

Reserve Name JOB NERR NERR Water Quality Metadata
Months and year the documentation covers: 01/01/2009-12/31/2009
Latest Update: 12/04/2020

I. Data Set and Research Descriptors

1) Principal investigator(s) and contact persons

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2) Entry verification

Deployment data are uploaded from the YSI data logger to a Personal Computer (IBM compatible) by Enid Malavé and Nilsa Marrero. Files are exported from EcoWatch in a comma-delimited format (.CDF) and uploaded to the CDMO by Nilsa Marrero and Angel Dieppa 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 by Nilsa Marrero and Angel Dieppa. 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. The final yearly file and metadata was submitted by Angel Dieppa. For more information on QAQC flags and codes, see Sections 11 and 12.

3) Research objectives

The principal objective is to record and track long-term changes and short term variability in water quality parameters that can be associated to changes in estuarine habitats. Through this, we support management decisions based on scientific data. A secondary objective is to promote the access and use of reliable baseline information by federal and local agencies, universities, researchers, educators and local communities to enhance the process by which they make decisions

regarding their daily activities. This data is also invaluable in the identification and development of future monitoring and research activities.

A total of four data loggers (YSI 6600 EDS, YSI 6600 v2, YSI 6600 v4) are deployed in Jobos Bay. Two sondes are deployed in the inner lagoons of the Mar Negro Component and the other two in the Jobos Bay. The instruments are suspended from a pole at a distance at about 0.5 meters from the surface at each selected site. Data from stations 9, 10, 19 and 20 are being submitted to the Centralized Data Management Office as part of the System-Wide Monitoring Program. Measurements are taken at fifteen-minute intervals for approximately two-week periods. The sites are identified as representative of areas within the reserve and comparable to the sites that may be receiving impact from human activities from surroundings areas or may act as a habitat gradient in the Bay.

Station number nine (9), the impacted site, collects water quality data in a site associated with runoff from littoral and basin mangrove areas. This sampling station is located in the most inland lagoon, closest to the Thermoelectric Power Plant (oil and natural gas). It is subjected to runoff, which may include potential oil spill contamination from this industrial facility. Information compiled from historical environmental documents, indicate that station nine (9) was used as a disposal site for residues of the previously operating sugar mill operation, and therefore might have high organic input into the sediments.

Station number ten (10), located in a mangrove lagoon area towards the southwestern section of Mar Negro is considered the reference or non-impacted site.

Station number (19) is located over a sea grass bed (*Thalassia testudinum*) in the inner western part of the bay just northeast of Cayo Colchones. This station is located near the thermal outfall and operating piers of the Aguirre Power Plant Complex, both activities may have significant effects on sea grass communities. This area is exposed to barge stranding, sediment re-suspension and oil spills.

Station number (20) is located on the eastern inner bay section of the Cayos Caribe cays. This station is just south of the mangrove islets associated with the Reserve's coral reefs. Water streams coming through the coral platform may help characterize water conditions of the main marine currents reaching Jobos Bay, as well as possible effects of industrial and chemical activities associated with Phillips Core, AES Coal Energy Plant and Pharmaceuticals located just east to this system.

4) Research methods

The National Estuarine Research Reserve Water Quality Monitoring Program began sampling at Station nine (9) on December 20, 1995 and Station ten (10) on February 1, 1996. Monitoring at station 19 began in April 2004 and at station 20 in June 2004. Long term water quality monitoring is being performed at these stations.

Before each YSI 6600 data logger is deployed, calibration and maintenance is performed following the Standard Operation Procedures of the NEERS. Calibration standards are only required for pH, salinity, and turbidity, all other parameters are done as described in the manual. Buffer solutions for two-point calibration (pH 7 and pH 10) are purchased from a scientific supply company. Salinity is calibrated with a specific conductance standard 50 mS/cm and is purchased from YSI or a scientific supply company.

The two-point turbidity calibration is performed using a 0 NTU (DI water) and 126 NTU standard purchased from a scientific company. Sondes are equipped with one of two different dissolved oxygen sensors. YSI 6600 EDS uses rapid pulse oxygen sensores which their membranes are replaced before any deployment, YSI 6600 v2 and v4 are equipped with dissolved oxygen optical sensors, both are allowed to sit at least 24 hours after proper calibration. Weather conditions and tide stage are recorded in the field observation log during deployment. Measurements of DO, pH,

salinity, specific conductance, turbidity, and temperature are taken at the deployment time to check the accuracy and functionality of the instruments.

Each YSI data logger is tied with steel cable to an iron galvanized pole, which is plunged into the sediments at each sampling area. Data loggers are suspended from a pole at approximately 0.5 meter from the surface of the selected site. Data is recorded every 15 minutes. The following measurements are recorded: date, time, temperature, specific conductance, salinity, dissolved oxygen saturation, dissolved oxygen concentration, depth, pH, and turbidity, station 09 has an optical chlorophyll-a sensor. Chl-a is an optional parameter non-required for SWMP program. Approximately, every two weeks the data loggers are retrieved, inspected, cleaned, data is downloaded into a personal computer and re-calibrated as noted previously. The data logger is then ready to be deployed again.

The data is processed through a standard quality control/quality assurance established for all 27 reserves within the system. It consists in submitting the raw data to the Centralized Data Management Office (CDMO) server where data undergoes through a macro to flag anomalies predetermine for each station. The data is sent back to the reserve to pass through a secondary QA/QC and finally resubmitted to CDMO for the final approval. Data may be available in different stages of the QA/QC process.

A Sutron Sat-Link2 transmitter was installed at the JOB20 station on 07/20/06 and transmits data to the NOAA GOES satellite, NESDIS ID # 3B0297EC. The 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 “real-time” telemetry data become part of the provisional dataset until undergoing 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 Jobos Bay National Estuarine Research Reserve (JBNERR) is located on the southern coastal plain of the island of Puerto Rico, a reserve within the West Indies geographical area. JBNERR is composed of two major areas: (1) Mar Negro, located on the western margin of the Bay, and (2) Cayos Caribe (a chain of 17 tear-shaped islets located to the southeast) and Cayos Barca (a chain of 7 tear-shaped islets located to the southwest boundaries) both with a back-reef system. The Mar Negro area comprises the bulk of the Reserve, and consists of mangrove forests and a complex system of lagoons and channels interspersed with salt and mud flats. Coral reefs and sea grass beds, with small beach deposits and upland areas fringe Cayos Caribe and Cayos Barca mangrove islands. Few areas in the watershed drain directly to the bay. Rio Seco to the north-east of the bay is active only during heavy rain events during the wet season. A small creek, Quebrada Coqui, near JBNERR’s pier to the north of the bay, drains into an extensive mangrove fringe forest in a laminar flow. During heavy rain events, Station 09 received runoff water from upland and finally, a diffuse flow of water reach the bay from the local aquifer.

Station 9 is an impacted site and is located on the northeastern section of the Mar Negro component. This sampling station is associated with mangrove lagoon areas and receives runoff from mudflats, the Thermoelectric Power Plant, and adjacent areas. The tidal range varies from 12 to 14 inches near the monitoring station. The salinity at the vicinity of the monitoring station varies from 26.0 ppt to 41.1 ppt. The average depth at station 09 is 1 meter. The bottom is covered by a thick layer of thin sediments with a high content of organic material. *Microcoleus* sp. (blue-green algae), brown and green algae (*Caulerpa* sp.) are also present at this site, but a better assessment is needed. The station pole is located at 17° 56' 36.8" N and 66° 14' 18.5" W. Fresh water input to the station comes only from runoff and rain. This station has been subject of several studies indicating the presence of relatively high level of cooper and pesticides compared to other stations.

Station 10 is located in a mangrove lagoon not impacted directly by any upland or marine activities. It provides a reference for comparison of data obtained in other stations, especially to the station in Mar Negro lagoon. The tidal range varies from 12 to 14 inches. The salinity at the vicinity of the monitoring station varies from 27.0 ppt to 41.7 ppt. The average depth at station 10 is 1 meter. The bottom is covered with a layer of fine sediments with organic material, followed by a layer of calcareous material mainly from shells and oysters. At this site, we can find sea grass (*Thalassia*), calcareous algae (*Halimeda* sp.), green algae (*Caulerpa* sp.) and brown algae (*Dictyota* sp.) among others. The pole is located at 17° 56' 19.00 N, 66° 15' 27.85 W. Fresh water input to the station comes only from runoff and rain. There is not any direct source of fresh water.

Station 19 is located on the western inner section of the bay at a distance of 233 meters from Cayo Colchones Mangroves over sea grass beds (*Thalassia testudinum*). Tidal ranges in this area vary from 12 to 14 inches. The salinity at the vicinity of the monitoring station varies from 30.0 ppt to 36.0 ppt. The average depth at this station is of 2 meters. The YSI' sonde is deployed at about 1 foot from the bottom. The bottom is of sandy composition. Sea grass, algae, echinoderms and other related organisms could be found in the area. The pole is located at 17° 56' 34.49 N and 66° 13' 43.77 W. There is no freshwater input to this area.

Station 20 is located in the inner eastern section at about 190 meters of Cayos Caribe Mangrove islets and at about 688 meters from the coral reef barrier. This station is the closest to Mar Caribe. It has a sandy bottom, with calcareous and coral fragments, sea grass (*Thalassia*) communities, echinoderms and other associated organisms. Tidal ranges in this area vary from 12 to 14 inches. The salinity at the vicinity of the monitoring station varies from 30.0 ppt to 36.0 ppt. The average depth of the site is 2 meters. There is no freshwater input to this area. The pole is located at 17° 55' 49.14258" N and 66° 12' 41.29771" W.

Data from stations 9, 10, 19 and 20 is being submitted to the CDMO. Eight sondes are permanently devoted to taking readings from these two sites, to assure continuous readings while sondes are taken out of the water for data upload and maintenance. This will avoid data gaps for the stations between sonde maintenance procedures. Due to errors in calibration, turbidity data in these files is considered inadequate. All monitoring is considered long term.

6) Data collection period

Station nine (9) water quality monitoring began on December 20, 1995.
 Station ten (10) water quality monitoring began on February 1, 1996.
 Station nineteen (19) water quality monitoring began on April 1, 2004.
 Station twenty (20) water quality monitoring began on May 13, 2004.

Deployment and Retrieval Dates 2009:

STATION 09				STATION 10			
Date/Time IN		Date/Time Out		Date/Time IN		Date/Time Out	
12/9/2008	12:45	1/13/2009	10:15	12/9/2008	12:30	1/14/2009	9:45
1/13/2009	10:30	2/3/2009	9:45	1/14/2009	10:15	2/3/2009	10:30
2/3/2009	10:00	2/25/2009	10:00	2/3/2009	10:45	2/25/2009	9:30
2/25/2009	10:15	3/10/2009	8:30	2/25/2009	9:45	3/10/2009	10:15
3/10/2009	8:45	3/25/2009	10:15	3/10/2009	10:45	3/25/2009	10:45
3/25/2009	10:30	4/7/2009	11:00	3/25/2009	11:00	4/14/2009	9:15
4/7/2009	11:15	4/28/2009	16:00	4/14/2009	9:45	5/7/2009	8:30
4/28/2009	11:30	5/19/2009	9:45	5/12/2009	9:30	6/1/2009	9:15
5/19/2009	10:00	6/10/2009	0:30	6/1/2009	9:45	6/16/2009	12:00

6/16/2009	10:30	7/14/2009	11:00
7/14/2009	11:15	8/18/2009	10:15
8/18/2009	10:30	9/2/2009	9:15
9/2/2009	9:30	9/15/2009	9:30
9/15/2009	9:45	9/29/2009	10:30
9/29/2009	10:45	10/13/2009	9:15
10/13/2009	9:30	10/27/2009	10:00
10/27/2009	10:15	11/17/2009	10:00
11/17/2009	10:15	12/1/2009	10:00
12/1/2009	10:30	12/15/2009	9:15
12/15/2009	9:30	1/20/2010	10:15

6/16/2009	12:15	7/14/2009	11:30
7/14/2009	12:15	8/18/2009	9:45
8/18/2009	10:00	9/2/2009	8:45
9/2/2009	9:15	9/15/2009	10:00
9/15/2009	10:15	9/29/2009	9:45
9/29/2009	10:15	10/13/2009	9:45
10/13/2009	10:00	10/27/2009	8:45
10/27/2009	9:00	11/17/2009	10:30
11/17/2009	10:45	12/1/2009	9:45
12/1/2009	10:00	12/15/2009	9:45
12/15/2009	10:00	1/20/2010	10:45

STATION 19			
Date/Time IN		Date/Time Out	
12/9/2008	9:30	1/14/2009	8:45
1/14/2009	9:00	2/3/2009	9:15
2/3/2009	9:45	2/25/2009	9:00
2/25/2009	9:30	3/10/2009	9:00
3/10/2009	9:15	3/25/2009	9:45
3/25/2009	10:00	4/7/2009	10:30
4/7/2009	10:45	4/28/2009	8:45
4/28/2009	9:00	5/19/2009	9:15
5/19/2009	9:30	6/16/2009	10:00
6/16/2009	10:15	6/18/2009	9:00
6/30/2009	10:45	8/18/2009	9:00
8/18/2009	9:15	9/2/2009	10:00
9/2/2009	10:15	9/15/2009	11:15
9/15/2009	11:45	9/16/2009	8:45
9/16/2009	9:00	10/14/2009	10:30
10/14/2009	10:45	10/27/2009	8:15
10/27/2009	8:30	11/17/2009	9:30
11/17/2009	9:45	12/1/2009	9:00
12/1/2009	9:15	12/15/2009	10:00
12/15/2009	10:15	1/20/2010	9:30

STATION 20			
Date/Time IN		Date/Time Out	
12/16/2008	12:15	1/15/2009	8:45
1/15/2009	9:00	2/3/2009	12:30
2/3/2009	13:00	2/25/2009	10:30
2/25/2009	11:00	3/10/2009	9:45
3/10/2009	10:00	3/25/2009	11:30
3/25/2009	11:45	4/7/2009	11:30
4/7/2009	12:00	4/28/2009	12:15
4/28/2009	12:45	5/19/2009	11:30
5/19/2009	11:45	6/16/2009	10:30
6/16/2009	10:45	6/30/2009	10:45
6/30/2009	11:00	8/18/2009	11:00
8/18/2009	11:15	9/2/2009	8:00
9/2/2009	8:15	9/15/2009	9:00
9/15/2009	9:15	9/29/2009	11:00
9/29/2009	11:30	10/13/2009	10:45
10/13/2009	11:00	10/27/2009	10:30
10/27/2009	11:00	11/16/2009	12:00
11/17/2009	12:15	12/1/2009	10:45
12/1/2009	11:00	12/9/2009	11:30
12/9/2009	11:45	12/15/2009	10:15
12/15/2009	10:45	1/20/2010	11:30

7) Distribution

NOAA/ERD retains the right to analyze, synthesize and publish summaries of the NERRS System-wide Monitoring Program data. The PI retains the right to be fully credited for having collected and processed the data. Following academic courtesy standards, the PI and NERR site (JBNERR) where the data were collected will be contacted and fully acknowledged in any subsequent publications in which any part of the data are used. Manuscripts resulting from this NOAA/OCRM supported research that are produced for publication in open literature,

including refereed scientific journals, will acknowledge that the research was conducted under an award from the Estuarine Reserves Division, Office of Ocean and Coastal Resource Management, National Ocean Service, National Oceanic and Atmospheric Administration. 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.

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 <http://cdmo.baruch.sc.edu/>. Data are available in text tab-delimited format.

8) Associated researchers and projects

The Jobos Bay NERR maintains four water quality monitoring stations as part of the System Wide Monitoring Program (SWMP) to monitor variability in the estuarine environment. Meteorological station collect continuous information that support water quality data intended to address short-term variability and long-term changes in estuarine water parameters within the bay (i.e., localized impacts of seasonal storms and hurricane events, variability due to tidal circulation, seasonal and interannual differences in rainfall, magnitude and influence of major events such hurricanes, spatial extent of oceanic and tidal forcing. Data will also be of fundamental baseline for future development of a hydrodynamic model for the Jobos Bay estuary with the help of CaRICOOS.

Our water quality monitoring program is a key component of SWMP. Variables measured include Temperature, Dissolved Oxygen, Turbidity, pH, Salinity and Depth in 4 permanent stations equipped with YSI datasondes. The program support a nutrient monitoring at the same stations, nitrogen, phosphorus, and chlorophyll are measured in a monthly basis. Also, a diel nutrient sampling is performed in a monthly basis.

SWMP data has been incorporated in the Conservation Effects Assessment Project (CEAP), a collaborative study of USDA, NOAA and JBNERR that pretends to implement best management practices in agricultural lands to improve water quality within the aquifer and Jobos Bay. Also, the Caribbean Regional Association for the Caribbean Regional Integrated Coastal Ocean Observing System (CaRICOOS) integrated and monitors Real Time data from our SWMP stations.

II. Physical Structure Descriptors

9) Sensor specifications –

JOB NERR deployed 6600EDS, 6600 EDS v2 and 6600 EDS v4 data sondes in 2009. Rapid-pulse (membrane) DO sensors were deployed at Station 20 through 01/01/09 to 12/31/09. ROX (optical) DO sensors were deployed at Station 09, Station 10 and Station 19. Chlorophyll-a sensors (an optional parameter for SWMP) were installed at Station 19 through 2008.

YSI 6600EDS 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, polarographic
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

Parameter: Dissolved Oxygen mg/L (Calculated from % air saturation, temperature, and salinity)
Units: milligrams/Liter (mg/L)
Sensor Type: Rapid Pulse - Clark type, polarographic
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

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

YSI 6600EDS V2/ YSI 6600EDS V4 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
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% of reading
Resolution: 0.1% air saturation

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

Dissolved Oxygen Qualifier:

The reliability of the dissolved oxygen (DO) data 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). Many reserves have upgraded to the YSI 6600 EDS data sondes, which increases DO accuracy and longevity by reducing the environmental effects of fouling. The user is therefore advised to consult the metadata and to exercise caution when utilizing the DO data beyond the initial 96-hour time period. However, this 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. The Research Coordinator at the specific NERR site should be contacted concerning the reliability of the DO data because of the site and seasonal variation in the 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.

10) Coded variable definitions

Sampling station:	Sampling site code:	Station code:
Station 9	ST09	job09wq
Station 10	ST10	job10wq
Station 19	ST19	job19wq
Station 20	ST20	job20wq

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
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

STATION 09		Post Deployment Calibration Values			
		SpCond (50mS/cm)	DO%	pH (7)	Turb (0 NTU)
1/1/2009	1/13/2009	51.26	68.5	7.07	0.6
1/13/2009	2/3/2009	51.05	96.3	6.96	-0.1
2/3/2009	2/25/2009	50.31	73.3	6.99	-1.2
2/25/2009	3/10/2009	49.11	95.5	6.91	-0.1
3/10/2009	3/25/2009	48.43	106	7.12	0.2
3/25/2009	4/7/2009	54.38	98.4	7.01	2.2
4/7/2009	4/28/2009	52.09	92.3	7.13	0.3
4/28/2009	5/18/2009	49.83	87.5	7.04	-0.4
5/19/2009	6/10/2009	50.37	99.1	6.7	0.9
6/17/2009	7/14/2009	50.66	99.8	6.58	3.6
7/14/2009	8/18/2009	44.37	75.8	7.06	3
8/18/2009	9/2/2009	57.05	100.8	7	1.5
9/2/2009	9/15/2009	no data	no data	no data	no data
9/15/2009	9/29/2009	94.8	94.8	6.67	0.4
9/29/2009	10/13/2009	50.2	91.6	7	-0.4
10/13/2009	10/27/2009	50.33	96.1	7.17	2
10/27/2009	11/17/2009	50.07	94.5	7.14	0.1
11/17/2009	12/1/2009	49.53	97.2	7.06	0.6
12/1/2009	12/15/2009	48.3	99	6.98	0
12/15/2009	12/31/2009	50.25	99.7	7.01	-0.1

STATION 10		Post Deployment Calibration Values			
		SpCond (50mS/cm)	DO%	pH (7)	Turb (0 NTU)
1/1/2009	1/14/2009	49.9	98.5	6.99	0
1/14/2009	2/3/2009	50.12	100.2	6.97	-0.8
2/3/2009	2/25/2009	50.04	98.3	7.1	0
2/25/2009	3/10/2009	50.75	97.2	6.95	-0.4
3/10/2009	3/25/2009	no data	no data	no data	no data
3/25/2009	4/14/2009	50.75	89.5	6.94	0
4/14/2009	5/7/2009	50.04	80.9	6.75	2.1
5/12/2009	6/1/2009	50.78	102.6	6.98	2
6/1/2009	6/16/2009	49.49	99.1	6.71	2.4
6/16/2009	7/14/2009	50.6	54.6	7.04	13.7
7/14/2009	8/18/2009	49	81	7.01	1.9
8/18/2009	9/2/2009	51.69	101.4	7.1	1.5
9/2/2009	9/15/2009	50.83	99.1	7.18	0.4
9/15/2009	9/29/2009	50.07	98.7	6.99	0.4
9/29/2009	10/13/2009	50.3	98.5	6.94	-1.2
10/13/2009	10/27/2009	50.1	98.8	7.14	1.6
10/27/2009	11/17/2009	49.93	88	6.96	0.2
11/17/2009	12/1/2009	50.12	97.6	7.01	0.3
12/1/2009	12/15/2009	49.9	99	6.92	-0.3
12/15/2009	12/31/2009	47.57	87.3	7.08	39.3

STATION 19		Post Deployment Calibration Values			
		SpCond (50mS/cm)	DO%	pH (7)	Turb (0 NTU)
1/1/2009	1/14/2009	51.34	93.4	6.85	1.3
1/14/2009	2/3/2009	48.6	87.1	7.14	2.9
2/3/2009	2/25/2009	48.58	98.1	7.22	1.5
2/25/2009	3/10/2009	50.45	92.7	7.01	1
3/10/2009	3/25/2009	49.72	94.7	7.18	4.2
3/25/2009	4/7/2009	54.76	100.9	7.02	0.6
4/7/2009	4/28/2009	50.18	84.9	7.19	1.2
4/28/2009	5/19/2009	52.9	97.3	7.03	-0.2
5/19/2009	6/16/2009	50.32	99.6	7.08	2.3
6/16/2009	6/18/2009	52.5	99.9	7.1	0.4
6/30/2009	8/18/2009	49.87	68.9	7.15	6.4
8/18/2009	9/2/2009	51.63	94	7.34	2.5
9/2/2009	9/15/2009	53.64	96.4	6.96	-0.1
9/15/2009	9/16/2009	49.45	100.1	7.18	0.4
9/16/2009	10/14/2009	50.89	82.5	7.04	0.4
10/14/2009	10/27/2009	49.87	97.7	7.02	1.8
10/27/2009	11/17/2009	48.4	94.3	7.01	0.2
11/17/2009	12/1/2009	49.45	92.5	7.07	0.9
12/1/2009	12/15/2009	49.46	98.9	7.01	-0.6
12/15/2009	12/31/2009	49.57	66.5	7.11	12.5

STATION 20		Post Deployment Calibration Values			
		SpCond (50mS/cm)	DO%	pH (7)	Turb (0 NTU)
1/1/2009	1/15/2009	49.05	100.5	6.95	1.7
1/15/2009	2/3/2009	48.5	97.3	7.29	0.2
2/3/2009	2/25/2009	51.32	99.4	6.87	0.1
2/25/2009	3/10/2009	50.06	97.6	7.02	0.4
3/10/2009	3/25/2009	49.1	100	7.29	2.2
3/25/2009	4/7/2009	51.76	84.2	7.13	2.7
4/7/2009	4/28/2009	50.99	99.7	7.2	2.1
4/28/2009	5/19/2009	48.08	88	7.12	4.6
5/19/2009	6/16/2009	51.5	96.4	7.23	0
6/16/2009	6/30/2009	53.18	87.1	7.04	0.2
6/30/2009	8/18/2009	50.06	83.9	6.99	1.2
8/18/2009	9/2/2009	51	109.7	7.18	1.4
9/2/2009	9/15/2009	52.2	86.3	7.2	-0.4
9/15/2009	9/29/2009	50.05	100.3	7.1	1.6
9/29/2009	10/13/2009	49.5	99.5	7.2	0.5
10/13/2009	10/27/2009	50.07	98	7.1	0.3
10/27/2009	11/16/2009	24.4	89.9	7.07	1.6
11/17/2009	12/1/2009	50.1	83.6	7.03	-0.2
12/1/2009	12/9/2009	47.98	17.2	7.02	1
12/9/2009	12/15/2009	49.46	98.8	7.02	0.9
12/15/2009	12/31/2009	50.04	91	7.14	8

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.

Station 9:

7/14/2009 11:15 to 8/18/2009 10:15: SpCond/salinity data is marked 1 SSM CSM. The cell constant for the probe was reading 4.08 at the calibration, the pre-cal value was 55.34 and the post value was 44.37.

Station 19:

After 6/30/2019 10:45 there was a shift in depth of 0.2m deeper. During the time period from June to December there were graduate students helping to deploy instruments. This led to the depth data being erratic during this time. The water column at this station is well mixed and while the depth is definitely impacted other parameters do not appear to be. Depth data is marked 1 GSM CWD after 06/30/2019 10:45 and all other parameters are marked 0 GSM CWD.

Station 20:

During the 04/7/2019 deployment there was an issue with the chain that the sonde is deployed with in the tube. This left to the sonde not being deployed at the correct depth. The water column at this station is well mixed and while the depth is definitely impacted other parameters do not appear to be. Depth data is marked 1 GSM CWD during the 4/7/2019 deployment and other parameters are marked 0 GSM CWD.

During the 05/19/2019 deployment there was an issue with the chain that the sonde is deployed with in the tube. The sonde hung about 0.5m lower in the tube than normal. The water column at this station is well mixed and while the depth is definitely impacted other parameters do not appear to be. Depth data is marked 1 GSM CWD during the 05/19/2019 deployment and other parameters are marked 0 GSM CWD.