

**NERRS / SWMP**

**Training Workshop: *R*, *SWMPPr*, *SWMPPrats***

**Williamsburg, VA, Nov 13, 2016**

## The SWMPPrats website and the Widgets

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## Objectives for the session (1:15 - 2:00)

- Overview of the website
- Overview of the widgets
  - ▶ SWMP summary - evaluate trends of a single parameter at a single site
  - ▶ SWMP trends - compare trends of a single parameter within and between reserves using a map
  - ▶ SWMP aggregate - compare aggregated trends of different parameters within and between reserves

# Interactive portion

We will use the widgets on the website or follow on my screen

Following along as we go:

- flash drive
- online: [swmprats.net](http://swmprats.net) 2016 workshop tab

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You will run examples whenever you see this guy:

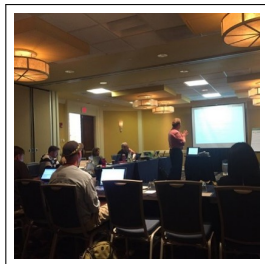


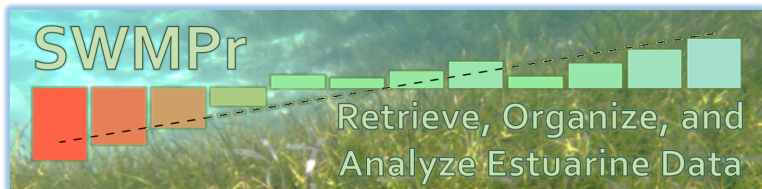


*S*ystem- *W*ide *M*onitoring *P*rogram  
*R*esources for the *A*nalysis of *T*ime *S*eries

*An ad hoc group formed to develop and expand the capacity of the NERRS program to more effectively use SWMP data*

## 1) Training workshops 2014, 2015, today





2) SWMPPr is an open-source R package described on the website, v2.1.7

```
# install/load from R
install.packages('SWMPPr')
library(SWMPPr)
```



3) [SWMPrats.net](http://SWMPrats.net) ([#swmprats](https://twitter.com/swmprats)) is our base of operations...

- Training materials
- SWMPPr cookbook
- Forum (POTM)
- Widgets

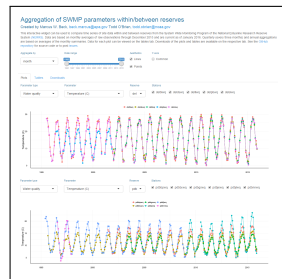
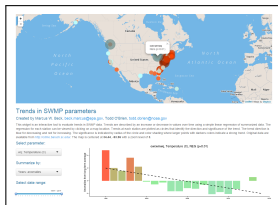
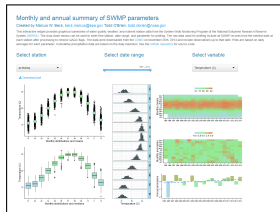


# Widgets of SWMPrats.net

Improved data integration and accessibility with a point-and-click approach

Three Shiny applications allow users to visualize trends in SWMP data

These apps allow 'reactive' use of SWMPr functions



# Widgets of SWMPrats.net

When using the widgets, understand...

- Focus is on a single reserve or comparisons between reserves

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- Focus is on a single reserve or comparisons between reserves
- Focus is on a single parameter or comparisons between parameters
- They are for exploration - results or trends are not absolute
- Data have been processed a particular way - there are possible errors
- Data are static - hosted directly with app or on private site after processing, updated once a year or catastrophic error...

# Widgets of SWMPrats.net: SWMP summary

 For summarizing trends at one site and one parameter

## Monthly and annual summary of SWMP parameters

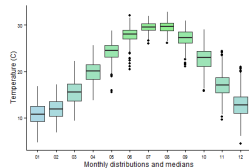
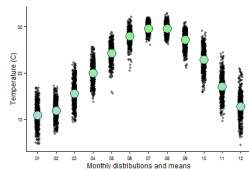
Created by Marcus W. Beck, [beck.marcus@epa.gov](mailto:beck.marcus@epa.gov) Todd O'Brien, [todd.obrien@noaa.gov](mailto:todd.obrien@noaa.gov)

This interactive widget provides graphical summaries of water quality, weather, and nutrient station data from the System Wide Monitoring Program of the National Estuarine Research Reserve System (NERRS). The drop down menus can be used to select the station, date range, and parameter for plotting. The raw data used for plotting include all SWMP records from the earliest date at each station after processing to remove QA/QC flags. The data were downloaded from the CDMO on November 25th, 2014 and include observations up to that date. Plots are based on daily averages for each parameter. Cumulative precipitation data are based on the daily maximum. See the [GitHub repository](#) for source code.

### Select station

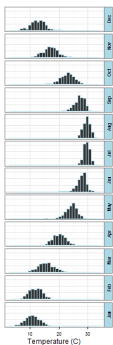
acebbwq

[Download plot](#)



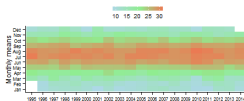
### Select date range

1995 - 2014



### Select variable

Temperature (C)



# Widgets of SWMPPrats.net: SWMP summary

For a given *site*, *date range*, and *variable*, it shows:

- Monthly distribution with means (top left)
- Monthly distributions by boxplots (bottom left)
- Histogram frequency by month (center)
- Monthly means by years (top right)
- Monthly anomalies by year (center right)
- Annual anomalies and trend (bottom right)

Options for tabular data and saving plots/tables



## Widgets of SWMPPrats.net: SWMP summary

Note: The `plot_summary` function in SWMPPr is used to create the plots.

```
library(SWMPPr)

## import data
data(apacpnut)
dat <- qaqc(apacpnut)

## plot
plot_summary(dat, param = 'chla_n', years = c(2007, 2013))

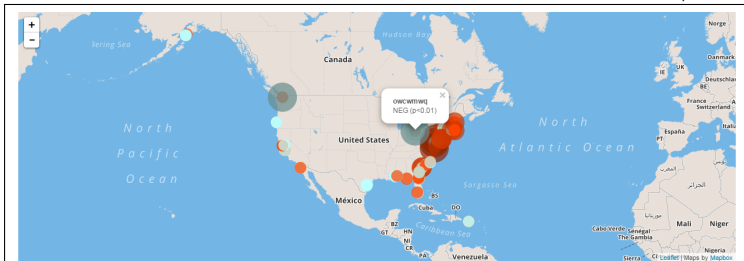
## get individual plots
plots <- plot_summary(dat, param = 'chla_n', years = c(2007, 2013),
  plt_sep = TRUE)

plots[[1]] # top left
plots[[3]] # middle
plots[[6]] # bottom right

## get summary data
plot_summary(dat, param = 'chla_n', year = c(2007, 2013), sum_out = TRUE)
```

# Widgets of SWMPrats.net: SWMP compare

🐘 Compare trends for a single parameter between reserves/space



## Trends in SWMP parameters

Created by Marcus W. Beck, [beck.marcus@epa.gov](mailto:beck.marcus@epa.gov), Todd O'Brien, [todd.obrien@noaa.gov](mailto:todd.obrien@noaa.gov)

This widget is an interactive tool to evaluate trends in SWMP data. Trends are described by an increase or decrease in values over time using a simple linear regression of summarized data. The regression for each station can be viewed by clicking on a map location. Trends at each station are plotted as circles that identify the direction and significance of the trend. The trend direction is blue for decreasing and red for increasing. The significance is indicated by radius of the circle and color shading where larger points with darker colors indicate a strong trend. Original data are available from <http://cdmo.baruch.sc.edu/>. The map is centered at 34.44, -93.96 with a zoom level of 3.

Select parameter:

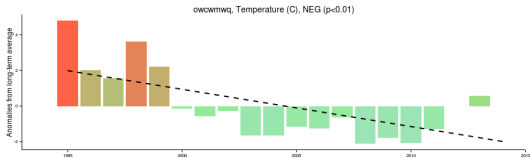
wq: Temperature (C)

Summarize by:

Years: anomalies

Select date range:

1904 - 2014



# Widgets of SWMPrats.net: SWMP compare

For a *given parameter* and *date range*, at all sites:

- Evaluate annual or monthly changes

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For a *given parameter* and *date range*, at all sites:

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- Evaluate anomalies (difference from grand mean) or observed

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For a *given parameter* and *date range*, at all sites:

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- Evaluate anomalies (difference from grand mean) or observed
- Trends shown as increasing (red), decreasing (blue)

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For a *given parameter* and *date range*, at all sites:

- Evaluate annual or monthly changes
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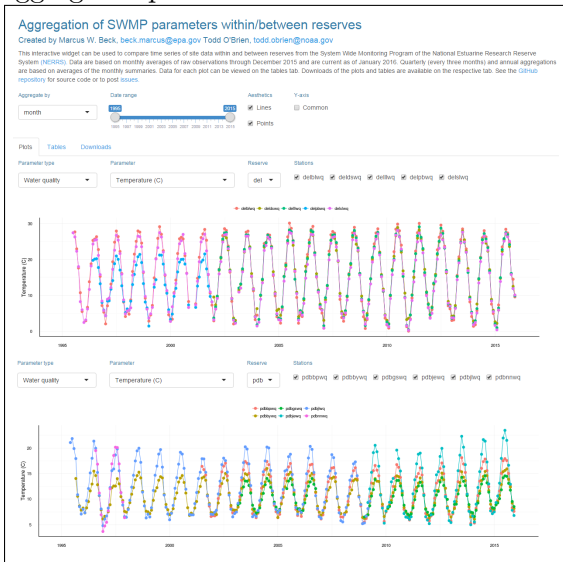
All trends are relative (*compare*)...

Zoom the map to view finer spatial scale and click to view results for single stations

# Widgets of SWMPrats.net: SWMP aggregate



Compare aggregated parameters within and between reserves





# Widgets of SWMPrats.net: SWMP aggregate

This app allows multiple comparisons:

- Within and between sites

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- Within and between sites
- Same or different parameters
- Seasonal (monthly, quarterly) or annual trends
- Options for tabular data and saving plots/tables

# Widgets of SWMPPrats.net: SWMP aggregate

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- Within and between sites
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Water and air temperature example at ACE basin.... note the common y-axis and effect of aggregating incomplete years

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Up next... Time Series Topic 1: Weighted Regression

*Questions??*