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

**Water Quality Metadata**

**January 1 – December 31, 2021**

**Latest Update:** September 28, 2022

**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 with Windows 7 or newer operating system. Files are exported from EcoWatch in a comma-delimited format (.CDF), EcoWatch Lite in a comma separated file (CSV) or KOR Software in a comma separated file (CSV) 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. Cassy Porter was responsible for data QAQC in 2021.

**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 and SWMP SOPs. For Conductivity and Salinity, YSI calibrator solution 3169 (50,000 µS/cm) is used without dilution. Fisher pH solutions SB107-4 and SB115-4 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 126/124 NTU. Depth is calibrated in air and is barometrically corrected. DO calibrations were performed in saturated air until 2014 and since then have been performed in an aerated bucket of tap water. All data are collected every 15 minutes. All data are recorded in Central Standard Time.

One data logger (sonde) is always deployed at each permanent monitoring station in the Grand Bay estuary. 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 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 one data point is recorded while the sonde is wrapped in the towel to record post-deployment dissolved oxygen in 100% water-saturated air. Other post-deployment calibrations, including one dissolved oxygen reading in the aerated tap water bucket, 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 calibration checks, 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. This system was used as primary telemetry for the SWMP water quality stations until EcoNet services were discontinued in May 2017.

As of May 11, 2017, we are again transmitting to GOES, via YSI STORM-3 loggers, at two stations. Although, Bangs lake was not telemetered in 2021 due to hurricane damage. The stations and NESDIS IDs are:

**Bayou Heron (GNDBHWQ) - 3B006C4E** – transmits at 05:10 past every hour

**Bangs Lake (GNDBLWQ) - 3B007F38** – transmits at 08:00 past every hour

Bayou Cumbest and Point aux Chenes are no longer telemetered.

Transmissions are scheduled hourly and contain four (4) data sets reflecting fifteen- minute data sampling intervals. Upon receipt by the CDMO, the data undergoes the same automated primary QAQC process detailed in Section 2 above. 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 www.nerrsdata.org.

**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.

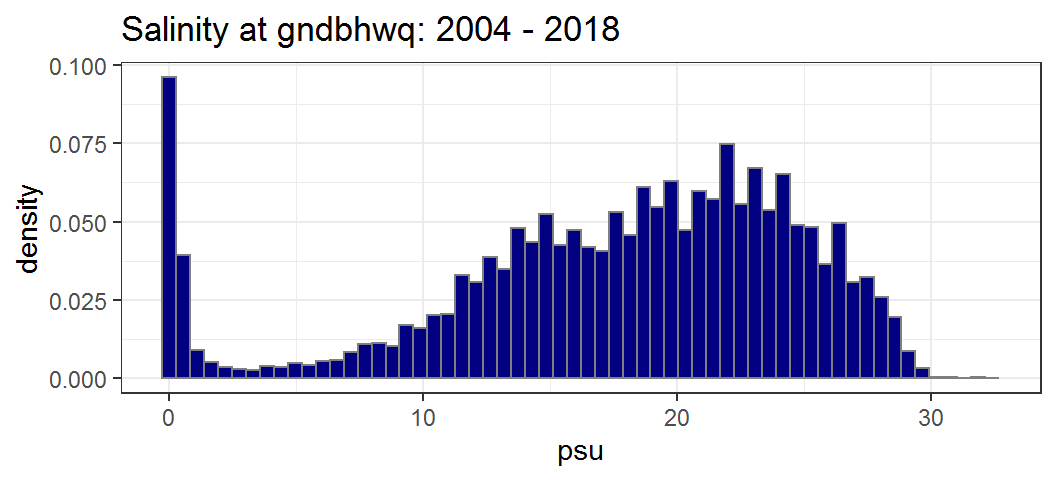
The Grand Bay NERR is part of the Coastal Streams Basin watershed, which consists of three primary sub-watersheds that provide much of the freshwater inputs into the system: Bayou Heron, Bayou Cumbest, and Bangs Lake.

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): [30.4178° N, 88.4054° 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
* Bottom habitat: soft sediments
* Salinity range in 2021: 0.0 – 24.5 psu
* Average Salinity in 2021: 12.7 (± 7.4) psu
* Historical salinity distribution (histogram bin width = 0.5 psu):



|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Quantile** | **min** | **1%** | **5%** | **25%** | **median** | **75%** | **95%** | **99%** | **max** | **n** |
| psu | 0 | 0 | 0.2 | 13.6 | 18.9 | 23.1 | 27.2 | 28.6 | 32.4 | 456454 |

* Former summary values used in metadata were based on data from 2005-2011:
  + Typical salinity range: 5.9 – 27.6 psu

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

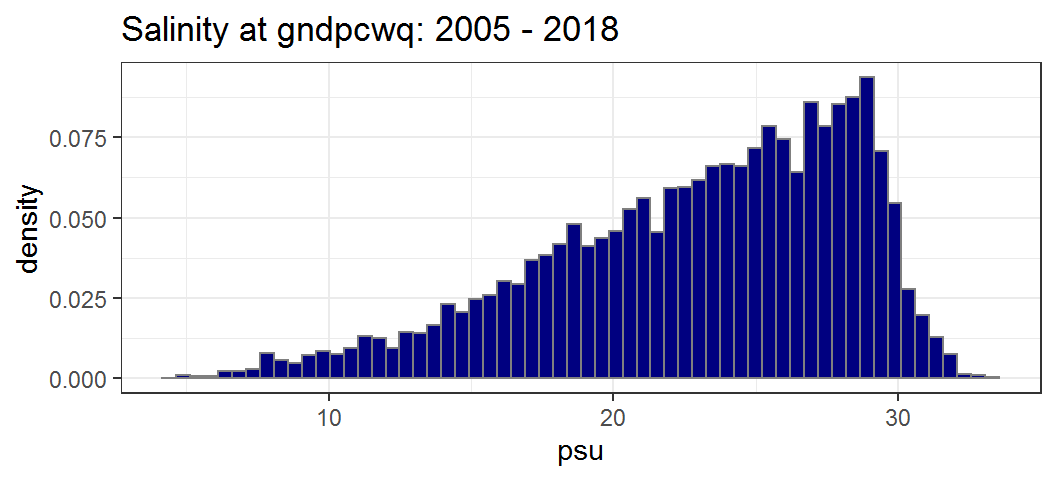
* + Median salinity from 2005-2011: 20.9 psu

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

b) Point Aux Chenes (PC): [30.3486° N, 88.4185° W].

This is the most southern water quality site within the boundaries of Grand Bay NERR. It is 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. The PC station was destroyed during Hurricane Sally in September 2020 and was replaced in October 2021.

* Depth range: 0.3 – 1.6 m
* Bottom habitat: soft sediments
* Salinity range in 2021 (October through December only): 15.7 – 28.3 psu
* Average Salinity in 2021 (October through December only): 23.1 (± 3.3) psu
* Historical Salinity Distribution (histogram bin width = 0.5 psu):



|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Quantile** | **min** | **1%** | **5%** | **25%** | **median** | **75%** | **95%** | **99%** | **max** | **n** |
| psu | 4.3 | 8.2 | 12.6 | 19.4 | 24 | 27.3 | 29.8 | 31.2 | 33.2 | 345813 |

* Former summary values used in metadata were based on data from 2005-2011:
  + Typical salinity range: 12.4 – 29.7 psu

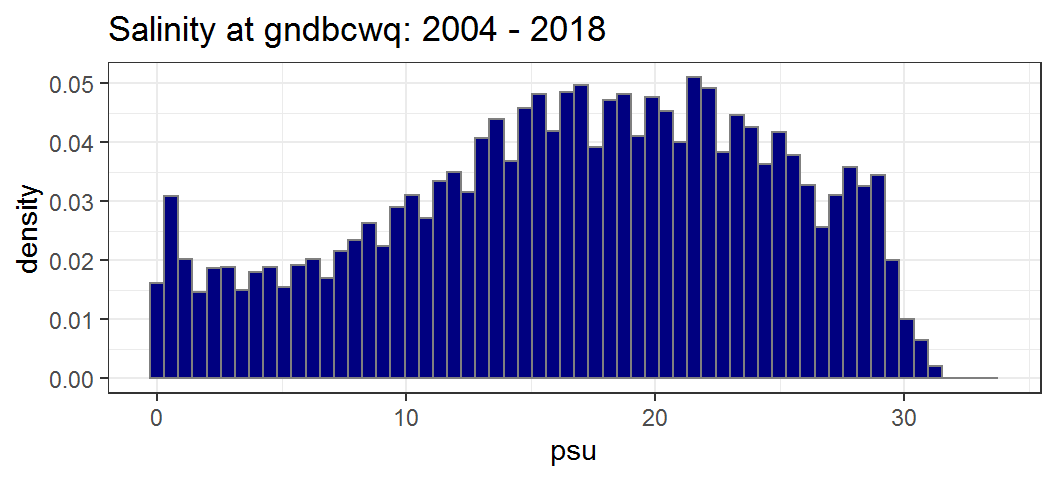
The above typical salinity range represents 90% of the data points collected from 2005-2011 (n=195,836)

* + Median salinity from 2005-2011: 24.2

c) Bayou Cumbest (BC): [30.3836° N, 88.4364° 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.

* Depth range: 0.00 – 1.10 m
* Bottom habitat: soft sediments with fringing oyster shell reefs
* Salinity range in 2021: 0.1 – 27.2 psu
* Average Salinity in 2021: 13.2 (± 7.6) psu
* Historical Salinity Distribution (histogram bin width = 0.5 psu):



|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Quantile** | **min** | **1%** | **5%** | **25%** | **median** | **75%** | **95%** | **99%** | **max** | **n** |
| psu | 0 | 0.3 | 2.1 | 11.3 | 17.4 | 22.9 | 28.4 | 29.9 | 33.5 | 436307 |

* Former summary values used in metadata were based on data from 2005-2011:
  + Typical salinity range: 3.8 – 28.4 psu

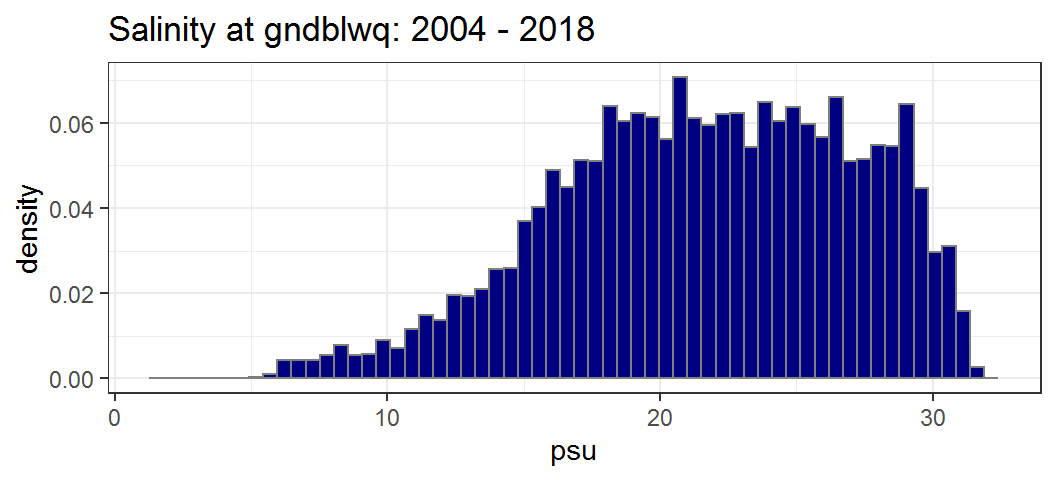
The above typical salinity range represents 90% of the data points collected from 2005-2011 (n=211,045)

* + Median salinity from 2005-2011: 19.1

d) Bangs Lake (BL): [30.3571° N, 88.4629° 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 former Mississippi Phosphates industrial facility (now a Superfund site). Both sites are surrounded by containment levees constructed to direct any contaminant spills towards Bayou Casotte, a 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. After Hurricane Isaac in 2012, phosphate was also substantially higher than baseline for an extended period. Beck et al. 2018 discuss both inputs and their impacts. Mississippi Phosphates has since been added to the EPA’s Superfund Site list and site closure is in progress. 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 former 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
* Bottom habitat: soft sediments
* Salinity range in 2021: 2.3 – 27.9 psu
* Average Salinity in 2021: 17.2 (± 6.0) psu
* Historical Salinity Distribution (histogram bin width = 0.5 psu):



|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Quantile** | **min** | **1%** | **5%** | **25%** | **median** | **75%** | **95%** | **99%** | **max** | **n** |
| psu | 1.5 | 8 | 12.2 | 17.9 | 22 | 26 | 29.6 | 30.8 | 32.1 | 420746 |

* Former summary values used in metadata were based on data from 2005-2011:
  + Typical salinity range: 13.1 – 29.6 psu

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

*Sources cited within this section:*

Beck, M.W., Cressman, K., Griffin, C., & Caffrey, J. (2018). Water Quality Trends Following Anomalous Phosphorus Inputs to Grand Bay, Mississippi, USA. Gulf and Caribbean Research, 29(1), 1–14. https://doi.org/10.18785/gcr.2901.02

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.

*SWMP Station Timeline*:

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Station Code | SWMP Status | Station Name | Location | Active Dates | Reason Decommissioned | Notes |
| gndbcwq | P | Bayou Cumbest | 30° 23' 0.96 N, 88° 26' 11.04 W | 03/25/2004 –current | NA | NA |
| gndbhwq | P | Bayou Heron | 30° 25' 4.08 N, 88° 24' 19.44 W | 01/22/2004 –current | NA | NA |
| gndblwq | P | Bangs Lake | 30° 21' 25.56 N, 88° 27' 46.44 W | 03/25/2004 –current | NA | NA |
| gndpcwq | P | Point Aux Chenes Bay | 30° 20' 54.96 N, 88° 25' 6.60 W | 08/01/2005 –current | NA | Replaced CR as primary site. 1 km away from original CR location. |
| gndcrwq | P | Crooked Bayou | 30° 21' 35.64 N, 88° 25' 8.40 W | 01/22/2004 - 08/01/2005 | Water depth at station | due to the magnitude of data lost during low tide events |

**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.

2021 collection periods follow. EXO2 sondes are exclusively in use at all sites.

| **Bayou Heron** | | | | |
| --- | --- | --- | --- | --- |
| Deploy Date | Deploy Time | Retrieve Date | Retrieve Time | Sonde (EXO2) |
| 12/18/2020 | 13:00 | 01/15/2021 | 09:45 | Merle |
| 01/15/2021 | 10:15 | 02/26/2021 | 10:45 | Merle |
| 02/26/2021 | 11:00 | 03/11/2021 | 08:45 | Madonna |
| 03/11/2021 | 09:15 | 03/26/2021 | 07:00 | Merle |
| 03/26/2021 | 07:15 | 04/19/2021 | 12:45 | Madonna |
| 04/19/2021 | 13:15 | 05/26/2021 | 11:15 | Merle |
| 05/26/2021 | 11:30 | 06/23/2021 | 07:45 | Willie |
| 06/23/2021 | 08:00 | 07/21/2021 | 12:45 | Salt |
| 07/21/2021 | 13:00 | 08/13/2021 | 08:15 | Merle |
| 08/13/2021 | 08:30 | 08/26/2021 | 12:15 | Willie |
| 09/03/2021 | 09:00 | 09/29/2021 | 12:15 | Willie |
| 09/29/2021 | 12:30 | 10/13/2021 | 08:45 | Merle |
| 10/13/2021 | 09:00 | 10/26/2021 | 09:30 | Willie |
| 10/26/2021 | 09:45 | 11/19/2021 | 14:00 | Merle |
| 11/19/2021 | 14:30 | 12/14/2021 | 09:45 | Willie |
| 12/14/2021 | 10:00 | 01/19/2022 | 13:15 | Merle |

| **Point aux Chenes** | | | | |
| --- | --- | --- | --- | --- |
| Deploy Date | Deploy Time | Retrieve Date | Retrieve Time | Sonde (EXO2) |
| 10/13/2021 | 09:45 | 10/26/2021 | 10:00 | Madonna |
| 10/26/2021 | 10:30 | 11/17/2021 | 08:30 | Dolly |
| 12/02/2021 | 14:45 | 01/19/2022 | 16:00 | Madonna |

\*station and sonde lost to Hurricane Sally in 2020. Piling replaced 10/12/21.

| **Bayou Cumbest** | | | | |
| --- | --- | --- | --- | --- |
| Deploy Date | Deploy Time | Retrieve Date | Retrieve Time | Sonde (EXO2) |
| 12/18/2020 | 12:45 | 01/15/2021 | 11:30 | June |
| 01/15/2021 | 12:00 | 02/26/2021 | 10:15 | Reba |
| 02/26/2021 | 11:00 | 03/26/2021 | 10:15 | June |
| 03/26/2021 | 10:45 | 04/19/2021 | 14:45 | Reba |
| 04/19/2021 | 15:00 | 05/26/2021 | 09:30 | June |
| 05/26/2021 | 10:30 | 06/23/2021 | 09:15 | Reba |
| 06/23/2021 | 09:30 | 06/24/2021 | 13:30 | Cash |
| 08/13/2021 | 09:30 | 09/03/2021 | 08:00 | Reba |
| 09/03/2021 | 08:30 | 9/29/2021 | 13:15 | June |
| 09/29/2021 | 13:30 | 10/13/2021 | 10:15 | Reba |
| 10/13/2021 | 10:30 | 10/26/2021 | 11:15 | June |
| 10/26/2021 | 11:45 | 11/19/2021 | 15:00 | Reba |
| 11/19/2021 | 15:15 | 12/14/2021 | 11:15 | June |
| 12/14/2021 | 11:30 | 01/24/2022 | 11:30 | Reba |

| **Bangs Lake** | | | | |
| --- | --- | --- | --- | --- |
| Deploy Date | Deploy Time | Retrieve Date | Retrieve Time | Sonde (EXO2) |
| 12/18/2020 | 11:30 | 1/15/2021 | 11:15 | Britney |
| 01/15/2021 | 11:30 | 2/26/2021 | 12:00 | Cash |
| 02/26/2021 | 12:30 | 3/26/2021 | 11:00 | Britney |
| 03/26/2021 | 11:15 | 4/19/2021 | 14:00 | Cash |
| 04/19/2021 | 14:15 | 5/26/2021 | 8:45 | Britney |
| 05/26/2021 | 9:15 | 6/11/2021 | 8:30 | Cash |
| 06/11/2021 | 8:45 | 6/23/2021 | 8:45 | June |
| 06/23/2021 | 9:15 | 7/12/2021 | 8:30 | Britney |
| 07/12/2021 | 9:00 | 7/30/2021 | 9:30 | Cash |
| 07/30/2021 | 9:45 | 8/13/2021 | 9:45 | Britney |
| 08/13/2021 | 10:15 | 8/26/2021 | 13:30 | Cash |
| 09/3/2021 | 12:15 | 9/29/2021 | 8:30 | Cash |
| 09/29/2021 | 8:45 | 10/13/2021 | 9:45 | Salt |
| 10/13/2021 | 10:15 | 10/26/2021 | 8:15 | Cash |
| 10/26/2021 | 8:30 | 11/19/2021 | 14:30 | Salt |
| 11/19/2021 | 15:00 | 12/14/2021 | 10:30 | Cash |
| 12/14/2021 | 10:45 | 1/24/2022 | 10:45 | Salt |

**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:

NOAA National Estuarine Research Reserve System (NERRS). System-wide Monitoring Program. Data accessed from the NOAA NERRS Centralized Data Management Office website: http://www.nerrsdata.org/; *accessed* 12 October 2021.

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. Data are available in comma delimited format.

**8) Associated researchers and projects:**

Several research and monitoring projects, in addition to educational workshops and outreach events, are currently using water quality data from the Grand Bay NERR. Some of these are listed below.

As part of the SWMP long-term monitoring program, Grand Bay NERR also collects 15-minute meteorological data and monthly grab and diel samples for nutrient/pigment data which may be correlated with this water quality dataset. These data are available at [www.nerrsdata.org](http://www.nerrsdata.org).

* **Site Selection for Natural Resource Damage Assessment (NRDA) funded subtidal and intertidal reefs in the Grand Bay NERR** –Mississippi Department of Environmental Quality (MDEQ) and Mississippi Department of Marine Resources (MDMR)
* **Long-term monitoring of artificial reef fish communities in the Grand Bay NERR**. – Dr. Jonathan Pitchford, Michael Archer, Michael Brochard (Grand Bay NERR)
* **GNDNERR Sentinel Site Initiative: A program to better understand SLR and its effects on coastal environments** – Dr. Jonathan Pitchford, Will Underwood, Jay McIlwain, Michael Archer, Michael Brochard (Grand Bay NERR)
* **Erosion Monitoring - 11 Shorelines are monitored to Estimate the Rate of Erosion at Sites Representing Varying Degrees of Wave Exposure and Geological Substrates** - Jay McIlwain, Michael Archer, Michael Brochard, Dr. Jonathan Pitchford, Will Underwood (Grand Bay NERR)
* **Fish Communities of Nearshore Habitats within the Grand Bay NERR/NWR** –Michael Brochard, Kim Cressman, Dr. Jonathan Pitchford, Dr. Ayesha Gray (Grand Bay NERR)
* **Distribution and Abundance of Winter Marsh Birds Across Coastal Mississippi Tidal Marshes –** Dr. Mark Woodrey (Mississippi State University), Dr. Ray Iglay (Mississippi State University), Dr. Kristine Evans (Mississippi State University), Dr. Scott Rush (Mississippi State University), Jared Feura (Mississippi State University), Spencer Weitzel (Mississippi State University)
* **Distribution and Abundance of Breeding Marsh Birds Across Coastal Mississippi Tidal Marshes –** Dr. Mark Woodrey (Mississippi State University), Dr. Ray Iglay (Mississippi State University), Dr. Kristine Evans (Mississippi State University), Dr. Scott Rush (Mississippi State University), Jared Feura (Mississippi State University), Spencer Weitzel (Mississippi State University)
* **Fire Effects in Gulf of Mexico Marshes: Historical Perspectives, Management, and Monitoring of Mottled Ducks and Black and Yellow Rails** - Dr. Auriel Fournier (Illinois Natural History Survey), Dr. Mark Woodrey (Mississippi State University), and Dr. Kristine Evans (Mississippi State University)
* **Refining techniques for high-frequency monitoring of chlorophyll *a* in the NERRS** – Dr. Nikki Dix (GTM NERR), Dr. Erik Smith (NIWB NERR), Silas Tanner (GTM NERR), Shannon Dunnigan (GTM NERR), Dr. Scott Phipps (Weeks Bay NERR), Thomas Gregory (Great Bay NERR), Jeremy Miller (Wells NERR), Kim Cressman (Grand Bay NERR), Sebastian Mejia (OWC NERR), Dr. Sylvia Yang (Padilla Bay NERR), Nicole Burnett (Padilla Bay NERR), Dr. Ed Buskey (MAR NERR), Cammie Hyatt (MAR NERR), Hannah Ramage (Lake Superior NERR), Dr. Rachel Guy (Sapelo NERR), Dr. Rikke Jeppesen (Elkhorn Slough NERR), and Dr. Shimi Rii (He’eia NERR)

**II. Physical Structure Descriptors**

**9) Sensor Specifications:**

In 2021, GND NERR used EXO2 sondes exclusively at all sites.

***YSI EXO Sonde:***

Parameter: Temperature

Units: Celsius (C)

Sensor Type: CT2 Probe, Thermistor

Model#: 599870

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: CT2 Probe, 4-electrode cell with autoranging

Model#: 599870

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: CT2 probe, 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

OR

Parameter: Temperature

Units: Celsius (C)

Sensor Type: Wiped probe; Thermistor

Model#: 599827

Range: -5 to 50 C

Accuracy: ±0.2 C

Resolution: 0.001 C

Parameter: Conductivity

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

Sensor Type: Wiped probe; 4-electrode cell with autoranging

Model#: 599827

Range: 0 to 100 mS/cm

Accuracy: ±1% of the reading or 0.002 mS/cm, whichever is greater

Resolution: 0.0001 to 0.01 mS/cm (range dependent)

Parameter: Salinity

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

Model#: 599827

Sensor Type: Wiped probe; Calculated from conductivity and temperature

Range: 0 to 70 ppt

Accuracy: ±2% of the reading or 0.2 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 Depth - Shallow

Units: feet or meters (ft or m)

Sensor Type: Stainless steel strain gauge

Range: 0 to 33 ft (10 m)

Accuracy: +/- 0.013 ft (0.004 m)

Resolution: 0.001 ft (0.001 m)

Parameter: pH

Units: pH units

Sensor Type: Glass combination electrode

Model#: 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

**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 1.02 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.

**NOTE: older depth data cannot be corrected without verifying that the depth offset was in place and whether a vented or non-vented depth sensor was in use. No SWMP data prior to 2006 can be corrected using this method.** The following equation is used for corrected depth/level data provided by the CDMO beginning in 2010:

((1013-BP)\*0.0102)+Depth/Level = cDepth/cLevel.

**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 considered equivalent. 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.

**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 data sonde, 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:**

\*Note: pH post-deployment readings are temperature dependent and minor variations are expected as a result.

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

PA probe absent/not functioning

NA reading not available

| **Bayou Heron** | | | | | | | | |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Deploy Date | SpCond (50) | ODO 1 | ODO 2 | pH (7.0) | pH (10.0) | Turb (0.0) | Turb (124.0) | Depth (true) |
| 1/15/2021 | 50.09 | 100.5 | 100.2 | 7.21 | 9.99 | 0.12 | 124.09 | 0.04 (0.03) |
| 2/26/2021 | 49.934 | 100.5 | 101.4 | 7.11 | 10.09 | -0.11 | 123.33 | 0.124 (0.132) |
| 3/11/2021 | 49.77 | 100 | 102.2 | 7.01 | 9.85 | -0.09 | 123.21 | 0.017 (0.065) |
| 3/26/2021 | 50.149 | 100.4 | 100.6 | 6.99 | 9.94 | 0.42 | 125.23 | 0.064 (0.01) |
| 4/19/2021 | 50.33 | 100.1 | 100.8 | 7.07 | 10.01 | 0.67 | 123.19 | 0.086 (0.076) |
| 5/26/2021 | 49.352 | 99.1 | 99.9 | 7.04 | 10.2 | 0.04 | 123.64 | 0.039 (0.033) |
| 6/23/2021 | 49.73 | 99.9 | 98.9 | 7.1 | 10.58 | 0.37 | 124.04 | 0.11 |
| 7/21/2021 | 50.138 | 99.9 | 99.2 | 7.15 | 10.07 | -0.1 | 123.55 | 0.066 (0.057) |
| 8/13/2021 | 49.27 | 99.6 | 100.2 | 7.31 | 9.96 | -0.16 | 126.09 | -0.015 (-0.0010) |
| 9/3/2021 | 49.766 | 98.9 | 99.1 | 7.14 | 10.04 | -0.17 | 124.66 | 0.013 (0.037) |
| 9/29/2021 | 50.159 | 98.9 | 98.5 | 6.99 | 10.02 | -0.25 | 124.19 | 0.0080 (0.037) |
| 10/13/2021 | 49.413 | 100.5 | 100 | 7.09 | 10.09 | 0.68 | 123.25 | 0.122 (0.012) |
| 10/26/2021 | 49.956 | 101.3 | 102 | 7.09 | 10.05 | 0.96 | 23.48 | 0.157 |
| 11/19/2021 | 50.637 | 101.2 | 101.3 | 7.05 | 9.94 | 0.16 | 123.05 | 0.146 (0.08) |
| 12/14/2021 | 50.531 | 100 | 100.7 | 7.17 | 10.1 | -0.13 | 124.14 | 0.043 (0.044) |

| **Point aux Chenes** | | | | | | | | |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Deploy Date | SpCond (50) | ODO 1 | ODO 2 | pH (7.0) | pH (10.0) | Turb (0.0) | Turb (124.0) | Depth (true) |
| 10/13/2021 | 49.748 | 100.4 | 101.1 | 7.08 | 10.09 | 0.24 | 124.12 | 0.139 (0.014) |
| 10/26/2021 | 49.301 | 102.1 | 103.1 | 7.08 | 10.02 | -0.26 | 124.72 | 0.169 |
| 12/02/2021 | 50.008 | 100.5 | 101.1 | 7.1 | 10.13 | 0.16 | 123.71 | 0.044 (0.041) |

| **Bayou Cumbest** | | | | | | | | |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Deploy Date | SpCond (50) | ODO 1 | ODO 2 | pH (7.0) | pH (10.0) | Turb (0.0) | Turb (124.0) | Depth (true) |
| 1/15/2021 | 50.102 | 100.5 | 101.3 | 7.29 | 10.18 | 0.39 | 126.67 | 0.038 (0.03) |
| 2/26/2021 | 49.998 | 99.9 | 99.8 | 7.22 | 10.1 | -0.34 | 123.35 | 0.043 (0.067) |
| 3/26/2021 | 50.121 | 101.5 | 102.1 | 7.14 | 10.22 | 0.13 | 124.18 | 0.063 (0.024) |
| 4/19/2021 | 50.068 | 99.9 | 100.4 | 7.524 | 9.97 | -0.54 | 124.14 | 0.108 (0.073) |
| 5/26/2021 | 49.52 | 99.5 | 100.3 | 7.08 | 10.12 | 4.01 | 124.12 | 0.069 (0.038) |
| 6/23/2021 | 49.732 | 99.8 | 100.6 | 7.01 | 9.99 | 0.15 | 123.4 | 0.037 (0.038) |
| 8/13/2021 | 49.51 | 101.9 | 100.5 | 7.07 | 10.07 | 0.13 | 123.89 | -0.015 (-0.0010) |
| 9/03/2021 | -50 | 98.9 | 98.8 | 8.01 | 10.63 | -0.3 | 124.62 | 0.016 (0.037) |
| 9/29/2021 | 49.867 | 99.3 | 100.2 | 7.06 | 10.91 | 0.05 | 123.45 | -0.115 (0.039) |
| 10/13/2021 | 49.405 | 100 | 100.2 | 7.21 | 10.19 | 1.13 | 124.27 | 0.135 (0.01) |
| 10/26/2021 | 50.325 | 99 | 101 | 7.01 | 10.02 | 0.08 | 123.42 | 0.2 (NA) |
| 11/19/2021 | 49.624 | 100.6 | 101.3 | 6.98 | 10.13 | 0.25 | 124.95 | 0.142 (0.129) |
| 12/14/2021 | 50.537 | PA | PA | 7.06 | 9.96 | 0.13 | 127.07 | 0.054 (0.0040) |

| **Bangs Lake** | | | | | | | | |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Deploy Date | SpCond (50) | ODO 1 | ODO 2 | pH (7.0) | pH (10.0) | Turb (0.0) | Turb (124.0) | Depth (true) |
| 1/15/2021 | 49.46 | 100.3 | 99.7 | 7.16 | 10.04 | 0 | 124.33 | 0.036 (0.033) |
| 2/26/2021 | 49.923 | 99.3 | 99.2 | 7.47 | 10.3 | -0.57 | 124.28 | 0.056 (0.067) |
| 3/26/2021 | 49.107 | 100.4 | 100.4 | 7.05 | 9.97 | 0.52 | 123.09 | 0.053 (0.0030) |
| 4/19/2021 | 33.3 | 3.8 | 4.3 | 7.56 | 7.94 | 46.06 | 75.06 | 0.142 (0.071) |
| 5/26/2021 | 49.875 | 100.1 | 99.1 | 7.13 | 10.01 | 0.16 | 123.58 | 0.0080 (0.0050) |
| 6/11/2021 | 49.649 | 100.1 | 96.4 | 7.08 | 10.03 | 0.01 | 122.82 | 0.064 (0.037) |
| 6/23/2021 | 48.795 | 101.1 | 101.2 | 7.13 | 10.13 | 0.23 | 123.96 | 0.085 (0.068) |
| 7/12/2021 | 49.236 | 98.5 | 99.6 | 7.04 | 10.03 | 0.08 | 123.2 | 0.031 (0.024) |
| 7/30/2021 | 49.55 | 100.3 | 100.4 | 7.17 | 10.14 | 0.05 | 123.82 | 0.079 (0.054) |
| 8/13/2021 | 46.173 | 100.3 | 100.5 | 7.2 | 9.95 | 0.64 | 123.7 | -0.019 (0.068) |
| 9/3/2021 | 49.208 | 99.6 | 99.5 | 7.09 | 9.94 | 0.29 | 126.48 | -0.024 (0.037) |
| 9/29/2021 | 50.114 | 99.3 | 99.1 | 7.03 | 10.02 | 0.16 | 124.47 | 0.016 (0.037) |
| 10/13/2021 | 48.42 | 100.4 | 100.4 | 7.06 | 9.99 | 0.04 | 122.43 | 0.157 (0.019) |
| 10/26/2021 | 50.251 | 102.2 | 101.8 | 7.18 | 10.15 | 0.83 | 123.86 | 0.142 (0.109) |
| 11/19/2021 | 49.467 | 101.4 | 101.2 | 7.04 | 10.06 | 0.46 | 125.01 | 0.158 (0.131) |
| 12/14/2021 | 50.192 | 100.6 | 100.1 | 7.14 | 10.09 | -0.24 | 123.95 | 0.023 (0.042) |

**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 | |  |  |  |
|  |  |  |

10/26/2017 – Deployment tube at Point aux Chenes was reinstalled, exactly 25 cm above the sediment.

08/04/2021 – Deployment tube at Bayou Cumbest was reinstalled, exactly 25 cm above the sediment

**All sites:**

**Tropical Activity**

**2021 was an active tropical season and Moss Point, MS reached record rainfall with over 110 inches recorded. Bolded storms are those where the record comment “CWE CSM”, indicating a significant weather event, has been added to at least one data file.**

• **Tropical Storm Claudette**; landfall 6/18/2021 west of New Orleans, LA. Grand Bay NERR Fish and Wildlife Services MET station recorded 5.56” of rain from 6/18/21 to 6/20/21.

• **Hurricane Ida;** landfall 8/29/21, Port Fourchon, La as a category 4 hurricane. Grand Bay NERR Fish and Wildlife Services MET station recorded 7.27” of rain from 8/29/21 to 8/30/21.

• **Hurricane Nicholas;** landfall 9/14/21, 10 miles SW of Sargent Beach, TX as a category 1 hurricane. The hurricane traveled west over the next several days and Grand Bay NERR Fish and Wildlife Services MET station recorded 5.65” of rain from 9/14/21 to 9/16/21.

**Other:**

**Bayou Heron:**

1/15/2021 10:15 – 2/26/2021 10:45 – Depth missing. Occasionally when EXO2 sondes are connected to our telemetry cables, they drop depth. We are in contact with YSI on the issue, but it is infrequent and difficult to replicate, so there has not yet been a resolution of the underlying issue.

05/26/21 11:30 – 06/23/21 07:45 – Timestamps on this deployment corresponded to an internal clock that was 12 hours ahead. The raw CSV files were corrected before upload by subtracting 12 hours from timestamp. Timestamps in these files do not match timestamps in the archived BIN files; it is the BIN files that are incorrect. At Bayou Heron, the correct time (CST) was 12 hours ahead of the logged time, e.g. 10:00 when the sonde logged 21:00.

07/21/21 13:00 – 08/13/21 8:15 – Depth missing. Occasionally, when EXO2 sondes are connected to our telemetry cables, they drop depth.

08/26/21 12:30 – 09/03/21 8:45 – Sonde not deployed. Piling at this station is not reliable and the sonde was removed in preparation for Hurricane Ida. The piling and platform are currently scheduled to be replaced.

**Point Aux Chenes:**

9/4/2020 8:45 – 10/13/2021 – Sonde station was destroyed by Hurricane Sally. The previous deployment had ended 9/4/2020 at 8:30 and data is missing from this station until a new piling was installed.

10/28/2021 16:45 – 10/29/2021 3:15 – The sonde deployment tube was vandalized and pivoting in a horizontal position. The data during this time-period was collected at the both the wrong depth and not according to SOPs due to the damage caused by the vandalism, and wave action could have been a variable in the data parameter readings flagged as <-3> [GSM] (CWD).

10/29/2021 3:30 – 11/17/2021 8:30 – The data indicates the sonde tube detached from the piling and fell to the sediment on 10/29/21 between 3:15-3:30. The tube was laying on its side when the sonde was retrieved and could have rolled around during this time since it was only attached to the piling with a rope. Mud was found in the probe guard. Each sensors post-calibration was within acceptable range and was flagged with <-3> [GSM] (CWD). The F record column was marked {CSM} {CMD} because the sonde was laying in the sediment, not stationary, and had mud in the guard.

11/17/2021 8:45 – 12/02/21 14:30 – The sonde deployment tube was vandalized and required maintenance. The sonde was not deployed during this time. The sonde tube was re-installed on 12/02/21 and a sonde was deployed.

**Bayou Cumbest:**

2/26/2021 11:00 – 3/26/2021 10:15 – Sonde not deployed at proper depth in tube. Water dropped below sensors many times during this deployment and these periods are rejected, coded <-3> [GOW] (CSM). Remaining depth values were rejected, <-3> [GSM] (CWD). Values for other parameters were marked suspect, <1> [GSM] (CWD); the site is generally well mixed but can stratify in high rain conditions. The values are not out of the normal range for this site but may not match what the values were at sonde depth.

5/26/2021 10:00 – 6/23/2021 9:15 – Sonde not deployed at proper depth in tube. The bottom of the tube deteriorated and was knocked off while cleaning the tube. Depth values were marked suspect <1> [GSM] (CWD), Turbidity values were marked suspect <1> [GSM] (CMD) to indicate mud in the sonde guard, and all other parameter values were marked <0> [GSM] CWD to indicate data being collected at the wrong depth; the site is generally well mixed but can stratify in high rain conditions. The values are not out of the normal range for this site but may not match what the values were at sonde depth. No sonde was redeployed as the new sonde tube at this station is being constructed.

6/23/2021 9:30 – 6/24/2021 13:30 - Sonde not deployed at proper depth in tube. The bottom of the tube deteriorated and was knocked off while cleaning the tube. Depth values were marked suspect <1> [GSM] (CWD), and all other parameter values were marked <0> [GSM] CWD to indicate data being collected at the wrong depth; the site is generally well mixed but can stratify in high rain conditions. The values are not out of the normal range for this site but may not match what the values were at sonde depth. No sonde was redeployed as the new sonde tube at this station is being constructed.

6/24/2021 14:00 – 8/13/2021 9:15 – Sonde not deployed due to sonde tube replacement. The new sonde tube was installed on 8/4/2021 and the first deployment began on 8/13/2021 9:30.

9/03/2021 8:45 – 9/29/2021 13:15 – KOR software indicated a yellow pH QC during pre-calibration and pH failed post-calibration. No heavy fouling was recorded on the pH electrode before post-calibration. pH tip was replaced before next deployment.

11/03/2021 12:15 – 11/19/2021 15:00 – Salinity, specific conductivity and turbidity flagged <1> SWM CSM. After retrieving the sonde, it was apparent the wiper was stuck over the CT probe. After thorough review of the data, and more specifically, the “wiperpositionvolt” data, it was determined that inconsistencies began at 11/03/2021 12:15.

**Bangs Lake:**

5/9/2021 19:30 – 5/26/2021 8:45 – Wiper was lost during deployment and significant biofouling occurred, causing DO, SpCond, pH, and Turbidity to fail post-calibration.

8/26/2021 13:45 – 9/03/2021 12:00 – Sonde not deployed. Piling at this station is not reliable and the sonde was removed in preparation for Hurricane Ida. The piling and platform are currently scheduled to be replaced.

9/22/2021 – 9/23/2021 9:30 – In field sonde/probe cleaning at 9:30 on 9/23/2021. Salinity and specific conductivity data before cleaning flagged <1> suspect due to significant biofouling (CBF) on the probe.