Reserve Name JOB NERR Water Quality Metadata
Months and year the documentation covers: 01/01/2020 to 12/31/2020
Latest Update:10/04/2022

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), EcoWatch Lite in a comma separated file (CSV) or KOR Software in a comma separated file (CSV) and uploaded to the CDMO by Enid Malavé 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 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 for secondary QAQC 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 –

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 EXO-2) 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 depth-fixed from a pole at a distance at about 0.5 meters from the bottom 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), subject to impacts from coastal processes (close to a power plant retentions pond), 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 or EXO-2 data logger is deployed, calibration and maintenance is performed following the Standard Operation Procedures of the NERRS. 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.

The two-point turbidity calibration is performed using a 0 NTU (DI water) and 124 FNU (for EXO-2) standard purchased from a scientific company. EXO-2 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 hangs inside a 6-inch diameter PVC pipe which is attached to a concrete filled PVC stable pole. Data loggers are at approximately 0.5 meter from the bottom 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 29 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 a second station JOB09, transmits data to the NOAA GOES satellite, NESDIS ID # 3B0297EC and NESDIS ID # 3B0424AC respectively. 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.
Station 20 and Station 9 telemetry was interrupted on 09/20/17 after Hurricane Maria destroyed the platform losing all the equipment. We are planning to reestablish communication in the near future.

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 reaches 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 during this year varies from 26.1 ppt to 40.8 ppt. The average depth and total depth at station 09 is 0.28 and 0.88 meters respectively. 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°56'34.87"N and 66°14'18.64"W until 09/02/2010 12:00PM, then it was relocated to 17° 56' 35.0" N and 66° 14' 18.9" W approximately 65.0 meters from original position. The relocalization 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. Since 2015 an invasive seagrass, *Halophila stipulacea* was reported at Jobos Bay, it was after the pass of Hurricane Maria in September 21, 2017 that it was more evident and wide distributed. Although it is not present at Station 9, it is present in the channels toward the station and we expect it will colonize the area in the near future.

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 during this year varies from 15.7 ppt to 40.4 ppt. The average depth and total depth at station 10 is 0.29 and 0.87 meters respectively. 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 testudinum*), 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. Since 2015 an invasive seagrass, *Halophila stipulacea* was reported at Jobos Bay, it was after the pass of Hurricane Maria in September 21, 2017 that it was more evident and wide distributed been observed in the perimeter of the station. See notes below regarding Sargassum arrivals.

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 (*Thallasia testudinum*). Tidal ranges in this area vary from 12 to 14 inches. The salinity at the vicinity of the monitoring station during this quarter varies from 22.9 ppt to 37.4 ppt. The average depth and total depth at this station is 0.52 and 1.11 meters respectively. The YSI sonde is deployed at about .05 meter 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, 66° 13' 43.77"W. There is no freshwater input to this area. Since 2015 an invasive seagrass, *Halophila stipulacea* was reported at Jobos Bay, it was after the pass of Hurricane Maria in September 21, 2017 that it was more evident and wide distributed been observed in the perimeter of the station.

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 testudinum*) 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 during this year varies from 31.6 ppt to 37.4 ppt. The average depth and total depth at this station is 0.28 and 0.88 meters respectively. There is no surface freshwater input to this area. The pole is located at 17° 55' 49.14"N, 66° 12' 41.30"W. Since 2015 an invasive seagrass, *Halophila stipulacea* was reported at Jobos Bay, it was after the pass of Hurricane Maria in September 21, 2017 that it was more evident and wide distributed been observed in the perimeter of the station.

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.

Station Code	SWMP Status	Station Name	Location	Active Dates	Reason Decommissioned	Notes
JOB09 WQ	P	Station 9	17.94306 N 66.23858 W	12/20/1995 Present	NA	NA

JOB10 WQ	P	Station 10	17.93861 N 66.25774 W	02/01/1996 Present	NA	NA
JOB19 WQ	P	Station 19	17.94291 N 66.22883 W	04/01/2004 Present	NA	NA
JOB20 WQ	P	Station 20	17.93032 N 66.21147 W	03/13/2004 Present	NA	NA
JOB06WQ	P	Station 06	17.93499 N 66.22793 W	12/1996-12/1998	Affected by thermal outfall	NA
JOB11WQ	P	Station 11	17.94461 N 66.26203 W	03/1996-12/1998	Exposed to vandalism	NA
JOB18WQ	P	Station 18	17.94443 N 66.23188 W	10/1998-11/1998	Does not represent normal conditions	NA

6) Data collection period

Deployment and Retrieval Dates 2020:

Station 09			
Date/	**Time In**	**Date/**	**Time Out**
01/01/2020	0:00	01/21/2020	10:30
01/21/2020	10:45	02/11/2020	10:45
02/11/2020*	11:00	02/25/2020	10:15
02/25/2020	10:30	03/10/2020	11:15
03/10/2020	11:30	04/16/2020	11:30
04/16/2020	11:45	05/19/2020	10:15
05/19/2020	10:30	06/11/2020	10:00
06/11/2020	10:15	06/29/2020	10:30
06/29/2020	11:00	08/01 /2020	22:45
08/04/2020	11:30	08/17/2020	10:15
08/17/2020	10:45	09/15/2020	10:30
09/15/2020	10:45	09/28/2020	10:30
09/28/2020	10:45	10/13/2020	11:45
10/13/2020	12:45	10/26/2020	10:30
10/26/2020	10:45	11/05/2020	10:00
11/05/2020	10:45	11/24/2020	10:00
11/24/2020	10:15	12/02/2020	03:15
12/07/2020	11:00	12/18/2020	08:30

Station 19			
Date/	**Time In**	**Date/**	**Time Out**
01/01/2020	0:00	01/21/2020	09:15
01/21/2020	09:30	02/07/2020	10:00
02/07/2020	10:15	02/25/2020	08:45
02/25/2020	09:00	03/10/2020	09:15
03/10/2020	09:30	04/16/2020	12:30
04/16/2020	12:45	05/19/2020	09:00
05/19/2020	09:15	06/11/2020	08:45
06/11/2020	09:00	06/29/2020	08:45
06/29/2020	10:00	08/04/2020	10:00
08/04/2020	10:15	09/01/2020	09:30
09/01/2020	09:45	09/21/2020	10:00
09/21/2020	10:15	10/05/2020	09:45
10/05/2020	10:00	10/19/2020	10:30
10/19/2020	10:45	11/02/2020	09:30
11/02/2020	10:00	11/12/2020	10:30
11/12/2020	10:45	11/30/2020	09:15
11/30/2020	09:45	12/14/2020	10:15
12/14/2020	10:30	01/07/2021	10:30

12/18/2020	08:45	01/19/2021	10:15

Station 10			
Date/	Time In	Date	Time Out
01/01/2020	0:00	01/21/2020	10:00
01/21/2020	10:15	02/07/2020	11:00
02/07/2020*	11:15	02/25/2020	09:30
02/25/2020	09:45	03/10/2020	11:00
03/10/2020	11:30	04/16/2020	10:30
04/16/2020	10:45	05/19/2020	09:45
05/19/2020	10:00	06/11/2020	09:30
06/11/2020	09:45	06/29/2020	10:15
06/29/2020	10:30	08/04 /2020	10:45
08/04/2020	11:45	08/17/2020	09:45
08/17/2020	10:00	09/15/2020	10:00
09/15/2020	10:15	09/28/2020	09:45
09/28/2020	10:00	10/13/2020	11:30
10/13/2020*	11:45	10/26/2020	10:00
10/26/2020	10:15	11/05/2020	09:15
11/05/2020	10:00	11/23/2020	11:30
11/24/2020	10:15	12/07/2020	10:45
12/07/2020	11:00	12/18/2020	07:45
12/18/2020	08:00	01/19/2021	09:45

Station 20			
Date/	Time In	Date/	Time Out
01/01/2020	0:00	01/21/2020	09:00
01/21/2020	09:15	02/07/2020	09:45
02/07/2020*	10:00	02/25/2020	08:45
02/25/2020	09:00	03/10/2020	09:45
03/10/2020	10:00	04/16/2020	09:15
04/16/2020	09:30	05/19/2020	08:45
05/19/2020	09:00	06/11/2020	11:45
06/11/2020	12:15	06/29/2020	08:30
06/29/2020	08:45	08/04/2020	09:00
08/04/2020	09:30	09/01/2020	09:30
09/01/2020	09:45	09/21/2020	11:15
09/21/2020	11:45	10/05/2020	08:45
10/05/2020	09:00	10/19/2020	09:45
10/19/2020	10:15	11/02/2020	10:15
11/02/2020	10:45	11/12/2020	11:00
11/12/2020	11:15	11/30/2020	09:45
11/30/2020	10:00	12/14/2020	10:45
12/14/2020	11:15	01/07/2021	11:00

*** A sonde was deployed during deployments denoted with an asterisk but due to a malfunction no data was collected.**

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

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 collects 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.

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 data sondes. The program supports 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 EXO-2 Sonde:
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 Level - Shallow (Depth)
Units: feet or meters (ft or m)
Sensor Type: Stainless steel strain gauge
Range: 0 to 33 ft (10 m)
Accuracy: +/- 0.013 ft (0.004 m)
Resolution: 0.001 ft (0.001 m)

Parameter: pH
Units: pH units
Sensor Type: Glass combination electrode
Model#: 599701(guarded) or 599702(wiped)
Range: 0 to 14 units
Accuracy: +/- 0.1 units within +/- 10° of calibration temperature, +/- 0.2 units for entire temperature range
Resolution: 0.01 units

Parameter: Turbidity
Units: formazin nephelometric units (FNU)
Sensor Type: Optical, 90-degree scatter
Model#: 599101-01
Range: 0 to 4000 FNU
Accuracy: 0 to 999 FNU: 0.3 FNU or +/-2% of reading (whichever is greater); 1000 to 4000 FNU +/-5% of reading
Resolution: 0 to 999 FNU: 0.01 FNU, 1000 to 4000 FNU: 0.1 FNU

Parameter: Chlorophyll
Units: micrograms/Liter
Sensor Type: Optical probe
Model#: 599102-01

Range: 0 to 400 ug/Liter
Accuracy: Dependent on methodology
Resolution: 0.1 ug/L chl a, 0.1% FS

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

Depth Qualifier:

The NERR System-Wide Monitoring Program utilizes YSI data sondes that can be equipped with either vented or non-vented depth/level sensors. Readings for both vented and non-vented sensors are automatically compensated for water density change due to variations in temperature and salinity; but for all non-vented depth measurements, changes in atmospheric pressure between calibrations appear as changes in water depth. The error is equal to approximately 1.02 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.

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
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

STATION 09			Post Deployment Calibration Values		
Date In	Date Out	SpCond (50mS/cm)	DO%	pH (7)	Turb (0 NTU)
01/01/2020	01/21/2020	***	93.5	7.12	0.36
01/21/2020	02/11/2020	49.68	99.3	7.11	0.32
02/11/2020	02/25/2020	50.46	99.2	6.99	1.31
02/25/2020	03/10/2020	49.52	97.2	7.14	0.41
03/10/2020	04/16/2020	55.09	92.3	7.14	0.49
04/16/2020	05/19/2020	46.4	86.7	7.00	0.09
05/19/2020	06/11/2020	49.64	90.5	6.92	-0.22
06/11/2020	06/29/2020	48.75	100.9	6.99	1.49
06/29/2020	08/04 /2020	16.43**	93.2	7.16	2.69
08/04/2020	08/17/2020	49.61	99.1	7.22	1.39
08/17/2020	09/15/2020	49.04	97.9	7.14	-0.36
09/15/2020	09/28/2020	49.67	98.8	7.08	0.09
09/28/2020	10/13/2020	49.36	98.3	8.93*	0.92
10/13/2020	10/26/2020	49.08	92.1	7.78*	1.54
10/26/2020	11/05/2020	49.99	99.0	7.05	0.68
11/05/2020	11/24/2020	49.69	98.1	7.05	0.61
11/24/2020	12/02/2020	49.90	99.8	7.04	0.67
12/07/2020	12/18/2020	49.52	101.3	7.22	-0.83
12/18/2020	01/19/2021	49.89	98.0	7.11	0.15

STATION 10		Post Deployment Calibration Values			
Date In	Date Out	SpCond (50mS/cm)	DO%	pH (7)	Turb (0 NTU)
01/01/2020	01/21/2020	9.57*	98.5	7.12	0.04
01/21/2020	02/07/2020	49.36	99.5	7.03	0.53
02/07/2020	02/25/2020	50.50	97.1	7.03	1.09
02/25/2020	03/10/2020	49.76	99.2	7.11	-0.32
03/10/2020	04/16/2020	*	96.0	7.14	1.00
04/16/2020	05/19/2020	27.62**	98.2	6.90	-0.03
05/19/2020	06/11/2020	*	125.8	6.93	-0.38
06/11/2020	06/29/2020	48.88	104.1	6.99	-0.14
06/29/2020	08/04 /2020	49.97	99.8	7.00	-0.34
08/04/2020	08/17/2020	49.20	98.6	7.02	0.19
06/11/2020	06/29/2020	48.75	100.9	6.99	1.49
06/29/2020	08/04 /2020	16.43**	93.2	7.16	2.69
08/04/2020	08/17/2020	49.61	99.1	7.22	1.39
08/17/2020	09/15/2020	49.04	97.9	7.14	-0.36
09/15/2020	09/28/2020	49.67	98.8	7.08	0.09
09/28/2020	10/13/2020	49.36	98.3	8.93*	0.92
***10/13/2020	10/26/2020	49.75	99.9	7.14	-0.45
10/26/2020	11/05/2020	49.09	98.5	7.09	0.24
11/05/2020	11/23/2020	49.30	99.0	7.06	0.01
11/23/2020	12/07/2020	50.01	100.2	6.96	0.38
12/07/2020	12/18/2020	50.09	101.8	7.07	0.27
12/18/2020	01/19/2021	49.77	99.2	7.11	0.18

STATION 19		Post Deployment Calibration Values			
Date In	Date Out	SpCond (50mS/cm)	DO%	pH (7)	Turb (0 NTU)
01/01/2020	01/21/2020	49.09	98.4	7.13	-0.08
01/21/2020	02/07/2020	49.45	97.7	7.08	0.09
02/07/2020	02/25/2020	50.34	99.4	7.02	-0.07
02/25/2020	03/10/2020	33.0*	98.7	7.12	0.49
03/10/2020	04/16/2020	46.63	100	7.16	0.42
04/16/2020	05/19/2020	16.26**	98.1	7.01	0.33
05/19/2020	06/11/2020	49.90	99.6	7.03	0.28
06/11/2020	06/29/2020	39.95**	96.6	6.97	-0.56
06/29/2020	08/04 /2020	49.92	99.3	7.09	0.58
08/04/2020	09/01/2020	49.0	98.5	7.00	0.11
09/01/2020	09/21/2020	47.89	98.4	6.99	0.28
09/21/2020	10/05/2020	49.75	99.9	7.14	-0.45
10/05/2020	11/02/2020	50.28	100	7.07	0.36
11/02/2020	11/12/2020	49.99	101.8	7.08	0.63
11/12/2020	11/30/2020	50.04	100.7	7.08	0.34

11/30/2020	12/14/2020	49.97	99.6	7.14	0.16
12/14/2020	01/07/2021	49.11	100.5	7.10	0.12

STATION 20		Post Deployment Calibration Values			
Date In	Date Out	SpCond (50mS/cm)	DO%	pH (7)	Turb (0 NTU)
01/01/2020	01/21/2020	7.36*	99.0	7.14	0.09
01/21/2020	02/07/2020	49.20	100	7.08	-0.07
02/07/2020	02/25/2020	34.71*	98.0	7.12	1.02
02/25/2020	03/10/2020	50.04	99.8	7.18	0.54
03/10/2020	04/16/2020	*	101.9	7.15	0.61
04/16/2020	05/19/2020	49.45	95.0	6.98	0.17
05/19/2020	06/11/2020	45.2**	99.1	6.98	-0.38
06/11/2020	06/29/2020	47.27**	99.1	7.01	-0.49
06/29/2020	08/04 /2020	***	98.9	7.14	0.78
08/04/2020	09/01/2020	6.69**	97.6	7.16	0.68
09/01/2020	09/21/2020	49.22	98.0	7.59	0.50
09/21/2020	10/05/2020	49.78	105.3	7.46	0.03
10/05/2020	10/19/2020	45.7	79.1	7.20	0.33
10/19/2020	11/02/2020	49.90	100.3	7.11	0.24
11/02/2020	11/12/2020	64.54*	58	7.15	0.38
11/12/2020	11/30/2020	49.31	99.8	7.00	0.10
11/30/2020	12/14/2020	50.00	99.8	7.08	0.13
12/14/2020	01/07/2021	49.10	101.4	7.11	0.54

***Bad sensor, **Fouling, ***No Data**

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:

JOB09WQ: New Conductivity sensor 19J105131 for 14K101410 EXO sonde on 02/03/2020.
JOB09WQ: From 04/07/2020 at 04:15 to 04/16/2020 at 11:30 Conductivity/Temp sensor, (1, CBF)
JOB09WQ: Change Conductivity sensor 19J105131 by 19J105129 from 14K101409 EXO sonde on 05/15/2020.
JOB09WQ: Repair Conductivity sensor 19J105132 put on 14K101410 EXO sonde on 11/18/2020.

JOB10WQ: New Conductivity sensor 19J105132 for 14K101406 EXO sonde on 12/16/2019
JOB10WQ: New Conductivity sensor 16F101025 for 14K101406 EXO sonde on 02/04/2020

JOB10WQ: Change Conductivity sensor 19J105128 by 19J105131 from 14K101406 EXO on 06/26/2020.

JOB19WQ: New Conductivity sensor 19J105129 for 14K101407EXO sonde on 12/03/2019.
JOB19WQ: Change Conductivity sensor 19J105129 by 19J105131 from 14K101407 EXO on 04/15/2020.
JOB19WQ: Change Conductivity sensor 19J105131 by 16B101677 from 14K101407 EXO on 06/08/2020.
JOB19WQ: Change Conductivity sensor 16B101677 by 16F101023 from 14K101407 EXO on 07/07/2020.
JOB19WQ: New Conductivity sensor 19J105127 for 14K101407 EXO sonde on 11/10/2020.

JOB20WQ: New Conductivity sensor 19J105130 for 13J101770 EXO sonde on 12/16/2019.
JOB20WQ: New Conductivity sensor 19J105128 for 13J101770 EXO sonde on 02/04/2020.
JOB20WQ: Change Conductivity sensor 16F101025 by 19J105128 from 14K101406 EXO on 05/15/2020.
JOB20WQ: Change Conductivity sensor 19J105128 by 19J105131 from 14K101406 EXO on 06/26/2020.
JOB20WQ: New Conductivity sensor 20E101973 for 13J101771 EXO sonde on 11/10/2020.

DO Data comments:

JOB09WQ: New Optical DO Membrane 16E101490 for 13K1002082 sensor on 13J101771 EXO sonde on 12/03/2019.

JOB10WQ: New Cap Kit membrane(16E101515) for 16J100237 sensor on 16J100690 EXO sonde on 12/03/2019**.**
JOB10WQ: New DO sensor 16F103426 on 14K101407 EXO sonde on 10/21/2020.

JOB19WQ: New Optical DO Membrane 18C105454 for 17L100579 sensor on 17L101173 EXO sonde on 10/27/2020.

JOB10WQ: New DO sensor 18C104348 on 14K101409 EXO sonde on 12/08/2020.

JOB20WQ:

pH Data comments:

JOB09WQ: New pH Unguarded sensor 19L100361 for 15G101000 sensor on 14K101410 EXO sonde on 12/16/2019
JOB09WQ: New pH Unguarded tip 19L101361 on 18D104344 sensor on 13J101770 EXO sonde on 10/07/2020.

JOB10WQ: New pH Unguarded sensor 19L100528 for 14K101593 sensor on 16J100690 EXO sonde on 12/03/2019.

JOB19WQ: New pH Unguarded sensor 19L100361 for 17L100028 sensor on 17L101173 EXO sonde on 12/17/2019.
JOB19WQ: New pH Unguarded sensor 19L100361 for 15G101000 sensor on 14K101410
JOB19WQ: New pH sensor 19L101548 on 14K101407 EXO sonde on 11/10/2020.
JOB19WQ: New pH sensor 19L101547 on 16J100690 EXO sonde on 11/24/2020.

JOB20WQ: New pH Unguarded sensor 18K100370 for 14K101595 sensor on 14K101406 EXO sonde on 02/12/2019.

New pH Unguarded sensor 19L100528 for 14K101359 sensor on 15G100841 EXO sonde on 12/03/2019.
New pH Unguarded sensor 19J105128 for 18D104344 sensor on 13J101770 EXO sonde on 12/16/2019.

JOB20WQ: New pH sensor 19L101549 for 13J101771 EXO sonde on 07/07/2020.

JOB20WQ: Change pH sensor 19L101528 by 19L101550 on 15G100841 from 14F101406 EXO sonde on 08/25/2020.

JOB20WQ: New pH Unguarded tip 19L100361 on 19L101550 sensor on 15G100841 EXO sonde on 10/14/2020.

Turbidity Data comments:

JOB09WQ: New Turbidity sensor 19K104038 on 13J101771 EXO sonde on 12/01/2020.

JOB10WQ:
JOB19WQ:
JOB20WQ:

Depth Data Comments (CSM):

JOB09WQ: From 3/10/2020 at 11:30 to 04/16/2020 11:30 to depth data are marked 1 GSM CWD and other parameters are marked 0 GSM CWD. The sonde appears to have been at the wrong depth during this deployment. We are unsure of the cause.

Notes:

JOB09WQ: From 02/11/2020 at 11:00 to 02/25/2020 at 10:15 <-2> GIM

JOB09WQ: 03/03/2020 at 11:34 change battery. Field maintenance/ cleaning

JOB09WQ: On 05/10/2020 at 21:00 to 5/19 at 10:15, Conductivity sensor showed low values (<-3> [SSD] (CSM)) sensor drift due to minerals deposition and clogging from an extended deployment due to curfew limitations.

JOB09WQ: On 06/08/2020 at 13:45 to 06/11 at 10:00, Conductivity sensor showed low values (<-3> [SSD] (CSM)) sensor drift due to minerals deposition and clogging from an extended deployment due to curfew limitations.

JOB09WQ: From 07/20/2020 at 07:45 to 08/01/2020 at 22:45, Conductivity sensor showed low values. When Return to laboratory the sensor had a pin broken. Part of the pin stay in the bulkhead. Affected Cond/Sal, DO and Depth.

JOB09WQ: Repair EXO WIPER sensor 14K100031 put on 14K101410 EXO sonde on 11/18/2020.

JOB09WQ: From 11/23/2020 at 11:45 to 11/24/2020 at 10:00, (-2, GPF) low battery on 15G100841 EXO sonde.

JOB10WQ: From 02/07/2020 at 11:15 to 02/25/2020 at 09:30 <-2> GIM

JOB10WQ: From 03/10/2020 at 11:30 to 04/16/2020 at 10:30 Conductivity/Temp sensor, (-3, SSM) sensor malfunction.

JOB10WQ: From 05/02/2020 at 16:45 to 05/19/2020 at 09:45 Conductivity sensor showed low values (<1> [SPC] (CSM), <-3> [SPC] (CSM)) sensor drift due to minerals deposition and clogging from anextended deployment due to curfew limitations. There was potential fouling from fish or crabs. The post for this data read 27.62 (50).

JOB10WQ: From 05/22/2020 at 09:45 to 06/11/2020 at 9:30 Conductivity/Temp sensor, (-3, SCM) sensor malfunction, minerals deposition and clogging of Conductivity

sensor from an extended deployment due to curfew limitations. All data except turbidity were rejected (<-3, > (CSM)) as per SOP's.

JOB10WQ: Repair EXO WIPER sensor 14K100028 put on 14K101408 EXO sonde on 11/18/2020.

JOB19WQ: From 02/28/2020 at 13:15 to 03/10/2020 at 09:15 Conductivity/Temp sensor, (-3, SSM) sensor malfunction.

JOB19WQ: From 03/30/2020 at 05:30 to at 19:30 Conductivity/Temp sensor, (-3, SSM) sensor malfunction

JOB19WQ: From 04/16/2020 at 11:30 to 05/19/2020 at 12:45 Conductivity sensor showed low values (<-3> [SSD] (CSM)) sensor drift due to minerals deposition and clogging from an extended deployment due to curfew limitations.

JOB19WQ: From 06/23/2020 at 3:45 to 06/29/2020 at 8:56 Conductivity sensor showed low values. The post for this data read 39.95 (50).
<-3> [SPC] (CSM

JOB19WQ: From 10/25/2020 at 10:15 to 11/02/2020 at 09:30 Conductivity/Temp sensor, (-3, SSM) sensor malfunction.

JOB19WQ: From 11/18/2020 at 17:00 to 11/12/2020 at 10:30 Conductivity/Temp sensor, showed low values (1, CBF).

JOB20WQ: From 01/01/2020 at 07:30 to 01/21/2020 at 09:00 Conductivity/Temp sensor, (-3, SSM) sensor malfunction.

JOB20WQ: From 02/07/2020 at 10:00 to 02/25/2020 at 08:45 <-2> GIM

JOB20WQ: From 03/11/2020 at 12:45 to 04/16/2020 at 09:15 Conductivity sensor, (-3, SSM) sensor drift due to minerals deposition and clogging from an extended deployment due to curfew limitations.

JOB20WQ: From 05/19/2020 at 11:15 to 06/11/2020 at 11:45 Conductivity sensor showed low values (<-3> [SPC] (CSM)) sensor drift due to minerals deposition and clogging from an extended deployment due to curfew limitations. The post calibration reading was 45 (50).

JOB20WQ: From 07/29/2020 at 15:00 to 08/04/2020 at 09:00, stop reading good Conductivity sensor. When return to laboratory the sensor had a pin broken. Part of the pin stay in the bulkhead. Affected Cond/Sal.

JOB20WQ: From 10/05/2020 at 09:30 to 10/19/2020 at 09:45 Conductivity sensor, (-3, SSD)

JOB20WQ: All Data from 10/19/2020 at 10:15 to 11/02/2020 at 10:15 Conductivity sensor, (-3, SSD)

JOB20WQ: All Data from 11/02/2020 at 10:45 to 11/12/2020 at 11:00 Conductivity sensor, (-3, SSD)

Other:

A curfew was in effect from 03/13/20 to 12/31/20 limiting our programmed sonde swap and maintenance schedules. That resulted in extended deployments that affected some of the conductivity sensors. There was significant mineral deposition on the conductivity sensor that clogged the electrodes causing a drift on the values. This does not seem to affect other parameters. Sensors were soaked on vinegar and cleaned for future deployments.

Saharan dust "Godzilla" Event:
During June 22 to June 23 PAR a record arrival of Saharan Dust affected Puerto Rico and the Caribbean. The event was called Godzilla and had no precedent. Air quality reached unhealthy

rates, also reduced visibility to 3-5 miles. It is knowing that dust deposition may increase phytoplankton productivity. These may eventually have affected water quality but no correlation has made so far with this dataset.

Sargasso arrival events:
From April to June 2020 we observed significant *Sargassum sp.* beaching/arrivals. These is a floating brown algae that has been observed more frequent since 2011 with peaks on 2015 and 2019. Stations 10 and 19 are more prone to its effects by experiencing direct accumulation over the instrument (ex. St 09) and sensing water quality degradation (ex. St 09 and St 19). We observed lowest Dissolved Oxygen and pH values due to the high decomposition of the algae die-off and high turbidity values. Due to low currents at station 10, the detritus persists for long periods of time and may affect water quality especially when a boat or high wind conditions disturb the bottom.

Significant rain events:

Date	Precipitation (mm)	Event associated with
03/23/2020	11.4	
07/07/2020	13.0	
07/16/2020	15.5	
07/30/2020	44.5	Isaías Tropical Storm
08/22/2020	58.2	Laura Tropical Storm
09/19/2020	10.4	
09/30/2020	26.4	
10/02/2020	24.4	
10/06/2020	18.03	
10/16/2020	21.59	
10/18/2020	10.92	
11/10/2020	24.1	
11/11/2020	80.0	
11/12/2020	27.4	
11/23/2020	21.8	