ACE Basin (ACE) National Estuarine Research Reserve Water Quality Metadata
January-December 2008 Report
Latest edit: 10/16/2019

I. Data Set and Research Descriptors

1) Principal investigator(s) and contact persons

Addresses:

SCDNR/Marine Resources Division
217 Fort Johnson Road
Charleston, SC 29422
(843) 953-9300

ACE Basin NERR Field Station
15717 Bennett's Point Road
Green Pond, SC 29441
(843) 844-8822

Contact Persons:

Dr. Elizabeth Wenner, Research Coordinator
E-mail: wennere@dnr.sc.gov ; (843) 953-9226
Saundra Upchurch, Reserve Biologist
E-mail: upchurchs@dnr.sc.gov ; (843) 953-9223
Justin L. Hart, Reserve Technician
E-mail: hartj@dnr.sc.gov ; (843) 953-9225
Patrick Williams, Reserve Technician
E-mail: williamsp@dnr.sc.gov; (843) 953-9225

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.Justin Hart was responsible for these tasks. For more information on QAQC flags and codes, see Sections 11 and 12.

3) Research objectives

Long-term water quality monitoring in the ACE Basin provides a unique opportunity to increase understanding of how various environmental factors influence estuarine processes. The Reserve research staff has elected to compare water quality conditions in shallow creeks along a salinity gradient and at different levels of development. Based on discussions with local Coastal Zone Management (CZM) personnel and ACE Basin NERR staff knowledge of land use within the Reserve, the South Edisto River drainage basin was selected because it is well suited for studying contrasting hydrographic conditions and land use patterns. Two tributaries, St. Pierre Creek and Fishing Creek, are in areas where boat traffic is light and development is sparse, and they are designated as "control" sites. In contrast, the two "treatment" sites are in Big Bay Creek and Mosquito Creek where boat traffic is moderate to heavy and residential and commercial development is medium to dense. The four sites also are located along the salinity gradient in the South Edisto River watershed: Big Bay Creek and St. Pierre Creek are in the polyhaline zone (18-30 ppt), Mosquito Creek is in the mesohaline zone (5-18 ppt), and Fishing Creek is in the oligohaline zone. See *Section 5 - Site Location and Character* for detailed descriptions of the sites.

The water quality monitoring program began on March 3, 1995 at Big Bay Creek and St. Pierre Creek; in October 2002, a monitoring station was established in Fishing Creek and in Mosquito Creek. Initially, YSI electronic data loggers were deployed to monitor the water temperature, specific conductance, dissolved oxygen, water level, and pH conditions, approximately 0.5 meters above the creek bottom, at 15-minute intervals; on August 11, 1995, the sampling interval was changed to 30 minutes, and turbidity monitoring was added to the program on April 11, 1996. On December 12, 2007, the sampling interval was changed to 15 minutes.

4) Research methods

One data logger is deployed at each permanent monitoring station (Big Bay, St. Pierre, Fishing Creek, and Mosquito Creek). The data logger is attached to a deployment mount at each station to ensure that the sensor is positioned approximately 0.5 m from the creek bottom during a deployment. At each monitoring station, the deployment mount consists of a PVC pipe that is attached vertically to a galvanized pole, which is driven approximately 1 m into the sediment. To facilitate water flow across the sensors, four 2" X 12" slots are cut into the PVC pipes. On October 21, 2008 a new Mosquito Creek deployment tube was installed on the original deployment mount, which was last used in August 2006. The sonde is deployed 0.5-meters from the creek bottom.

A Sutron Sat-Link2 transmitter was installed at the Saint Pierre station on 06/28/06 and transmits data to the NOAA GOES satellite, NESDIS ID #3b02f20a. (Where 3b02f20a is the GOES ID for that particular station.) 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.

To minimize fouling (i.e. settlement of barnacles and sponges) of data loggers, new sensors and sensor guards are wrapped in nonconductive copper tape. A plastic mesh is wrapped around the sensor guard to keep out large animals (i.e. crabs, fish); the mesh is coated with anti-fouling paint. In addition, fouling organisms are removed from the PVC deployment mounts during monthly inspections.

The YSI data loggers are deployed for one to two weeks during the summer months, and the sampling period is extended up to one month during the cooler months. A data logger is retrieved and replaced with a newly calibrated data logger prior to a 15-minute reading to prevent interruption of data collection. After deploying the calibrated data logger, a water sample is collected from same depth as the sensor to measure several water quality parameters (water temperature, salinity, pH, dissolved oxygen [mg/l]). Water temperature, salinity, and pH are measured directly with a thermometer, refractometer and hand-held pH meter, respectively, dissolved oxygen, expressed at mg/l, is determined with a field Winkler titration kit. Water depth and meteorological conditions (i.e. precipitation and wind speed and direction) also are recorded. The in-situ measurements are used to determine if the sensor readings drifted significantly during deployment and to evaluate anomalous readings (<28% air saturation).

When the data loggers are retrieved, they are taken to the laboratory for cleaning, post-deployment calibration checks and servicing, in accordance with guidelines set by YSI Operating and Service Manual. Upon returning to the laboratory, the data are downloaded, and the dataset is reviewed to determine if any equipment malfunctions occurred during deployment that need immediate attention. Post-deployment calibration checks of all the parameters except turbidity are done before cleaning the data loggers. Turbidity checks are performed after cleaning the data loggers to prevent contamination of the standard. Sensors are immersed in the appropriate standard solutions (i.e. pH) and readings are recorded. A DO membrane integrity test also is conducted to determine if the membrane was damaged during deployment.

A series of diagnostic values, including dissolved oxygen charge, dissolved oxygen gain, and pH millivolt value at pH 7 and at pH 10, are recorded during calibration and post-deployment calibration checks of data loggers. These diagnostic values are strong indicators of the individual sensor performance, and they are used to determine the accuracy of the data.

Before the data loggers are deployed dissolved oxygen (DO) membranes are changed and allowed to stretch for 24 hours, and the voltage of the batteries are checked. Next, the pH, conductivity, and turbidity sensors are calibrated, using the following standards: pH 7 and 10, 50 mS/cm potassium chloride solution, and 0 and 123 NTU solutions, respectively. The water level sensor is zeroed in air, and the barometric pressure in the laboratory is recorded. Before leaving the laboratory the following day, the DO sensor is calibrated in air-saturated water. In addition to the procedures outlined in the CDMO manual, we conduct a DO membrane integrity test prior to deployment to determine if the membrane was installed properly or was damaged during calibration.

5) Site location and character –

ACE Basin National Estuarine Research Reserve is one of the largest undeveloped estuaries on the East Coast. The study area encompasses the Ashepoo, Combahee and South Edisto River

basins, which empty into St. Helena Sound. The NERR consists of approximately 150,000 acres of diverse estuarine wetlands providing preserved habitats for fish and wildlife.

Three monitoring stations are tributaries of the South Edisto River and one is in a tributary of both the S. Edisto and Ashepoo rivers, contributing to freshwater input to each site. The average tidal range at all stations is approximately 2.0 m (6.5 feet), with a maximum of 2.36 m (7.8 feet) and a minimum of 1.39 m (4.6 feet). The bottom habitat at each of the four sites consists of mud intermixed with dead shell hash. The descriptions of the sites are as follow:

Big Bay - GPS coordinates: 32.4941N and -80.3241W

This monitoring station is in Big Bay Creek proper, approximately 2 km (1.24 mi) from the mouth of the creek, and is located about 5 m (16.41 ft) from the southern bank of the creek. In 2008, the mean depth at the station was 2.28 m (7.48 ft), and the mean salinity was 31.51 parts per thousand (ppt).

The Big Bay monitoring station is designated as a "treatment" site because it is subject to nonpoint source pollution and has a high density of development. The southern bank of the creek is bordered by residential and commercial development, with little setback from the bordering *Spartina* marsh. For instance, there are over forty private docks, two commercial seafood docks and a marina with 75 slips, three paved boat ramps, and two fueling areas along the southern bank. Docks and bulkheads are constructed of concrete, or creosote, CCA-treated or Wolmanized material. Boat traffic is heavy, especially during the warmer months, and the creek is closed to shellfish harvesting because of the surrounding human activities. The major sources of nonpoint source pollution are surface runoff from lawns, golf courses, and paved ramps that contain fertilizers, pesticides, herbicides and PAHs. All of the high ground along the southern bank is developed (i.e. residential homes, condominiums and restaurants); and maritime plant communities have been replaced by golf courses, lawns and ornamental gardens. Small patches of a few maritime species (i.e. live oak (*Quercus virginiana*), cabbage palmetto (*Sabal palmetto*), and Southern red cedar (*Juniperus silicicola*)) are found along the roads. In contrast, the northern bank is bordered by a wide expanse of *Spartina alterniflora* marsh, and no high ground is present. American oyster (*Crassostrea virginica*) forms a reef along the creek banks, especially the northern side, and on intertidal mud flats within the creek.

St. Pierre - GPS coordinates: 32.5233N and -80.3568W

This monitoring station is in a small tributary of St. Pierre Creek, approximately 0.25 km (0.16 mi) from the mouth of the creek, and it is about 5 m (16.41 ft) from the northern bank of the creek. The tributary flows through the southern portion of Bailey Island, and creek forms the eastern border of the island. The monitoring station is surrounded by a wide expanse of *Spartina alterniflora* marsh. Extensive mud flats and oyster reefs fringe the banks. Maritime forest communities comprised of species such as wax myrtles, live oaks, and palmettos dominate the upland areas. In 2008, the mean depth at the station was 2.71 m (8.89 ft), and the mean salinity was 30.64 parts per thousand (ppt).

The St. Pierre station is designated as a “control” site because development in the immediate area was sparse when the station was established on March 3, 1995, and the tributary is subject to relatively light boat traffic. In 1996, the 695-acre island was sold, and the owners partnered with The Nature Conservancy to design a conservation-based development. Four hundred and three acres in the center of Bailey Island were set aside as a nature preserve that is managed by The Nature Conservancy, and number of residential lots on the remaining 292 acres is limited to

67. Access to the island is limited to one bridge and all roads on the island are single lane and made of crushed seashells. In addition, a conservation manual was developed for the property owners that provide specific lot designs and construction guidelines as well as landscaping guidelines to protect the maritime and estuarine habitats.

Fishing Creek – GPS coordinates: 32.6358 N and -80.3655W

This monitoring station is in a tributary of Fishing Creek, approximately 1.79 km (1.11 mi) from the mouth of the creek, and is located approximately 5 m (16.41 ft) from the northern bank of the creek. The tributary flows through the eastern half of Jehossee Island, part of the USFWS Ernest F. Hollings ACE Basin National Wildlife Refuge, and Fishing Creek forms the northeast border of the island. The station is surrounded by extensive *Spartina cynosuroides* marsh and vast mud flats. The upland area is characterized by slash pine, live oak, and cabbage palmetto. In 2008, the mean depth at the station was 2.27 m (7.45 ft), and the mean salinity was 10.91 parts per thousand (ppt).

Fishing Creek monitoring station is designated as a "control" site because there is no development in the immediate area, and boat traffic is relatively light in the creek. The Wildlife Management Area contains impoundments (formerly rice fields) that are managed as wildlife habitat for endangered fauna and migratory waterfowl. No pesticides or herbicides are applied to the managed wetlands. Water level in the managed wetland is regulated by rice trunks that control the flow of water between the impoundment and the South Edisto River.

Mosquito Creek – GPS coordinates: 32.5558 N and -80.4380W

This monitoring station is in Mosquito Creek proper (a tributary of both the South Edisto and Ashepoo rivers), approximately 2.51 km (1.56 mi) from the Ashepoo River and 12 km (7.46 mi) from the South Edisto River, and it is about 5 m (16.41 ft) from the southern bank of the creek. In 2008, the mean depth at the station was 4.32 m (14.17 ft), and the mean salinity was 22.23 parts per thousand (ppt).

Mosquito Creek station is designated as a "treatment" site because of the land use practices in the surrounding area. Agriculture fields and impounded wetlands are found upstream of the monitoring station. Ten docks constructed of creosote, concrete and Wolmanized pilings; a public boat landing; a commercial seafood business with three commercial shrimp boats and a fueling area are located about 0.8 km (0.5 mi) downstream of the monitoring station. The major source of nonpoint source pollution to the monitoring station is surface runoff from the impoundments and agricultural lands that contain high levels of nutrients and, at times, herbicides and pesticides. Impoundment trunks open and drain into the creek increasing the nutrient load and possibly introducing herbicides and pesticides. Vegetation in the area includes salt marsh dominated by *Spartina alterniflora* and *Juncus roemerianus*. Upland fringe areas consist of cabbage palmetto, live oaks and pine trees.

6) Data collection period –

BEGAN	**ENDED**
Big Bay Site	
12/06/07 – 09:30	01/07/08 – 11:30
01/07/08 – 12:00	02/04/08 – 11:30
02/04/08 – 12:15	03/05/08 – 11:15
03/05/08 – 11:45	04/01/08 – 10:00
04/01/08 – 10:30	05/05/08 – 11:00

05/05/08 – 11:45
06/02/08 – 09:45
06/16/08 – 10:45
07/01/08 – 12:15
07/15/08 – 10:00
08/01/08 – 11:45
08/12/08 – 08:45
08/27/08 – 11:30
09/11/08 – 10:00
09/30/08 – 11:30
10/21/08 – 12:15
11/11/08 – 10:00
12/12/08 – 11:00
06/02/08 – 09:15
06/16/08 – 10:30
07/01/08 – 11:45
07/15/08 – 09:30
08/01/08 – 11:00
08/12/08 – 08:15
08/27/08 – 11:00
09/11/08 – 09:30
09/30/08 – 10:45
10/21/08 – 11:45
11/11/08 – 09:30
12/12/08 – 10:15
01/07/09 – 07:45

St. Pierre Site

12/06/07 – 10:30
01/07/08 – 11:15
02/04/08 – 11:15
03/05/08 – 12:45
04/01/08 – 09:45
05/05/08 – 10:45
06/02/08 – 11:15
06/16/08 – 11:45
01/07/08 – 11:00
02/04/08 – 10:45
03/05/08 – 12:00
04/01/08 – 09:15
05/05/08 – 10:15
06/02/08 – 10:45
06/16/08 – 11:15
07/01/08 – 11:15

No data was recorded from 07/01/08 at 11:30 thru 07/15/08 at 08:45 (logger malfunction)

07/15/08 – 09:15
08/01/08 – 12:15
08/12/08 – 08:00
08/27/08 – 10:45
09/11/08 – 09:15
09/30/08 – 12:00
10/21/08 – 11:30
11/11/08 – 10:30
12/12/08 – 11:30
08/01/08 – 11:45
08/12/08 – 07:30
08/27/08 – 10:15
09/11/08 – 08:45
09/30/08 – 11:30
10/21/08 – 11:00
11/11/08 – 10:00
12/12/08 – 11:00
01/07/09 – 08:15

Fishing Creek

12/06/07 – 11:30
01/07/08 – 13:00
02/04/08 – 13:30
03/06/08 – 11:45
04/01/08 – 11:45
05/05/08 – 13:00
06/02/08 – 12:30
06/16/08 – 12:45
07/01/08 – 13:30
07/15/08 – 11:15
08/01/08 – 13:15
01/07/08 – 12:45
02/04/08 – 13:00
03/06/08 – 11:15
04/01/08 – 11:30
05/05/08 – 12:30
06/02/08 – 11:45
06/16/08 – 12:15
07/01/08 – 13:00
07/15/08 – 10:45
08/01/08 – 12:45
08/12/08 – 09:30

08/12/08 – 10:00	08/27/08 – 12:15
08/27/08 – 12:45	09/11/08 – 10:30
09/11/08 – 11:00	09/30/08 – 12:30
09/30/08 – 13:00	10/21/08 – 13:00
10/21/08 – 13:30	11/11/08 – 11:00
11/11/08 – 11:30	12/12/08 – 12:00
12/12/08 – 12:15	01/07/09 – 09:15

Mosquito Creek

12/06/07 – 14:15	01/07/08 – 14:00
01/07/08 – 14:30	02/04/08 – 15:00
02/04/08 – 15:30	03/05/08 – 10:15
03/05/08 – 10:45	04/01/08 – 08:00
04/01/08 – 08:30	05/05/08 – 13:30
05/05/08 – 14:00	06/02/08 – 13:00
06/02/08 – 13:30	06/16/08 – 14:00
06/16/08 – 14:30	07/01/08 – 14:15
07/01/08 – 15:00	07/15/08 – 12:00
07/15/08 – 12:30	08/01/08 – 14:30
08/01/08 – 15:00	08/12/08 – 10:30
08/12/08 – 11:00	08/27/08 – 1415
08/27/08 – 14:45	09/11/08 – 12:15
09/11/08 – 12:45	09/30/08 – 14:30

No data was recorded from 09/30/08 at 14:45 thru 10/21/08 at 10:00 (site destroyed)

10/21/08 – 10:15	11/11/08 – 12:45
11/11/08 – 13:15	12/12/08 – 13:15

No data was recorded from 12/12/08 at 13:30 thru 12/18/08 at 10:45 (site destroyed)

12/18/08 – 11:15	01/07/09 – 10:15

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 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 2018.

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

Dr. Charles Wenner of SCDNR/Marine Resources Research Institute received funding through the National Marine Fisheries Service in January of 2001 to continue an ongoing survey of red drum (*Sciaenops ocellatus*) in the South Edisto and Combahee River basins, by electrofishing in tidal freshwater and low salinity brackish water. Although red drum is the target species, all species are identified to species, measured and weighed.

The ACE Basin NERR received funding from the U.S. Environmental Protection Agency to establish a National Atmospheric Deposition Program site in the Reserve. Sampling efforts began on January 1, 2002 and will continue for five years. Weekly precipitation samples are collected and analyzed for atmospheric pollutants. The precipitation collector is located on Bear Island, a Wildlife Management Area inside the NERR. This program was discontinued January 1, 2008.

In February 2006, the ACE Basin NERR installed a RASSL – Remote Access Satellite Sensor Link – transmitter unit to the deployment structure at the Mosquito Creek water quality sampling station, and in August 2006 installed an additional transmitter unit at the Big Bay station. North Star Science and Technology, funded by a CICEET grant, designed a compact and field rugged satellite communicator. The transmitter unit, compatible with YSI 6 series data sondes, communicates directly to the sonde and asks the sonde to take an additional reading once an hour. This additional reading is not stored by the data sonde and does not interfere with the scheduled SWMP data collection. The additional hourly reading is then transmitted via a satellite link. The provisional data are posted to a secure website provided and maintained by North Star Science and Technology. The RASSL project ended on January 2008 due to funding shortage.

On September 19, 2006 the Algal Ecology Lab began screening water samples from the ACE BASIN. Algal assemblages are being identified at these sites to monitor these areas and identify any harmful algal blooms. If a bloom is present, the fixed sample will be counted to determine algal density. These water samples are also being processed for HPLC (High Performance Liquid Chromatography), which will identify the pigments that are present in the water at that time, and can be later analyzed for estimates of algal community biomass. This project was discontinued October 2008.

As part of the System-wide Monitoring Program (SWMP), nutrient and weather data are gathered at the ACE NERR in conjunction with water quality data obtained by YSI 6600-EDS data loggers. Diehl nutrient samples are gathered once per month at the St. Pierre water quality monitoring station, and grab samples are obtained at each of the four sites once per month. The concentrations of the following parameters are measured and recorded for the nutrient monitoring program: ammonium (NH4), nitrite + nitrate (NO2 + NO3), ortho-phosphate (PO4), and chlorophyll-A (Chl-a). Real-time weather data is gathered 24/7 and is transmitted to the Centralized Data Management Office (CDMO). Historic water quality, nutrient, and weather data can be obtained at http://cdmo.baruch.sc.edu/QueryPages/viewstations.cfm?Site_ID=ace.

Information about other studies conducted in the ACE Basin may be obtained from the Research Coordinator.

II. Physical Structure Descriptors

9) Sensor specifications
YSI 6600EDS datalogger
Parameter: Temperature
Units: Celsius (C)
Sensor Type: Thermistor
Model #: 6560
Range: -5 to 45 °C
Accuracy: +/-0.15 °C
Resolution: 0.01 °C

Parameter: Conductivity
Units: milli-Siemens per cm (mS/cm)
Sensor Type: 4-electrode cell with auto-ranging
Model #: 6560
Range: 0-100 mS/cm
Accuracy: +/-0.5% of reading +0.001mS/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 or 0.1 ppt, whichever is greater
Resolution: 0.01 ppt

Parameter: Dissolved Oxygen % saturation
Units: percent air saturation (%)
Sensor Type: Rapid Pulse – Clark type, polarographic
Model #: 6562
Range: 0 to 500 % air saturation
Accuracy: 0-200% air saturation, +/-2%of the reading or 2% air saturation, whichever is greater; 200-500% air saturation, +/-6% of the reading
Resolution: 0.1% air saturation

Parameter: Dissolved Oxygen mg/L (Calculated from % air saturation, temperature and salinity)
Units: milligrams per Liter (mg/L)
Sensor Type: Rapid Pulse – Clark type, polarographic
Model #: 6562
Range: 0 to 50mg/L
Accuracy: 0 to 20 mg/L, +/- 2% of the reading or 0.2 mg/L, whichever is greater; 20 to 50 mg/L, +/-6% of the reading
Resolution: 0.01 mg/L

Parameter: Non-Vented Level –Shallow (Depth)
Units: feet or meters (ft or m)
Sensor Type: Stainless steel strain gauge
Range: 0 to 30 ft (9.1m)
Accuracy: +/- 0.06 ft (0.018m)
Resolution: 0.001ft (0.001 m)

Parameter: pH
Units: units
Sensor Type: Glass combination electrode; flat glass electrode
Model #: 6561; 6561FG
Range: 0-14 units
Accuracy: +/- 0.2 units
Resolution: 0.01 units

Parameter: Turbidity
Units: nephelometric turbidity units (NTU)
Sensor Type: Optical, 90 ° scatter, with mechanical cleaning
Model #: 6136
Range: 0 to 1000 NTU
Accuracy: +/-5% reading or 2 NTU (whichever is greater)
Resolution: 0.1 NTU

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.

Probe Identification:	**Standards for Calibration:**
Turbidity 6136 Probe	YSI 6073G Turbidity Standard 123 NTU
pH 116031 Probe	RICCA CHEMICAL COMPANY LLC. Buffer 7.00 and 10.00
pH 6561FG Probe	RICCA CHEMICAL COMPANY LLC. Buffer 7.00 and 10.00
Specific Conductivity 6030 Probe	YSI 3169 Conductivity Calibrator 50 mS/cm +/- 1%

10) Coded variable definitions

Sampling Station:	Sampling site code:	Station Code:
St. Pierre	SP	acespwq
Big Bay	BB	acebbwq
Fishing Creek	FC	acefcwq
Mosquito Creek	MC	acemcwq

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

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 –

Site ID	Date	DO%Air	pH (7.00)	Depth (m)	Turbid 0 NTU	SpCond 50mS/cm
BB						
	01/07/08	102.9	6.91	0.100	0.0	48.39
	02/04/08	101.2	7.29	0.052	0.4	50.34
	03/05/08	104.6	6.95	-0.443	0.2	49.92
	04/01/08	100.1	7.04	0.084	0.7	50.49
	05/05/08	102.4	7.21	-0.004	0.6	50.53
	06/02/08	99.6	7.03	-0.021	0.1	50.41
	06/16/08	99.5	7.14	-0.065	-0.6	51.21

07/01/08	101.5	6.96	0.037	6.0	48.76
07/15/08	101.6	6.75	0.002	7.3	48.56
08/01/08	102.2	6.94	-0.006	-0.2	50.59
08/12/08	98.2	7.04	-0.095	0.5	49.87
08/27/08	100.0	7.06	-0.054	-0.2	50.02
09/11/08	101.8	6.78	-0.043	0.1	50.10
09/30/08	98.8	7.01	-0.107	-0.2	49.63
10/21/08	101.7	7.03	0.115	0.2	51.37
11/11/08	97.7	6.97	-0.023	1.5	49.99
12/10/08	97.1	6.80	0.038	-0.4	50.85
01/07/09	97.4	6.99	0.068	-2.0	50.28

Site ID	**Date**	**DO%Air**	**pH (7.00)**	**Depth (m)**	**Turbid 0 NTU**	**SpCond 50mS/cm**
SP						
	01/07/08	100.3	7.03	-0.028	0.0	49.86
	02/04/08	98.3	7.01	0.045	0.1	49.81
	03/05/08	102.8	7.07	-0.082	0.7	49.92
	04/01/08	106.9	6.93	0.050	0.1	51.15
	05/05/08	104.7	7.02	-0.015	0.9	44.37
	06/02/08	101.7	6.96	-0.029	0.7	50.42
	06/16/08	100.8	7.16	-0.074	0.4	49.55
	07/01/08	COND. PROBE MALFUNCTIONED				
	07/15/08	POST CAL WAS NOT CONDUCTED				
	08/01/08	98.1	6.72	-0.019	1.7	50.99
	08/12/08	97.6	6.93	-0.106	-1.0	50.01
	08/27/08	96.8	7.01	-0.054	-0.2	50.03
	09/11/08	100.6	6.96	-0.043	0.3	49.91
	09/30/08	102.9	7.05	-0.096	0.5	49.73
	10/21/08	95.7	7.13	0.110	0.5	50.29
	11/11/08	99.8	7.04	-0.016	0.6	49.91
	12/10/08	101.4	6.94	0.021	0.0	50.34
	01/07/09	104.2	7.09	0.054	-1.8	51.08

Site ID	**Date**	**DO%Air**	**pH (7.00)**	**Depth (m)**	**Turbid 0 NTU**	**SpCond 50mS/cm**
FC						
	01/07/08	101.0	7.06	0.086	0.0	49.73
	02/04/08	99.0	7.02	0.052	0.2	50.23
	03/05/08	100.9	7.05	-0.427	0.0	50.61
	04/01/08	102.9	7.24	0.077	0.1	49.79
	05/05/08	104.7	6.98	-0.003	0.5	49.96
	06/02/08	107.9	7.24	-0.028	0.1	49.70
	06/16/08	110.7	6.94	-0.074	-0.1	49.86

07/01/08	103.8	7.02	0.040	0.4	49.84
07/15/08	72.1	7.00	-0.002	*	50.30
08/01/08	98.3	7.06	-0.023	-0.1	50.06
08/12/08	102.8	6.90	-0.090	-0.6	49.48
08/27/08	98.3	6.98	-0.055	0.1	50.02
09/11/08	103.4	7.16	-0.041	0.2	49.88
09/30/08	98.7	7.02	-0.097	-0.3	50.37
10/21/08	104.9	7.19	0.115	-0.1	50.23
11/11/08	102.5	6.99	-0.011	3.5	50.25
12/10/08	98.9	6.75	0.045	2.2	49.62
01/07/09	100.8	7.27	0.051	0.1	51.30

Site ID	Date	DO%Air	pH (7.00)	Depth (m)	Turbid 0 NTU	SpCond 50mS/cm
MC						
	01/07/08	100.3	7.03	-0.028	0.0	49.86
	02/04/08	78.2	7.00	0.039	0.2	50.56
	03/05/08	100.2	6.65	-0.089	0.3	49.93
	04/01/08	103.0	7.06	0.058	0.0	50.11
	05/05/08	102.4	7.13	0.003	0.0	49.82
	06/02/08	104.1	7.04	-0.027	-0.4	49.84
	06/16/08	96.4	7.10	-0.064	0.2	49.63
	07/01/08	99.7	6.96	0.043	0.5	49.50
	07/15/08	102.0	7.06	0.005	4.0	50.90
	08/01/08	91.3	6.95	-0.017	12.0	50.46
	08/12/08	95.3	6.99	-0.091	-0.7	50.11
	08/27/08	99.0	6.86	-0.054	-0.1	50.03
	09/11/08	101.9	6.98	-0.038	2.1	49.50
	09/25/08	104.3	6.96	-0.101	0.2	49.80
	10/21/08	STATION SITE WAS DESTROYED…SONDE NOT DEPLOYED				
	11/11/08	101.9	7.04	-0.012	0.0	50.03
	12/10/08	102.1	7.11	0.139	0.3	49.29
	01/07/09	100.8	6.89	0.056	-1.1	49.64

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.

Blanket Statement(s)

Turbidity

Turbidity sensors for all sites recorded values over 1000 NTU. These values are outside the sensor specifications and are therefore rejected with the flag <-3> and code [STS]. The cause is unknown. In addition, anomalous spikes/outliers of less than 1000 NTU were also recorded throughout the year, cause unknown. These anomalous data were flagged suspect <1> and coded [GSM] (CTS).

Turbidity sensors for all sites provided values over 1000 NTU. These values are outside the sensor specifications and the cause is unknown (Code: STS CSM). Therefore, these anomalous data points have been marked as rejected (Code: <-3>).

All Data

For the following dates & times for each site, the sonde was not at the proper deployment depth (Code: GSM CMC). The sonde was removed from the deployment mount in order to check its final reading against the newly deployed sonde's first reading in order to gather comparison data between the two sondes. This data was considered pre-deployment data <-2> because the sonde is not deployed in the tube at the correct depth.

BB

01/07/2008 11:45	08/01/2008 11:30
02/04/2008 11:45	08/12/2008 08:30
02/04/2008 12:00	08/27/2008 11:15
03/05/2008 11:30	09/11/2008 09:45
04/01/2008 10:15	09/30/2008 11:15
05/05/2008 11:30	10/21/2008 12:00
06/02/2008 09:30	11/11/2008 09:45
07/15/2008 09:45	12/12/2008 10:30
08/01/2008 11:15	12/12/2008 10:45

SP

02/04/2008 11:00	08/12/2008 07:45
03/05/2008 12:30	08/27/2008 10:30
04/01/2008 09:30	09/11/2008 09:00
05/05/2008 10:30	09/30/2008 11:45
06/02/2008 11:00	10/21/2008 11:15
06/16/2008 11:30	11/10/2008 09:30
07/15/2008 09:00	11/11/2008 10:15
08/01/2008 12:00	12/12/2008 11:15

FC

02/04/2008 13:15	08/01/2008 13:00
04/01/2008 11:30	08/12/2008 09:45
05/05/2008 12:45	08/27/2008 12:30
06/02/2008 12:00	09/11/2008 10:45
06/16/2008 12:30	09/30/2008 12:45
07/01/2008 13:15	10/21/2008 13:15
07/15/2008 11:00	11/11/2008 11:15

MC

01/07/2008 14:15	02/04/2008 15:15

03/05/2008 10:30
04/01/2008 08:15
05/05/2008 13:45
06/02/2008 13:15
06/16/2008 14:15
07/01/2008 14:45
07/15/2008 12:15
08/01/2008 14:45
08/12/2008 10:45
08/27/2008 14:30
09/11/2008 12:30
11/11/2008 13:00
12/18/2008 11:00

Big Bay

Missing Data (Code: <-2>)

a) All Data:
Data missing due to sonde being removed from water before sample was taken for the following dates and times:
05/05/2008 – 11:15
09/30/2008 – 11:00

Suspect Data (Code: <1>)

a) Depth is negative due to low barometric pressure. Values are within the probes accuracy error (Code: CAF).
03/08/2008 14:45
03/08/2008 15:00
03/08/2008 15:15
03/08/2008 15:30

Rejected Data (Code: <-3>

a) pH:
The data for the following dates and times were rejected due to a sensor malfunction (SSM). The sensor recorded an unusual increase in pH of 0.7 within a half hour of deployment. Post calibration was unacceptable at 7.29 in 7 standard.
01/07/08 – 12:00 through 02/04/08 – 12:00

The data for the following dates and times were rejected due to a sensor drift (SSD). Post calibration was unacceptable at 6.75 in 7 standard.
07/01/08 – 12:15 through 07/15/08 – 09:30

St. Pierre

Missing Data (Code: <-2>)

a) All Data:
All data missing due to sonde malfunction for the following dates and times:
07/01/2008 – 11:30 through 07/15/2008 – 08:45

b) Data missing due to sonde being removed from water before sample was taken for the following dates and times:
03/05/2008 – 12:15

Suspect Data (Code: <1>)

a) Data for the following dates and times were marked suspect (SPC) (CSM) because the post-calibration check was 44/50 and the probe was retired after this deployment. Overall the readings were similar to other deployments. Post Calibrations were acceptable.
04/01/2008 – 9:45 through 05/05/08 – 10:15

Rejected Data (Code: <-3>)

a) All Data:
All data was rejected due to a catastrophic failure of the temperature probe for the following dates and times:
06/30/2008 – 11:00 through 07/01/2008 – 11:15

b) For the following dates and times, turbidity data was rejected due to biofouling (Code: CBF). Most of the readings consistently were above 150 NTU and readings remained high until the end of deployment. Field checks showed moderate algae growth on the sensor. The probe passed post calibration checks, showing that high readings were not due to sensor malfunction.
08/23/08 – 03:30 through 08/27/08 – 10:15

c) Data at 11/10/2008 09:30 the sonde may have been pulled up by staff on site doing the monthly ISCO sampling. The depth reflects that the sonde was out of the water when they were on site. Data is marked GSM CMC.

Fishing Creek

Suspect Data (Code: <1>)

a) Depth is negative due to low barometric pressure. Values are within the probes accuracy error (Code: CAF).
2/19/2008 -- 1:00
3/8/2008 -- 14:45-15:00
3/8/2008 -- 16:30

b) Turbidity spiked (Code: CTS) during following dates & times:
03/09/2008 22:45

Rejected Data (Code: <-3>)

a) All Data:
Data was rejected during an out of water event caused by an extreme low tide. The probes were not damaged and the data for the remaining deployment were not compromised. Data for the following dates and times was rejected:
03/08/2008 – 15:15 through 03/08/2008 – 16:15
03/09/2008 – 03:30

b) DO

Data was rejected due to temporary sensor malfunctions (Code: SSM) for the following dates and times. Post calibrations were acceptable indicating the malfunction was temporary.
01/20/2008 21:45 through 01/23/2008 13:45
01/26/2008 09:30 through 01/30/2008 17:15

c) Turbidity
Data was rejected due to biofouling (Code: CBF) for the following dates and times:
06/08/2008 01:15 through 06/16/2008 12:15

d) DO
Data was rejected during the 7/1 deployment due to a wiper issue. The wiper was not installed before the sonde was deployed. This caused fouling including barnacles growing on the membrane.
07/01/08 13:30 through 07/15/08 10:45

Mosquito Creek

Missing Data (Code: <-2>)

a) All Data:
Data missing due to sonde being removed from water before samples was taken for the following dates and times:
07/01/2008 – 14:30

b) The deployment site was destroyed and the sonde was not deployed for the following dates and times:
09/30/2008 – 14:45 through 10/21/2008 – 10:00
12/12/2008 – 13:30 through 12/18/2008 – 10:45

Suspect Data (Code: <1>)

a) Depth:
The following depth data were marked suspect due to the deployment tube being destroyed on the following dates:
09/18/2008 – 08:45 through 09/30/2008 – 14:30
Depth readings began reading approximately 1-meter shallower after incident occurred.

b) pH
Data for the following dates and times were marked suspect (CCU) because deployment readings were 0.5 units greater than those of next deployment. However they were similar with the readings of previous deployments. Post Calibrations were acceptable at 6.95 in 7 standard.
01/01/2008 – 00:00 through 01/07/08 – 14:00

c) Turbidity

Data for the following dates and times were marked suspect (SWM) (CSM) because deployment readings were higher than normal and dropped by over half to the next deployment. Post Calibrations were acceptable.
04/25/2008 – 19:15 through 05/05/08 – 13:30

Rejected Data (Code: <-3>)

a) DO

Data were rejected for the following dates and times due to a sensor malfunction discovered during post-calibrations (Code: SSM). Post calibration was unacceptable at 78.2%
01/10/2008 -- 20:45 through 02/04/2008 -- 15:00

Rain Data: Bennetts Point Weather Station

Date	Total Precipitation (mm)
01/11/2008	3.4
01/12/2008	2.5
01/30/2008	2.8
01/31/2008	1.1
02/01/2008	0.3
02/05/2008	0.3
02/06/2008	1.1
02/07/2008	0.3
02/12/2008	6.9
02/13/2008	3.2
02/18/2008	21.4
02/21/2008	0.6
02/22/2008	1.8
02/23/2008	2.9
02/26/2008	9.5
03/04/2008	1.7
03/07/2008	11.8
03/08/2008	0.3
03/10/2008	0.8
03/11/2008	1.8
03/15/2008	23.5
03/19/2008	4.0
03/20/2008	1.8
04/01/2008	1.0
04/02/2008	0.3
04/03/2008	0.3
04/05/2008	12.8

04/12/2008	0.3
04/19/2008	5.6
04/20/2008	0.3
04/23/2008	1.9
04/28/2008	11.2
05/06/2008	0.5
05/09/2008	25.4
05/11/2008	4.8
05/16/2008	0.3
05/20/2008	3.6
05/21/2008	2.8
05/23/2008	13.7
05/24/2008	0.3
05/28/2008	2.8
05/29/2008	1.3
06/02/2008	9.4
06/15/2008	50.8
06/19/2008	35.1
06/20/2008	10.2
06/21/2008	1.5
06/22/2008	16.3
06/23/2008	24.4
06/29/2008	6.9
07/05/2008	4.3
07/10/2008	4.8
07/11/2008	5.6
07/14/2008	4.6
07/15/2008	23.4
07/17/2008	5.1
07/18/2008	2.3
07/21/2008	0.3
07/23/2008	1.0
07/24/2008	1.8
07/26/2008	4.6
07/31/2008	3.6
08/07/2008	17
08/08/2008	4.6
08/12/2008	1.8
08/13/2008	37.3
08/15/2008	14.5
08/16/2008	0.3
08/17/2008	1.0
08/20/2008	1.8
08/21/2008	17.5
08/22/2008	43.7
08/23/2008	68.3

08/25/2008	0.3
08/26/2008	0.3
08/31/2008	0.3
09/01/2008	6.4
09/05/2008	60.5
09/10/2008	1.3
09/11/2008	22.1
09/12/2008	2.8
09/16/2008	11.2
09/17/2008	0.3
09/26/2008	12.7
10/08/2008	25.7
10/09/2008	10.2
10/10/2008	3.0
10/11/2008	6.4
10/12/2008	47.2
10/18/2008	10.9
10/24/2008	104.4
10/25/2008	0.3
11/03/2008	3.0
11/05/2008	1.8
11/13/2008	1.3
11/14/2008	0.3
11/15/2008	10.2
11/20/2008	2.3
11/29/2008	29.0
11/30/2008	15.0
12/09/2008	2.3
12/11/2008	5.1
12/21/2008	1.5
12/29/2008	1.0