Waquoit Bay (WQB) National Estuarine Research Reserve Water Quality Metadata
January 2015 – December 2015
Latest Update: March 29, 2017

I. Data Set & Research Descriptors

1) Principal investigator & contact persons:

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2) Entry verification:

The data are uploaded in three file formats (each to separate files identified with the same file name but with unique extensions: .CSV, .DAT, .INI) from the YSI 6600 data loggers to a PC with the YSI 6600 EcoWatch software. Two of these (PC6000 and ASCII text formats) are kept on file in the WBNERR archive. Initially, file contents visually examined for anomalies (e.g., sensor malfunction, battery failure, spurious values, etc.) by a technician after downloading data after deployment and post calibration analysis.

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.

Copies of all files are retained at the Reserve which includes the formatted PC6000 data files (.dat), as well as the raw text files (.csv) and final exported text files (.txt) archived at the CDMO site.

3) Research objectives:

For the NERR System-Wide Monitoring Program (SWMP), the YSI 6600 data loggers are programmed to record water quality parameters every 15 minutes. A total of four SWMP sites were located in the Waquoit Bay estuarine system during 2015. These four are: 1) Metoxit Point (MP), in operation since 1998, is located in the middle of Waquoit Bay's main basin; 2) Menauhant (MH), in operation since March 2001, is located adjacent to Eel Pond Inlet on Vineyard Sound – one of the two tidal inlets into the Waquoit Bay estuary; 3) Child's River (CR), in operation since May 2002, located near the head of the tidal section of Child's River— one of the two main surface fresh water sources to Waquoit Bay; and 4) Sage Lot (SL), in operation since May 2002, located in Sage Lot Pond—a relatively pristine tidal pond surrounded by salt marsh and barrier beach, possessing one of the bay's few remaining eelgrass stands.

The main purpose of the SWMP water quality monitoring program is to aid Waquoit Bay NERR in one of its priority missions - to perform as a natural laboratory and platform for coastal and estuarine research. The long term, continuous detailed monitoring of the estuary's basic hydro-physical parameters is an essential tool and context for any research activities located here. Besides this overarching mission, there are also several specific research interests. One primary issue for the Waquoit Bay ecosystem is the influence of anthropogenic induced alterations by nitrogen enrichment. Waquoit Bay receives nitrogen from several sources, including but not limited to septic systems (their leachate percolates into groundwater which then enters the bay), run off from roads, run off containing domestic and agricultural fertilizer and animal waste, and atmospheric sources. This elevated nitrogen loading to the bay has resulted in enhanced eutrophication that has contributed to the alteration of the bay's habitats. For example, thick mats of seaweeds (macroalgae) now cover the bottom where eelgrass meadows thrived in the 1970's. Unfortunately, there are few definitive records of the bay's water quality conditions during that period, which makes it difficult to evaluate the rates of change. To facilitate future evaluation, long-term records from SWMP can be used to track water column conditions. Of particular interest, in this regard are measurements of dissolved oxygen (DO) and turbidity, as well as dissolved nitrogen and chlorophyll concentration (this data is available by contacting the reserve). Such records will facilitate evaluation of changes which may come about from a continuation of watershed alteration that result from current development patterns (i.e., non-sewered residential areas served by private septic systems typically consisting of septic tanks and leach fields) as well as non-industrial commercial development, such as golf courses, cranberry bogs, and retail shopping outlets. The records will be useful for evaluating the efficacy of remediation efforts intended to reduce the nitrogen loading from these sources to Waquoit Bay.

Another focus of long-term research interest is the detection of climate change and the determination of its effects on the estuarine environment. Characterizing the variability of the various water column parameters, such as their scale, magnitude and frequency, is likely to be an important aspect of the estuarine ecosystem that may be sensitive to climate change. Related to this focus is an interest in the impact of storms (hurricanes and northeasters) and other extreme meteorological events on the estuary. For example, what temperature and wind field thresholds exist that might bring about or trigger certain conditions within the bay? The observations recorded by the SWMP will allow for these types of studies.

4) Research methods:

YSI 6600 series Sondes are deployed at each permanent water quality monitoring station at the Waquoit Bay Reserve. Since in-situ instrumentation can only record conditions at a specific location, permanent monitoring stations for SWMP are chosen to be in some way representative of the overall estuary. This is difficult in practice since estuaries by their very definition are coastal regions where large physical, chemical and biological variations tend to occur in space and time, so that often no particular location within the system is "typical" of the overall system. Establishing a number of stations can overcome this problem somewhat, and as of 2002 four permanent stations were established in the Waquoit Bay estuaries. Our current SWMP stations are situated to represent, as much as possible, the diversity of the estuary and its inputs/outputs. Additional details concerning the station characteristics are discussed in the next section.

The YSI Sondes measure and record ambient water temperature, specific conductivity (and calculate salinity), dissolved oxygen (mg/L and % saturated), turbidity (NTU), Chlorophyll-a (ug/L) water level (m), and pH at 15 minute intervals during deployment periods extending for approximately three weeks (three weeks during the summer months, four weeks during winter months). Note that the pressure sensors currently in use are non-vented and so variations in atmospheric pressure are recorded as changes in water depth (atmospheric data are available from our SWMP meteorological station (as of January 2002) and other nearby meteorological observatories), so it is possible to make this correction to the depth data (approximately +1 cm of depth is equal to +1 mb of air pressure), for increased accuracy. Also, at our Metoxit Point site (from 12/2000 to present), Child's River site (from 3/2003 to present), Menauhant site (from 7/2006 to present), and our Sage Lot site (from 6/2006 to present) we have been using an YSI 6025 optic chlorophyll fluorescence sensor.

Sondes are deployed and retrieved every two to three weeks. The "old" Sonde is retrieved and a "new" replacement Sonde is deployed immediately so that ideally no record gap occurs. The 2-3 week deployment duration is constrained by a combination of battery life (shorter life in colder waters) and fouling of the DO sensor (and other sensors to a lesser degree) during the warm summer months. Prior to deployment (usually within 24 hrs), each instrument is checked and its sensors re-calibrated using standard YSI (Operating Manual) protocols. Similarly, after a deployment, each Sonde is brought back to the laboratory for a post-deployment check, data downloading, instrument and sensor cleaning. The conductivity sensors are calibrated with 50.00 mS/cm YSI standard. The pH sensors are calibrated with 7.0 and 10.0 pH standard solutions (2-point calibrations). The turbidity standard used is YSI 6073G turbidity standard for 126.0 NTU, and distilled water (DI) for 0 NTU. Temperature sensors are checked periodically against a calibrated mercury thermometer. The chlorophyll probe is calibrated on a 2-point calibration with distilled water (DI) and a Fluorescent Red Dye (Rhodamine WT) at a 0.5 mg/ L concentration. *See Chlorophyll Qualifier in Sensor Specifications section below regarding chlorophyll fluorescence accuracy.* Oxygen sensor membranes are inspected before and after each deployment. Oxygen sensor membranes are replaced 24 hours prior to each deployment when the sensor seemed to need reconditioning. Final DO calibration was not done until the membrane had been in place for at least 8 hours. As another check on instrument performance, in-situ measurements of air and water temperature, DO, salinity, Specific Conductance, and pH are made using a hand-held YSI 650 at deployment/retrieval times.

Two types of silos housed the YSI sondes during their deployment. One type for dock side stations (Menauhant and Childs River) and the other for open water stations away from shore structures (Metoxit

and Sage Lot). For open water, a two part structure has been designed consisting of a submerged fixed tower and a separate removable silo apparatus that sleeves over the fixed tower. The removable silo apparatus can be lifted on and off the tower for inspection, cleaning or other maintenance. The sondes are deployed into the removable silos consisting of open-ended vertically mounted 4" PVC pipe (each silo is perforated in its lower portion around the business end of the sonde). The fixed tower structure consists of a vertical reinforced concrete filled 3" PVC pipe about 1.3 meters in height extending upward from a 300 lb cast reinforced concrete base (30" in diameter and 6" thickness) anchored into the bottom by a reinforced concrete filled 4" PVC pipe about 1 m in length. The whole structure is somewhat reminiscent of large "child's toy top". The Metoxit Point and Sage Lot silos are set so that the sonde's sensor package is 0.5 m off the bottom. For dock-side locations and the silo apparatuses are a more typical type – a single PVC section (4" ID) mounted vertically onto a pier piling or bulkhead. The Menauhant site, located at a yacht club dock, is adjacent to a tidal inlet, and the Child's River site, located at commercial marina and boat yard, is adjacent to the upper reaches of a tidal river. The base of these silos is also ventilated with large holes (1.0" diameter) and their sensor packages (bottom of the Sonde) are both mounted about 0.5 m off the bottom. All mooring silos are painted with antifouling paint at the beginning of the spring season, and periodically checked and scrubbed during the summer season.

In July of 2006, a Sutron Sat-Link2 transmitter was installed at the Menauhant Yacht Club station and transmits data to the NOAA GOES satellite, NESDIS ID #3B030074 (where 3B030074 is the GOES ID for that particular station.) The transmissions are scheduled hourly and contain four (4) datasets 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 QAQC and assimilation in the CDMO's "Authoritative" online database. This data can be viewed by going to http://cdmo.baruch.sc.edu."

5) Site location and character:

General description of Waquoit Bay estuarine system:

The Waquoit Bay National Estuarine Research Reserve (WBNERR) is located in the northeastern United States on the southern coast of Cape Cod, Massachusetts. About 8,000 people maintain permanent residency in Waquoit Bay's drainage area, which covers parts of the towns of Falmouth, Mashpee, and Sandwich. During summer months, the population swells 2-3 times with the greatest housing concentrations immediate to the coastline (water views and frontage). In addition, the upper portions of the watershed include a military base, Otis Air Force Base and the Massachusetts Military Reservation, portions of which have been designated by the EPA as Superfund sites due to past practices of dumping jet fuel and other volatile groundwater contaminants.

WBNERR's estuaries are representative of shallow tidal lagoons that occur from Cape Cod to Sandy Hook, New Jersey. WBNERR is within the northern edge of the Virginian biogeographic province, on the transitional border (Cape Cod) with the Acadian biogeographic province to the north and east. Like many embayment's located on glacial outwash plains, Waquoit Bay is shallow (< 5 m), fronted by prominent barrier beaches (i.e., those of South Cape Beach State Park and Washburn Island), and is backed by salt marshes and upland coastal forests of scrub pine and oak. Two narrow, navigable inlets, reinforced with granite jetties, pass through two barrier beaches to connect Waquoit Bay with Vineyard Sound to the

south. A third shallow and generally un-navigable inlet opened through the Washburn Island barrier beach during Hurricane Bob in August 1991, and closed up in February 2002.

Bottom sediments in the bay are organic rich (Corg conc. ~ 3-4%) silts and medium sands. Sediment cores taken in summer of 2002 indicate that the depth of these estuarine sediments is up to 9 m thick in places. Dating work on these sediment cores suggests that the Waquoit Bay basin has been inundated by the sea for about 5000 years, and sedimentation rates over the past 500 years are estimated to be range from 1.6 to 4.9 mm/yr. Thick (up to 0.3 m) macroalgae (seaweed) mats overlie much of the bottom of the bay, and largely consist of species *Cladophora vagabunda*, *Gracilaria tikvahiayae*, and *Enteromorpha*. The dominant marsh vegetation in Waquoit Bay is *Spartina alterniflora* and *Spartina patens*. Dominant upland vegetation includes mixed forests of red oak, white oak, and pitch pine, and other shrubs and plants common to coastal New England. Land-use in the bay's watershed is about 60% natural vegetation, but the remaining land is largely residential housing, with some commercial (retail malls), and minor amounts of agriculture (~3%; e.g., cranberry bogs).

Dense housing developments cover the two peninsulas that form the western shore of the Waquoit Bay estuarine system. Although the developments themselves are outside of the Reserve boundaries, dissolved nitrogen in discharges from their septic systems (via groundwater) and in fertilizer run-off from their lawns has significant effects on the functioning of the Waquoit Bay ecosystem. These impacts have been a primary subject of study at the Reserve since its designation (1988). One outcome of this research has been the delineation of sub-watersheds within the overall drainage area for Waquoit Bay, of which WBNERR is a small part. This knowledge allows for the design of experiments based on the spatial variation of nutrient loading and other land-use related impacts.

At the northern end of the bay, an area comprising a separate sub-watershed, coastal bluffs of glacial till rise 30 feet above sea level. The northern basin of the bay, just below these bluffs, is its deepest area (approximately 3 m MLW), while much of the remainder of the bay is about 1.5 m. Bourne, Bog, and Caleb Ponds are freshwater kettle hole ponds on the northern-most shore of the bay. As components of the same sub-watershed, they have a common albeit minor freshwater outflow into the bay's northern basin via a narrow channel through a brackish marsh. To the east and south, other sub-watersheds surround several tidal and freshwater ponds, including Hamblin and Jehu Ponds, brackish salt ponds that are connected to the main bay by the tidal waters of Little and Great Rivers, respectively. The shorelines of the ponds are developed with residences that are occupied both seasonally and year round. Hamblin Pond and Little River are components of one sub-watershed, and Jehu Pond and Great River are elements of a separate sub-watershed. Further south lays Sage Lot Pond. It is in the least developed sub-watershed and also contains a barrier beach and salt marsh ecosystem of the reserve's South Cape Beach State Park. To the east of Sage Lot Pond and within the same sub-watershed, lies the highly brackish Flat Pond. It receives minimal tidal flows of salt water from Sage Lot Pond through a narrow, excavated and culvered channel. In the spring of 2008 two (2) channel culverts were replaced, one with a bridge and the second with a wider, less restrictive culvert to aid in tidal flushing of the pond. The preponderance of the input to Flat Pond is groundwater and run off, both of which are likely affected (e.g., nutrients, pesticides, bacteria) by an adjacent golf course and near-by upper-scale residential development.

The largest source of surface freshwater to Waquoit Bay is the Quashnet / Moonakis River. Although named "river", this and Child's River are more appropriately described as "streams" because of their small channels and discharge ~1.0 CFS. A component of yet another sub-watershed, the Quashnet River

originates in Johns Pond situated north of the bay and traverses forests, cranberry bogs, residential areas, and the Quashnet Valley Golf Course before entering the bay near the southern "boundary" of the northern basin. ("Quashnet" applies to that portion of the river within the town of Mashpee, and "Moonakis" refers to the brackish estuary at the river's mouth, lying in the town of Falmouth. Quashnet will be used hereafter to refer to the entire river.) The Quashnet River's tidal portion has sufficient numbers of coliform bacteria to cause it to be closed to shell fishing most of the time. The source(s) of these bacteria (human or avian) is unknown at this time.

The Childs River is the second largest input of surface freshwater to the bay. A component of another sub-watershed, it runs through densely developed residential areas. The Childs River sub-watershed receives the highest nitrogen loading and is the largest nitrogen contributor to the Waquoit Bay system of all the sub-watersheds. In the upper tidal portions of the river the highest nutrient and chlorophyll levels and the lowest dissolved oxygen readings of any region in the bay have been recorded and so this location represents an end-member for looking at anthropogenic inputs and impacts on the system. Another, albeit smaller, source of freshwater to Waquoit Bay is the discharge of Red Brook through brackish marshlands into Hamblin Pond. Additional freshwater enters the bay elsewhere through groundwater seepage (perhaps up to 50% of all freshwater input into the bay), precipitation and the flows of smaller brooks. There is relatively little surface water runoff entering directly into the bay due to the high percolation rates of Cape Cod's coarse, sandy soils.

Knowledge of the homo/heterogeneity of the water masses in Waquoit Bay was originally derived from measurements made by reserve staff and from data obtained by the reserve's volunteer water quality monitoring group, the Waquoit BayWatchers who have collected depth profiles of Waquoit Bay water quality since 1993. Subsequent research by reserve staff (including some numerical modeling by T. Isaji) has revealed that lateral mixing has considerable influence because tidal currents follow a general course through the bay. This results in an overall structure to horizontal patterns of water quality characteristics. The pattern it produces is a gyre in the central portion of the main bay whereby currents follow a generally counter-clockwise flow around a central area that exhibits reduced exchange with the remainder of the bay. The flushing rate within the gyre is diminished when compared with other more peripheral areas of the bay. The location of the gyre meanders slightly, apparently under the influence of tides and wind. Because of the shallow conditions, restricted tidal inlets, and low amplitude tidal forcing of Vineyard Sound here (tides are semi-diurnal with a range about 0.5 m) water levels in the bay are also strongly influenced by wind forcing. Southerly winds increase tidal heights and advance the phase of the flood and retard the phase of ebb (Northerly winds have the opposite effect).

Metoxit Point (MP)

The Metoxit Point station (41^{o} 34.119 N 70^{o} 31.281' W, 2.2 m deep) initiated in 1998, is located in the main basin of Waquoit Bay and was selected to be within or near the outer regions of the gyre (described above) and more or less represents "typical" water mass conditions and residence times for the bay. The location is at least a half mile from shore, well flushed and mixed by tides, and is in an area that is minimally disturbed by routine activities on the bay (e.g. boat traffic, shell fishing, etc.). Bottom sediments at the site are organic rich mud often overlain by thick algal (*Cladophora*) mats. Because of this site's fairly open exposure to the south (greatest fetch over the bay), it has been observed that when sustained southerly winds are greater than about 20 kts, the Metoxit Point site experiences increased turbidity (sediment suspension events).

A mean tidal range of 0.46m (SD = 0.17) is calculated based on one month of data (May 2003), with a minimum of 0.13 m and a maximum of 0.91 m. A mean monthly salinity range of 4.2 ppt, from a mean monthly min of 27.8 ppt to a mean monthly max of 32.0 ppt, has been calculated for this site based on one year of observations (2002).

Menauhant Yacht Club (MH)

The Menauhant station (41^{o} 33.156' N 70^{o} 32.912' W, 1.2 m deep), initiated in March 2001, is located within the Eel Pond Inlet at the Menauhant Yacht Club dock. Eel Pond Inlet is the westernmost of the two main tidal inlets into the Waquoit Bay system. The site was chosen because it occupies one of the strategic locations for gauging the system's water mass characteristics. Entering waters represent the marine end-member while outflows represent the final product of estuarine water mass modification and export to shelf waters. The site also has easy walk-in access to a secure private pier that extends into the throat of the inlet.

Also, because of the turbulent tidal flow within the inlet, conditions are vertically well mixed, and the site can be maintained year round even through ice-over conditions in the rest of the bay during severely cold winters. Bottom sediments at this site are clean sands and gravels with almost no attached bottom vegetation. Since inception, we have noted that strong south to southeast (onshore) winds tend to produce turbidity events at this site from the wave induced suspension of fine sediments and organic material in the upstream near-shore zone. While we have found that these types of turbidity events are localized to windward near-shore areas in the bay, the transport of these sediments at inlet mouths during such times is perhaps a dominant sedimentation process within the estuarine system. In other words, while the choice of our location may be producing a localized signal in one of our measured parameters that signal may reflect key processes in the system at large.

A mean tidal range of 0.48m (SD = 0.19) is calculated based on one month of data (May 2003), with a minimum of 0.11 m and a maximum of 0.99 m. A mean monthly salinity range of 3.9 ppt, from a mean monthly min of 28.5 ppt to a mean monthly max of 32.4 ppt, has been calculated for this site based on one year of observations (2002).

Child's River (CR)

The Child's River station (41^{o} 34.793' N 70^{o} 31.854' W, 1.2 m deep), initiated in May 2002, is located on a dock piling at Edwards Boat Yard, a commercial marina near the upper tidal reaches of Child's River— one of the two main surface fresh water sources to Waquoit Bay (see general description of Waquoit Bay watershed above). This location is very strongly stratified, characterized by a salt wedge with fresher river water overlying saline ocean water. Vertical salinity ranges can run from 0-10 ppm at the surface to more than 30 ppm just 1 m below. The Sonde sensors are usually well within the salt wedge portion of the water column, nonetheless this location is also our freshest SWMP site, and is at the opposite end of Child's River from the seaward Menauhant station. Bottom sediments are fine organic rich muds.

This location represents the most terrigenously and anthropogenically-impacted SWMP site. Monthly water quality, collected near this location for the past decade, shows very high chlorophyll concentrations during the warmer months and more recent dissolved nutrient records show very high nutrient-loads. Boat traffic at the marina likely leads to increased turbidity during the boating season as well. As this site is dockside at a private marina, general security is high and access is easy available. The station is also serviceable year-round and usually not subject to seasonal shutdown due to ice over.

A mean tidal range of 0.46 m (SD = 0.17) is calculated based on one month of data (May 2003), with a minimum of 0.11 m and a maximum of 0.95 m. A mean monthly salinity range of 14.7 ppt, from a mean monthly min of15.8 ppt to a mean monthly max of 30.5 ppt, has been calculated for this site based on one year of observations (2002).

Sage Lot (SL)

The Sage Lot station (41^{o} 34.7' N 70^{o} 31.18' W, 1.2 m deep), initiated in May 2002, is located in a deeper portion of Sage Lot Pond – a small sub-estuary of Waquoit Bay (20 ha) surrounded by salt marsh and barrier beach. Its small watershed is the least developed of all of Waquoit Bay's sub-watersheds and Sage Lot Pond is considered to be its least impacted and most pristine sub-estuary. Bottom sediments are organic rich muds. Sage Lot Pond possesses one of the few remaining eelgrass beds in the Waquoit Bay system.

The Child's River and Sage Lot Pond sites are considered to represent opposite end-members of nutrient-loading and human-induced influence. Researchers often locate their experiments in these two locations to take advantage of this difference. However, Sage Lot Pond is hydrologically connected to an upstream brackish source -- Flat Pond – via a series of tidal creeks, drainage ditches and culverts. Flat Pond borders a country club and golf course and some concern exists for its impact on the water quality of Sage Lot Pond. Currently, Sage Lot Pond is closed to shellfishing in summer months because of high fecal coliform concentrations, though these are thought to be of avian source.

A mean monthly salinity range of 4.9 ppt, from a mean monthly min of 27.2 ppt to a mean monthly max of 32.1 ppt, has been calculated for this site based on one year of observations (2002).

6) Data collection period:

SWMP water quality monitoring in Waquoit Bay was initiated in 1995. Several different pilot sites (i.e., North Basin and Central Basin) were occupied for varying durations before settling on our first permanent long term site at Metoxit Point in summer 1998. The Menauhant site was our second permanent station and began operation in March 2001. Sage Lot and Childs River sites began operation in May 2002.

In 2015, year-round data was only possible at the Menauhant station. Due to interference from a bubbler system at the marina on Childs River, that station was not occupied from January 1, 2015 to April 2, 2015. Due to icy conditions during the winter season and timing of boat launch, the Metoxit Point and Sage Lot stations were not occupied between January 1, 2015 and May 4, 2015. In preparation for the winter (before the boats are pulled), the Metoxit Point and Sage Lot stations were removed on 12/07/2015 and 12/09/2015, respectively. Childs River station was removed on 12/08/2015 once the bubblers were observed at the marina. The deployment dates and times for 2015 are indicated below:

Menauhant

START	END
12/19/2014, 11:15	01/07/2015, 14:00
01/07/2015, 14:15	01/10/2015, 13:30
01/10/2015, 13:45	02/04/2015, 14:30

02/04/2015, 14:45	03/06/2015, 14:45
03/06/2015, 15:00	04/02/2015, 14:45
04/02/2015, 15:00	04/23/2015, 10:45
04/23/2015, 11:00	05/11/2015, 11:15
05/11/2015, 11:45	06/03/2015, 11:45
06/03/2015, 12:00	06/19/2015, 19:30
06/23/2015, 09:00	07/14/2015, 10:45
07/14/2015, 11:00	08/04/2015, 07:15
08/04/2015, 07:30	08/26/2015, 08:45
08/26/2015, 09:00	09/15/2015, 10:45
09/15/2015, 11:15	10/15/2015, 09:00
10/15/2015, 09:15	11/13/2015, 10:15
11/13/2015, 10:30	12/08/2015, 10:30
12/08/2015, 11:00	12/30/2015, 10:15
12/30/2015, 10:30	01/26/2016, 10:30

Metoxit Point

START	END
05/04/2015, 13:45	05/18/2015, 09:45
05/18/2015, 10:00	06/05/2015, 09:15
06/05/2015, 09:30	06/25/2015, 09:15
06/25/2015, 09:30	07/15/2015, 10:15
07/15/2015, 10:45	08/06/2015, 09:00
08/06/2015, 09:15	08/25/2015, 08:45
08/25/2015, 09:00	09/16/2015, 13:45
09/16/2015, 14:15	10/15/2015, 14:30
10/15/2015, 14:45	11/09/2015, 13:45
11/09/2015, 14:00	12/07/2015, 15:00

Child's River

START	END
04/02/2015, 14:30	04/23/2015, 11:00
04/23/2015, 11:15	05/11/2015, 11:45
05/11/2015, 12:00	06/03/2015, 12:00
06/03/2015, 12:15	06/23/2015, 09:00
06/23/2015, 09:30	07/14/2015, 11:00
07/14/2015, 11:15	08/05/2015, 08:00
08/05/2015, 08:15	08/26/2015, 09:00
08/26/2015, 09:15	09/15/2015, 11:15
09/15/2015, 11:30	10/15/2015, 09:00
10/15/2013, 09:30	11/13/2015, 10:30

11/13/2015, 11:00	12/08/2015, 11:00

Sage Lot

START	END
05/04/2015, 13:00	05/18/2015, 12:00
05/18/2015, 12:30	06/04/2015, 08:15
06/04/2015, 08:30	06/24/2015, 10:00
06/24/2015, 10:15	07/17/2015, 09:00
07/17/2015, 09:15	08/07/2015, 09:30
08/07/2015, 09:45	08/28/2015, 09:30
08/28/2015, 09:45	09/16/2015, 11:45
Missing data between 09/16/2015 to 10/14/2015 due to station repair	
10/14/2015, 15:45	11/09/2015, 15:15
11/09/2015, 15:30	12/09/2015, 12:45

7) Distribution:

According to the Ocean and Coastal Resource Management Data Dissemination Policy for the NERRS System-wide Monitoring Program:

> 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:
>
> National Estuarine Research Reserve System (NERRS). 2012. System-wide Monitoring Program. Data accessed from the NOAA NERRS Centralized Data Management Office website: www.nerrsdata.org; *accessed* 12 October 2012.

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

8) Associated researchers and projects:

BayWatchers:

The Reserve has carried out a citizen-based water quality monitoring program since 1993 called *BayWatchers*. Water quality measurements are carried out at 9 sites within Waquoit Bay estuary for the purposes of 1) constructing a long time series of water quality information to determine trends, as well as 2) providing a sentinel role to detect unusual changes and events. Monthly (October-May) and Bi-weekly (June-September) measurements are made year-round on a set schedule. Chl-*a* samples are processed and analyzed using a HACH spectrophotometer at WBNERR. Dissolved inorganic nutrient samples are currently analyzed by Matt Charrette at WHOI. All data is processed and archived at WBNERR and is publicly available through our web site.

A new field procedure was initiated in July 2007 and a ninth site was added at the south basin of Waquoit Bay at the first inlet buoy in the main channel. A change at this time was made from previous wet chemical measurements to utilizing hand-held YSI 85 meters to measure water temperature, salinity, and dissolved oxygen (% and mg/L). Each meter is calibrated each sampling period for dissolved oxygen. Measurements are taken at the surface (0.25m) and the bottom at each site. The bottom depth is recorded. Additionally, due to shallow depths in most sites, water clarity measurements with Secchi discs have been discarded for a more meaningful analysis of turbidity. Turbidities are run on a portable turbidity meter (Orbeco-Helige Model #3322). The direct-reading display gives results in 0.01 NTUs (Nephelometric Turbidity Units), has drift-free reading, has an automatic error-free decimal shift, and a low battery signal. The turbidity meter range and sensitivity are: Low: 0.00 to 19.99 NTU, resolution 0.01 NTU; Medium: 00.0 to 199.9 NTU, resolution 0.1 NTU; High: 000 to 999 NTU, resolution 1 NTU. Accuracy: ±2% of reading for low and medium ranges. Repeatability: ±1%. Design in accordance with USEPA Method 180.1., sample tubes are optically reproducible 28 mm O.D. X 61 mm glass vials with screw caps. The reserve utilizes three calibration standards:0 NTU and 40 NTU and 100 NTU; the standards are run after running five sites each time.

Two bottles of water are now collected at each site, at approximately 0.25m below the surface, by locking the bottles into a hand-held apparatus. This new sampling procedure has helped in standardizing the depth sampled for all sites in our chemical analysis. The bottles are mounted to a pole and capped with rubber stoppers attached to a rope. When the bottles are lowered to a marked level (0.25m) on the apparatus, the rope is pulled and water enters the bottle. The cap is placed on the bottles and returned back to the lab for turbidity, chlorophyll, and nutrient analysis. Physical characterization of the site and sampling period are recorded each sampling date (time of sampling, weather conditions-sun/clouds/rain/fog, name of team members, etc) and any other observations are recorded.

II. Physical Structure Descriptors

9) Sensor specifications:

YSI 6600 V2 data logger (six (6) units)
All parameters are the same as the YSI 6600/YSI 6600EDS data logger except dissolved oxygen.

Parameter: Temperature
Units: Celsius (C)
Sensor Type: Thermistor

Model #: 6560
Range: -5 to 45 °C
Accuracy: +/-0.15 °C
Resolution: 0.01 °C

Parameter: Chlorophyll
Units: microgram per Liter (µg/Liter)
Sensor Type: optical, fluorescence, with mechanical cleaning
Model #: 6025
Range: 0 to 400 µg/L Chl; 0-100 Percent Full Scale (%FS) Fluorescence
Accuracy: No specification provided
Resolution: 0.1 µg/L Chl; to 0.1 % FS

Parameter: Conductivity
Units: milli-Siemens per cm (mS/cm)
Sensor Type: 4-electrode cell with auto-ranging
Model #: 6560
Range: 0 to 100 mS/cm
Accuracy: +/-0.5% of reading + 0.001 mS/cm
Resolution: 0.001 mS/cm to 0.1 mS/cm (range dependent)

Parameter: Salinity
Units: parts per thousand (ppt)
Sensor Type: Calculated from conductivity and temperature
Range: 0 to 70 ppt
Accuracy: +/- 1.0% of reading or 0.1 ppt, whichever is greater
Resolution: 0.01 ppt

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
Units: units
Sensor Type: Glass combination electrode
Model #: 6561
Range: 0 to 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

Parameter: Dissolved Oxygen % saturation
Units: percent air saturation (%)
Sensor Type: Optical, Luminescence Lifetime
Model#: 6150
Range :0 to 500% air saturation
Accuracy: 0-200% air saturation, +/-1% if the reading or 1% air saturation, Whichever is greater
200-500% air saturation, +/- 15% of reading; Relative to Calibration Gases.
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: Optical, Luminescence Lifetime
Model #: 6150
Range: 0 to 50 mg/L
Accuracy: 0 to 20 mg/L, +/- 1% of the reading or 0.1 mg/Lm whichever is greater
20 to 50 mg/L, +/- 15% of the reading; Relative to Calibration Gases.
Resolution: 0.01 mg/L

Sensor Qualifiers:

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.

10) Coded variable definitions:

All NERRS sites are required to use the following file naming convention.

Station Codes:

Sampling Station	Sampling Site Code	Station Code
Metoxit Point	MP	wqbmpwq
Menauhant	MH	wqbmhwq
Child's River	CR	wqbcrwq
Sage Lot	SL	wqbslwq

File definitions: NERR Reserve/YSI deployment site/data type code/year
Example: wqbmpwq2008 (designates 2008 water quality data for the Metoxit Point site)

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:** End of deployment post-calibration readings in standard calibration solutions

Sage Lot

Site	Date Retrieved	DO	Baro. Pres.	Depth	Depth Offset	SpCond	pH 7	pH 10	Turbidity DI	Turbidity	Chl 0 DI	Chl Rhodamine	Rhodamine Std value
		%	mmHg	m	m	mS/cm			NTU	NTU	µg/L	µg/L	µg/L
SL	05/18/2015	100.1	765.0	0.074	0.068	49.58	7.02	10.0	-0.9	125.9	-0.1	129.6	129.2
	6/4/2015	105.6	763.0	0.033	0.041	49.56	7.05	10.05	3.5	129.1	0.1	113.2	117.1
	06/24/2015	98.6	758.9	-0.01	-0.015	49.87	7.03	10.0	0.2	127.1	-0.1	116.4	116.8
	7/17/2015	100.6	762.5	0.055	0.034	48.92	7.13	10.24	0.6	126.5	0.2	124.1	128.4
	08/07/2015	98.3	758.3	-0.022	-0.024	50.30	7.04	10.04	-1.7	125.7	0.1	113.5	115.4
	08/28/2015	97.3	763.5	0.051	0.048	49.83	7.02	10.05	6.0	121.0	0.2	117.3	114.6
	09/16/2015	101.3	763.1	0.048	0.042	50.59	7.04	10.06	0.0	129.6	-0.1	115.3	114.8
	11/09/2015	100.4	765.0	0.07	0.068	51.08	6.98	10.03	-0.5	123.6	0.3	119.2	124.4
	12/09/2015	103.6	763.0	0.046	0.041	49.33	7.17	10.19	0.2	129.2	-0.4	128.5	125.9

Childs River

Site	Date Retrieved	DO	Baro. Pres.	Depth	Depth Offset	SpCond	pH 7	pH 10	Turbidity DI	Turbidity	Chl 0	Chl Rhodamine	Rhodamine Std value
		%	mmHg	m	m	mS/cm			NTU	NTU	µg/L	µg/L	µg/L
CR	4/23/2015	99.1	750.9	NA	-0.124	48.92	7.07	10.12	0.2	127.0	0.1	141.9	144
	5/11/2015	99.3	762.5	0.033	0.034	49.97	6.97	10.0	-2.8	123.3	0.3	131.9	127
	6/3/2015	100.2	766.0	0.075	0.082	49.43	7.07	10.11	1.4	126.7	4.3	2.4	119.6
	6/23/2015	99.4	756.4	-0.063	-0.049	49.27	7.11	10.19	0.2	127.0	0.3	116.5	112.9
	7/14/2015	97.5	753.8	-0.093	-0.085	51.31	6.99	10.06	2.1	126.6	-0.1	116.2	118.2
	8/05/2015	98.3	755.8	-0.058	-0.058	49.38	7.19	10.16	4.1	126.6	0.8	106.3	114.2
	8/26/2015	96.7	757.4	-0.029	-0.036	49.9	6.98	10.03	3.5	124.8	0.4	109.8	113.8
	9/15/2015	99.7	765.2	0.077	0.071	51.3	7.08	10.12	2.9	126.7	0.5	117.1	118.8
	10/15/2015**	99.4	758.0	-0.028	-0.028	50.84	7.02	9.98	1.3	129.7	0.1	114.0	114.2
	11/13/2015	98.9	748.8	-0.156	-0.153	49.89	7.03	10.02	0.3	124.6	NA	NA	NA
	12/08/2015	99.1	760.4	0.009	0.005	53.03	6.99	9.98	0.5	126.5	-0.2	123.6	124.4

*Chlorophyll probe was out of calibration post-deployment. Probe was removed and replaced with functional one.

** Post-calibration for the sonde retrieved on 10/15/2015 was not completed due to time restraints. Data provided here are from pre-cal for MP deployment, which was completed immediately after retrieving from CR.

Metoxit Point

Site	Date Retrieved	DO	Baro. Pres.	Depth	Depth Offset	SpCond	pH 7	pH 10	Turbidity DI	Turbidity	Chl 0	Chl Rhodamine	Rhodamine Std value
		%	mmHg	m	m	mS/cm			NTU	NTU	µg/L	µg/L	µg/L
MP	5/18/2015	100.3	764.8	0.078	0.065	49.04	7.16	10.09	0.1	125.9	-0.3	128.8	128.8
	6/5/2015	100.7	763.1	0.041	0.042	50.52	7.15	10.06	1.8	128.4	20.2	-0.1	112.7
	6/25/2015	101.2	758.9	-0.012	-0.015	50.02	7.05	10.05	0.1	124.7	-0.3	113.1	114.8
	7/15/2015	98.7	751.1	-0.11	-0.121	48.95	7.08	10.12	-0.3	123.0	-0.2	111.4	114.5
	08/06/2015	100.7	758.4	-0.017	-0.022	50.55	7.03	10.01	1.5	127.7	6.5	10.2	133.8
	08/25/2015	97.0	757.7	-0.030	-0.032	49.86	7.05	10.06	0.6	123.2	-0.1	120.2	115.8
	09/16/2015**	NA	763.0	0.043	0.041	49.59	7.09	10.07	1.8	130.5	NA	NA	NA
	10/15/2015	100.5	758.5	-0.027	-0.021	49.70	7.11	10.14	0.9	124.8	1.2	126.5	127.4
	11/09/2015	102.1	765.0	0.056	0.068	50.39	6.81	9.95	-0.1	125.4	-0.1	119.2	124.4
	12/07/2015	100.8	760.8	0.004	0.011	50.41	7.19	10.22	1.8	126.5	0.0	126.9	126.2

*Chlorophyll probe was out of calibration post-deployment. No replacements available.
** No chlorophyll probe.

Menauhant

Site	Date Retrieved	DO	Baro. Pres.	Depth	Depth Offset	SpCond	pH 7	pH 10	Turb DI	Turb	Chl 0	Chl Rhodamine	Rhodamine Std value
		%	mmHg	m	m	mS/cm			NTU	NTU	µg/L	µg/L	µg/L
MH	01/10/2015	100.4	768.8	0.126	0.12	49.87	7.07	10.08	1.6	130.4	-0.4	124.0	121.7
	02/04/2015	100.0	756.1	-0.058	-0.054	49.71	7.0	10.0	6.7	134.5	0.3	139.4	145.3
	03/06/2015	102.5	770.5	0.14	0.143	50.67	7.07	10.09	4.0	130.2	0.0	142.0	135.4
	04/02/2015	99.8	756.2	-0.06	-0.052	50.2	6.93	10.02	1.6	126.2	0.4	145.3	145.8
	04/23/2015	98.6	750.9	-0.133	-0.124	49.44	6.86	9.91	0.5	127.1	0.8	134.5	138.0
	05/11/2015	98.8	763.0	0.044	0.041	50.2	7.0	10.0	-1.5	124.6	-0.1	133.5	128.6
	06/03/2015	99.4	766.0	0.077	0.082	49.56	7.05	10.04	-0.1	126.1	0.2	114.5	119.6
	06/23/2015	98.8	756.0	-0.058	-0.055	48.95	7.04	10.01	0.2	126.1	0.1	116.7	112.1
	07/14/2015	100.3	753.2	-0.095	-0.093	50.23	7.09	10.09	-0.2	126.4	-0.1	117.4	117.0
	08/04/2015	96.1	756.1	-0.046	-0.054	49.35	7.03	10.08	2.3	126.4	0.1	111.2	114.0
	08/26/2015	98.0	757.5	-0.028	-0.034	49.75	7.05	10.02	0.1	128.8	-0.6	111.4	114.1
	09/15/2015	101.6	765.1	0.073	0.069	50.2	6.93	9.93	3.4	128.4	0.1	116.3	116.8

10/15/2015	102.5	759.1	-0.020	-0.013	48.68	6.96	10.0	0.4	122.7	-0.3	124.8	125.1
11/13/2015	98.5	748.8	-0.153	-0.153	49.86	7.07	9.92	0.9	123.4	0.1	118.6	123.4
12/08/2015	100.3	761.0	0.019	0.014	49.86	6.87	9.99	3.9	128.6	0.6	123.1	123.8
12/30/2015	99.8	768.1	0.118	0.11	50.11	7.02	10.05	0.7	125.5	-0.5	128.9	125.7
01/26/2016	99.9	760.8	0.004	0.011	50.64	7.41	10.42	2.4	124.4	0.2	118.6	124.2

14) Other remarks/notes:

NOTE 1: SMALL NEGATIVE TURBIDITY ANOMALIES: Slight negative turbidity values sometimes occur as a result of small calibration offsets. Often these turbidity minimum values are between 0 and -2 NTU. All of these small negative turbidity values (the minimum for a given deployment) should be considered to be within 2 NTU of the true datum for correction purposes. This data has been given a Flag Code of <1> and retained.

NOTE 2: BIOLOGICAL-RELATED TURBIDITY ANOMALIES: This type anomaly includes turbidity readings that are either outside of the normal range or spikes way above background and unrelated to increased sediment suspension or decreased water column clarity. We believe these records are real (and not sensor malfunction), though not reflective of actual water column turbidity. These extreme values are likely due to biological factors (such as small fish, crabs, or other marine organisms). Our criteria for flagging these data are single spikes (above rather constant background) over 50NTU that are more than 10 times surrounding values. These readings were rejected <-3>.

NOTE 3: SUSPENSION EVENT RELATED TURBIDITY ANOMALIES: This type of anomaly includes turbidity readings that were either outside the normal range, or spikes way above background that are related to elevated turbidity levels indicative of wind wave-induced suspension (at the Menauhant site typically where vegetation often re-circulates due to wind and tidal currents or gets caught on the sonde guard) or prop wash-related suspension events (at the Childs River site typically). We believe these are real (and not sensor malfunction), though not reflective of actual water column turbidity. These extreme values are likely due to large floating particles (i.e., seaweeds, detritus, etc.) suspended in the water column during storm events usually from strong southerly winds in the Waquoit Bay area. (see end of section 5 for more detail on these events at this site). Our criteria for flagging these data are values over 100NTU that are more than 5 times the magnitude of surrounding values, and linked to high winds. These readings were rejected <-3>.

NOTE 4: SMALL NEGATIVE DEPTH ANOMALIES: This type of anomaly occurs due to barometric pressure differences between time of calibration and the reading and ice conditions. In all such cases, barometric pressure differences are checked as well as comparison with other parameters for indications of aerial exposure to verify that all data are valid submerged readings.

NOTE 5: MISSING DATA: 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.

NOTE 6: ELEVATED CHLOROPHYLL FLUORESCENCE ANOMALIES

Due to interference from biofouling or floating detritus, the chlorophyll fluorescence optic sensors will record values which are above the normal environmental range. Values over three times the magnitude of surrounding values are flagged as suspect <1> and given the code [SCS] indicating a chlorophyll spike. Additionally, sustained values > 100µg/L are considered suspect unless the conditions at the site can be verified (e.g., discrete chlorophyll samples processed in the lab). Spikes that exceed 400 µg/L are flagged as rejected <-3> with the code [SCS].

FIELD and "CSM" NOTES:

All times reported in Eastern Standard Time (EST)

Menauhant (MH)

General (MH)

- Telemetry not reconnected during sonde rotation on 01/10/2015 because concerned that cable was compromised and might be leaking water into main board of the sonde. On January 9th, 2015 at 17:00, the sonde was checked because telemetry readings were off. This check resulted in an out of water reading event.

- Before sonde rotation on 02/04/2015, telemetry field cable was replaced, so real-time measurements were available online again.

- On the below dates and times, the depth sensor was out of water, extreme low tide events are suspected as the cause.

  02/16/2015: 12:30 – 16:15 {CLT} <-3> [GOW](CSM)

  02/20/2015: 16:45 – 19:00 {CLT} <-3> [GOW](CSM)

  02/23/2015: 20:45 – 21:15 {CLT} <-3> [GOW](CSM)

  03/18/2015: 13:45 – 16:15 {CLT} <-3> [GOW](CSM)

- On 03/19/2015, checked the sonde because temperature and dissolved oxygen were showing spikes during low tide (e.g., 03/18/2015 13:45-16:15). Removed plastic mesh around guard because might have been trapping algae. However, everything else looked normal and sonde appeared to be at correct depth.

- 06/19/2015 to 06/23/2015, <-2> GPF – Battery power failed and resulted in missing data.

- 08/11/2015, <0> (CSM) – Received significant rain event, 0.43in of precipitation, resulting in altered water quality patterns in temperature, dissolved oxygen, specific conductivity, salinity, and pH.

- 09/07/2015 – 09/15/2015, <1> [SSD] (CSM) – Data marked as suspect. Impacts from biofouling (crabs and algae) may have caused drifting in the conductivity sensor starting on 09/07/2015. Conductivity readings during the post-calibration were normal. Additionally, strong thunderstorms started on 09/10/2015 {CWE} which may have caused the drawdown in specific conductivity, salinity, and temperature and dissolved oxygen.

- 09/30/2015 – 10/06/2015, <0> (CDF) – Data appear to fit conditions. Heavy rainfall starting 9/30/2015 through 10/02/2015 caused steep decreases in temperature, salinity, pH, and dissolved oxygen. Temperature and salinity show the slowest recovery time due to the large volumes of freshwater run-off and many days of strong, cold, northeast winds.

pH (MH)

- 04/2/2015 15:00 to 04/23/2015 10:45, <-3> (CSM) – pH probe (SN#: 12K) is reading reduced values compared to following deployment. This problem reoccurs from 05/11/15 to 06/3/15 with the same probe (SN#: 12K), so likely a probe problem and not the standard solution, however, exact cause is unknown.

- 05/11/2015 11:45 to 06/3/2015 11:45, <1> (CSM) – pH probe (SN#: 12K) is reading slightly reduced values compared to following and previous deployments. This problem occurred earlier from 4/2/2015 to 4/23/2015 with the same probe (SN#: 12K), so likely a probe problem and not the solution, however, exact cause is unknown.

- 11/14/2015 to 12/08/2015, <-3>(CSM) – pH values are rejected; unstable pH probe suspected. In-situ readings from the YSI 650 are comparable to pre- and post- data to this deployment period.

- 12/30/2015 to 1/26/2016, <-3>[SPC](CSM) – pH values are rejected; the probe showed no indication of trouble during pre-calibration, but post-calibration indicates inaccurate readings. In-situ readings from the YSI 650 are comparable to pre- and post- data to this deployment period.

Turbidity (MH)

- 04/23/2015 to 05/11/2015, <-3> [SWM] (CSM) – Turbidity wiper began to malfunction on 4/27/2015 and continued to park incorrectly throughout deployment resulting in very high (>1200 NTU) spikes in the data. Most of this deployment (the high spike readings) has been rejected due to wiper interference.

- 06/3/2015 12:15 to 06/11/2015 15:30, <-3> [SQR] (CSM) – Turbidity measurements were not returning to baseline. The turbidity probe was checked briefly on 6/9/2015 but no obvious signs of obstruction were observed. On 6/11/2015, the station was revisited and the turbidity sensor was wiped clean with a Kim Wipe. Reddish brown copper residue was interfering with turbidity optic sensor. After cleaning (6/11/15, 15:45), the turbidity baseline resumed to between 0-5 NTU.

- 08/26/2015, 15:45 – 09/02/2015, 15:30, <-3> [SQR] (CSM) – The turbidity numbers were elevated and not returning to baseline. On 09/02/2015, the optic sensor was cleaned with a Kim wipe and the numbers returned to normal. Crabs and algae were noted inside the guard during the cleaning. Likely, biofouling was causing drift in the sensor readings.

- Turbidity, 11/14/2015 to 12/08/2015, <1>[SSD](CSM) – Turbidity values indicate drift over most of the deployment. May have been copper resin or biofouling on the optical sensor.

- Turbidity, 12/31/2015 to 1/6/2016, <1>[SSD](CSM) – Turbidity values are suspect due to sensor drift. Optic sensors were wiped clean on 1/6/2016 with a kimwipe and values return to zero for baseline. May have been copper resin or biofouling on the optical sensor.

Chlorophyll Fluorescence (MH)

- 3/20/2015 9:00 to 4/2/2015 14:45, <1> (CSM) – Algae stuck in the guard appears to have potentially impacted chlorophyll data during this time.

- 4/6/2015 16:00 to 4/20/2015 13:00, <-3> {CSM}[SCS](CBF) – Crabs were found on the sensor at retrieval and post-calibration was normal suggesting that the series of rejected, erratic data was due to crab interference.

- 4/23/2015 00:00 to 4/23/2015 10:45, <-3> [SCS](CBF) - Crabs were found on the sensor at retrieval and post-calibration was normal suggesting that the series of rejected, erratic data was due to crab interference.

- 6/1/2015 5:15 to end of deployment 6/3/2015 11:45 - <-3>[SCS](CBF) – Data rejected because erratic and baseline is lost. Biofouling is suspected because the post-calibration of the sensor was normal.

- 10/10/2015 to 10/11/2015, <1>(CSM) and <-3> [SCS] – Chlorophyll fluorescence data is suspect, and some rejected, within this timeframe as data appears to spike unnaturally and then fall back to baseline abruptly. This is most likely the impact of a crab sitting over the optic sensor – several Asian shore crabs were found on the sonde at retrieval.

- 10/16/2015 to 11/13/2015, <1>(CSM) and <-3> [SCS] - Chlorophyll fluorescence data is suspect, and some rejected, within this timeframe as data appears to drift from the baseline. This is most likely the impact of a crab sitting over the optic sensor or algae caught near the sensor causing interference.

- 11/14/2015 to 12/08/2015, <1>(CSM) and <-3> [SCS] - Chlorophyll fluorescence data is suspect, and some rejected, within this timeframe as data seem to drift and spike more than is common. This is most likely the impact of algae caught near the sensor causing interference during readings.

- 12/30/2015 to 1/10/2016 07:30, <1>(CSM) and <-3> [SCS] - Chlorophyll fluorescence data is suspect, and some rejected, within this timeframe as data seem to drift and spike more than is common. This is most likely the impact of algae caught near the sensor causing interference during readings. On 1/6/2016, the optic sensors were wiped with a kimwipe to reset baseline to zero. The outer guard mesh was also removed, but there must have been algae caught somewhere in the PVC

station near the optic sensor because wiping the chlorophyll sensor did not solve the problem. Post-calibration of this sensor seemed fine, so biofouling is the likeliest cause of the suspect readings.

Childs River (CR)

General (CR)

- 09/10/2015, 9:50 to 19:10 {CWE} {CSM} – Significant weather event: thunderstorm. Passing thunderstorm resulted in heavy rain and strong winds. Temperature dropped several degrees as a result of the storm.

- 09/30/2015 04:30 to 23:30, <0> (CDF) – Data seem to fit conditions. Heavy rainfall caused steep drop in salinity levels at Childs River.

- 11/27/2015 19:15 to 20:45, <0> {CSM}(CDF) – Data seem to fit conditions. Following two days of very high barometric pressure and a low tide, the pH, salinity, and specific conductivity show extremely low levels before the tide turns.

Specific Conductivity and Salinity (CR)

- 05/23/2015 11:30 to 06/01/2015 04:00, <1> (CSM) – Data suspect due to depressed values spanning roughly one week. The decreased values follow two heavy rainstorms which may have caused the drawdown in conductivity and salinity as the freshwater drained into Childs River. Post-calibration confirms that the probe function was not an issue. However, exact cause is unknown.

Dissolved Oxygen (CR)

- 05/26/2015 15:30 to 5/26/2015 18:45, <1> [SDO] (CSM) - Dissolved oxygen readings are suspect. Values seem uncharacteristically high (>200% saturation) although cause unknown.

- 5/30/2015 13:00 to 5/30/2015 21:15, <1> [SDO] (CSM) - Dissolved oxygen readings are suspect. Values seem uncharacteristically high (>200% saturation) although cause unknown.

- 5/31/2015 13:45 to 5/31/2015 18:15, <1> [SDO] (CSM) - Dissolved oxygen readings are suspect. Values seem uncharacteristically high (>200% saturation) although cause unknown.

Turbidity (CR)

- 04/23/2015 to 5/11/2015 11:45, <-3> [SSM] (CCU) – Turbidity probe malfunction – all data rejected. Post-calibration values were normal, so problem may have been biofouling.

Chlorophyll Fluorescence (CR)

- 04/22/2015 01:15 to 4/23/2015 2:00, <-3> [SSM] (CCU) - Chlorophyll probe showed irregular readings (wide range of negative numbers and then spiking to 499.99), so all data rejected during this time period. Chlorophyll probe #SN: 10F100652.

- 05/11/2015 to 06/03/2015, <-3> [SSM] (CSM) - Chlorophyll probe showed irregular readings (wide range of negative numbers and then spiking to 499.99). All data rejected. Same probe as showing irregularities in 4/22/15-4/23/15 (SN# 10F100652). However, probe was replaced on 6/3/2015 with another used probe (SN# 09L101283), and problem was resolved. It should be noted as well that the wiper was not installed on this probe during this deployment due to the malfunction.

- 10/15/2015 to 11/13/2015 – No chlorophyll data. One of the sondes is missing a chlorophyll probe (not a required parameter for CDMO), following the removal of a malfunctioning one. Due to funding limitations, replacement of chlorophyll probes is no longer feasible.

Metoxit Point (MP)

General (MP)

- 7/8/2015, 8:30-8:45 – During nutrient sampling, noticed that sonde station had lost its buoy marker. Removed sonde from the water to check that it was still there and not damaged. Sonde looked fine, so we redeployed it and replaced the buoy.

- 09/10/2015, 4:00 to 09/16/2015, 13:45, {CSM} <1> (CBF) [SDO] – Data are marked as suspect. Biofouling has compromised the impact of a significant rain event. The shift in temperature, conductivity, and salinity is likely the combined effect of high winds and rainfall as well as biofouling. Dissolved oxygen is also marked as suspect, as it is partially based on temperature.

- 9/16/15, 14:00, <-2> (CSM) - Missing data between deployments while detangling the ropes around the station.

- 09/30/2015 to 10/05/2015, <0> (CDF) - Data appear to fit conditions. Heavy rainfall starting 9/30/2015 through 10/02/2015 caused steep decreases in temperature, salinity, pH, and dissolved oxygen. Temperature does not recover due many days of strong, cold, northeast winds.

- 11/09/2015 to 12/09/2015, <1> (CSM) – Data suspect following sonde rotation. Temperature drops nearly two degrees Celsius. Specific conductivity, salinity, and dissolved oxygen may also be affected; cause unknown.

Specific Conductivity & Salinity (MP)

- 06/05/2015 9:30 to 06/25/2015 9:15, <1> [SIC](CSM) – Specific conductivity and salinity measurements are relatively low at initial deployment reading until end of deployment. The conductivity solution used to calibrate this instrument may have been compromised or the sensor might not have been completely clean during calibration.

- 7/11/2015 19:15 to 7/15/2015 10:15, <1> [SSD] (CBF) {CSM} – Biofouling seen on temperature and conductivity sensor chamber (fish eggs) during retrieval caused drift in conductivity and salinity. Temperature also showed drift during last day of deployment.

- 8/22/2015 15:30 to 8/24/2015 16:45 and 9/11/2015 2:15 to 9/16/2015 13:45, <-3> [SQR] (CSM) – SpCond and salinity data (and dependent parameters, DO mg/L and depth) were most likely impacted by fouling seen on the probe during these times.

- 10/23/2015 14:00 to 15:30, <1> (CSM)> - Data flagged as suspect for unusual decrease in specific conductivity and salinity. No other parameters seem affected and no weather events account for the anomaly. Biofouling is the most likely cause of this possibly invalid data – perhaps a shrimp inside the conductivity probe cavity.

Dissolved Oxygen (MP)

- 06/05/2015 09:30 to 06/25/2015 09:15, <1> [SSM] (CSM) - Dissolved oxygen readings may have been impacted by calibration issue seen in the conductivity sensor during this deployment.

pH (MP)

- 7/11/2015 to end of deployment 7/15/2015, <1> [SSD] (CBF) {CSM} – Biofouling seen on pH probe at retrieval caused downward drift in pH values.

- 11/09/2015 to 12/09/2015, <-3> [SSM] (CSM) – Calibration indicates that pH probe may be in need of reconditioning. The readings exceed normal environmental conditions for Metoxit, and thus, are rejected.

Turbidity (MP)

- 05/04/2015 13:45 to 5/18/2015 09:45, <1> (CSM) – Data is flagged as suspect because the baseline is not zero, average is 3 NTU. Pre- and post-calibration readings look good, so might have been light film or smudge on the optic sensor that the wiper couldn't remove.

Chlorophyll fluorescence (MP)

- 08/01/2015 to 08/06/2015, <-3> [SPC] (CSM) – Chlorophyll data is rejected because post-calibration indicates a probe malfunction. Starting on 8/1/2015, the chlorophyll readings drift downward and do show the normal range.

- 08/25/2015, 9:00 to 09/16/2015, 13:45, <-2> (CSM) - No chlorophyll data. One of the sondes is missing a chlorophyll probe (not a required parameter for CDMO), following the removal of a malfunctioning one. Due to funding limitations, replacement of chlorophyll probes is no longer feasible.

Sage Lot (SL)

General (SL)

- 07/01/2015 11:30 to 07/01/2015 18:30 <0> (CSM) – Strong thunderstorm combined with low tides resulted in significantly reduced salinity and conductivity for a few hours before the tide came back in.

- 08/11/2015 – 08/12/2015, <0> {CSM} (CDF) – Received significant thunderstorm event on 8/11/2015 (flagged as {CWE}), 0.43in of precipitation, resulting in altered water quality patterns in temperature, dissolved oxygen, specific conductivity, salinity, and pH.

- 08/22/2015, 5:45 to 8/24/2015, 15:00, <0> {CSM} (CDF) – Significant weather event: thunderstorm. Passing strong thunderstorm resulted in heavy rain and wind which dropped temperature, salinity, and dissolve oxygen readings. Delayed effects were seen in salinity and pH readings for almost two full days.

- 09/10/2015, 9:50 to 19:10 {CWE} – Significant weather event: thunderstorm. Passing thunderstorm resulted in heavy rain and wind.

- 09/11/2015 {CSM} (CDF) – Delayed effects from thunderstorm resulted in decreased temperature, salinity, and dissolved oxygen.

- 09/13/2015 – 09/16/2015, <1> [GSM] (CWD) – On 09/13/2015 at 21:45, the bolt disintegrated from corrosion and the sonde dropped to the bottom of the pond. All readings following that time were collected at the wrong depth. The problem was observed upon retrieval of the sonde on 09/16/2015, and the station was removed for repair. Due to murky water, which made the base of the station impossible to see, and inclement weather, the station was not reinstalled until 10/06/2015.

- 09/16/2015 to 10/14/2015, <-2> [GMC] (CSM) - Missing data due to station repair. The bolt disintegrated from corrosion and the sonde dropped to the bottom of the pond. Due to murky water, which made the base of the station impossible to see, and inclement weather, the station was not reinstalled until 10/06/2015. The station was not occupied with a sonde until 10/14/2015.

Specific Conductivity and Salinity (SL)

- 06/04/2015 8:30 to 06/24/2015 10:00, <1> [SIC](CSM) – Specific conductivity measurements are low starting at initial deployment reading until end of deployment. Although salinity and temperature readings seem unaffected, the conductivity solution used to calibrate this instrument may have been over concentrated or the sensor might not have been cleaned.

Dissolved Oxygen (SL)

- 8/7/2015 9:45 to 8/28/2015 9:30, <1> [SWM] (CSM) – There was a wiper issue that appears to have potentially impacted dissolved oxygen data during the 8/7 deployment.

Turbidity (SL)

- 7/12/2015, 12:30 to 7/13/2015 1:30, <1> [STS] (CSM) – This high turbidity event may be real or could be influenced by a crab or algae interfering with the optic, so data flagged as suspect. During retrieval minimal biofouling was seen on the probe but three crabs were inside the guard.

YSI 650 In-Situ Comparison Data

A hand-held YSI 650 was used for field calibration and data were recorded at YSI deployment depths. Sonde deployment and retrieval (or last / first) comparisons for each site in addition to the hand-held measurements are shown below in Tables 1-4. They represent another form of post-check on retrieved sonde data as it is assumed that the recently calibrated deployed sonde is highly accurate on its initial measurement. If the assumption holds true, we should expect last / first readings to be quite similar within the usual 15 minute time difference between readings if the retrieved instrument was still reading accurately. Large differences indicate potential problems.

Table 1: Metoxit Point (MP) Deployment/Retrieval YSI 650 Data

	Date	Time	Temp	SpCond	Salinity	DO %	DO Conc.	pH	Depth
MP	M/D/Y	hh:mm:ss	C	mS/cm	ppt	%	mg/L		m
Deploy	05/04/15	13:38	15.82	46.36	30.14	138.0	11.36	7.90	1.0
Retrieve	05/18/15	9:59	17.82	46.74	30.43	99.5	7.89	7.44*	1.023
Deploy	05/18/15	9:59	17.82	46.74	30.43	99.5	7.89	7.44*	1.023
Retrieve	06/05/15	9:25	17.91	45.88	29.81	108.1	8.7	7.75	0.626
Deploy	06/05/15	9:25	17.91	45.88	29.81	108.1	8.7	7.75	0.626
Retrieve	6/25/15	9:19	23.85	47.75	31.1	98.7	6.97	7.69	0.874
Deploy	6/25/15	9:19	23.85	47.75	31.1	98.7	6.97	7.69	0.874
Retrieve	7/15/15	10:33	25.34	47.1	30.6	103.9	7.18	7.87	0.701
Deploy	7/15/15	10:33	25.34	47.1	30.6	103.9	7.18	7.87	0.701
Retrieve	8/6/15	9:00	25.98	47.35	30.78	96.6	6.59	7.67	0.829
Deploy	8/6/15	9:00	25.98	47.35	30.78	96.6	6.59	7.67	0.829
Retrieve	8/25/15	8:52	26.68	46.95	30.47	96.9	6.55	7.58	0.939
Deploy	8/25/15	8:52	26.68	46.95	30.47	96.9	6.55	7.58	0.939
Retrieve	9/16/15	1:45	23.09	46.06	29.91	118.2	8.47	7.75	1.013
Deploy	9/16/15	1:45	23.09	46.06	29.91	118.2	8.47	7.75	1.013
Retrieve	10/15/15	14:40	17.47	44.67	28.93	103.5	8.31	7.49*	1.159
Deploy	10/15/15	14:40	17.47	44.67	28.93	103.5	8.31	7.49*	1.159
Retrieve	11/09/15	14:02	13.31	45.51	29.46	104.7	9.12	7.79	1.113
Deploy	11/09/15	14:02	13.31	45.51	29.46	104.7	9.12	7.79	1.113

Retrieve	12/07/15	15:07	8.34	46.24	29.73	92.8	8.99	7.78	0.594

*The pH is suspect because it's much lower than average.

Table 2: Menauhant (MH) Deployment/Retrieval YSI 650 Data

	Date	Time	Temp	SpCond	Salinity	DO %	DO Conc.	pH	Depth
MH	M/D/Y	hh:mm:ss	C	mS/cm	ppt	%	mg/L		m
Deploy	1/7/15	14:08	3.08	48.49	30.7	97.7	10.64	7.19	0.846
Retrieve	1/10/15	13:32	2.05	50.50	31.85	95.6	10.65	7.27	1.140
Deploy	1/10/15	13:32	2.05	50.50	31.85	95.6	10.65	7.27	1.140
Retrieve	2/4/15	14:42	-0.14	50.08	31.17	103.3	12.21	NA*	0.798
Deploy	2/4/15	14:42	-0.14	50.08	31.17	103.3	12.21	NA*	0.798
Retrieve	3/6/15	14:54	0.19	50.54	31.51	109.8	12.82	7.82	0.871
Deploy	3/6/15	14:54	0.19	50.54	31.51	109.8	12.82	7.82	0.871
Retrieve	4/2/15	14:53	5.69	51.12	32.95	118.7	12.01	7.49	0.756
Deploy	4/2/15	14:53	5.69	51.12	32.95	118.7	12.01	7.49	0.756
Retrieve	4/23/15	10:50	10.97	47.85	31.05	105.8	9.59	7.33	0.728
Deploy	4/23/15	10:50	10.97	47.85	31.05	105.8	9.59	7.33	0.728
Retrieve	5/11/15	11:31	16.99	47.27	30.81	102.3	8.22	7.35	0.694
Deploy	5/11/15	11:31	16.99	47.27	30.81	102.3	8.22	7.35	0.694
Retrieve	6/3/15	11:56	16.89	47.81	31.20	133.3	10.7	7.62	0.774
Deploy	6/3/15	11:56	16.89	47.81	31.20	133.3	10.7	7.62	0.774
Retrieve	6/23/15	8:56	21.73	47.97	31.30	102.6	7.5	7.68	0.992
Deploy	6/23/15	8:56	21.73	47.97	31.30	102.6	7.5	7.68	0.992
Retrieve	7/14/15	10:50	23.84	48.79	31.88	116.5	8.19	7.76	0.789
Deploy	7/14/15	10:50	23.84	48.79	31.88	116.5	8.19	7.76	0.789
Retrieve	8/4/15	7:26	25.46	48.35	31.52	81.7	5.59	7.78	0.663
Deploy	8/4/15	7:26	25.46	48.35	31.52	81.7	5.59	7.78	0.663
Retrieve	8/26/15	8:55	25.95	48.76	31.8	124.8	8.47	7.73	0.873
Deploy	8/26/15	8:55	25.95	48.76	31.8	124.8	8.47	7.73	0.873
Retrieve	9/15/15	11:00	21.82	48.34	31.58	100.8	7.36	7.43	1.025
Deploy	9/15/15	11:00	21.82	48.34	31.58	100.8	7.36	7.43	1.025
Retrieve	10/15/15	9:06	16.50	48.10	31.4	100.2	8.07	7.32	0.954

Deploy	10/15/15	9:06	16.50	48.10	31.4	100.2	8.07	7.32	0.954
Retrieve	11/13/15	10:22	12.73	47.72	31.0	86.2	7.53	7.62	0.922
Deploy	11/13/15	10:22	12.73	47.72	31.0	86.2	7.53	7.62	0.922
Retrieve	12/08/15	10:50	8.5	48.62	31.43	90.2	8.56	7.41	1.431
Menauhant Data Cont'd									
Deploy	12/08/15	10:50	8.5	48.62	31.43	90.2	8.56	7.41	1.431
Retrieve	12/30/15	10:23	7.2	47.77	30.71	96.3	9.51	7.63	0.625
Deploy	12/30/15	10:23	7.2	47.77	30.71	96.3	9.51	7.63	0.625
Retrieve	1/26/16	10:40	1.23	48.75	30.56	116.7	13.32	NA*	1.025

*The pH is suspect because it's much lower than average.

Table 3: Child's River Deployment/Retrieval YSI 650 Data

	Date	Time	Temp	SpCond	Salinity	DO %	DO Conc.	pH	Depth
CR	M/D/YY	hh:mm	C	mS/cm	ppt	%	mg/L		m
Deploy	4/2/2015	14:27	10.44	23.22	14.05	127.7	13.16	7.47	0.516
Retrieve	4/23/2015	11:08	14.62	31.69	19.84	129.9	11.74	7.63	0.419
Deploy	4/23/2015	11:08	14.62	31.69	19.84	129.9	11.74	7.63	0.419
Retrieve	5/11/2015	11:51	19.24	12.19	7.09	129.4	11.5	7.71	NA
Deploy	5/11/2015	11:51	19.24	12.19	7.09	129.4	11.5	7.71	NA
Retrieve	6/3/2015	12:13	17.29	44.83	29.05	114.7	9.24	7.72	0.627
Deploy	6/3/2015	12:13	17.29	44.83	29.05	114.7	9.24	7.72	0.627
Retrieve	6/23/2015	9:16	24.17	40.67	26.03	151.6	10.95	7.79	0.467
Deploy	6/23/2015	9:16	24.17	40.67	26.03	151.6	10.95	7.79	0.467
Retrieve	7/14/2015	11:10	26.41	43.40	27.92	97.5	6.67	7.60	0.604
Deploy	7/14/2015	11:10	26.41	43.40	27.92	97.5	6.67	7.60	0.604
Retrieve	8/05/2015	8:15	27.07	42.97	27.57	25.9	1.77	7.38	0.468
Deploy	8/05/2015	8:15	27.07	42.97	27.57	25.9	1.77	7.38	0.468
Retrieve	8/26/2015	9:08	26.7	37.45	23.8	72.7	5.1	7.38	0.557
Deploy	8/26/2015	9:08	26.7	37.45	23.8	72.7	5.1	7.38	0.557
Retrieve	9/15/2015	11:21	23.53	43.83	28.3	75.5	5.44	7.28	0.879
Deploy	9/15/2015	11:21	23.53	43.83	28.3	75.5	5.44	7.28	0.879
Retrieve	10/15/2015	9:20	18.04	43.4	28.02	88.1	7.05	7.32	0.799
Deploy	10/15/2015	9:20	18.04	43.4	28.02	88.1	7.05	7.32	0.799
Retrieve	11/13/2015	10:45	12.67	41.42	26.53	64.4	5.8	7.38	0.726

Deploy	11/13/2015	10:45	12.67	41.42	26.53	64.4	5.8	7.38	0.726
Retrieve	12/08/2015	11:05	9.06	45.33	29.14	90.4	8.63	7.52	0.919

Table 4: Sage Lot Deployment/Retrieval YSI 650 Data

	Date	Time	Temp	SpCond	Salinity	DO %	DO Conc.	pH	Depth
SL	M/D/Y	hh:mm:ss	C	mS/cm	ppt	%	mg/L		m
Deploy	05/04/15	13:01	17.19	45.84	29.79	124.3	10.07	7.44	0.96
Retrieve	05/18/15	12:20	20.01	47.30	30.83	123.9	9.39	7.67	0.780
Deploy	05/18/15	12:20	20.01	47.30	30.83	123.9	9.39	7.67	0.780
Retrieve	06/04/15	8:29	15.59	46.07	29.94	123.2	10.23	7.59	0.387
Deploy	06/04/15	8:29	15.59	46.07	29.94	123.2	10.23	7.59	0.387
Retrieve	06/24/15	9:16	24.17	40.67	26.03	151.6	10.95	7.79	0.498
Deploy	06/24/15	9:16	24.17	40.67	26.03	151.6	10.95	7.79	0.498
Retrieve	07/17/15	9:07	23.55	48.02	31.32	122.1	8.66	7.72	0.626
Deploy	07/17/15	9:07	23.55	48.02	31.32	122.1	8.66	7.72	0.626
Retrieve	08/07/15	9:43	24.71	48.26	31.47	68.7	4.77	7.20*	0.331
Deploy	08/07/15	9:43	24.71	48.26	31.47	68.7	4.77	7.20*	0.331
Retrieve	08/28/15	9:39	23.91	46.85	30.46	88.0	6.23	7.58	0.504
Deploy	08/28/15	9:39	23.91	46.85	30.46	88.0	6.23	7.58	0.504
Retrieve	09/16/15	11:57	NA	NA	NA	NA	NA	NA	NA
09/16/2015 – Station was removed for repair – no retrieval data.									
Deploy	10/14/15	15:43	18.37	44.2	28.6	114.9	9.11	7.26*	0.431
Retrieve	11/09/15	15:17	12.24	43.51	28.0	100.1	8.95	7.76	0.671
Deploy	11/09/15	15:17	12.24	43.51	28.0	100.1	8.95	7.76	0.671
Retrieve	12/09/15	12:54	7.87	45.86	29.43	89.6	8.76	NA*	0.686

*The pH is suspect because it's much lower than average.