

# NERRS / SWMP

## Training Workshop: *R* Intro & SWMP*r*

October 25, 2015

## SWMP*r* overview, retrieve, and organize

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# Objectives and agenda

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- ▶ What are the various ways data are obtained from SWMP?
- ▶ What are some issues that need to be addressed before importing into a statistical program for time series analysis?

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- Agenda

- ▶ Brief overview of SWMP network and available data
- ▶ Format and potential issues with output data
- ▶ Retrieving and importing the data

# Interactive portion

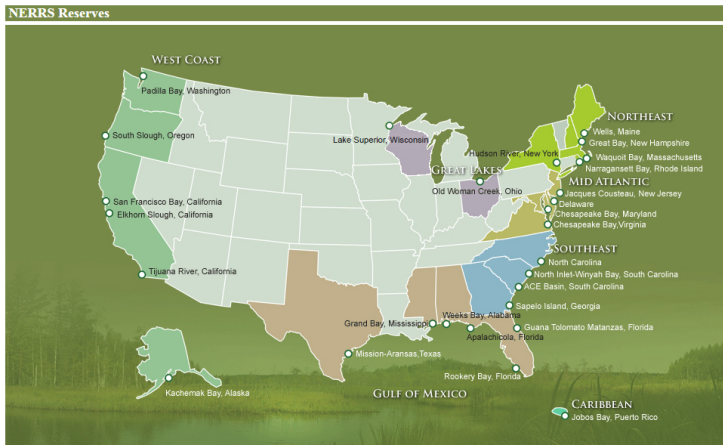
You can follow along later in this module:

- dataset1
- script1

*Interactive!*

# Overview of SWMP and available data

SWMP - System Wide Monitoring Program, initiated in 1995 to provide continuous monitoring data at over 300 stations in 28 US estuaries



<http://nerrs.noaa.gov/ReservesMap.aspx>



# Overview of SWMP and available data

CDMO ([link](#)) is your one-stop shop for retrieving SWMP data

Home	About CDMO	About Data	Get Data	Web Services	Contact CDMO
					
View / Download Data		Real Time Monitoring Data		CDMO News	
 <a href="#">Requested Citation Format</a>		<div>Choose Reserve... ▾</div> <div>GTMPMET 10/08/14 09:45 AM GTMPCVQ 10/08/14 09:45 AM</div>  <div>Air Temperature: 27.8 °C (82 °F) Wind Speed: 1.1 m/Sec (02 mph) Water Temperature: 22.7 °C (73 °F) Salinity: 7.1 PPT Dissolved Oxygen: 4.7 mg/L</div>		<p>The CDMO is excited to announce the launch of our new <b>SWMP Mobile application</b>. Near real-time SWMP data is now available on your smartphone or tablet at: <a href="http://www.nerrsdata.org/mobile">www.nerrsdata.org/mobile</a></p> <hr/> <p>Our <b>Data Export System</b> has been updated and now has enhanced graphing capabilities! Want to easily export or graph data? If so, check out our <a href="#">Data Export System!</a></p>	

# Overview of SWMP and available data

A wide range of data can be requested... a few records for one site to all records for multiple sites

Requests can return a lot of data so make sure you have clear objectives

Check the [available data](#) before making a request!

- station names
- data types
- date ranges
- parameters

# Format and potential issues with output data

To orient yourself, understand the NERRS/SWMP naming convention

**Site** (reserve), **station**, and **parameter type** are identified by a 7 or 8 character name



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E.g., elkcwmet

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**Site** (reserve), **station**, and **parameter type** are identified by a 7 or 8 character name

E.g., elkcwmet

- elk: site, Elkhorn Slough
- cw: station, Caspian Weather Station
- met: parameter type (weather)

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The fundamental unit of data is the 'station' defined by a parameter type

The parameters for a station are specific to the parameter type

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## ***Nutrients***

po4f, chla\_n, no3f,  
no2f, nh4f, no23f,  
ke\_n, urea

## ***Water quality***

temp, spcond, sal,  
do\_pct, do\_mgl,  
depth, cdepth, level,  
clevel, ph, turb,  
chlfluor

## ***Meteorology***

atemp, rh, bp, wspd,  
maxwspd, wdir,  
sdwdir, totpar,  
totprcp, cumprcp,  
totsorad

# Format and potential issues with output data

The raw data will look like this...

	A	B	C	D	E	F	G	H	I	J	K	L
1	StationCo	isSWMP	DateTimeStamp	Historical	Provisional	CollMeth	REP	F_Record	PO4F	F_PO4F	NH4F	F_NH4F
2	apacpnut	P	1/10/2012 10:20	0	1	1	1		0.003	<-4> [SBL]	0.03	<0>
3	apacpnut	P	2/7/2012 11:41	0	1	1	1		0.005	<0>	0.019	<0>
4	apacpnut	P	3/5/2012 11:51	0	1	1	1		0.003	<-4> [SBL]	0.041	<0>
5	apacpnut	P	4/4/2012 10:30	0	1	1	1		0.003	<-4> [SBL]	0.043	<0>
6	apacpnut	P	5/9/2012 10:12	0	1	1	1		0.003	<0>	0.053	<0>
7	apacpnut	P	5/9/2012 10:15	0	1	1	2		0.003	<-4> [SBL]	0.022	<0>
8	apacpnut	P	5/9/2012 10:20	0	1	1	3		0.003	<0>	0.016	<0>
9	apacpnut	P	6/5/2012 8:30	0	1	1	1		0.003	<-4> [SBL]	0.04	<0>
10	apacpnut	P	7/3/2012 9:58	0	1	1	1 {CSM}		0.004	<0>	0.094	<0>
11	apacpnut	P	7/3/2012 9:59	0	1	1	2 {CSM}		0.004	<0>	0.066	<0>
12	apacpnut	P	7/3/2012 10:01	0	1	1	3 {CSM}		0.005	<0>	0.069	<0>
13	apacpnut	P	8/7/2012 9:53	0	1	1	1 {CSM}		0.003	<-4> [SBL]	0.05	<0>
14	apacpnut	P	9/5/2012 10:56	0	1	1	1		0.003	<-4> [SBL]	0.026	<0>
15	apacpnut	P	10/2/2012 9:22	0	1	1	1		0.003	<-4> [SBL]	0.042	<0>
16	apacpnut	P	10/2/2012 9:27	0	1	1	2		0.003	<-4> [SBL]	0.024	<0>
17	apacpnut	P	10/2/2012 9:32	0	1	1	3		0.003	<0>	0.042	<0>
18	apacpnut	P	11/6/2012 10:30	0	1	1	1		0.003	<-4> [SBL]	0.07	<0>
19	apacpnut	P	11/26/2012 11:39	0	1	1	1		0.003	<-4> [SBL]	0.041	<0>

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*We will learn how to handle most of these challenges!*

# Overview of the SWMP<sub>r</sub> package

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**Why:** There are many challenges for working with SWMP data... a toolkit for addressing these challenges will be useful (I hope!)

**How:**

- Install R/RStudio on your computer (done already!)
- Install the SWMP<sub>r</sub> package (dont already!)
- Use the SWMP<sub>r</sub> functions to **retrieve**, **organize**, and **analyze** SWMP data

# Overview of the SWMPPr package

This is where SWMPPr lives - <https://github.com/fawda123/SWMPPr>

The screenshot shows the GitHub repository page for **fawda123 / SWMPPr**. The repository is described as "r package for accessing, processing, and evaluating data from SWMP of NERRS". It has 21 commits, 1 branch, 0 releases, and 1 contributor. The main branch is **master**. The repository is currently on the **master** branch.

The commit history shows a recent commit by **fawda123** 23 minutes ago, titled "added method to na.approx for swmpr objects". The commit message is "added method to na.approx for swmpr objects". The commit hash is **552d945adf**.

The file list includes:

- R**: added method to na.approx for swmpr objects (23 minutes ago)
- README\_files**: added method to na.approx for swmpr objects (23 minutes ago)
- data/zip\_ex**: Sort of working package, functions are incomplete and need to be tested (2 days ago)
- man**: added method to na.approx for swmpr objects (23 minutes ago)
- .Rbuildignore**: Sort of working package, functions are incomplete and need to be tested (2 days ago)
- .Rprofile**: added method to na.approx for swmpr objects (23 minutes ago)
- .gitignore**: Sort of working package, functions are incomplete and need to be tested (2 days ago)
- DESCRIPTION**: added method to na.approx for swmpr objects (23 minutes ago)

The right sidebar shows the repository's code, issues, pull requests, wiki, pulse, graphs, and settings. The HTTPS clone URL is <https://github.com/fawda123/SWMPPr>.



# Overview of the SWMP<sub>r</sub> package

What is provided in the SWMP<sub>r</sub> package?

## *Retrieve*

```
all_params  
all_params_dtrng  
single_param  
import_local
```

## *Organize*

```
qaqc.swmpr  
qaqcchk.swmpr  
subset.swmpr  
setstep.swmpr  
comb.swmpr
```

## *Analyze*

```
aggregate.swmpr  
smoother.swmpr  
na.approx.swmpr  
plot.swmpr  
hist.swmpr  
lines.swmpr  
decomp.swmpr  
map_reserve
```

Built around the concept of ***object-oriented programming*** - retrieval functions return a data type with specific methods to organize and analyze

# Overview of the SWMP<sub>r</sub> package

To view the help file for any function (including examples for most):

```
?all_params
```

all\_params {SWMP<sub>r</sub>}

R Documentation

## Import current station records from the CDMO

### Description

Import current station records from the CDMO starting with the most current date, CDMO equivalent of `exportAllParamsXMLNew`

### Usage

```
all_params(station_code, Max = 100)
```

### Arguments

`station_code` chr string of station, 7 or 8 characters

`Max` numeric value for number of records to obtain from the current date, maximum of 100

### Value

Returns a `swmpr` object, all available parameters including QAQC columns

# Overview of the SWMP<sub>r</sub> package

Let's get some data into R!

The ***retrieval*** functions do two things:

Import data directly from the CDMO:

```
all_params  
all_params_dtrng  
single_param
```

These functions require [registering your IP address](#) with CDMO
















Import data from a local path:

```
import_local
```

Allows import of data obtained from (and only from) the [zip downloads](#) feature

# Overview of the SWMPPr package

After unzipping, data from [zip downloads](#) will have separate .csv files for each station and year

Name	Date modified	Type	Size
 apacpnut2011.csv	9/19/2014 7:04 AM	Microsoft Excel C...	3 KB
 apacpnut2012.csv	9/19/2014 7:04 AM	Microsoft Excel C...	3 KB
 apacpnut2013.csv	9/19/2014 7:04 AM	Microsoft Excel C...	3 KB
 apacpwq2011.csv	9/19/2014 7:06 AM	Microsoft Excel C...	5,481 KB
 apacpwq2012.csv	9/19/2014 7:06 AM	Microsoft Excel C...	5,472 KB
 apacpwq2013.csv	9/19/2014 7:06 AM	Microsoft Excel C...	5,567 KB
 apadbnut2011.csv	9/19/2014 7:06 AM	Microsoft Excel C...	3 KB
 apadbnut2012.csv	9/19/2014 7:06 AM	Microsoft Excel C...	3 KB
 apadbnut2013.csv	9/19/2014 7:06 AM	Microsoft Excel C...	3 KB
 apadbwq2011.csv	9/19/2014 7:08 AM	Microsoft Excel C...	5,407 KB
 apadbwq2012.csv	9/19/2014 7:08 AM	Microsoft Excel C...	5,483 KB
 apadbwq2013.csv	9/19/2014 7:08 AM	Microsoft Excel C...	5,337 KB
 apaebmet2011.csv	9/19/2014 7:10 AM	Microsoft Excel C...	5,453 KB
 apaebmet2012.csv	9/19/2014 7:10 AM	Microsoft Excel C...	5,401 KB
 apaebmet2013.csv	9/19/2014 7:11 AM	Microsoft Excel C...	5,669 KB

# Overview of the SWMPPr package

Use the following to import some data into R...

Open script1.R, change the path to where you have the folder 'dataset1'

```
# get data for apacpwq, all years  
  
# location of data  
mypath <- 'C:/data/dataset1'  
  
# import and assign to 'dat'  
dat <- import_local(mypath, 'apacpwq', trace = T)
```

The console will return some informative text...

# Overview of the SWMP<sub>r</sub> package

Now we have data in our 'workspace' that we can organize/analyze

```
head(dat)
```

```
##           datetimestamp temp f_temp spcond f_spcond sal f_sal do_pct f_do_pct
## 1 2011-01-01 00:00:00    11  <0>      44    <0>    28  <0>      68    <0>
## 2 2011-01-01 00:15:00    11  <0>      44    <0>    28  <0>      68    <0>
## 3 2011-01-01 00:30:00    11  <0>      44    <0>    28  <0>      68    <0>
## 4 2011-01-01 00:45:00    11  <0>      44    <0>    28  <0>      68    <0>
## 5 2011-01-01 01:00:00    11  <0>      44    <0>    29  <0>      68    <0>
## 6 2011-01-01 01:15:00    11  <0>      44    <0>    29  <0>      67    <0>
##  do_mgl f_do_mgl depth f_depth cdepth f_cdepth level f_level clevel f_clevel
## 1      6    <0>      2  <0>        2    <3>      NA  <-1>      NA      NA
## 2      6    <0>      2  <0>        2    <3>      NA  <-1>      NA      NA
## 3      6    <0>      2  <0>        2    <3>      NA  <-1>      NA      NA
## 4      6    <0>      2  <0>        2    <3>      NA  <-1>      NA      NA
## 5      6    <0>      2  <0>        2    <3>      NA  <-1>      NA      NA
## 6      6    <0>      2  <0>        2    <3>      NA  <-1>      NA      NA
##  ph f_ph turb f_turb chlfluor f_chlfluor
## 1  8 <0>      3  <0>        NA    <-1>
## 2  8 <0>      3  <0>        NA    <-1>
## 3  8 <0>      2  <0>        NA    <-1>
## 4  8 <0>      1  <0>        NA    <-1>
## 5  8 <0>      2  <0>        NA    <-1>
## 6  8 <0>      1  <0>        NA    <-1>
```

**NERRS / SWMP**

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***Questions??***