**Grand Bay (GND) National Estuarine Research Reserve**

**Water Quality Metadata**

**January 1 – December 31, 2013**

**Latest Update:** June 18, 2019

**I. Data Set & Research Descriptors**

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**2) Entry verification:**

Deployment data are uploaded from the YSI data logger to a Personal Computer (PC compatible). Files are exported from EcoWatch in a comma-delimited format (.CDF) and uploaded to the CDMO where they undergo automated primary QAQC, automated depth/level corrections for changes in barometric pressure (cDepth or cLevel parameters), and become part of the CDMO’s online provisional database. All pre- and post-deployment data are removed from the file prior to upload. During primary QAQC, data are flagged if they are missing or out of sensor range. The edited file is then returned to the Reserve for secondary QAQC where it is opened in Microsoft Excel and processed using the CDMO’s NERRQAQC Excel macro. The macro inserts station codes, creates metadata worksheets for flagged data and summary statistics, and graphs the data for review. It allows the user to apply QAQC flags and codes to the data, remove any overlapping deployment data, append files, and export the resulting data file for upload to the CDMO. Upload after secondary QAQC results in ingestion into the database as provisional plus data, recalculation of cDepth or cLevel parameters, and finally tertiary QAQC by the CDMO and assimilation into the CDMO’s authoritative online database. Where deployment overlap occurs between files, the data produced by the newly calibrated sonde is generally accepted as being the most accurate. For more information on QAQC flags and codes, see Sections 11 and 12. Kim Cressman is responsible for data management.

**3) Research objectives:**

The National Estuarine Research Reserve (NERR) System-wide Monitoring Program (SWMP) was designed to fulfill two major overall goals: 1) to support state-specific non-point pollution control programs by establishing local networks of continuous water quality monitoring stations in representative protected estuarine ecosystems and 2) to develop a nation-wide database of baseline environmental conditions in the NERR system of estuaries. The specific goal of SWMP is to identify and track short-term variability and long-term changes in the integrity and biodiversity of representative estuarine ecosystems and coastal watersheds for the purpose of contributing to effective national, regional, and site specific coastal zone management. This comprehensive program consists of three phased components: 1) abiotic conditions such as water quality and meteorological monitoring; 2) biodiversity monitoring; and 3) habitat mapping and change analysis. With the initial focus of phase 1, the NERR SWMP provides data necessary for intra- and inter- site baseline studies, trend analyses, and impact assessments.

Four long-term monitoring stations have been established across the Grand Bay NERR in order to collect essential baseline water quality information to improve our understanding of the tidal dynamics and freshwater inputs into this system. Specifically, the Grand Bay NERR system wide monitoring program stations collect continuous data to address the following objectives: (1) track short-term variability and long-term changes in estuarine water parameters within four (Bayou Heron, Bayou Cumbest, Bangs Lake, and Point aux Chenes Bay) different regions within the reserve; (2) provide bayou-specific water quality data to be applied towards the development of a hydrologic model for the Grand Bay NERR; and (3) provide background data to design more robust experiments/research projects across the reserve.

Grand Bay research staff, in consultation with local scientists, carefully considered the arrangement of SWMP stations across the Reserve before implementing the program. The weather station was installed in the south-central portion of the Reserve to capture both short-term effects of weather on water quality and long-term trends in Reserve meteorological conditions.

The four water quality monitoring stations are intended to represent a gradient of salinity and habitat conditions within the Reserve. One site is located in each of three sub-watersheds within Reserve boundaries, and the fourth site is located to the south in a more marine-influenced location. This arrangement of monitoring stations allows the research staff to capture effects of both freshwater runoff and marine influence on short-term variability and long-term trends in water quality at the Reserve.

Current and future research projects have been and will be developed around this monitoring program. The four sites identified here monitor areas with varying degrees of human disturbance and impacts, providing an excellent framework for developing reserve-wide research projects focusing on anthropogenic impacts.

**4) Research methods:**

Sonde cleaning and calibrations of the DO, Conductivity, Depth, pH, and Turbidity probes are performed as outlined in the YSI manual. For Conductivity and Salinity, YSI calibrator solution 3169 (50,000 µS/cm) is used without dilution. Fisher pH solutions SB107-20 and SB115-20 are used for pH 7 and 10, respectively. A two-point calibration is used for Turbidity. Distilled water serves as the calibrator solution for 0 NTU and YSI 6073G is used for 126 NTU. Depth is calibrated in air and is barometrically corrected. The DO membrane is replaced and calibrated every deployment. It is allowed to stretch for 16-20 hours, and re-calibrated prior to actual deployment. The sonde is programmed to brush the probes 1 minute prior to the actual measurement. All data are collected every 15 minutes. All data are recorded in Central Standard Time.

One data logger (sonde) is deployed at each permanent monitoring station in the Grand Bay estuary at all times. Two permanently assigned data loggers are interchanged among each site. Sites are accessed using a small skiff equipped with an outboard motor. During transport, each sonde is wrapped in a white towel soaked in tap water and placed horizontally in a cooler for insulation against jarring. For deployment, the data loggers are lowered into a five inch diameter stainless steel (SS) pipe that has been bolted to a 14 inch log piling driven into the mud at each site. The SS pipes have cut outs to ensure adequate tidal flushing and exposure of the probes to ambient water conditions. A grate across the bottom of the pipe prevents the sonde from descending beyond the bottom of the pipe and ensures that the sonde probes are at the same depth on every deployment. The SS pipes, along with the sonde probes, are coated with an anti-fouling paint to minimize biofouling.

As a quality assurance measure, a discrete reading is taken with a freshly calibrated sonde or other handheld logger and recorded on a data sheet during sonde deployment and retrieval. During retrieval, the data loggers are again wrapped in a saturated white towel and placed in a cooler for transport to the lab. At least two data points are recorded while the sonde is wrapped in the towel to record post-deployment dissolved oxygen in 100% water-saturated air. Other post-deployment calibrations are performed in the laboratory prior to cleaning to determine if instrument drift has occurred and to evaluate the validity of the data. After post-deployment calibrations, the sondes are cleaned and stored in calibration cups until the next deployment.

A Sutron Sat-Link2 transmitter was installed at the Bangs Lake station from 6/21/06 to August 2009 and transmitted data to the NOAA GOES satellite, NESDIS ID #3B02A276.

The YSI EcoNet telemetry system was installed at all four sites in 2007. Data are transmitted every 15 minutes via cell modem to the YSI website. Data can be accessed through the EcoNet website as well as through the CDMO. The near real-time telemetry data become part of the provisional dataset until data are downloaded from the loggers upon retrieval. Data then undergoes secondary and tertiary QAQC and assimilation in the CDMO’s authoritative online database. Provisional and authoritative data are available at http://cdmo.baruch.sc.edu.

**5) Site location and character:**

The Grand Bay Delta was created by sediments from both the Pascagoula and Escatawpa Rivers several thousand to hundreds of years ago. Soon after the delta was created, the Escatawpa became a major tributary to the Pascagoula River when its flow was captured by the larger river system. With the Escatawpa’s freshwater inflow shunted to the Pascagoula River, sediment discharge to Grand Bay Delta and the delta’s further growth was terminated. The meandering delta channels of the Escatawpa became exclusively tidal water courses a few hundred years ago, after cessation of river flow (Otvos 2007). In 1999, the retrograding delta became home to the 24th National Estuarine Research Reserve, the Grand Bay NERR.

The Grand Bay NERR is part of the Coastal Streams Basin watershed, which consists of three primary sub-watersheds that provide much of the freshwater inputs into the system: Bayou Heron, Bayou Cumbest, and Bangs Lake.

The four water quality monitoring sites within the Grand Bay NERR have a tidal range of approximately 0.5 meter. Additional site specific characteristics are as follows:

a) Bayou Heron (BH): [30° 25.068’ N, 88° 24.324’W]

The Bayou Heron site, located in the middle reaches of the Bayou Heron sub-watershed, monitors water quality for a semi-pristine area with little development and serves as a reference site for the reserve. Freshwater input is derived from several sources including networks of hydric drains, sheet flow from pine flatwoods/savannas, and groundwater. Hydric drains import large amounts of surface water from the sub-watershed, including water originating north of Hwy 90 and Interstate 10. Franklin Creek, located northeast of the reserve, flows WNW into the Escatawpa River. Franklin Creek drains a large portion of agricultural land on the Grand Bay plateau and periodically crests into the Bayou Heron sub-watershed during high water events via a small network of hydric drains. These drains eventually deposit water into numerous tidal creeks that enter Bayou Heron. Little is known about the quantity and quality of water flowing through these drains.

* Depth range: 0.16 – 1.69 m
* Salinity range in 2013: 0 – 25.6 ppt
* Average Salinity in 2013: 14.1 (± 6.8) ppt
* Typical salinity range: 5.9 – 27.6 ppt

The above typical salinity range represents 90% of the data points collected from 2005-2011 (n=217,996)

* Median salinity from 2005-2011: 20.9 ppt
* Bottom habitat: soft sediments

Due to water column stratification and poor mixing, this site can become naturally hypoxic during warmer months (March – October).

b) Point Aux Chenes (PC): [30° 20.916’N, 88° 25.112’W].

This is the most southern water quality site within the boundaries of Grand Bay NERR. It is located in Point Aux Chenes Bay, which is highly influenced by the Mississippi Sound and also receives inputs from waters to the east, including Mobile Bay. PC was established in 2005 to replace the Crooked Bayou water quality monitoring station. This site provides baseline data on the relative influence of marine inputs and tidal influence from the East Mississippi Sound.

* Depth range: 0.3 – 1.6 m
* Salinity range in 2013: 6.1 – 29.7 ppt
* Average Salinity in 2013: 20.2 (± 5.5) ppt
* Typical salinity range: 12.4 – 29.7 ppt

The above typical salinity range represents 90% of the data points collected from 2005-2011 (n=195,836)

* Median salinity from 2005-2011: 24.2
* Bottom habitat: soft sediments

c) Bayou Cumbest (BC): [30° 23.016’N, 88° 26.184’W].

The Bayou Cumbest site monitors water quality for the Bayou Cumbest sub-watershed, which is a moderately impacted area with some residential housing development and non-point source pollution issues related to failing septic tanks (i.e., elevated levels of fecal coliforms; LaSalle 1997). A substantial canal, called the Nine Mile Canal, was built in the late 1930’s and connects the Escatawpa River to Bayou Cumbest upstream from the water quality station. Nutrient and flow data are currently being collected through a collaborative project between the Grand Bay NERR, Dauphin Island Sea Lab, and the EPA-Gulf Breeze Laboratory to better understand the water quality impacts of watershed development on coastal watersheds.

* Depth range: 0.0 – 1.10 m
* Salinity range in 2013: 0.0 – 29.0 ppt
* Average Salinity in 2013: 14.1 (± 7.3) ppt
* Typical salinity range: 3.8 – 28.4 ppt

The above typical salinity range represents 90% of the data points collected from 2005-2011 (n=211,045)

* Median salinity from 2005-2011: 19.1
* Bottom habitat: soft sediments with fringing oyster shell reefs

d) Bangs Lake (BL): [30° 21.426’N, 88° 27.774’W].

The Bangs Lake site is located towards the southern end of the Bangs Lake sub-watershed, an area with minimal residential development. Adjacent parcels include Chevron USA oil and gas refinery and the Mississippi Phosphates industrial facility. Both sites are surrounded by containment levees constructed to direct any contaminant spills towards Bayou Casotte, an heavily industrialized and impacted area to the west of these facilities. However, a spill from a gypsum pile at the phosphate facility was discharged into Bangs Lake in 2005 and had substantial negative impacts. A man-made drainage ditch runs into the north part of Bangs Lake and is believed to drain a residential area, which may have failing septic tanks (LaSalle 1997). The ditch is also adjacent to the Jackson County Industrial Water Plant. Bangs Lake has been impacted by high fecal coliform counts and a fecal coliform TMDL was developed for the Bayou Cumbest and Bangs Lake watersheds in 2000 (MSU-CREC 2000).

* Depth range: 0.0 – 1.37 m
* Salinity range in 2012: 5.6 – 29.9 ppt
* Average Salinity in 2013: 18.4 (± 5.3) ppt
* Typical salinity range: 13.1 – 29.6 ppt

The above typical salinity range represents 90% of the data points collected from 2005-2011 (n=201,833)

* Median salinity from 2005-2011: 23.1
* Bottom habitat: soft sediments

*Sources cited within this section:*

LaSalle, M.W. (1997). Water Quality Monitoring of Shellfish Growing Waters and Residential Rock-Reed Wastewater Treatment Systems at Bayou Cumbest, Mississippi. Final Report to the Gulf of Mexico Program. 58 pp.

Mississippi State University Coastal Research and Extension Center (MSU-CREC). (2000). Fecal Coliform TMDL for Bayou Cumbest/Bangs Lake Watershed, Coastal Streams Basin, Jackson County, MS. Prepared for the Mississippi Department of Environmental Quality. Approved Final Version May 5, 2000.

Otvos, E.G. (2007). Geological Framework and Evolution History. Pages 22-46 in Grand Bay National Estuarine Research Reserve: An Ecological Characterization (Peterson, M.S., G.L. Waggy and M.S. Woodrey, editors). Grand Bay National Estuarine Research Reserve, Moss Point, Mississippi.

**6) Data Collection Periods:**

Data loggers were first deployed at Bayou Heron (BH) and Crooked Bayou (CR) on January 22, 2004. Additional data loggers were deployed at Bayou Cumbest (BC) and Bangs Lake (BL) on March 25, 2004. Bayou Heron, Bayou Cumbest, and Bangs Lake have been in service continuously since inception. Crooked Bayou (CR) was relocated to the weather station across the bayou in August 2004 [30° 21.551’N, 88° 25.202’W] due to the loss of the permanent log piling at the original site [30° 21.597’N, 88° 25.143’W]. During August 2005, the Crooked Bayou site was discontinued due to the magnitude of data lost during low tide events. The Point Aux Chenes site (PC) [30° 20.916’N, 88° 25.112’W] was designated to replace the Crooked Bayou site. Also during August 2005, all sites were lowered from 0.5m to 0.25m above the bottom to increase data collection during low tide events.

2013 data collection periods were as follows:

**Bayou Heron**

6600-V2 sondes with ROX DO probes were deployed all year at this station.

Deploy Date Time Retrieve Date Time

11/26/12 14:00 1/22/13 13:45

1/22/13 14:00 3/15/13 12:15

3/15/13 12:30 4/17/13 13:30

4/17/13 13:45 5/21/13 15:30

5/21/13 15:45 6/27/13 12:15

6/27/13 12:30 7/23/13 11:15

7/23/13 11:30 8/15/13 15:30

8/15/13 15:45 9/12/13 14:00

9/12/13 14:30 10/8/13 12:00

10/8/13 12:15 12/3/13 10:45

12/3/13 11:00 1/17/14 12:15

**Point Aux Chenes**

6600 sondes deployed through 6/11/13. EXO2 sondes deployed beginning with 6/11 deployment.

Deploy Date Time Retrieve Date Time

11/26/12 12:45 1/22/13 14:45 6600-EDS (Clark style DO)

1/22/13 15:00 3/7/13 12:30 6600-V2 (ROX DO)

3/7/13 13:15 4/17/13 12:15 6600-V2 (ROX DO)

4/17/13 12:30 5/21/13 13:30 6600-EDS (Clark style DO)

5/21/13 13:45 6/11/13 11:45 6600-V2 (ROX DO)

6/11/13 12:00 6/27/13 11:15 EXO2 (Optical DO)

6/27/13 11:45 7/23/13 10:00 ‘’

7/23/13 10:30 8/15/13 15:00 ‘’

8/15/13 15:15 9/12/13 11:15 ‘’

9/12/13 11:45 9/25/13 8:00 ‘’

9/25/13 8:15 10/8/13 9:15 ‘’

10/8/13 9:45 12/3/13 11:30 ‘’

12/3/13 11:45 1/17/14 12:45 ‘’

**Bayou Cumbest**

6600 sondes deployed all year at this station.

Deploy Date Time Retrieve Date Time

11/26/13 13:30 1/15/13 10:00 6600-V2 (ROX DO)

1/15/13 10:15 3/7/13 14:30 6600-EDS (Clark style DO)

3/7/13 14:45 4/17/13 11:45 6600-V2 (ROX DO)

4/17/13 12:00 5/21/13 14:00 6600-EDS (Clark style DO)

5/21/13 14:15 6/27/13 10:00 6600-V2 (ROX DO)

6/27/13 10:30 7/23/13 10:30 6600-EDS (Clark style DO)

7/23/13 10:45 8/15/13 14:30 6600-EDS (Clark style DO)

8/15/13 14:45 9/12/13 13:30 6600-EDS (Clark style DO)

9/12/13 13:45 10/8/13 10:30 6600-EDS (Clark style DO)

10/8/13 11:00 12/3/13 11:45 6600-V2 (ROX DO)

12/3/13 12:15 1/17/14 14:15 6600-V2 (ROX DO)

**Bangs Lake**

6600-V2 sondes deployed all year at this station EXCEPT 1/15 deployment, which was 6600-EDS.

Deploy Date Time Retrieve Date Time

11/26/12 13:00 1/15/13 10:30

1/15/13 10:45 3/7/13 13:30 6600-EDS (Clark style DO)

3/7/13 14:00 4/17/13 11:45

4/17/13 12:00 6/11/13 12:00

6/11/13 12:30 7/17/13 14:15

7/17/13 14:30 8/15/13 13:00

8/15/13 13:15 9/12/13 11:45

9/12/13 12:00 10/8/13 9:45

10/8/13 10:15 10/28/13 11:45

10/28/13 12:15 12/3/13 11:45

12/3/13 12:00 1/17/14 13:30

**7) Distribution**

NOAA retains the right to analyze, synthesize and publish summaries of the NERRS System-wide Monitoring Program data.  The NERRS retains the right to be fully credited for having collected and process the data.  Following academic courtesy standards, the NERR site where the data were collected should be contacted and fully acknowledged in any subsequent publications in which any part of the data are used.  The data set enclosed within this package/transmission is only as good as the quality assurance and quality control procedures outlined by the enclosed metadata reporting statement.  The user bears all responsibility for its subsequent use/misuse in any further analyses or comparisons.  The Federal government does not assume liability to the Recipient or third persons, nor will the Federal government reimburse or indemnify the Recipient for its liability due to any losses resulting in any way from the use of this data.

Requested citation format:

National Estuarine Research Reserve System (NERRS). 2012.  System-wide Monitoring Program. Data accessed from the NOAA NERRS Centralized Data Management Office website: [www.nerrsdata.org](http://www.nerrsdata.org); *accessed* 12 October 2012.

NERR water quality data and metadata can be obtained from the Research Coordinator at the individual NERR site (please see Principal Investigators and Contact Persons), from the Data Manager at the Centralized Data Management Office (please see personnel directory under the general information link on the CDMO home page) and online at the CDMO home page [www.nerrsdata.org](http://www.nerrsdata.org).  Data are available in comma delimited format.

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**8) Associated researchers and projects:**

Several research and monitoring projects are currently using the water quality data from the Grand Bay NERR. In addition to water quality data, the NERR SWMP program also generates meteorological and nutrient data sets that are available for use.

Some projects that utilize 2013 SWMP water quality data are listed below:

* **Water Quality in Bangs Lake: effects of recurrent phosphate spills to a coastal estuary** – Dr. Kevin Dillon (Gulf Coast Research Laboratory, University of Southern Mississippi), Dr. Mark Woodrey (Grand Bay NERR/Mississippi State University), Kim Cressman (Grand Bay NERR), Larissa Graham (Grand Bay NERR), Dr. Ruth Carmichael (Dauphin Island Sea Lab), Dr. Jane Caffrey (University of West Florida)
* **Characterizing Stormwater Nitrogen Inputs To Mississippi’s Coastal Waters: A Landscape Approach** – Dr. Kevin Dillon (Gulf Coast Research Lab, University of Southern Mississippi)
* **Initial observations of Colored Dissolved Organic Matter (CDOM) in the Grand Bay National Estuarine Research Reserve (GBNERR), Southeastern Mississippi** – Kim Cressman (Grand Bay NERR), Christina Mohrman (Florida A&M University/Grand Bay NERR)
* **Spectroscopic Characterization of Chromophoric Dissolved Organic Matter (CDOM) in the Grand Bay National Estuarine Research Reserve** – Dr. Daniel Osborne (NOAA Environmental Cooperative Science Center, Florida A&M University), Kim Cressman (Grand Bay NERR), Christina Mohrman (NOAA Environmental Cooperative Science Center, Florida A&M University / Grand Bay NERR), Dr. Charles Jagoe (NOAA Environmental Cooperative Science Center, Florida A&M University)
* **GNDNERR Sentinel Site Initiative: A program to better understand SLR and its effects on coastal environments** - William V. Underwood, Brenna W. Ehmen, Lindsay Spurrier, Jay McIlwain (Grand Bay NERR)
* **Incorporating Future Change into Current Conservation Planning: Evaluating Wetland Migration along the Gulf of Mexico under Alternative Sea Level Rise and Urbanization Scenarios** - Michael J. Osland, Nicholas Enwright, Steve Hartley (USGS, National Wetlands Research Center); working with the four DOI Gulf Coast Landscape Conservation Cooperatives (GCPO; GCP; South Atlantic; Peninsular Florida LCCs)
* **Freshwater availability and coastal wetland foundation species: ecological transitions along a rainfall gradient** - Michael J. Osland, Nicholas Enwright, and Camille L. Stagg (USGS, National Wetlands Research Center)
* **Ecological Effects of Sea Level Rise** – Dr. Scott Hagan (University of Central Florida), Dr. Linda Walters (University of Central Florida), Dr. Jim Morris (University of Central Florida)
* **Determining localized impacts of predicted sea level rise to engineered versus natural landscapes, and how risk perception may alter response strategies adopted by ecosystem-dependent communities versus resource-managers** – Dr. Matthew Bethel (Pontchartrain Institute for Environmental Sciences, University of New Orleans), Dr. Wei Wu (Department of Coastal Sciences, The University of Southern Mississippi), Dr. Patrick Biber (Department of Coastal Sciences, The University of Southern Mississippi)
* **Shorebird and other waterbird use of wetlands and aquaculture ponds in the Mississippi Alluvial Valley and Gulf Coast region** – Dr. Francisco Vilella (Mississippi State University)
* **Monitoring breeding marsh bird populations at the Grand Bay NERR and Pascagoula River Marshes Coastal Preserve** – Dr. Mark Woodrey (Grand Bay NERR/Mississippi State University) Dr. Bob Cooper (University of Georgia), Dr. Scott Rush (Mississippi State University)
* **Effects of Landscape-Level Metrics on Marsh Bird Occupancy and Abundance within Tidal Marshes of the Northern Gulf of Mexico** – Dr. Bob Cooper (University of Georgia), Ali Leggett (Mississippi Department of Marine Resources), Dr. Mark Woodrey (Grand Bay NERR/Mississippi State University)
* **Mercury burden of selected biota within the Grand Bay National Estuarine Research Reserve** – Dr. Chuck Jagoe (Florida A&M University), Christina Mohrman (Florida A&M University), Dr. Mark Woodrey (Grand Bay NERR/Mississippi State University)
* **Erosion Monitoring - 6 Monitoring Stations Used to Estimate the Rate of Erosion at Sites Representing Varying Degrees of Wave Exposure and Geological Substrates** - Tom Strange (Grand Bay NERR), Jay McIlwain (Grand Bay NERR), Brenna Ehmen (Grand Bay NERR), Lindsay Spurrier (Grand Bay NERR), Will Underwood (Grand Bay NERR)
* **Legacy Effects of Land-use Change and Nitrogen Source Shifts on a Benchmark System: Building Capacity for Collaborative Research Leadership at the Grand Bay Reserve** - Lead PI Dr. Ruth Carmichael (Dauphin Island Sea Lab, University of South Alabama); collaborators: Elizabeth Darrow (PhD student, Dauphin Island Sea Lab, University of South Alabama), Capt William Burkhardt (USFDA Office of Food Safety), Cdr Kevin Calci (USFDA Office of Food Safety), Dr. Wei Wu (Gulf Coast Research Laboratory, University of Southern Mississippi), Dave Ruple (Grand Bay NERR), Dr. William Walton (Auburn University Shellfish Laboratory)
* **Fish Communities of Nearshore Habitats within the Grand Bay NERR/NWR** – Ron Cole (Grand Bay NERR), Brenna Ehmen (Grand Bay NERR), Gretchen Grammer (Grand Bay NERR), Jake Walker (Grand Bay NERR), Dr. Mark Woodrey (Grand Bay NERR/Mississippi State University)
* **Nesting ecology of the diamondback terrapin (Malaclemys terrapin pileata) at the Grand Bay National Estuarine Research Reserve, Mississippi** - Collaborators - Christina Mohrman (Florida A&M University/Grand Bay NERR) and Dr. Mark Woodrey (Grand Bay NERR/Mississippi State University)

**II. Physical Structure Descriptors**

**9) Sensor Specifications:**

GND NERR deployed 6600EDS, 6600-V2, and EXO-2 sondes in 2013. Details on individual deployments are available in the Data Collection Periods section of this document.

YSI 6600 data sonde:

Parameter: Temperature

Units: Celsius (C)

Sensor Type: Thermistor

Model#: 6560

Range: -5 to 50 C

Accuracy: +/- 0.15

Resolution: 0.01 C

Parameter: Conductivity

Units: milli-Siemens per cm (mS/cm)

Sensor Type: 4-electrode cell with autoranging

Model#: 6560

Range: 0 to 100 mS/cm

Accuracy: +/- 0.5% of reading + 0.001 mS/cm

Resolution: 0.001 mS/cm to 0.1 mS/cm (range dependant)

Parameter: Salinity

Units: parts per thousand (ppt)

Sensor Type: Calculated from conductivity and temperature

Range: 0 to 70 ppt

Accuracy: +/- 1.0% of reading pr 0.1 ppt, whichever is greater

Resolution: 0.01 ppt

Parameter: Dissolved Oxygen % saturation

Units: percent air saturation (%)

Sensor Type: Rapid Pulse - Clark type, polargraphic

Model#: 6562

Range: 0 to 500% air saturation

Accuracy: 0-200% air saturation: +/- 2% of the reading or 2% air saturation, whichever is greater; 200 to 500% air saturation: +/- 6% of the reading

Resolution: 0.1% air saturation

or

Sensor Type: Optical probe w/ mechanical cleaning

Model#: 6150 ROX

Range: 0 to 500% air saturation

Accuracy: 0-200% air saturation: +/- 1% of the reading or 1% air saturation, whichever is greater 200-500% air saturation: +/- 15% or reading

Resolution: 0.1% air saturation

Parameter: Dissolved Oxygen mg/L (Calculated from % air saturation, temperature, and salinity)

Units: milligrams/Liter (mg/L)

Sensor Type: Rapid Pulse - Clark type, polargraphic

Model#: 6562

Range: 0 to 50 mg/L

Accuracy: 0-20 mg/L: +/- 2% of the reading or 0.2 mg/L, whichever is greater

20 to 50 mg/L: +/- 6% of the reading

Resolution: 0.01 mg/L

or

Units: milligrams/Liter (mg/L)

Sensor Type: Optical probe w/ mechanical cleaning

Model#: 6150 ROX

Range: 0 to 50 mg/L

Accuracy: 0-20 mg/L: +/-0.1 mg/l or 1% of the reading, whichever is greater

20 to 50 mg/L: +/- 15% of the reading

Resolution: 0.01 mg/L

Parameter: Non-vented Level - Shallow (Depth)

Units: feet or meters (ft or m)

Sensor Type: Stainless steel strain gauge

Range: 0 to 30 ft (9.1 m)

Accuracy: +/- 0.06 ft (0.018 m)

Resolution: 0.001 ft (0.001 m)

Parameter: pH – bulb probe or EDS flat glass probe

Units: pH units

Sensor Type: Glass combination electrode

Model#: 6561 or 6561FG

Range: 0 to 14 units

Accuracy: +/- 0.2 units

Resolution: 0.01 units

Parameter: Turbidity

Units: nephelometric turbidity units (NTU)

Sensor Type: Optical, 90 degree scatter, with mechanical cleaning

Model#: 6136

Range: 0 to 1000 NTU

Accuracy: +/- 2% of reading or 0.3 NTU (whichever is greater)

Resolution: 0.1 NTU

Parameter: Chlorophyll Fluorescence

Units: micrograms/Liter

Sensor Type: Optical probe w/ mechanical cleaning

Model#: 6025

Range: 0 to 400 ug/Liter

Accuracy: Dependent on methodology

Resolution: 0.1 ug/L chl a, 0.1% FS

YSI EXO Sonde:

Parameter: Temperature

Units: Celsius (C)

Sensor Type: Thermistor

Model#: 599870-01

Range: -5 to 50 C

Accuracy: -5 to -35: +/- 0.01, -35 to -50: +/- .005

Resolution: 0.01 C

Parameter: Conductivity

Units: milli-Siemens per cm (mS/cm)

Sensor Type: 4-electrode cell with autoranging

Model#: 599870-01

Range: 0 to 200 mS/cm

Accuracy: 0 to 100: +/- 0.5% of reading or 0.001 mS/cm; 100 to 200: +/- 1% of reading

Resolution: 0.001 mS/cm to 0.1 mS/cm (range dependant)

Parameter: Salinity

Units: practical salinity units (psu)/parts per thousand (ppt)

Sensor Type: Calculated from conductivity and temperature

Range: 0 to 70 psu

Accuracy: +/- 1.0% of reading pr 0.1 ppt, whichever is greater

Resolution: 0.01 psu

Parameter: Dissolved Oxygen % saturation

Sensor Type: Optical probe w/ mechanical cleaning

Model#: 599100-01

Range: 0 to 500% air saturation

Accuracy: 0-200% air saturation: +/- 1% of the reading or 1% air saturation, whichever is greater 200-500% air saturation: +/- 5% or reading

Resolution: 0.1% air saturation

Parameter: Dissolved Oxygen mg/L (Calculated from % air saturation, temperature, and salinity)

Units: milligrams/Liter (mg/L)

Sensor Type: Optical probe w/ mechanical cleaning

Model#: 599100-01

Range: 0 to 50 mg/L

Accuracy: 0-20 mg/L: +/-0.1 mg/l or 1% of the reading, whichever is greater

20 to 50 mg/L: +/- 5% of the reading

Resolution: 0.01 mg/L

Parameter: Non-vented Level - Shallow (Depth)

Units: feet or meters (ft or m)

Sensor Type: Stainless steel strain gauge

Range: 0 to 33 ft (10 m)

Accuracy: +/- 0.013 ft (0.04 m)

Resolution: 0.001 ft (0.001 m)

Parameter: pH

Units: pH units

Sensor Type: Glass combination electrode

Model#: 599701(guarded) or 599702(wiped)

Range: 0 to 14 units

Accuracy: +/- 0.01 units within +/- 10° of calibration temperature, +/- 0.02 units for entire temperature range

Resolution: 0.01 units

Parameter: Turbidity

Units: formazin nephelometric units (FNU)

Sensor Type: Optical, 90 degree scatter

Model#: 599101-01

Range: 0 to 4000 FNU

Accuracy: 0 to 999 FNU: 0.3 FNU or +/-2% of reading (whichever is greater); 1000 to 4000 FNU +/-5% of reading

Resolution: 0 to 999 FNU: 0.01 FNU, 1000 to 4000 FNU: 0.1 FNU

Parameter: Chlorophyll

Units: micrograms/Liter

Sensor Type: Optical probe

Model#: 599102-01

Range: 0 to 400 ug/Liter

Accuracy: Dependent on methodology

Resolution: 0.1 ug/L chl a, 0.1% FS

**Dissolved Oxygen Qualifier (Rapid Pulse / Clark type sensor):**

The reliability of dissolved oxygen (DO) data collected with the rapid pulse / Clark type sensor after 96 hours post-deployment for non-EDS (Extended Deployment System) data sondes may be problematic due to fouling which forms on the DO probe membrane during some deployments (Wenner et al. 2001). Some Reserves utilize the YSI 6600 EDS data sondes, which increase DO accuracy and longevity by reducing the environmental effects of fouling. Optical DO probes have further improved data reliability. The user is therefore advised to consult the metadata for sensor type information and to exercise caution when utilizing rapid pulse / Clark type sensor DO data beyond the initial 96-hour time period. Potential drift is not always problematic for some uses of the data, i.e. periodicity analysis. It should also be noted that the amount of fouling is very site specific and that not all data are affected. If there are concerns about fouling impacts on DO data beyond any information documented in the metadata and/or QAQC flags/codes, please contact the Research Coordinator at the specific NERR site regarding site and seasonal variation in fouling of the DO sensor.

**Depth Qualifier:**

The NERR System-Wide Monitoring Program utilizes YSI data sondes that can be equipped with either vented or non-vented depth/level sensors.  Readings for both vented and non-vented sensors are automatically compensated for water density change due to variations in temperature and salinity; but for all non-vented depth measurements, changes in atmospheric pressure between calibrations appear as changes in water depth.  The error is equal to approximately 1.03 cm for every 1 millibar change in atmospheric pressure, and is eliminated for vented sensors because they are vented to the atmosphere throughout the deployment time interval.

Beginning in 2006, NERR SWMP standard calibration protocol calls for all non-vented depth sensors to read 0 meters at a (local) barometric pressure of 1013.25 mb (760 mm/hg).  To achieve this, each site calibrates their depth sensor with a depth offset number, which is calculated using the actual atmospheric pressure at the time of calibration and the equation provided in the SWMP calibration sheet or digital calibration log.  This offset procedure standardizes each depth calibration for the entire NERR System.  If accurate atmospheric pressure data are available, non-vented sensor depth measurements at any NERR can be corrected.

In 2010, the CDMO began automatically correcting depth/level data for changes in barometric pressure as measured by the Reserve’s associated meteorological station during data ingestion. These corrected depth/level data are reported as cDepth and cLevel, and are assigned QAQC flags and codes based on QAQC protocols. Please see sections 11 and 12 for QAQC flag and code definitions.

**Salinity Units Qualifier:**

In 2013, EXO sondes were approved for SWMP use and began to be utilized by Reserves. While the 6600 series sondes report salinity in parts per thousand (ppt) units, the EXO sondes report practical salinity units (psu). These units are essentially the same and for SWMP purposes are understood to be equivalent, however psu is considered the more appropriate designation. Moving forward the NERR System will assign psu salinity units for all data regardless of sonde type.

**Turbidity Qualifier:**

In 2013, EXO sondes were approved for SWMP use and began to be utilized by Reserves. While the 6600 series sondes report turbidity in nephelometric turbidity units (NTU), the EXO sondes use formazin nephelometric units (FNU). These units are essentially the same but indicate a difference in sensor methodology, for SWMP purposes they will be consideredequivalent. Moving forward, the NERR System will use FNU/NTU as the designated units for all turbidity data regardless of sonde type. If turbidity units and sensor methodology are of concern, please see the Sensor Specifications portion of the metadata.

**Chlorophyll Fluorescence Disclaimer:**

YSI chlorophyll sensors (6025 or 599102-01) are designed to serve as a proxy for chlorophyll concentrations in the field for monitoring applications and complement traditional lab extraction methods; therefore, there are accuracy limitations associated with the data that are detailed in the YSI manual including interference from other fluorescent species, differences in calibration method, and effects of cell structure, particle size, organism type, temperature, and light on sensor measurements

**10) Coded variable definitions:**

Sampling station: Sampling site code: Station Code:

Bayou Heron BH gndbhwq

Point Aux Chenes PC gndpcwq

Bayou Cumbest BC gndbcwq

Bangs Lake BL gndblwq

**11) QAQC flag definitions:**

QAQC flags provide documentation of the data and are applied to individual data points by insertion into the parameter’s associated flag column (header preceded by an F\_). During primary automated QAQC (performed by the CDMO), -5, -4, and -2 flags are applied automatically to indicate data that is missing and above or below sensor range. All remaining data are then flagged 0, passing initial QAQC checks. During secondary and tertiary QAQC 1, -3, and 5 flags may be used to note data as suspect, rejected due to QAQC, or corrected.

-5 Outside High Sensor Range

-4 Outside Low Sensor Range

-3 Data Rejected due to QAQC

-2 Missing Data

-1 Optional SWMP Supported Parameter

0 Data Passed Initial QAQC Checks

1 Suspect Data

2 *Open - reserved for later flag*

3 Calculated data: non-vented depth/level sensor correction for changes in barometric pressure

4 Historical Data: Pre-Auto QAQC

5 Corrected Data

**12) QAQC code definitions:**

QAQC codes are used in conjunction with QAQC flags to provide further documentation of the data and are also applied by insertion into the associated flag column. There are three (3) different code categories, general, sensor, and comment. General errors document general problems with the deployment or YSI datasonde, sensor errors are sensor specific, and comment codes are used to further document conditions or a problem with the data. Only one general or sensor error and one comment code can be applied to a particular data point, but some comment codes (marked with an \* below) can be applied to the entire record in the F\_Record column.

General Errors

GIC No instrument deployed due to ice

GIM Instrument malfunction

GIT Instrument recording error; recovered telemetry data

GMC No instrument deployed due to maintenance/calibration

GNF Deployment tube clogged / no flow

GOW Out of water event

GPF Power failure / low battery

GQR Data rejected due to QA/QC checks

GSM See metadata

Corrected Depth/Level Data Codes

GCC Calculated with data that were corrected during QA/QC

GCM Calculated value could not be determined due to missing data

GCR Calculated value could not be determined due to rejected data

GCS Calculated value suspect due to questionable data

GCU Calculated value could not be determined due to unavailable data

Sensor Errors

SBO Blocked optic

SCF Conductivity sensor failure

SCS Chlorophyll spike

SDF Depth port frozen

SDG Suspect due to sensor diagnostics

SDO DO suspect

SDP DO membrane puncture

SIC Incorrect calibration / contaminated standard

SNV Negative value

SOW Sensor out of water

SPC Post calibration out of range

SQR Data rejected due to QAQC checks

SSD Sensor drift

SSM Sensor malfunction

SSR Sensor removed / not deployed

STF Catastrophic temperature sensor failure

STS Turbidity spike

SWM Wiper malfunction / loss

Comments

CAB\* Algal bloom

CAF Acceptable calibration/accuracy error of sensor

CAP Depth sensor in water, affected by atmospheric pressure

CBF Biofouling

CCU Cause unknown

CDA\* DO hypoxia (<3 mg/L)

CDB\* Disturbed bottom

CDF Data appear to fit conditions

CFK\* Fish kill

CIP \* Surface ice present at sample station

CLT\* Low tide

CMC\* In field maintenance/cleaning

CMD\* Mud in probe guard

CND New deployment begins

CRE\* Significant rain event

CSM\* See metadata

CTS Turbidity spike

CVT\* Possible vandalism/tampering

CWD\* Data collected at wrong depth

CWE\* Significant weather event

**13) Post deployment information:**

End of deployment post-calibration readings in standard solutions prior to probe cleaning.

The following variable codes are used to explain missing post-calibration readings:

PA probe absent/not functioning

NA reading not available

**Bayou Heron**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Deployment Date | SpCond | DO 1 | DO 2 | pH | pH | Turb | Turb | Depth |
| m/d/y | 50 mS/cm | 100% sat | 100% sat | 7 | 10 | 0 NTU | 126 NTU | m |
|  |  |  |  |  |  |  |  |  |
| 1/22/2013 | 49.51 | 101.6 | 100.6 | 7.04 | 9.98 | 0.7 | 130 | 0.044 |
| 3/15/2013 | 48.97 | 103.7 | 103.9 | 7.31 | 9.96 | -2.2 | 126.1 | 0.019 |
| 4/17/2013 | 49.53 | 98.9 | 99 | PA | PA | -0.7 | 109 | 0.061 |
| 5/21/2013 | 49.32 | 100.5 | 100.4 | 7.03 | 10.16 | 1.1 | 122.6 | -0.041 |
| 6/27/2013 | 50.5 | 100.8 | 100.7 | 7.11 | 10.11 | 0.6 | 123.8 | 0.045 |
| 7/23/2013 | 48.33 | 99.6 | 99.7 | 7.17 | 10.04 | -2.4 | 126.7 | 0.061 |
| 8/15/2013 | 50.09 | 100.6 | 100.5 | 7.05 | 10.09 | -0.5 | 125.4 | 0.039 |
| 9/12/2013 | 49.88 | 98.7 | 98.9 | 7.26 | 9.9 | 0.2 | 123.4 | 0.104 |
| 10/8/2013 | 46.9 | 97.7 | 97.6 | 7.24 | 10.02 | 7.3 | 7.1 | -0.03 |
| 12/3/2013 | 49.25 | 106.6 | 106.7 | 7.56 | 9.7 | 5.3 | 57.4 | 0.004 |

**Point Aux Chenes**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Deployment Date | SpCond | DO 1 | DO 2 | pH | pH | Turb | Turb | Depth |
| m/d/y | 50 mS/cm | 100% sat | 100% sat | 7 | 10 | 0 NTU | 126 NTU | m |
|  |  |  |  |  |  |  |  |  |
| 1/22/2013 | 6.421 | 99.7 | 99.6 | 6.88 | 6.9 | 1239.8 | 1239.8 | -0.023 |
| 3/7/2013 | 9.7 | 102.6 | 102.7 | 6.71 | 6.7 | 663.9 | 689.9 | 0.019 |
| 4/17/2013 | 44.36 | 48.1 | 49 | 8 | 8.02 | 1.3 | 140 | 0.056 |
| 5/21/2013 | 46.12 | 99.7 | 99.6 | 7.58 | 8.06 | 2.9 | 126.6 | 0.024 |
| 6/11/2013 | 42.08 | 99.1 | 99.3 | PA | PA | 1.9 | 126.4 | -0.042 |
| 6/27/2013 | 12.19 | 99.1 | 99 | 7.15 | 9.88 | 1.5 | 124.9 | 0.047 |
| 7/23/2013 | 43.97 | 99.9 | 100 | 7.01 | 9.97 | 0.8 | 125.3 | 0.054 |
| 8/15/2013 | 49.37 | 100.9 | 101 | 7.02 | 10 | -0.7 | 124.7 | 0.03 |
| 9/12/2013 | PA | 98.1 | 98.2 | NA | NA | NA | NA | NA |
| 9/25/2013 | 49.18 | 99.9 | 99.8 | 7.13 | 10.01 | 1.2 | 122.8 | 0.085 |
| 10/8/2013 | 46.19 | 99.9 | 99.8 | 7.18 | 10.19 | -0.3 | 122.6 | -0.03 |
| 12/3/2013 | 46.4 | 100.6 | 100.5 | 7 | 9.97 | 1.83 | 126.43 | -0.012 |

**Bayou Cumbest**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Deployment Date | SpCond | DO 1 | DO 2 | pH | pH | Turb | Turb | Depth |
| m/d/y | 50 mS/cm | 100% sat | 100% sat | 7 | 10 | 0 NTU | 126 NTU | m |
|  |  |  |  |  |  |  |  |  |
| 1/15/2013 | 49.29 | 111.4 | 111.3 | 7.34 | 10.33 | -3.3 | 125.1 | -0.05 |
| 3/7/2013 | 44.71 | 101.3 | 101.4 | 7.37 | 9.98 | 1.4 | 126.3 | 0.021 |
| 4/17/2013 | 50.86 | 106.7 | 106.8 | 7.67 | 10.67 | 0.8 | 126.4 | 0.06 |
| 5/21/2013 | 47.02 | 101.9 | 101.8 | 7.56 | 9.33 | -1.2 | 123.2 | -0.056 |
| 6/27/2013 | 47.8 | 99.5 | 99.3 | 7.1 | 9.76 | 0.5 | 131.5 | 0.041 |
| 7/23/2013 | 47.9 | 58.3 | 58.2 | 7.07 | 9.77 | 1 | 127.1 | 0.065 |
| 8/15/2013 | 47.04 | 106.9 | 107.1 | 7.45 | 9.05 | -1 | 169.1 | 0.03 |
| 9/12/2013 | 50.26 | 85.6 | 86.2 | 6.94 | 9.72 | 1.2 | 125.2 | 0.112 |
| 10/8/2013 | 49.64 | 101.1 | 101 | 6.67 | 9.78 | 0.7 | 96.5 | -0.028 |
| 12/3/2013 | 49.68 | 102.3 | 102.5 | 7.01 | 10.03 | 0.7 | 129.4 | 0.001 |

**Bangs Lake**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Deployment Date | SpCond | DO 1 | DO 2 | pH | pH | Turb | Turb | Depth |
| m/d/y | 50 mS/cm | 100% sat | 100% sat | 7 | 10 | 0 NTU | 126 NTU | m |
|  |  |  |  |  |  |  |  |  |
| 1/15/2013 | 50.31 | 105.4 | 105.5 | 7.03 | 10.04 | 0.2 | 126.2 | -0.027 |
| 3/7/2013 | 49.11 | 99.8 | 99.9 | 7.49 | 9.61 | 2.4 | 126.7 | -0.005 |
| 4/17/2013 | 49.42 | 97.2 | 97.1 | 7.5 | 9.56 | -1 | 127 | 0.029 |
| 6/11/2013 | 44.94 | 86.1 | 86.3 | 7.24 | 9.93 | 0.7 | 121.9 | 0.07 |
| 7/17/2013 | 48.37 | 100.2 | 100.3 | 7.58 | 7.93 | 1.8 | 109.5 | 0.057 |
| 8/15/2013 | 42.09 | 99 | 98.8 | 7.96 | 8.33 | 0.7 | 107.1 | 0.04 |
| 9/12/2013 | 49.69 | 99.8 | 99.5 | 7.06 | 10.03 | 6.6 | 78.7 | 0.1 |
| 10/8/2013 | 49.75 | 101.6 | 101.7 | 6.93 | 9.98 | 0.7 | 127.4 | -0.048 |
| 10/28/2013 | 49.85 | 97.1 | 97 | 7.02 | 10 | -2 | 117.1 | -0.021 |
| 12/3/2013 | 50.15 | 101 | 100.9 | 6.99 | 9.9 | 0.3 | 124.4 | -0.002 |

**14) Other remarks/notes:**

Data are missing due to equipment or associated specific probes not being deployed, equipment failure, time of maintenance or calibration of equipment, or repair/replacement of a sampling station platform. Any NANs in the dataset stand for “not a number” and are the result of low power, disconnected wires, or out of range readings. If additional information on missing data is needed, contact the Research Coordinator at the reserve submitting the data.

**General Remarks:**

5/29/13 – Deployment tubes were serviced. Sonde was removed from tube; old tube was removed and a clean tube was installed. Sonde was then placed back in the tube. Each sonde missed only 1-3 readings, noted for each site below. Due to the different tube construction and the way tubes were installed, the sondes are sitting at slightly different depths. The difference between depth sensor locations, based on measurements taken after the sonde tube servicing, are in the following table:

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| |  |  |  |  | | --- | --- | --- | --- | | New sonde tube at: | places the sonde: | than the tube that was in place from 8/10/2010-5/29/2013. | Distance between bottom of sonde and sediment as of 3/11/2014: | | **BH** | 9.3 cm higher | 33.5 cm | | **PC** | 14.3 cm lower | 7 cm | | **BC** | 11.9 cm lower | 25 cm | | **BL** | 12.1 cm lower | 20 cm | |  |  |  |
|  |  |  |

**Bayou Heron:**

5/29/2013 11:30-11:45 – sonde out of water for deployment tube replacement. Actual sensor depth is different after vs. before this time (see table at the beginning of this section).

9/12/2013 14:30 – 10/8/2013 12:00 – DO % and mg/L marked suspect. Wiper on ROX probe was not parking correctly, but no backup probe was available and sonde was deployed with no wiper. DO data at sonde switch-out on 9/12 did not match, and discrete reading matched better with the previous deployment. Both deployments had post-cals within the acceptable range. Because of the discrepancy and the wiper issue, we decided that this deployment should be flagged.

**Point Aux Chenes:**

General note on Turbidity at PC in 2013: After the sonde tube servicing on 5/29, the sonde was lower in the water than it had previously been. Turbidity levels after this date were much more responsive to wind and much higher during these events than before the sonde tube change. In general, high turbidity events due to wind before 5/29 were flagged <0> (CDF), along with an F\_Record code of {CWE}. After 5/29, high turbidity events due to wind were flagged <1> [GSM] (CWE) because, while the readings are believed to be accurate, we do not believe they are representative of the water column overall.

1/15/2013 11:00 – sonde out of water for in-field cleaning. Mid-deployment sonde cleaning performed on 1/15, using the same tools used in the lab (toothbrush, q-tips, toothpicks, SpC sensor brushes, squirt bottle, etc.). All fouling was believed to have been removed from sensor faces before sonde was replaced in the water. Some high turbidity values between 1/15 and 1/18 corresponded with a rain event, but on 1/18 a wiper malfunction allowed biofouling that impacted the rest of the deployment, and we are no longer certain the values between the cleaning and the wiper malfunction are rain-related. It could have been biofouling impact as well, so the values have been flagged suspect.

3/7/2013 12:45-13:00 – attempted to clean inside of deployment tube using PVC pole, as barnacles inside the tube could have prevented sondes from resting on the bottom of the tube. No depth difference between deployments is noticeable. The tubes will be serviced by divers in May 2013 and this may help us determine if depth was affected.

5/13/2013 08:45 – sonde out of water for in-field cleaning.

5/29/2013 08:00-08:45 – sonde out of water for deployment tube replacement. Actual sensor depth is different after vs. before this time (see table at the beginning of this section).

6/11/2013 12:00 – first deployment of an EXO sonde at this site. Depth may differ from 6600s. Only EXOs will be deployed at this site in the future.

7/25/2013 11:15 – 7/26/2013 19:30 - SWMP nutrient sampling conducted on 8/15 yielded chlorophyll a concentrations of approximately 30 ug/L; this is a known algae bloom. This DO pattern is presumed to be from an algae bloom as well.

8/14/2013 03:45 – 8/15/2013 13:00 – SWMP nutrient sampling conducted on 8/15 yielded chlorophyll a concentrations of approximately 30 ug/L; this is a known algae bloom. Other DO drops during this deployment are also presumed to be from algae blooms and have been flagged as well.

8/29/2013 18:30 – 8/31/2013 02:30 - SWMP nutrient sampling conducted on 8/15 yielded chlorophyll a concentrations of approximately 30 ug/L; this is a known algae bloom. This DO pattern is presumed to be from an algae bloom as well.

9/12/2013 11:45 – 9/25/2013 08:00 – During part of this deployment (9/17 01:30 – 9/18 23:30), SpC readings were extremely scattered. Data points from this scattered time period were all rejected. All other readings from the deployment are believed to be correct. The cause of this problem is unknown and the probe was replaced before subsequent deployments. Data marked 1 SSM CSM.

**Bayou Cumbest:**

1/15/2013 10:15 – 3/7/2013 14:30: DO % saturation and mg/L data marked suspect for entire deployment. Data values were 5-10% off from the previous deployment’s data at the beginning of the deployment; 10% higher than the subsequent deployment at the end; and post-calibration readings were 111%.

5/29/2013 10:15-10:30 – sonde out of water for deployment tube replacement. Actual sensor depth is different after vs. before this time (see table at the beginning of this section).

7/1/2013 – 10/8/2013 - ongoing turbidity issue: It is believed that there is an animal making a home in the sonde sleeve. There are turbidity spikes above 100 almost every night between 19:00-04:00. These have been marked 1 GSM CCU. Any spikes above 400 during these time periods are also assumed to be from this animal; but due to how high they were without any surrounding high turbidity, they were rejected.

9/12/2013 15:45-18:30 – DO spiked up to 172% saturation and DO values were marked suspect. However, pH and temperature increased, and salinity decreased in this same block of time. Based on pressure-corrected depth data downloaded from the CDMO, the sensors were not out of water at this time. This implies that something was indeed different in the water column during this time period (as opposed to some unknown sensor error).

**Bangs Lake:**

3/7/13 14:00 - 4/17/13 11:45 - 6-series ROX DO probes could malfunction in such a way that turbidity readings became unstable, due to the electrical connections inside the bulkhead. That was the case with this deployment; the DO probe was sent off for repair before this sonde or sensor were redeployed. Turbidity data is marked -3 SSM CSM. Although DO readings to not appear to be affected, they have been flagged out of caution because of the known sensor malfunction, data marked 1 SSM CSM.

5/21 14:30-45 - Mid-deployment sonde cleaning performed, using the same tools used in the lab (toothbrush, q-tips, toothpicks, SpC sensor brushes, squirt bottle, etc.). Unless noted, all fouling was believed to have been removed from sensor faces before sonde was replaced in the water. Unless flagged/coded, subsequent data values are believed to be correct.

5/29/2013 09:45 – sonde out of water for deployment tube replacement. Actual sensor depth is different after vs. before this time (see table at the beginning of this section).

6/27 11:00 - Mid-deployment sonde cleaning performed, using the same tools used in the lab (toothbrush, q-tips, toothpicks, SpC sensor brushes, squirt bottle, etc.). Unless noted, all fouling was believed to have been removed from sensor faces before sonde was replaced in the water. Unless flagged/coded, subsequent data values are believed to be correct.