

Reserve Name JOB NERR NERR Water Quality Metadata
Months and year the documentation covers: 01/01/2015 to 12/31/2015
Latest Update: 3/1/2017

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. Files are exported from EcoWatch in a comma-delimited format (.CDF) and uploaded to the CDMO by Enid Malavé and Angel Dieppa where they undergo automated primary QAQC and become part of the CDMO's online provisional database. Excessive pre- and post-deployment data are removed from the file prior to upload with up to 2 hours of pre- and post-deployment data retained to assist in data management. During primary QAQC, data are flagged if they are missing or out of sensor range. The edited file is then returned to the Reserve where it is opened in Microsoft Excel and processed using the CDMO's NERRQAQC Excel macro by Enid Malavé 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 Enid Malavé and Angel Dieppa. For more information on QAQC flags and codes, see Sections 11 and 12.

3) Research objectives – Describe briefly the nature of the monitoring program resulting in this data set (for example, control versus impacted site, long term monitoring, spatial or temporal coverage, etc.). Describe the goal or purpose of this research.

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 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. YSI sonde 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, all station have 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 – Describe your NERR site in general and the sampling sites associated with each YSI data logger. Include the following in your description for each sampling location. If certain characteristics apply to all sample sites or the entire Reserve they may be discussed in an overview:

- a) latitude and longitude
- b) tidal range
- c) salinity range
- d) type and amount of freshwater input
- e) water depth (mean depth or depth range at site, NOT depth of sonde deployment)
- f) bottom habitat or type (soft sediment, grass bed, oyster bar, etc.)
- g) pollutants in area
- h) description of watershed draining site

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 was located at 17° 56' 36.8" N and 66° 14' 18.5" W until 09/02/2010 12:00PM, then it was relocated to 17° 56' 34.88" N and 66° 14' 18.64" W approximately 65.0 meters from original position. The relocation was due to sedimentation issues and the construction of a new telemetry station. 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 – Include each YSI deployment and retrieval date and time (**first** and **last** readings in the water) for each monitoring site for the year. Do not include times of pre- and post-deployment or datasondes' transport. Note when data collection began initially for your Reserve or sample sites.

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 2015:

Station 09			
Date/Time In		Date/Time Out	
12/16/2014	09:45	01/13/2015	10:15
01/13/2015	10:45	01/27/2015	09:15
01/27/2015	09:30	02/10/2015	09:15
02/10/2015	09:30	02/24/2015	10:00
02/24/2015	10:15	03/10/2015	10:00
03/10/2015	10:30	03/25/2015	10:30
03/25/2015	10:45	04/07/2015	10:00
04/07/2015	10:15	04/21/2015	09:15
04/21/2015	09:30	05/07/2015	09:15
05/07/2015	09:30	05/19/2015	10:00
05/19/2015	10:30	06/15/2015	12:00
06/15/2015	12:15	07/02/2015	13:00
07/02/2015	13:30	07/15/2015	10:15
07/15/2015	10:30	07/30/2015	12:00
07/30/2015	12:30	08/19/2015	11:45
08/19/2015	12:15	09/02/2015	13:45
09/02/2015	14:00	09/15/2015	10:45
09/15/2015	11:00	10/06/2015	10:00
10/06/2015	10:15	10/20/2015	09:30
10/20/2015	10:00	11/03/2015	11:15
11/03/2015	11:30	11/16/2015	09:30
11/16/2015	09:45	12/01/2015	10:30
12/01/2015	11:00	12/15/2015	11:00
12/15/2015	11:30	01/13/2016	11:00

Station 19			
Date/Time In		Date/Time Out	
12/16/2014	10:45	01/13/2015	12:00
01/13/2015	12:15	01/27/2015	11:00
01/27/2015	11:15	02/10/2015	09:00
02/10/2015	09:15	02/24/2015	11:15
02/24/2015	11:30	03/10/2015	11:30
03/10/2015	11:45	03/25/2015	08:45
03/25/2015	9:00	04/07/2015	11:15
04/07/2015	11:30	04/21/2015	08:45
04/21/2015	09:00	05/07/2015	08:45
05/07/2015	09:00	05/19/2015	08:45
5/19/2015	09:00	06/15/2015	09:30
06/15/2015	09:45	7/2/2015	10:00
07/02/2015	10:15	07/15/2015	09:00
07/15/2015	09:15	07/30/2015	12:30
07/30/2015	12:45	08/19/2015	10:15
08/19/2015	10:30	09/15/2015	09:30
09/15/2015	09:45	10/01/2015	10:15
10/01/2015	10:30	10/14/2015	08:15
10/14/2015	08:30	10/27/2015	09:30
10/27/2015	09:45	11/09/2015	13:00
11/09/2015	13:15	11/24/2015	11:30
11/24/2015	12:00	12/09/2015	10:45
12/09/2015	11:15	12/21/2015	09:45
12/21/2015	10:30	01/13/2016	09:30

Station 10			
Date/Time In		Date/Time Out	
12/16/2014	10:15	01/13/2015	11:15
01/13/2015	11:30	01/27/2015	10:15
01/27/2015	10:45	02/10/2015	10:00
02/10/2015	10:15	02/24/2015	10:30
02/24/2015	11:00	03/10/2015	10:45
03/10/2015	11:00	03/25/2015	11:15
03/25/2015	11:45	04/07/2015	10:45
04/07/2015	11:00	04/21/2015	09:45
04/21/2015	10:15	05/07/2015	10:00
05/07/2015	10:15	05/19/2015	10:45
05/19/2015	11:00	06/15/2015	11:15
06/15/2015	11:30	07/02/2015	11:45

Station 20			
Date/Time In		Date/Time Out	
12/16/2014	11:45	01/13/2015	09:45
01/13/2015	10:00	01/27/2015	11:15
01/27/2015	11:45	02/10/2015	08:45
02/10/2015	09:00	02/24/2015	11:30
02/24/2015	11:45	03/10/2015	11:45
03/10/2015	12:00	03/25/2015	09:00
03/25/2015	09:15	04/07/2015	09:00
04/07/2015	09:15	04/21/2015	08:15
04/21/2015	08:30	05/07/2015	11:30
05/07/2015	11:45	05/19/2015	11:15
5/19/2015	11:45	06/15/2015	12:30
06/15/2015	12:45	7/2/2015	8:45

07/02/2015	12:15	07/15/2015	09:45
07/15/2015	10:00	07/30/2015	11:30
07/30/2015	11:45	08/19/2015	10:45
08/19/2015	11:00	09/02/2015	14:00
09/02/2015	14:15	09/15/2015	11:15
09/15/2015	11:30	10/01/2015	11:15
10/01/2015	11:45	10/14/2015	09:00
10/14/2015	9:15	10/27/2015	10:15
10/27/2015	10:45	11/09/2015	11:30
11/09/2015	11:45	11/24/2015	12:15
11/24/2015	12:45	12/09/2015	11:30
12/09/2015	11:45	12/21/2015	10:30
12/21/2015	11:00	01/13/2016	10:00

07/02/2015	09:15	07/15/2015	10:45
07/15/2015	11:15	07/30/2015	10:15
07/30/2015	10:45	08/19/2015	12:15
08/19/2015	12:30	09/02/2015	10:00
09/02/2015	10:15	09/21/2015	10:30
09/21/2015	11:15	10/01/2015	10:00
10/01/2015	10:15	10/14/2015	09:30
10/14/2015	10:00	10/27/2015	09:15
10/27/2015	09:30	11/09/2015	13:15
11/09/2015	13:45	11/24/2015	11:00
11/24/2015	11:30	12/09/2015	10:30
12/09/2015	10:45	12/21/2015	11:15
12/21/2015	11:45	01/19/2016	09:30

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 processed the data. Following academic courtesy standards, the 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. 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; *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. Data are available in text tab-delimited format.

8) Associated researchers and projects (link to other products or programs) – Describe briefly other research (data collection) that correlates or enhances the data collected by data loggers. At a minimum, mention the SWMP MET and NUT data sets.

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 inter annual

differences in rainfall, magnitude and influence of major events such hurricanes, spatial extent of oceanic and tidal forcing.

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 used by:

- Caribbean Regional Association for the Caribbean Regional Coastal Ocean Observing System (CariCOOS) who monitors Real Time data from our SWMP stations.
- Environmental Quality Board for their biennial Puerto Rico 305(b)/303(d) Integrated Report
- Puerto Rico Energy Power Authority (PREPA)
- Department of Natural and Environmental Resources

II. Physical Structure Descriptors

9) Sensor specifications –

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 auto ranging

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 dependent)

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% or 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 (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 depth or water 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 site 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.

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:
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			
	Date In	Date Out	SpCond (50mS/cm)	DO%	pH (7)	Turb (0 NTU)
	12/16/2014	01/13/2015	48.22	92.5	7.01	0
	01/13/2015	01/27/2015	48.57	96.3	7.09	0.4
	01/27/2015	02/10/2015	48.68	98.9	7.03	0
	02/10/2015	02/24/2015	48.50	100.5	7.04	-0.2
	02/24/2015	03/10/2015	48.08	97.7	6.97	3.5
	03/10/2015	03/25/2015	49.20	88	7.01	0.4
	03/25/2015	04/07/2015	49.08	97.6	6.88	8.8
	4/7/2015	4/21/2015	48.69	97.1	7.01	1.6
	4/21/2015	5/7/2015	48.46	100	7.00	896
	5/7/2015	5/19/2015	49.11	99.3	7.01	0.0
	5/19/2015	06/15/2015	51.53	92.4	6.93	656
	06/15/2015	07/02/2015	34.63	93.9	7.96	0.8
	07/02/2015	07/15/2015	55.31	100.9	7.21	3.6
	07/15/2015	07/30/2015	54.08	101.1	7.18	1.0
	07/30/2015	08/19/2015	49.98	81.6	7.26	0.5
	08/19/2015	09/02/2015	49.89	100.3	7.02	1329
	09/02/2015	09/15/2015	49.27	97.1	6.98	1.2
	09/15/2015	10/06/2015	50.30	98.4	6.85	22.6
	10/06/2015	10/20/2015	48.96	99.5	7.02	2.4
	10/20/2015	11/03/2015	47.08	106.3	6.98	1.3
	11/03/2015	11/16/2015	48.57	98.1	*	-0.6
	11/16/2015	12/01/2015	50.80	98.7	6.87	0.7
	12/01/2015	12/15/2015	47.43	95.1	6.90	5.1
	12/15/2015	01/13/2016	48.82	100.2	*	12.4*

STATION 10		Post Deployment Calibration Values			
		SpCond (50mS/cm)	DO%	pH (7)	Turb (0 NTU)
Date In	Date Out				
12/16/2014	01/13/2015	49.2	98.3	7	0.4
01/13/2015	01/27/2015	48.85	99.1	7.12	1.3
01/27/2015	02/10/2015	49.18	95.8	6.91	5.8
02/10/2015	02/24/2015	49.43	100	7.15	0
02/24/2015	03/10/2015	49.0	99.9	6.99	0.1
03/10/2015	03/25/2015	47.83	97.7	7.10	0.2
03/25/2015	04/07/2015	49.67	97.2	6.99	0
4/7/2015	4/21/2015	48.7	97.8	7	0.9
4/21/2015	5/7/2015	49.88	98.6	6.83	0
5/7/2015	5/19/2015	48.55	97.5	7.00	0.0
5/19/2015	06/15/2015	27.40	97.8	7.03	298.6
06/15/2015	07/02/2015	58.44	98.6	6.87	3.0
07/02/2015	07/15/2015	56.96	107.3	6.36	-0.3

07/15/2015	07/30/2015	54.24	101.3	7.08	-0.3
07/30/2015	08/19/2015	53.12	111.3	7.10	7.82
*08/19/2015	09/02/2015	50.18	84.7	6.99	1.6
09/02/2015	09/15/2015	48.60	93.8	7.01	-1.5
09/15/2015	10/01/2015	50.53	99.3	7.12	-0.4
10/01/2015	10/14/2015	56.79	101.3	7.00	0.1
10/14/2015	10/27/2015	48.10	96.9	6.96	0
10/27/2015	11/09/2015	51.40	99.8	7.11	0
11/09/2015	11/24/2015	47.54	97.6	7.03	0
11/24/2015	12/09/2015	50.03	99.6	7.03	1.2
12/09/2015	12/21/2015	49.61	99.8	7.05	1.3
12/21/2015	01/13/2016	48.60	98	7.01	18.2

STATION 19		Post Deployment Calibration Values			
		SpCond (50mS/cm)	DO%	pH (7)	Turb (0 NTU)
12/16/2014	01/13/2015	50.1	99.5	7.14	2.5
01/13/2015	01/27/2015	49.1	100.9	7.12	0.5
01/27/2015	02/10/2015	49.19	99	6.99	0
02/10/2015	02/24/2015	48.90	98.4	6.99	-0.6
02/24/2015	03/10/2015	48.46	100.2	7.17	0.3
03/10/2015	03/25/2015	49.05	98.3	7.02	-0.3
03/25/2015	04/07/2015	50.68	98.4	7.08	0.6
4/7/2015	4/21/2015	49	96.8	7.05	0
4/21/2015	5/7/2015	48.62	97.8	6.93	0.2
5/7/2015	5/19/2015	49.31	100.2	7.05	0.0
5/19/2015	06/15/2015	27.83	98.5	6.98	4.1
06/15/2015	07/02/2015	34.92	100.2	8.14	1.2
07/02/2015	07/15/2015	55.21	101.2	*NA	2.6
07/15/2015	07/30/2015	53.96	100.1	*NA	0.1
*07/30/2015	08/19/2015	49.43	99.8	6.84	8.47
08/19/2015	09/15/2015	47.53	97.6	7.02	2.21
09/15/2015	10/01/2015	47.12	95.1	6.86	0.5
10/01/2015	10/14/2015	53.30	14.2	7.01	2.9
10/14/2015	10/27/2015	47.47	99.6	7.28	0
10/27/2015	11/09/2015	52.23	98.7	7.14	5.2
11/09/2015	11/24/2015	49.50	52	6.96	0
11/24/2015	12/09/2015	48.56	96.4	7.0	11.3
12/09/2015	12/21/2015	48.50	101.7	7.07	1.3
12/21/2015	01/13/2016	50.02	12.2	6.95	43.3

STATION 20		Post Deployment Calibration Values			
		SpCond (50mS/cm)	DO%	pH (7)	Turb (0 NTU)
12/16/2014	01/13/2015	48.69	96.9	7.08	1.5
01/13/2015	01/27/2015	47.11	98.2	7.09	0.2
01/27/2015	02/10/2015	48.44	100.2	7.08	0.7
02/10/2015	02/24/2015	48.80	98.5	7.11	0.7
02/24/2015	03/10/2015	47.80	99.3	7.10	2.0
03/10/2015	03/25/2015	48.50	97.5	7.02	0.8
03/25/2015	04/07/2015	48.6	97.3	7.11	1.5
4/7/2015	4/21/2015	48.15	98.1	7.07	0.9
4/21/2015	5/7/2015	48.95	97	7.11	2.7
5/7/2015	5/19/2015	48.21	96.7	7.10	0.1
5/19/2015	06/15/2015	53.06	97.9	7.04	1.3
06/15/2015	07/02/2015	34.11	99.4	8.53*	2.3
07/02/2015	07/15/2015	54.57	98.9	7.17	1614.1
07/15/2015	07/30/2015	53.60	101.1	7.01	0.5
07/30/2015	08/19/2015	49.98	101.9	7.15	0.6
08/19/2015	09/02/2015	49.50	104.2	6.89	3.8
09/02/2015	09/21/2015	49.40	99.3	7.05	1.9
09/21/2015	10/01/2015	49.69	99.3	7.08	-0.3
10/01/2015	10/14/2015	56.0	98	6.92	1.4
10/14/2015	10/27/2015	47.17	100.1	7.20	9.4
10/27/2015	11/09/2015	50.99	100.1	6.99	1.0
11/09/2015	11/24/2015	46	98.6	7.0	0.7
11/24/2015	12/09/2015	47.96	84.5	7.25	12.7
12/09/2015	12/21/2015	49.80	99.8	7.03	4.6
12/21/2015	01/13/2016	50.37	95.5	6.91	2.8

*Bad sensor

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.

Conductivity/Salinity comments:

DO Data comments:

JOB10WQ: Hypoxia values due to biofouling, high Sargasso on area.

JOB19WQ: Hypoxia values due to biofouling, high Sargasso on area, from 12/21/2015 to 01/13/2016.

pH Data comments:

JOB09WQ: From 11/14/15 at 21:45 to 11/16/15 at 09:30 sensor broken.

JOB19WQ: From 07/05/15 at 20:00 to 07/15/15 at 09:00 sensor broken.

JOB19WQ: From 07/16/15 at 2:15 to 07/30/15 at 12:30, SSM sensors malfunction.

Chlorophyll Data comments:

JOB10WQ: From 07/02/2015 at 12:15am to 07/15/2015 at 09:45 without Chlorophyll sensor on ST 10

JOB19WQ: -From 01/27/15 at 12:15 to 02/10/15 at 09:00 sensor drift reading high values.

JOB19WQ: -From 03/25/15 at 15:45 to 04/07/15 at 11:15 sensor drift reading high values.

JOB20WQ: From 07/07/2015 at 06:30am to 07/15/2015 at 10:45am suspect Chlorophyll data may be due to power issues on St 20.

Turbidity Data comments:

JOB09WQ: -From 4/6/15 to 4/7/15 sensor drift due to biofouling, sediment blocking the optics.

JOB09WQ: -From 5/4/15 at 18:01 to 5/7/15 at 09:16 high values, sensor drift.

JOB09WQ: -From 12/15/15 at 11:30 to 01/13/16 at 11:00 sensor malfunction.

JOB10WQ: -From 05/19/15 at 11:00 to 06/15/15 at 11:15, sensor malfunction.

JOB10WQ: From 7/28/15 to 9/2/15 high values due to biofouling and high Sargasso on area. This was due to an arrival of big amounts of Sargasso into the bay, this has been affecting wider Caribbean.

JOB19WQ: -From 1/18/2015 to 01/26/2015 high values due to biofouling, crab inside cup blocking the optics.

JOB19WQ: -From 4/11/2015 to 4/21/2015 high values due to biofouling, crab inside cup blocking the optics.

JOB19WQ: -From 4/24/2015 to 5/6/2015 high values due to biofouling, few Sargasso on area.

JOB19WQ: -From 9/2/2015 at 21:00 to 9/13/2015 at 14:30 high values due to biofouling, barnacles and others blocking the optics.

JOB19WQ: -From 12/09/15 at 11:15 to 12/21/15 at 9:45 reading negatives values, little crab between sensors.

JOB19WQ: -From 11/30/15 at 18:30 to 12/09/15 at 10:45 reading negatives values, <1> CBF little crab between sensors (barnacles, sediment).

JOB19WQ: -From 12/26/15 at 00:15 to 12/31/15 at 23:45 reading, <1> CBF little crab between sensors (barnacles, sediment).

JOB20WQ: -From 10/21/15 at 19:00 to 10/27/15 at 09:15, <1> CBF (larvae's, sediment).

Depth Data Comments:

JOB10WQ: From 8/19/15 to 12/31/15 the sonde data collection tube was replaced and when it was replaced it was not at the same depth. It was about 0.3 m higher than the previous tube.

JOB19WQ: - From 2/10/15 to 2/24/15 sonde was deployed at wrong depth (GSM). Data seems to fit conditions, no water column stratification.

JOB19WQ: - From 2/24/15 to 3/10/15 sonde was deployed at wrong depth (GSM). Data seems to fit conditions, no water column stratification.

JOB19WQ: - From 3/25/15 9:00 to 3/25/15 19:00 sonde was deployed at wrong depth (GSM). Data seems to fit conditions, no water column stratification.

JOB19WQ: - From 5/19/15 at 9:00 to 6/15/15 at 9:30 sonde deployed at wrong depth, data does not seem to be affected. Well mixed shallow water column.

Notes:

JOB09WQ: From 8/26/15 at 3:30 to 18:15 all data affected with significant rain event, (CRE).

JOB09WQ: -From 10/25/2015 at 18:45 to 10/31/2015 at 18:00, CRE all data affected with significant rain event.

JOB09WQ: -From 11/08/2015 at 1:15 to 11/12/2015 at 17:45, CRE all data affected with significant rain event.

JOB09WQ: -From 11/29/2015 at 16:30 to 12/01/2015 at 10:30, CRE all data affected with significant rain event.

JOB10WQ: -From 10/25/2015 at 05:45 to 10/27/2015 at 10:15, CRE all data affected with significant rain event.

JOB10WQ: -From 11/08/2015 at 02:45 to 17:45, CRE all data affected with significant rain event.

JOB10WQ: -From 11/29/2015 at 17:30 to 12/03/2015 at 05:15, CRE all data affected with significant rain event, low conductivities/salinities.

JOB10WQ: -From 7/30/2015 at 11:45 to 8/19/2015 at 10:45, GIM don't collect data.

JOB19WQ: -From 7/30/2015 at 12:45 to 8/19/2015 at 10:15, GIM don't collect data.

JOB19WQ: From 09/13/15 at 14:45 to 09/15/15 at 09:30. GPF don't collect data.

JOB19WQ: -From 10/01/2015 at 10:30 to 10/14/2015 at 08:15, GIM don't collect data.

Sensor's serial number in sonde's serial number.

JOB09WQ: - On 07/16/2015 new pH sensor on sonde's SN 01K0080AB.

JOB09WQ: - On 10/19/2015 ODO membrane replace in sensor on sonde's SN 02A0155AD

JOB09WQ: - On 11/18/2015 change pH sensor on sonde's SN F0319AB.

JOB10WQ: - On 02/03/2015 new pH sensor on sonde's SN D0765AA

JOB10WQ: - On 05/11/2015 new conductivity sensor on sonde's SN 02A0155AA

JOB10WQ: - On 06/18/2015 new turbidity and ROX sensors on sonde's SN 02A0155AA

On 12/16/2014 without Chlorophyll sensor on sonde's SN 01K0080AB

On 02/03/2015 without Chlorophyll sensor on sonde's SN D0765AA

From 01/27/2015 at 10:45am without Chlorophyll sensor on ST 10.

On 03/31/2015 without Chlorophyll sensor on sonde's SN 06B2025AB.

JOB10WQ: - On 10/01/2015 change pH sensor in 07M100799.

JOB19WQ: -From 4/21/2015 without Chlorophyll sensor in 07M100799.

JOB20WQ: - From 03/31/2015 used Chlorophyll sensor 13M101260 on D0765AA.

JOB20WQ: - On 04/14/2015 new pH sensor in 02J0915AA.

JOB20WQ: From 07/07/15 at 6:30 to 07/15/15 at 10:45 turbidity sensor malfunction may be due to power issues on ST 20.

JOB20WQ: From 11/24/15 at 11:30 to 12/09/15 at 10:30 anomalous turbidity data, (SSM) sensor malfunction.

JOB20WQ: From 12/02/15 at 14:15 to 12/03/15 at 4:15 (GPF) anomalous battery data, (GPF) high voltage value. Turbidity sensor malfunction may be due to power issues on ST 20.

Other:

Significant rain events:

Date	Precipitation (mm)	Event associated with
May 27, 2017	43.43*	
June 30	19.05*	
July 12	17.30*	
Aug 16	22.1*	
Aug 24	23.9	Tropical Storm Danny
Sept 12	25.9	
Sept 20	11.4	
Oct 24-26	118.8	
Nov 07-08	62.9	
Nov 29	32.5	
Dec 19-20	17.0	
Dec 28	11.4	

Remarks:

This year, starting on the rain season from September 2014 through year 2015 we experimented a severe drought. Also, a significant amount of *Sargassum* seaweed has been arriving to east, south, and southwest of Puerto Rico. Although there is a low probability to observe it in our SMWP stations, it affected station 10 due to decomposition of this seaweed promoting hypoxia and anoxic events. From 07/28/15 to 09/02/15 we observe an unprecedented hypoxia/anoxic event at station 10; DO values drop to 0.1 mg/l. The seaweed decomposed at a slow rate leaving detritus at the bottom of the station 10 where low oxygen levels last to present (1/29/16).

Picture showing *Sargassum* sp. at Station 10 on July 31, 2015.

