Great Bay (GRB) NERR Water Quality Metadata

April - December 2016

Latest update: August 28, 2017

I. Data Set & Research Descriptors

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

3. Research Objectives

YSI 6600 and EXO2 datasondes were deployed in Great Bay and in the Squamscott, Oyster and Lamprey Rivers as part of the National Estuarine Research Reserves' (NERRS) System-wide Monitoring Program (SWMP). The goal is to develop and maintain temporally intensive long-term datasets of physio-chemical parameters of water quality at locations that are representative of the Great Bay Estuarine System. The Great Bay site is relatively unimpacted, while the three tidal river sites (Lamprey, Oyster and Squamscott) have large drainage basins and are impacted by both point (wastewater treatment plants) and nonpoint sources of pollution. In addition to establishing a baseline of water quality, and understanding the spatial and temporal variability of important indicators of estuarine water quality, the data is used by a number of researchers in the analysis of physical and biological processes.

4. Research Methods

Datasondes are programmed to obtain measurements of specific conductivity,

salinity, dissolved oxygen, percent saturation, pH, temperature, water level,

and turbidity every 15 minutes. Sondes used in 2016 were model 6600 or EXO2 sondes equipped with non-vented depth sensors. The instruments are deployed continuously during ice-free seasons, except for brief periods when they are removed for cleaning, maintenance and recalibration. Pre and post-deployment calibrations are performed using the diagnostics menu of the YSI Ecowatch or Kor programs and QA/QC procedures developed by NERR Research Coordinators and YSI engineers. YSI conductivity and pH standards are used for calibration. YSI turbidity standard is used to calibrate turbidity probes.

During each deployment field measurements of temperature, salinity and dissolved oxygen are recorded using a YSI PRO field meter.

A Sutron Sat-Link2 transmitter was in use at the Oyster River station and transmits data to the NOAA GOES satellite, NESDIS ID #3B03437E. 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/get/export.cfm

The Great Bay sonde was deployed at 0.5 meters off the bottom in a PVC tube that was attached to the stem of a mushroom anchor. This site does not currently have telemetry. The sonde logged successfully during the reporting period.

The Lamprey and Squamscott River sondes were deployed inside piling mounted PVC tubes at 0.5 meters off the bottom. Both Lamprey and Squamscott River sondes were telemetered via Nexsens transmitters using cellular technology.  These telemetry systems operated successfully during most of the reporting period.

Due to shallow depths and narrow channels, the Oyster River sonde has to be deployed with the least amount of vertical expression above bottom. This was achieved by mounting the sonde inside a short PVC tube that was attached to the stem of a mushroom anchor. This allows for the sonde to be stationed in an upright position, while the anchor is less susceptible to dragging than the previous deployment method. The sonde was deployed at 0.3 meters off the bottom. It was telemetered via a Sutron GOES satellite telemetry system. The system functioned properly throughout most of the reporting period.

5. Site Location and Character

Site #1 Great Bay (GB)

Location: Central area of Great Bay proper.

The coordinates of the deployment are 43 04' 20" N latitude and 70 52' 10" W

longitude.

Salinity range: 5-32 ppt (seasonally); 0-5ppt from high to low tide.

Temperature range: -1C to 24C (seasonally); 0-3 ( from high to low tide)

Depth: 6.5 meters at MLW

Tidal height of 2.7 meters

Bottom type: Mud and rock channel bottom

Tidal velocity: maximum 50 cm/sec

Watersheds: Squamscott, Lamprey and Winnicut Rivers plus smaller

streams. High tide influence from Little Bay and associated rivers

Pollutant influence: clean reference site

Site #2 Squamscott River (SQ)

Location: Mid channel of the Squamscott River at the Boston and Maine Railroad

bridge, Stratham, NH.

Coordinates are 43 02' 30" N latitude and 7055' 20" W longitude

Salinity range: 0-30ppt (seasonally); 5-20 ppt from high to low tide.

Temperature range: -1 C to 27 C (seasonally);difference of 0-5( from high to

low tide)

Depth: 3.5 meters at MLW

Tidal height of 2.7 m

Bottom type: Mud/oyster channel bottom

Tidal velocity: maximum 50 cm/sec

Watersheds: Exeter River, adjacent marshes

Pollutant influence: Urban stormwater, agriculture, two municipal

wastewater treatment plants, residential septic systems

Site #3 Lamprey River (LR)

Location: West bank of the tidal portion of the Lamprey River, approximately 300 m downstream of the dam at Route 108 in Newmarket, NH.

Coordinates are 43 04' 48" N latitude and 70 56' 04" W longitude.

Salinity range 0 - 27 ppt (seasonally); difference of up to 15 ppt between high and low tides.

Temperature range -1C to 27C( (seasonally); difference of up to 5C between

high and low tides.

Depth: 3.5 m

Tidal height 2.7 m

Bottom type: mud/rock

Tidal velocity: maximum 40 cm/sec

Watershed: Lamprey River

Pollutant influence: Urban stormwater, adjacent marina, upstream and downstream wastewater treatment plants, upstream agriculture

Site #4 Oyster River (OR)

Location: in the center channel of the tidal portion of the Oyster River,

approximately 300 m downstream of the head of tide dam adjacent to Jackson’s

Landing in Durham, NH.

Coordinates are 43° 8' 2.40 N latitude 70° 54' , 39.60 W

longitude

Salinity range 0 –32ppt (seasonally); difference of up to 15 ppt between high and low tides

Temperature range -1C to 27C( (seasonally); difference of up to 5°C between high and low tides

Depth: 0.3 m at mlw, 3 m at highest high tides

Tidal height 2.7 m (maximum)

Bottom type: mud

Tidal velocity: maximum 40 cm/sec

Watershed: Oyster River

Pollutant influence: urban stormwater, mooring field and crew dock, downstream wastewater treatment plant, upstream agriculture, residential on-site sewage disposal.

SWMP Station Timeline

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Station Code | SWMP Status | Station Name | Location | Active Dates | Reason Decommissioned | Notes |
| grbgbwq | P | Great Bay | 43° 4' 19.92 N, 70° 52' 9.84 W | 07/01/1995 00:00 –current | NA | NA |
| grblrwq | P | Lamprey River | 43° 4' 48.00 N, 70° 56' 3.84 W | 10/01/1998 00:00 - current | NA | NA |
| grborwq | P | Oyster River | 43° 8' 2.40 N, 70° 54' 39.60 W | 04/01/2002 00:00 –current | NA | NA |
| grbsqwq | P | Squamscott River | 43° 2' 29.76 N, 70° 55' 19.20 W | 07/01/1997 00:00 – current | NA | NA |

6. Data collection period

Great Bay data collection began March 31, 2015 at 1000.

Squamscott River data collection began March 31, 2015 at 1015.

Lamprey River data collection began April 6, 2016 at 930.

Oyster River data collection began April 6, 2016 at 1200.

The instruments are removed from the water during the winter months due to non-navigable conditions caused by ice and the removal of channel markers. Icing is particularly severe in the rivers and is harmful to instruments, boats and telemetry equipment.

DEPLOYMENT DATES 2016

GREAT BAY

Deploy date and time Retrieve date and time

03/31/2016 10:00 4/20/2016 09:45

4/20/2016 10:00 05/18/2016 09:30

05/18/2016 09:45 06/17/2016 09:45

06/17/2016 10:00 07/13/2016 14:00

07/14/2016 14:30 08/15/2016 13:45

08/16/2016 08:30 09/15/2016 09:45

09/15/2016 10:00 10/14/2016 11:30

10/14/2016 11:45 11/04/2016 10:30

11/04/2016 11:00 12/01/2016 06:30

LAMPREY RIVER

Deploy date and time Retrieve date and time

04/06/2016 09:30 05/04/2016 12:45

05/04/2016 13:00 05/31/2016 11:30

05/31/2016 11:45 06/28/2016 08:30

06/28/2016 08:45 07/27/2016 09:30

07/27/2016 09:45 08/29/2016 11:30

08/29/2016 11:45 09/27/2016 11:45

09/27/2016 12:00 11/01/2016 14:30

11/01/2016 14:45 12/06/2016 09:15

OYSTER RIVER

Deploy date and time Retrieve date and time

04/06/2016 12:00 05/03/2016 12:30

05/03/2016 12:45 05/31/2016 09:30

05/31/2016 09:45 06/27/2016 05:15

06/27/2016 05:30 07/28/2016 07:00

07/28/2016 07:15 08/30/2016 10:00

08/30/2016 10:15 09/28/2016 12:15

09/28/2016 12:30 11/02/2016 14:00

11/02/2016 14:15 12/12/2016 11:00

SQUAMSCOTT RIVER

Deploy date and time Retrieve date and time

03/31/2016 10:15 04/18/2016 12:15

04/18/2016 12:30 05/17/2016 12:00

05/17/2016 12:15 06/15/2016 11:30

06/15/2016 11:45 07/14/2016 12:15

07/14/2016 12:30 08/15/2016 13:45

08/15/2016 14:00 09/15/2016 12:00

09/15/2016 12:15 10/14/2016 12:00

10/14/2016 12:15 12/05/2016 10:00

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 2012.

Also include the following excerpt in the metadata which will address how and where the data can be obtained.

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

8. Associated researchers and projects:

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

Evaluation of remote data acquisition technologies and advanced water quality sensors. Dr. Richard Langan, CICEET director, and Jeremy LeClair, U.N.H. Funded by CICEET.

Advanced optical monitoring technologies. Ru Morrison. Funded by Center for Ocean Observing and Analysis, U.N.H.

Smelt spawning studies. Kathy Mills, NH Fish & Game, and David Berlinsky, U.N.H. Funded by by NOAA Office of Protected Resources via a sub-contract from Maine Department of Marine Resources

Comprehensive water quality, organic nitrogen and photosynthetically active radiation (PAR) monitoring studies – Dr. Jonathan Pennock, Jackson Estuarine Laboratory. Supported by the New Hampshire Estuaries Project

Eelgrass modeling studies - Dr. Fred Short, Jackson Estuarine Laboratory. Supported by the New Hampshire Estuaries Project and the New Hampshire Port Authority.

Bathymetric modeling and tidal elevation studies conducted by the NOAA – Dr. Larry Mayer, UNH Center for Coastal Ocean Mapping. Supported by the UNH-NOAA Joint Hydrographic Center.

Oyster reef mapping and restoration – Dr. Ray Grizzle, Jackson Estuarine Laboratory. Supported by NH Fish and Game, the NOAA-UNH Joint Hydrographic Center and the Center for Coastal and Ocean Mapping.

Microbial source tracking studies using ribotyping - Dr. Stephen Jones, Jackson Estuarine Laboratory. Supported by NH DES, NHEP and CICEET

Lobster migration and behavior research - Dr. Winsor Watson and Dr. Hunting Howell, UNH Zoology Department. Ten years of studies supported by USDA and Sea Grant that track lobster abundance, movement and behavior in relation to physical and biological variables in the Great Bay Estuary.

EPA national Coastal Assessment Program - Dr. Stephen H. Jones, Jackson Estuarine Laboratory. Funded by the US-EPA.

Anadramous and juvenile fish population assessments – Cheri Patterson, NH Fish and Game Department and Great Bay NERRS. Supported by NH Fish and Game.

II. Physical Structure Descriptors

1. Sensor specifications

YSI 6600 model sondes with ROX DO sensors were deployed at the GB site for all of 2016. YSI EXO2 sondes were deployed at LR, OR and SQ for all of 2016.

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, polargraphic

Model#: 6562

Range: 0 to 500% air saturation

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

Resolution: 0.1% air saturation

or

Sensor Type: Optical probe w/ mechanical cleaning

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

Resolution: 0.1% air saturation

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

Units: milligrams/Liter (mg/L)

Sensor Type: Rapid Pulse - Clark type, polargraphic

Model#: 6562

Range: 0 to 50 mg/L

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

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

Resolution: 0.01 mg/L

or

Units: milligrams/Liter (mg/L)

Sensor Type: Optical probe w/ mechanical cleaning

Model#: 6150 ROX

Range: 0 to 50 mg/L

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

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

Resolution: 0.01 mg/L

Model#: 6150 ROX

Range: 0 to 500% air saturation

Parameter: Non-vented Level - Shallow (Depth)

Units: feet or meters (ft or m)

Sensor Type: Stainless steel strain gauge

Range: 0 to 30 ft (9.1 m)

Accuracy: +/- 0.06 ft (0.018 m)

Resolution: 0.001 ft (0.001 m)

Parameter: pH – bulb probe or EDS flat glass probe

Units: pH units

Sensor Type: Glass combination electrode

Model#: 6561 or 6561FG

Range: 0 to 14 units

Accuracy: +/- 0.2 units

Resolution: 0.01 units

Parameter: Turbidity

Units: nephelometric turbidity units (NTU)

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

Model#: 6136

Range: 0 to 1000 NTU

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

Resolution: 0.1 NTU

Parameter: Chlorophyll Fluorescence

Units: micrograms/Liter

Sensor Type: Optical probe w/ mechanical cleaning

Model#: 6025

Range: 0 to 400 ug/Liter

Accuracy: Dependent on methodology

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

YSI EXO Sonde:

Parameter: Temperature

Units: Celsius (C)

Sensor Type: CT2 Probe, Thermistor

Model#: 599870

Range: -5 to 50 C

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

Resolution: 0.01 C

Parameter: Conductivity

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

Sensor Type: CT2 Probe, 4-electrode cell with autoranging

Model#: 599870

Range: 0 to 200 mS/cm

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

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

Parameter: Salinity

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

Sensor Type: CT2 probe, Calculated from conductivity and temperature

Range: 0 to 70 psu

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

Resolution: 0.01 psu

OR

Parameter: Temperature

Units: Celsius (C)

Sensor Type: Wiped probe; Thermistor

Model#: 599827

Range: -5 to 50 C

Accuracy: ±0.2 C

Resolution: 0.001 C

Parameter: Conductivity

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

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

Model#: 599827

Range: 0 to 100 mS/cm

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

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

Parameter: Salinity

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

Model#: 599827

Sensor Type: Wiped probe; Calculated from conductivity and temperature

Range: 0 to 70 ppt

Accuracy: ±2% of the reading or 0.2 ppt, whichever is greater

Resolution: 0.01 psu

Parameter: Dissolved Oxygen % saturation

Sensor Type: Optical probe w/ mechanical cleaning

Model#: 599100-01

Range: 0 to 500% air saturation

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

Resolution: 0.1% air saturation

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

Units: milligrams/Liter (mg/L)

Sensor Type: Optical probe w/ mechanical cleaning

Model#: 599100-01

Range: 0 to 50 mg/L

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

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

Resolution: 0.01 mg/L

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

Resolution: 0.01 units

Parameter: Turbidity

Units: formazin nephelometric units (FNU)

Sensor Type: Optical, 90 degree scatter

Model#: 599101-01

Range: 0 to 4000 FNU

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

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

Parameter: Chlorophyll

Units: micrograms/Liter

Sensor Type: Optical probe

Model#: 599102-01

Range: 0 to 400 ug/Liter

Accuracy: Dependent on methodology

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

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

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

Depth Qualifier:

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

1. Coded variable definitions:

Sampling station Site code Station code

Central Great Bay GB grbgbwq

Squamscott River SQ grbsqwq

Lamprey River LR grblrwq

Oyster River OR grborwq

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** – This section details the secondary QAQC Code definitions used in combination with the flags above. Include the following excerpt:

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 : Included in annual metadata document.

Great Bay

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Deploy Date | SpCond | ROXDO1 | pH7.02 | Turb(0) |
| 3/31/2016 | 50.55 | 102.4 | 7.06` | 0.1 |
| 4/20/2016 | 49.74 | 99.4 | 6.92 | 0.1 |
| 5/18/2016 | 49.63 | 99.3 | 7.07 | -0.3 |
| 6/17/2016 | 50.06 | 99.6 | 6.81 | 0 |
| 7/14/2016 | 49.9 | 102 | 7.06 | -0.1 |
| 8/16/2016 | 50.3 | 103.2 | 6.83 | -0.2 |
| 9/15/2016 | 49.6 | 98.3 | 6.99 | 0.5 |
| 10/14/2016 | 48.6 | 98.3 | 6.9 | 2.4 |
| 11/4/2016 | 50.5 | 104.8 | 6.98 | -0.2 |

Lamprey River

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Deploy Date | SpCond | ROXDO1 | pH7 | Turb(0) |
| 4/6/2016 | 50.32 | 99.1 | 7.08 | -0.18 |
| 5/4/2016 | 50.07 | 98.8 | 7.13 | 0.08 |
| 5/31/2016 | 50.63 | 96.6 | 7.04 | -0.44 |
| 6/28/2016 | 49.67 | 99.7 | 6.99 | 0.14 |
| 7/27/2016 | 49.88 | 102.7 | 6.98 | 0.31 |
| 8/29/2016 | 50.34 | 105.5 | 7.03 | 0.51 |
| 9/27/2016 |  | 102.6 | 7.07 | 0.26 |
| 11/1/2016 |  | 104.5 | 7.06 | 0.2 |
|  |  |  |  |  |

Oyster River

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Deploy Date | SpCond | ROXDO1 | pH7 | Turb(0) |
| 4/6/2016 | 49.85 | 100 | 7.1 | -0.5 |
| 5/3/2016 | 49.29 | 99.6 | 7.08 | 0.69 |
| 5/31/2016 | 48.7 | 105.7 | 7.11 | -0.02 |
| 6/27/2016 | 40.61 | 101.9 |  | 0.18 |
| 7/28/2016 | 49.65 | 102.6 | 7.11 | -0.19 |
| 8/30/2016 | 21 | 98.7 | 7.01 | -0.45 |
| 9/28/2016 |  |  |  |  |
| 11/2/2016 | 49.7 | 101.9 | 7.08 | -0.1 |

Squamscott River

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Deploy Date | SpCond | ROXDO1 | pH7 | Turb(0) |
| 3/31/2016 | 49.56 | 99.5 | 7.15 | 0.17 |
| 4/18/2016 | 49.82 | 94 | 7.04 | 0.16 |
| 5/17/2016 | 49.5 | 100.1 |  | 0.31 |
| 6/15/2016 | 49.89 | 96.7 | 7.05 | 0.11 |
| 7/14/2016 | 49.78 | 98.8 | 7.03 | -0.05 |
| 8/15/2016 | 54.79 | 99.2 |  | -0.48 |
| 9/15/2016 | 50.3 | 100.5 | 6.89 | 0.09 |
| 10/14/2016 |  | 105.7 | 7.06 | 0.3 |

14. Other remarks/notes

a) Slight shifts in data are sometimes correlated with sonde exchanges. These shifts are most noticeable in pH, specific conductivity and salinity, and may be related to sensor drift (e.g., due to fouling).

b) 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.

c) Unusually high dissolved oxygen values can be the result of a plankton bloom brought on by a large volume of fresh water entering the system during and after heavy rains.

1. Heavy rain can decrease salinity in the rivers to near fresh water levels. Local rainfall data can be found at <http://www.weather.unh.edu/>
2. Only turbidity data beyond the upper range of the probe was rejected in the initial QA/QC. However, based upon historical record, any recorded value over 300 NTU should be considered suspect. Turbidity probes often record readings that reflect an object passing in front of the optics that isn’t necessarily representative of overall turbidity at the site.

Remarks on {CSM} coded data:

At OR for the first deployment the sonde was in a shallower location than normal. It was located about 40 feet from the normal site. However, the depth here is significantly different. Sometimes at low tide the sensors were out of the water. All data with Depth <0.2 m was rejected. The sonde was installed at its usual location for the rest of the year.

At LR for the final deployment, which began on 11/1/2016, the CT sensor failed after the sonde was recovered. It was impossible to conduct post-calibration tests on this sensor. However the data during the deployment seem reasonable.

At SQ for the final deployment, which began on 10/14/2016, the CT sensor experienced a pin failure after the sonde was recovered. It was impossible to conduct post-calibration tests on this sensor. However the data during the deployment seem reasonable.