- If needed, adjust the text box width (increasing or decreasing) to improve the text layout under the plots (i.e., not all of the text may fit within the template boundary).
- Fix orphans (i.e., a single word on a line) by adding a spaces(s) until the desired text moves to the next line.

The screenshot below provides an example of unformatted (top) and formatted (bottom) text box for a plot (Figure 82).

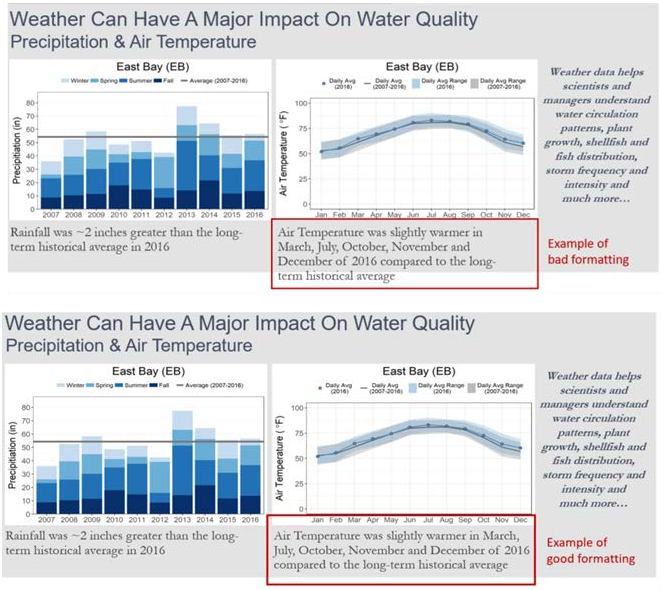


Figure 82. Example of Plot Text Unformatted (top) and Formatted (bottom)

7.4 Page Three Formatting Steps

Step 1. Remove bullets

- Remove the bullets on the entire page. See detailed instructions on how to perform this action above in section 7.3, Step 1.

Step 2. Topic area box

- If needed, move the topic area text box to the middle vertical position of the element box (i.e., select text box and use up or down arrows on keyboard to place in the middle of the box element).

Step 3. Plots

- Adjust the text box width (increasing or decreasing) to improve the text layout under the plots. See examples of unformatted (left) and formatted (right) versions below (Figure 83).

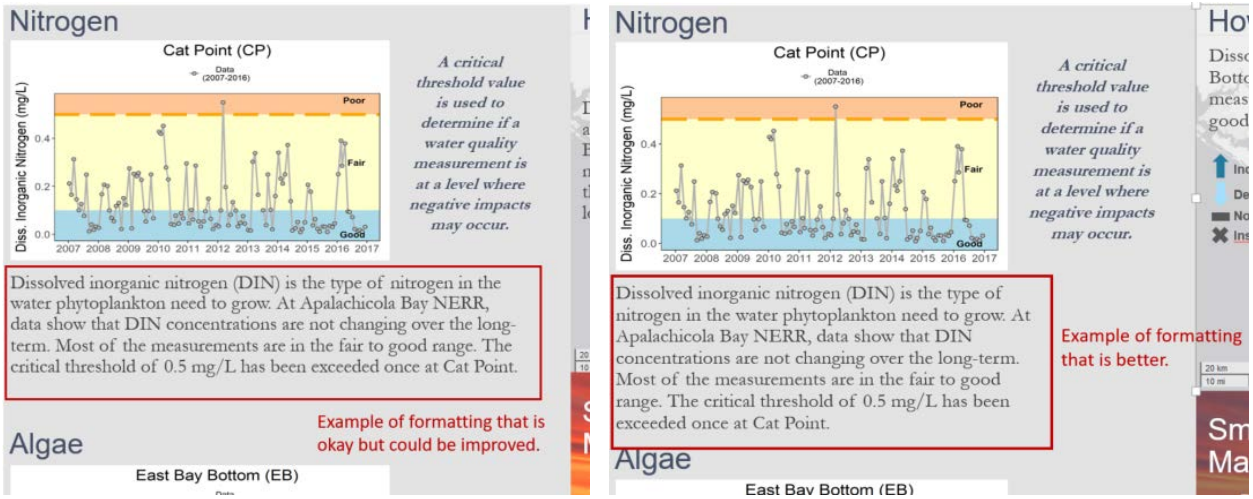


Figure 83. Example of Plot Text Unformatted (left) and Formatted (right)

Step 4. Trend map box

- If needed, adjust the plot text placement and text box width on the trend map to improve the layout.
- Add the **Legend for Trend Map** (see Template_Resources.pptx, Page 3) element. Adjust the placement of the legend on the map so that the legend is readable and does not interfere with the other map elements. An example of a formatted trend map is provided below in Figure 84.

Figure 84. Example of a Formatted Trend Map

Step 5. Small Changes You Can Make To Help box

- The generation of the raw report results in a slight misalignment of the "Small Changes You Can Make To Help" image and plot box to the left. Adjust the image to align with the bottom of the plot box to the left. Click on the image to select it and then move the image eight (10) spaces up by using the up arrow on the keyboard. An example of a misaligned (top) and aligned (bottom) image is provided below (Figure 85).

Figure 85. An Example of a Misaligned (top) and Aligned (bottom) Image

- Move the image to the "Back" so it is behind the map element above and doesn't cover the bottom of the map element (e.g., data source, scale, etc.). Click on the image and go to the "Format" section and the "Arrange" tab. Click on the "Send Backward" down arrow and select "Send to Back."
- *Optional* - If the text (in white font) does not have enough contrast with the background photo, add the **Call To Action Background** (see Template_Resources.pptx, Page 3) element to create contrast and improve readability. See detailed instructions on how to perform this action above in section 7.2, Step 1.
- *Optional* - Add the **Call To Action Photo Credit Label** (see Template_Resources.pptx, Page 3) element if a photo credit is required. Place the photo credit label at the bottom right of the image. See detailed instructions on how to perform this action above in section 7.2, Step 1.
- Add bullets back to the "action statement" text box. Select the text box and go to the "Home" section and the "Paragraph" tab. Click on the "Bullets" down arrow and select "Filled Round Bullets." A screenshot of a formatted box is provided below in Figure 86.

Figure 86. Example of a Formatted "Small Changes You Can Make to Help" Box

A screenshot of the Page 3 Template_Resources.pptx elements is provided below (Figure 87).

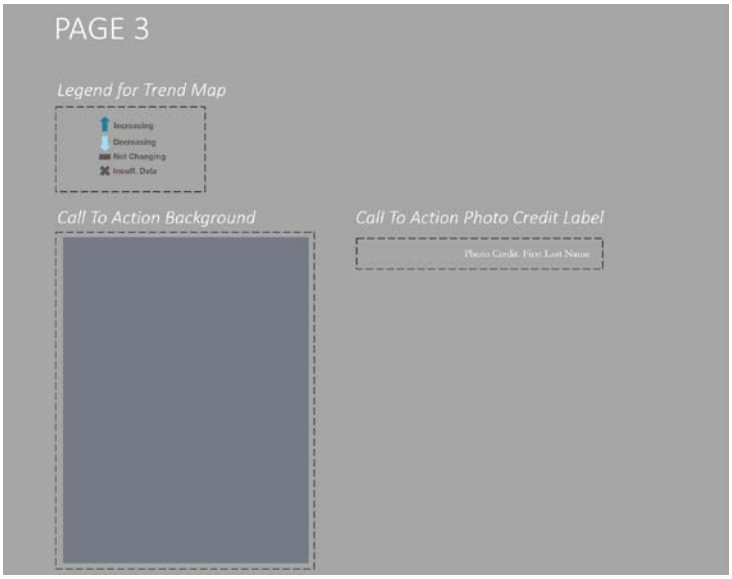


Figure 87. Screenshot of the Page 3 Template_Resources.pptx Elements

7.5 Page Four Formatting Steps

Step 1. NERR Map

- Add the **NERRS Map – Individual Reserve Call-out** label to the map (see Template_Resources.pptx, Page 4) element. Replace the "Reserve" text in label with the name of the reserve.

A screenshot of the Page 3 Template_Resources.pptx elements is provided below (Figure 88).

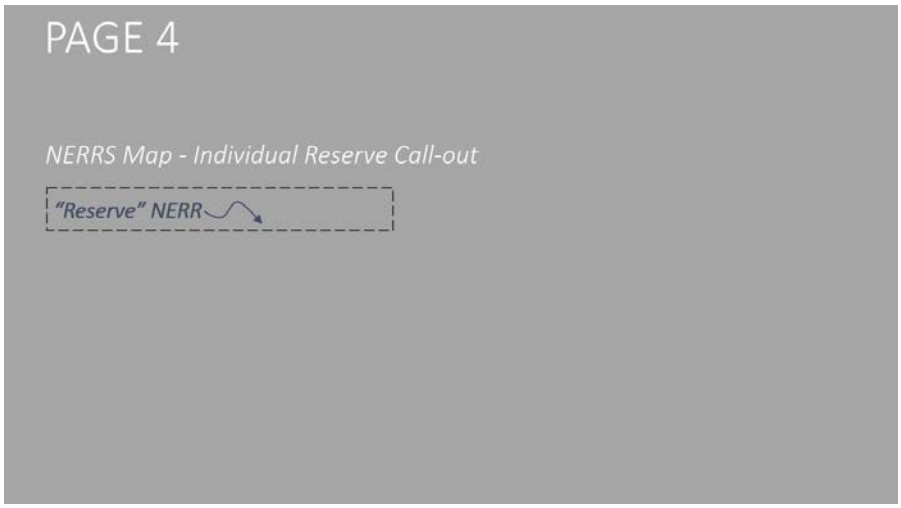


Figure 88. Screenshot of the Page 4 Template_Resources.pptx Elements

Step 2. Have Questions? box

- Remove the bullets. See detailed instructions on how to perform this action above in section 7.3, Step 1.
- Add contact information for the reserve staff member who will be the main point of contact.
- Adjust the spacing to be consistent with the formatting in other boxes. Go to the Home section and the "Paragraph" tab. Click on the "Line and Paragraph Spacing" down arrow and select the "Line Spacing Options" section. Under "Spacing", change "Before" to "0 pt" and "Line Spacing" to "Exactly" and "At" to "17 pt."

Step 3. Highlight statement "… - providing the science needed for today and tomorrow"

- Add the name of the reserve to the bottom highlight statement. Go to "View" then the "Master Views" tab and select "Slide Master." Click on the text box with the **[MANUAL EDIT NAME]** text and replace text with the name of the reserve. After the change has been made, go to "Presentation Views" and select "Normal" to return to the normal view mode.

Step 4. Logos

- Add any reserve or other organization logos to the bottom right side of the page. Make sure to resize the logos to fit and align with the other content on the page. An example of a logo layout is provided below (Figure 89).

Figure 89. Example of a Logo Layout

7.6 Create Final PDF

After the formatting steps have been completed, the user is ready to create the final annual reserve-level report as a PDF. Go to "File" and "Save As" (Figure 90). Specify the location where you want to save the PDF. Go to "Save as type:" and select "PDF" (Figure 91). Make sure the "Standard (publishing online and printing) option is selected and then click "Save." A PDF version of the annual reserve-level report should now be created and available for distribution.

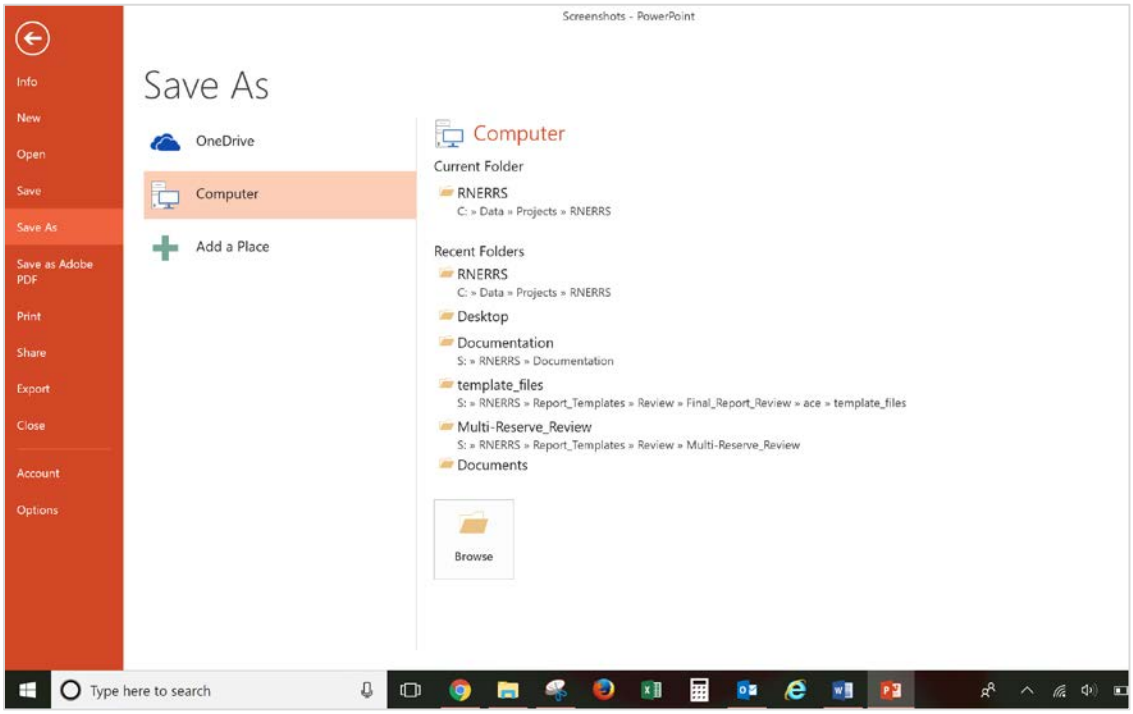


Figure 90. Screenshot of PowerPoint File and "Save As" Option Page

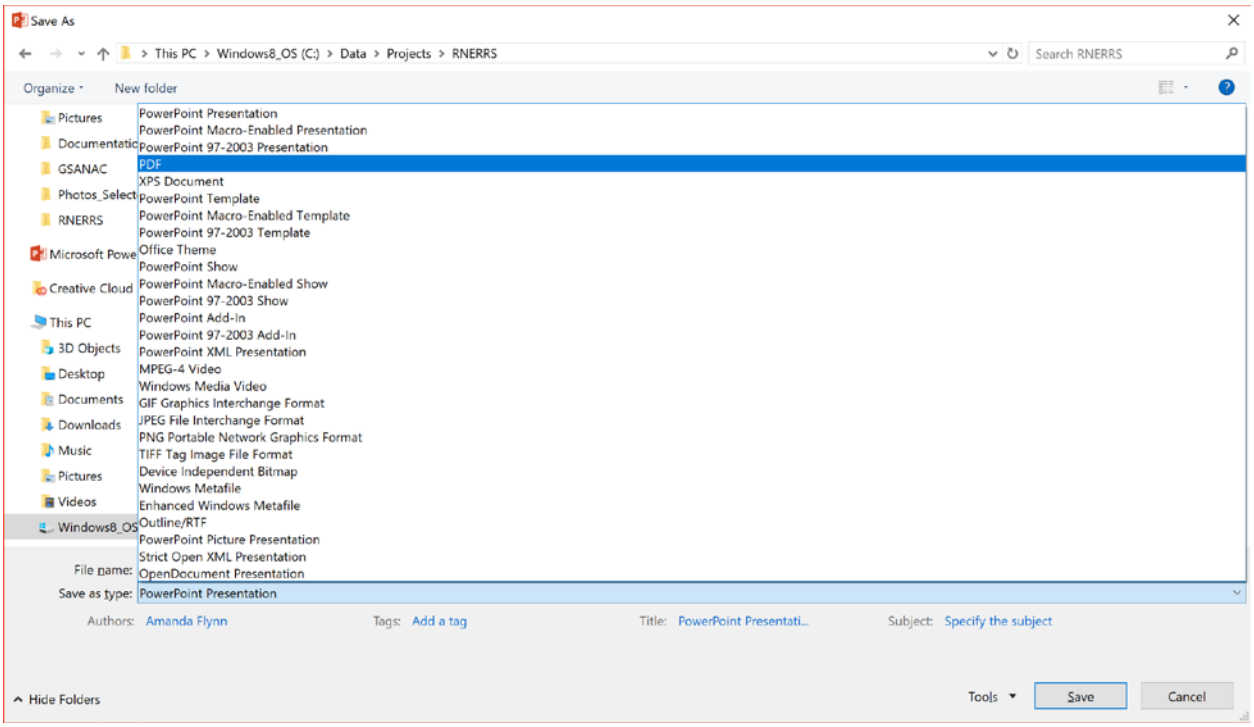


Figure 91. Screenshot of the "Save as type" Options in PowerPoint and Selection of PDF

Appendix A: Report Style Guide

Style Guide

NERRS SWMP Reserve-Level Annual Reports

Introduction

These guidelines describe the visual elements that represent the NERRS SWMP Reserve-Level Annual Report identity. This includes elements such as color, typography, graphics and images.

While each reserve is unique and has it’s own image and character, it is important to send a consistent message of the NERRS SWMP to present a strong and cohesive image for the program as a whole.

These guidelines reflect a commitment to quality, consistency, and style.

Table of Contents

1. Color Palette

The color palette is based on the NOAA Office of Coastal Management NERRS website reserve web pages. The color palette consists of blues and grays. All colors in the report should follow this color palette.

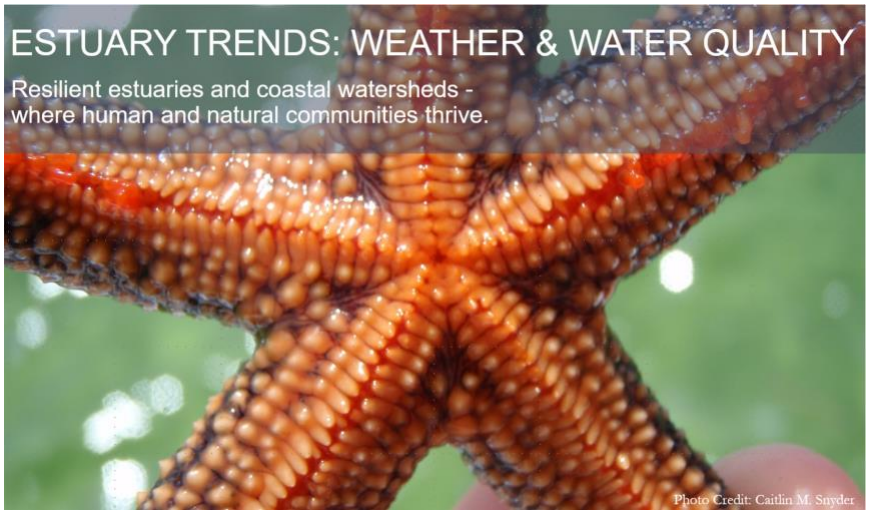
An example of the color palette used for the reserve web pages can be found here:
https://coast.noaa.gov/nerrs/reserves/wells.html

Light Blue	Medium Blue	Dark Blue
RGB 163,223,255 Hex #A3DFFF	RGB 36,123,160 Hex #247BA0	RGB 68,78,101 Hex #444E65

Light Gray	Medium Gray	Dark Gray
RGB 217,217,217 Hex #D9D9D9 **Set at 25% transparency*	RGB 89,89,89 Hex #595959	RGB 64,64,64 Hex #404040

The titles, headers, and highlight statement font color varies and includes white (RGB 255,255,255), medium gray (RGB 89,89,89), and dark blue (RGB 68,78,101). Examples are provided below.

Title



Header

2016 HIGHLIGHTS

Highlight Statement

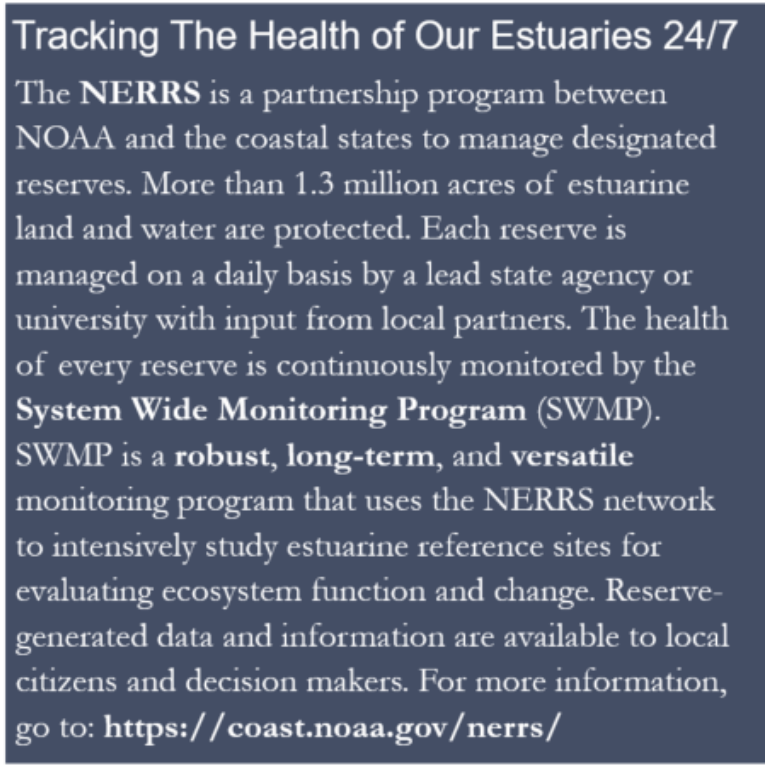
Water Quality is a MAJOR Driver of Ecosystem Change

What happens on the land affects the quality of the water and the health of the plants and animals that live in the estuary.

The body text font color is typically dark gray (RGB 64,64,64) or white (RGB 255, 255, 255). If dark gray body text is used and bolded words are needed, the bolded words are in dark blue (RGB 68,78,101). If white body text is used and bolded words are needed, the bolded words are in white. Examples are provided below.

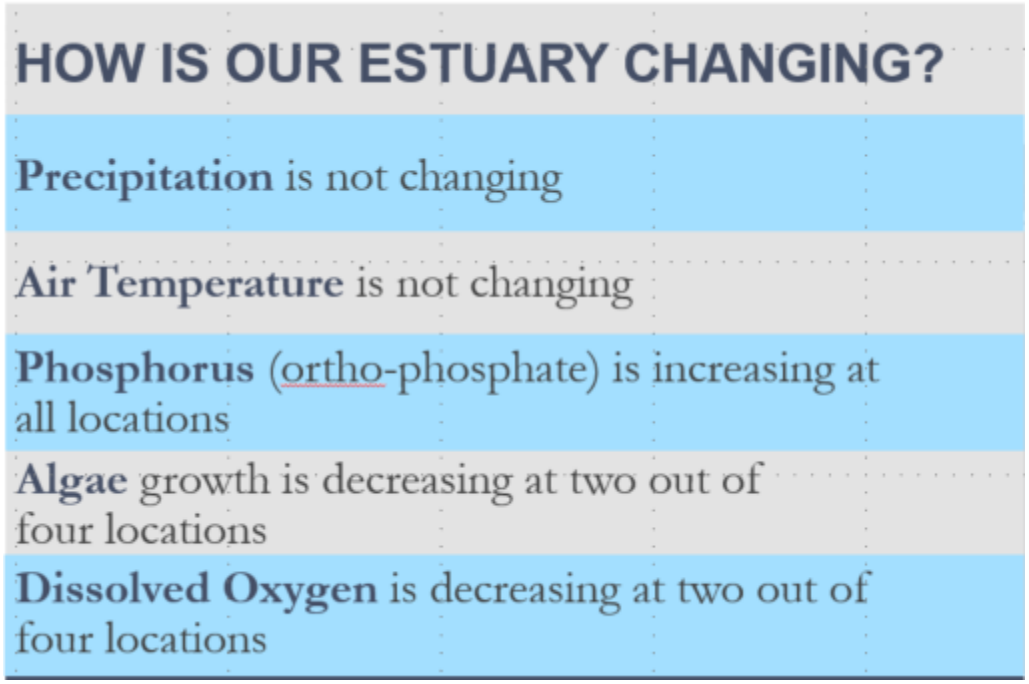
Dark gray Body Text & Dark Blue Bolded Words

White Body Text & White Bolded Words

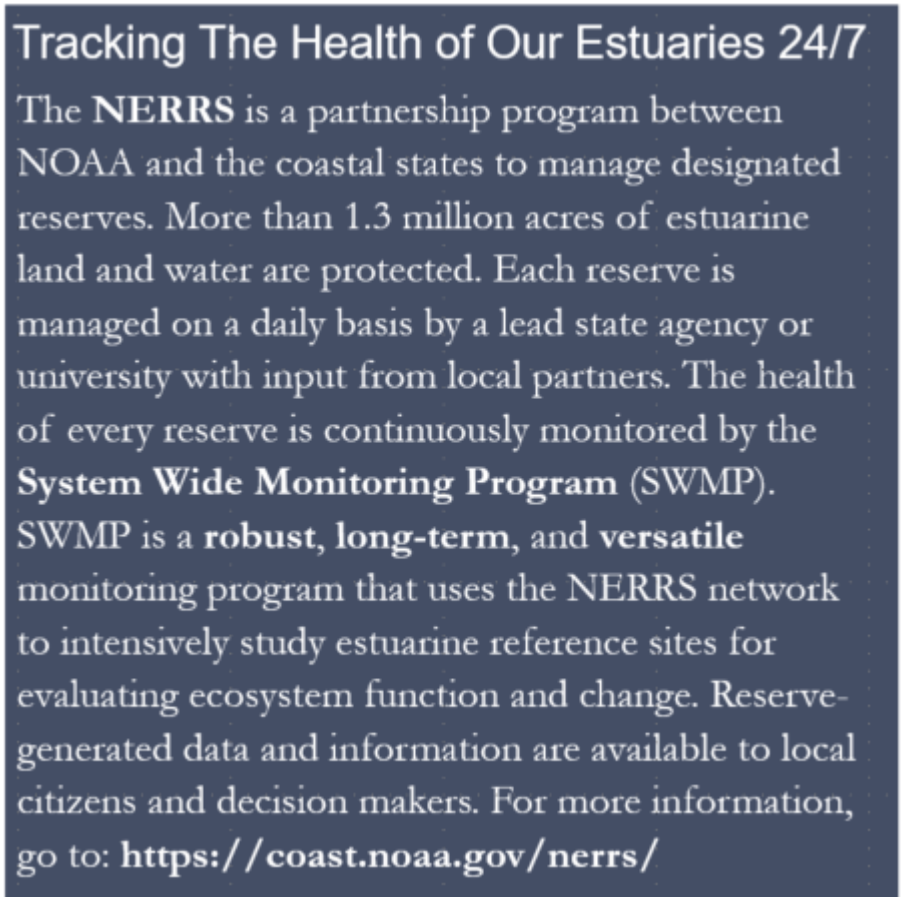


Box element fill colors vary and include dark blue (RGB 68,78,101), light blue (RGB 163,223,255), and light gray (RGB 217,217,217 at 25% transparency). Examples are provided below.

Light Blue & Light gray Fill

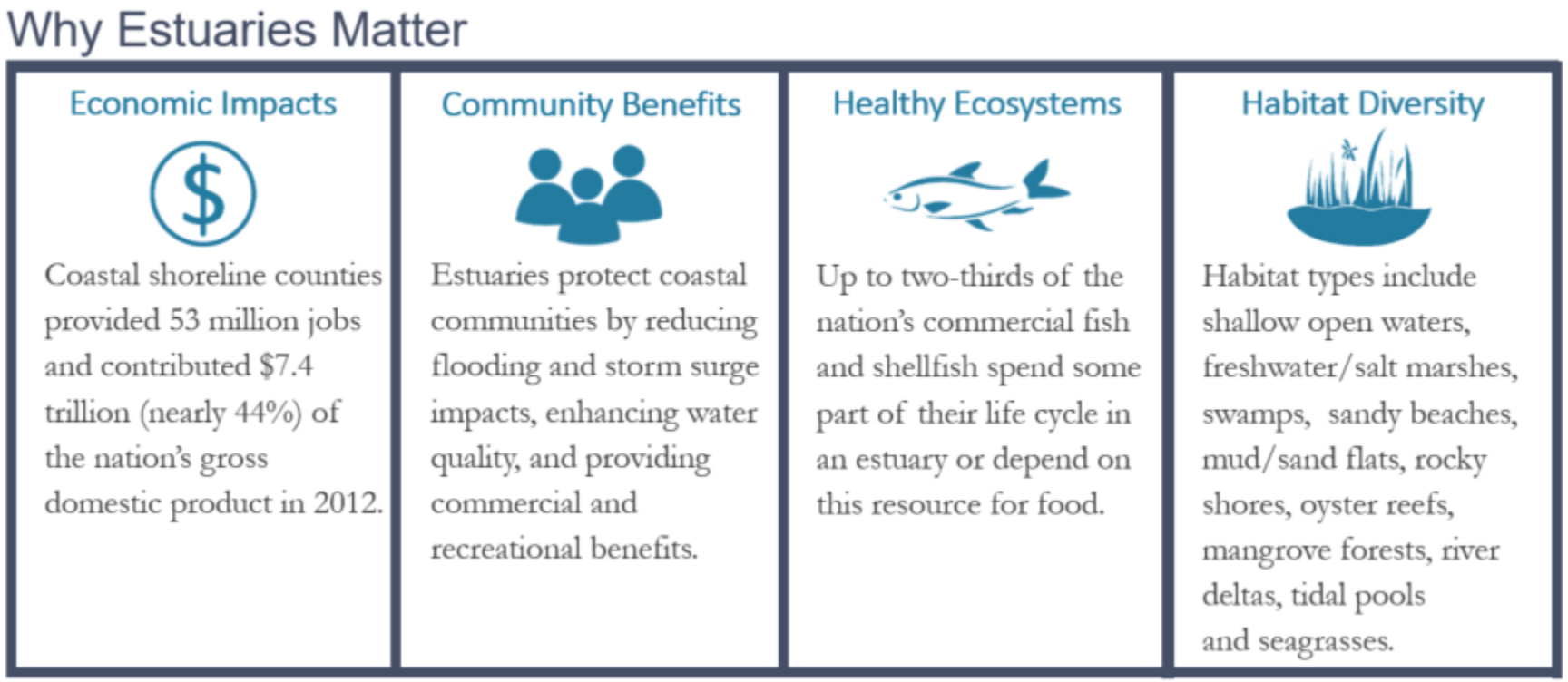


Dark Blue Fill



Icon colors are currently all in medium blue (RGB 36,123,160). An example is provided below.

Medium Blue Icons



2. Typography

The dominant typefaces are Calibri-Light and Garamond. A description and example of how each typeface is used in the report is provided below.

The Calibri-Light typeface is used for titles, headers, and highlight statements. In the current version of MS PowerPoint, Calibri-Light is a slight variation of Calibri Light (no hyphen). The use of the Calibri-Light variation of Calibri Light was needed for compatibility with the R package available at the time the reserves templates were being developed.

Calibri-Light

A B C D E F G H I J K L M N O P Q R S T U V W X Y Z

a b c d e f g h i j k l m n o p q r s t u v w x y z

0 1 2 3 4 5 6 7 8 9

The Garamond typeface is used for body text and dense text.

Garamond

A B C D E F G H I J K L M N O P Q R S T U V W X Y Z

a b c d e f g h i j k l m n o p q r s t u v w x y z

0 1 2 3 4 5 6 7 8 9

A third typeface is used in the report but ONLY for plots and tables. The Arial typeface is used in the plots generated for the report by the SWMPrExtension R package. The Arial typeface is also used in the "**Trends in Weather & Water Quality**" table on Page 2 of the report. Typically, only two typefaces are selected for the presentation of reports, brochures, fact sheets, infographics, etc. However, because the reports are also presenting data and Arial is the best typeface for plots and tables, this third typeface was selected. The intention is that the Arial typeface will only be used for plots and tables.

Arial

A B C D E F G H I J K L M N O P Q R S T U V W X Y Z

a b c d e f g h i j k l m n o p q r s t u v w x y z

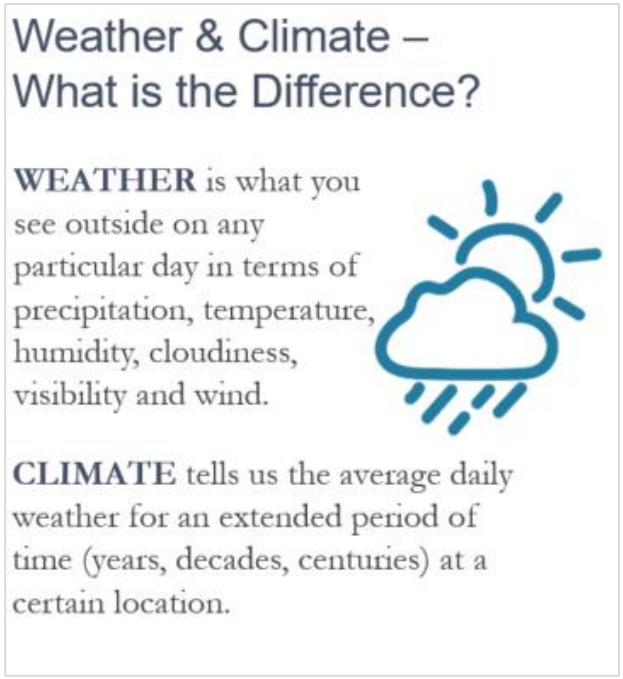
0 1 2 3 4 5 6 7 8 9

3. Graphics & Images

Graphics used in the report reflect a simple, flat design style. Any new graphics used in the report should maintain the style and look of the existing graphics. An example graphic is provided below.

Images should be visually pleasing, representative of the estuary environment in the reserve of interest, and reinforce the message conveyed. The images should be high quality and high resolution. Print quality resolution is typically 300 dpi. However, it should be noted that the current version of PowerPoint used to develop the reserve templates (i.e., PowerPoint 2013) only allows a maximum resolution of 220 dpi. Newer versions of PowerPoint (i.e., 2016) should allow for higher resolution images.

Simple, flat design graphic



Relevant, high quality image