WQB NERR Water Quality Metadata
January 2017 – December 2017
Latest Update: February 8, 2019

I. Data Set and Research Descriptors

1) Principal investigator(s) and 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-series or EXO data loggers to a PC with the YSI 6600 EcoWatch or KOR software. Raw files are kept on file on the WBNERR archive: one copy is stored on the shared server and one copy is stored on the laboratory computer's hard drive. Initially, file contents are visually examined for anomalies (e.g., sensor malfunction, battery failure, spurious values, etc.) by the Research Associate, Jordan Mora, after downloading data following deployment and before 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. All QAQC data reviews are conducted by Jordan Mora, Research Associate (see contact information above). 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 –

Multi-parameter YSI 6600-series or EXO2 data loggers, hereafter referred to as 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 optic chlorophyll fluorescence sensor.

Multi-parameter YSI 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 126.0 NTU/124.0 FNU, and distilled water (DI) for 0 NTU/FNU. 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 drifts substantially from 100% saturation at calibration. 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 water temperature, DO, salinity, specific conductance, and pH are made using a handheld YSI device (pre-December 2016: YSI 650; post-December 2016: YSI EXO1) at deployment/retrieval times. Deployment/retrieval in-situ data is available at the end of this document.

In July 2016, we upgraded the Metoxit Point site from the 6600-series sondes to the EXO2 sondes. In April 2017, the Childs River site was also upgraded from the 6600-series sondes to the EXO2 sondes. In December 2017, we upgraded the Menauhant site from the 6600-series to the EXO2 sondes. As of January 2018, the only site still occupied by 6600-series sondes is Sage Lot Pond.

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). 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. 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 Metoxit Point and Sage Lot silos are set so that the sonde's sensor package is 0.5 m off the bottom. 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". 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 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 and tertiary QAQC and assimilation in the CDMO's authoritative online database. Provisional and authoritative data are available at http://cdmo.baruch.sc.edu.

5) Site location and character –

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 (C organic 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 sediment accumulation rates were estimated to be between 2-10 mm/yr, with higher rates in the upper 1 m of sediments (Maio et al. 2016).. 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 tikvahiae*, and *Enteromorpha* spp. 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 culverted 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 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. Due to 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° 34' 8.04"N 70° 31' 17.76" 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. Sonde sensors are located 0.5m above the bottom sediments. 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).

The tidal range (maximum-minimum water level; including only the data which pass quality control standards) for Metoxit Point has been calculated using water level data, corrected for barometric pressure, for 2014-2016. The average value obtained from these three years is 0.90 m. Metoxit Point's average relative water level is 1.23 m, and has been calculated based on data available through 2016 (including only the data which pass quality control standards). The 2014 data was used to calculate salinities (ppt) for this site: the maximum value was 32.13, the minimum value was 13.69 and the average was 30.21.

Menauhant Yacht Club (MH)

The Menauhant station (41° 33' 9.36" N 70° 32' 54.60" 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.

Due to 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 turbidity, the turbidity signal may reflect key processes in the system at large.

The water level range (maximum-minimum water level, including only the data which pass quality control standards) for Menauhant has been calculated using water level data, corrected for barometric pressure, for the time period 2014-2016. The average value obtained from these three years is 1.55 m. Menauhant's average water level is 0.71 m. It has been calculated based on data available through the end of 2016 (including only the data which pass quality control standards). The 2014 data was used to calculate salinities (ppt) for this site: the maximum value was 32.13, the minimum value was 0.27 and the average was 31.34.

Child's River (CR)

The Child's River station (41° 34 ' 47.28" N 70° 31' 51.24" W, 1.2 m deep), initiated in May 2002, is located on a dock piling at Bosun's Marina (changed from Edward's Boat Yard in 2012), 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 (sonde sensors located ~25cm above the sediment), 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 easily available. During the winter, the marina installs bubblers (deicers) at the end of each pier to prevent damage from ice. During these months (generally mid-December through March), we do not deploy a sonde. The disturbance from the bubbler changes the water quality characteristics of the river such that any data collected is artificial.

The water level range (maximum-minimum water level, including only the data which pass quality control standards) for the Child's River site has been calculated using water level data, corrected for barometric pressure, for the time period 2014-2016. The average value obtained from these three years is 1.30 m. The Child's River's average water level is 0.8322 m. The average water level has been calculated based on data available through the end of 2016 (including only the data which pass quality control standards). The 2014 data was used to calculate salinities (ppt) for this site: the maximum value was 30.58, the minimum value was 14.76 and the average was 27.83.

Sage Lot (SL)

The Sage Lot station (41° 33'15.12" N 70° 30'30.20" 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.

The water level range (maximum-minimum water level, including only the data which pass quality control standards) for the Sage Lot Pond site has been calculated using water level data, corrected for barometric pressure, for the time period 2014-2016. The average value obtained from these three years is 0.99 m. Sage Lot Pond's average water level is 0.60 m. The average water level has been calculated based on data available through the end of 2016 (including only the data which pass quality control standards). The 2014 data was used to calculate salinities (ppt) for this site: the maximum value was 32.28, the minimum value was 24.22 and the average was 30.26.

Station Code	SWMP Status	Station Name	Location	Active Dates	Reason Decommissioned	Notes
wqbcrwq	P	Child's River	41° 34' 47.28 N, 70° 31'	05/01/2002 00:00 -	NA	NA

			51.24 W			
wqbslwq	P	Sage Lot	41° 33' 15.12 N, 70° 30' 30.20 W	05/01/2002 00:00 -	NA	NA
wqbmhwq	P	Menauhant	41° 33' 9.36 N, 70° 32' 54.60 W	03/01/2001 00:00 -	NA	NA
wqbmpwq	P	Metoxit Point	41° 34' 8.04 N, 70° 31' 17.76 W	11/01/1998 00:00 -	NA	NA
wqbcbwq	P	Central Basin	41° 33' 55.80 N, 70° 31' 15.96 W	10/01/1995 00:00 - 12/01/1998 00:00	MP was considered more representative of the average water quality dynamics in Waquoit Bay. The MP site is located outside an anti-clockwise gyre, where water exchange is reduced.	
wqbctwq	P	Adjacent to Central Basin	41° 33' 55.80 N, 70° 31' 15.96 W	09/01/1998 00:00 - 10/01/1998 00:00	Considered a "rover" site. Never designed to be long-term	
wqbnbwq	P	North Basin	41° 34' 43.68 N, 70° 31' 25.32 W	10/01/1995 00:00 - 12/01/1997 00:00	Considered a "rover" site. Never designed to be long-term	
wqbnswq	P	North Basin Surface	41° 34' 43.68 N, 70° 31' 25.32 W	07/01/1997 00:00 - 12/01/1997 00:00	Considered a "rover" site. Never designed to be long-term	

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 2017, 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 December 2016 to April 2017. Due to icy conditions during the winter season and timing of boat launch, the Metoxit Point and Sage Lot stations were not occupied between December 2016 and April 2017. In preparation for the winter (before the boats are pulled), the Metoxit Point and Sage Lot stations were removed on 12/13/2016 and 12/14/2016, respectively. Childs River station was removed on 12/20/2016 once the bubblers were observed at the marina. The deployment dates and times for 2017 are indicated below:

Menauhant

DEPLOYMENT Date/Time	RETRIEVAL Date/Time
12/20/2016 13:45	01/17/2017 12:00
01/17/2017 12:15	02/03/2017 11:00
02/03/2017 11:15	03/03/2017 10:30
03/03/2017 10:45	03/30/2017 11:45
03/30/2017 12:30	04/24/2017 15:15
04/24/2017 15:45	05/16/2017 08:00
05/16/2017 08:15	06/09/2017 10:30
06/09/2017 10:45	06/30/2017 09:15
06/30/2017 09:45	07/19/2017 14:15
07/19/2017 14:30	08/04/2017 10:30
08/04/2017 11:00	08/22/2017 14:00
08/22/2017 14:30	08/29/2017 09:30
08/29/2017 09:45	09/18/2017 13:30
09/18/2017 13:45	10/10/2017 07:30
10/10/2017 07:45	10/31/2017 10:00
10/31/2017 10:30	11/09/2017 13:00
11/09/2017 13:15	11/21/2017 13:15
11/21/2017 13:30	12/04/2017 12:00
12/04/2017 14:00	01/09/2018 10:00

Metoxit Point

DEPLOYMENT Date/Time	RETRIEVAL Date/Time
04/28/2017 08:15	05/17/2017 07:45
05/17/2017 08:00	06/07/2017 09:30
06/07/2017 09:45	07/05/2017 10:45
07/05/2017 11:00	07/20/2017 13:30
07/20/2017 13:45	08/09/2017 11:45
08/09/2017 12:00	08/24/2017 14:15
08/24/2017 14:30	09/18/2017 09:00
09/18/2017 09:15	10/13/2017 10:30
10/13/2017 11:00	11/03/2017 10:15
11/03/2017 10:30	11/22/2017 09:15
11/22/2017 09:45	12/18/2017 12:00

Child's River

DEPLOYMENT Date/Time	RETRIEVAL Date/Time
04/24/2017 16:00	05/16/2017 08:15
05/16/2017 08:45	06/09/2017 11:00
06/09/2017 11:15	06/30/2017 09:45
06/30/2017 10:00	07/19/2017 14:45
07/19/2017 14:45	08/04/2017 10:45
08/04/2017 11:15	08/22/2017 14:30
08/22/2017 14:45	09/18/2017 13:45
09/18/2017 14:00	10/10/2017 07:45
10/10/2017 08:00	10/31/2017 09:30
10/31/2017 09:45	11/21/2017 13:30
11/21/2017 14:00	12/19/2017 10:00

Sage Lot

DEPLOYMENT Date/Time	RETRIEVAL Date/Time
04/27/2017 09:00	05/17/2017 10:30
05/17/2017 10:45	06/07/2017 11:00
06/07/2017 11:15	06/27/2017 14:00
06/27/2017 14:15	07/20/2017 12:00
07/20/2017 12:15	08/09/2017 08:15
08/09/2017 08:30	08/24/2017 12:45
08/24/2017 13:00	09/15/2017 14:15
09/15/2017 14:30	10/04/2017 07:30
10/04/2017 07:45	10/27/2017 12:30
10/27/2017 12:45	11/15/2017 15:00
11/15/2017 15:15	12/12/2017 12:45

7) Distribution –

NOAA retains the right to analyze, synthesize and publish summaries of the NERRS System-wide Monitoring Program data. The NERRS retains the right to be fully credited for having collected and process the data. Following academic courtesy standards, the NERR site where the data were collected should be contacted and fully acknowledged in any subsequent publications in which any part of the data are used. The data set enclosed within this package/transmission is only as good as the quality assurance and quality control procedures outlined by the enclosed metadata reporting statement. The user bears all responsibility for its subsequent use/misuse in any further analyses or comparisons. The Federal government does not assume liability to the Recipient or third persons, nor will the Federal government reimburse or indemnify the Recipient for its liability due to any losses resulting in any way from the use of this data.

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

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

As part of the SWMP long-term monitoring program, the Waquoit Bay NERR also monitors 15-minute meteorological data. Additionally, Waquoit Bay collects monthly grab and 24-hour diel samples for nutrient data which may be correlated with this water quality dataset. These data are available at www.nerrsdata.org.

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 Turner 10AU fluorometer at WBNERR. Dissolved inorganic nutrient samples are currently analyzed by the Provincetown Center for Coastal Studies (pre-2015 data was analyzed at the Woods Hole Oceanographic Institute). All data is processed and archived at WBNERR and is publicly available upon request.

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 at most sites, water clarity measurements with Secchi discs have been discarded for turbidity measurements.

Two bottles of water are now collected at each site for nutrients analysis, 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 (deployed at MH and SL)

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: Transducer, 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

YSI EXO2 Sonde (MP, started 2016; CR, started April 2017; MH, started December 2017)

Parameter: Temperature
Units: Celsius (C)
Sensor Type: Thermistor
Model#: 599870-01
Range: -5 to 50 C
Accuracy: -5 to 35: +/- 0.01, 35 to 50: +/- .005
Resolution: 0.01 C

Parameter: Conductivity
Units: milli-Siemens per cm (mS/cm)
Sensor Type: 4-electrode cell with autoranging
Model#: 599870-01
Range: 0 to 200 mS/cm
Accuracy: 0 to 100: +/- 0.5% of reading or 0.001 mS/cm; 100 to 200: +/- 1% of reading
Resolution: 0.001 mS/cm to 0.1 mS/cm (range dependant)

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

Parameter: Dissolved Oxygen % saturation
Sensor Type: Optical probe w/ mechanical cleaning
Model#: 599100-01
Range: 0 to 500% air saturation
Accuracy: 0-200% air saturation: +/- 1% of the reading or 1% air saturation, whichever is greater 200-500% air saturation: +/- 5% or reading
Resolution: 0.1% air saturation

Parameter: Dissolved Oxygen mg/L (Calculated from % air saturation, temperature, and salinity)
Units: milligrams/Liter (mg/L)
Sensor Type: Optical probe w/ mechanical cleaning
Model#: 599100-01
Range: 0 to 50 mg/L
Accuracy: 0-20 mg/L: +/-0.1 mg/l or 1% of the reading, whichever is greater

20 to 50 mg/L: +/- 5% of the reading
Resolution: 0.01 mg/L

Parameter: Non-vented Level - Shallow (Depth)
Units: feet or meters (ft or m)
Sensor Type: Stainless steel strain gauge
Range: 0 to 33 ft (10 m)
Accuracy: +/- 0.013 ft (0.004 m)
Resolution: 0.001 ft (0.001 m)

Parameter: pH
Units: pH units
Sensor Type: Glass combination electrode
Model#: 599701(guarded) or 599702(wiped)
Range: 0 to 14 units
Accuracy: +/- 0.01 units within +/- 10° of calibration temperature, +/- 0.02 units for entire temperature range
Resolution: 0.01 units

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

Parameter: Chlorophyll
Units: micrograms/Liter
Sensor Type: Optical probe
Model#: 599102-01
Range: 0 to 400 ug/Liter
Accuracy: Dependent on methodology
Resolution: 0.1 ug/L chl a, 0.1% FS

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 –

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

Childs River *(In 2017, switched from 6600-series to EXO2)*

Date Retrieved	DO	Baro.	Depth	Depth	SpCond	pH 7	pH 10	Turbidity	Turbidity	Chl 0	Chl	Rhodamine
dd/mm/yyyy	100%	Pres.		Offset	50.00	7.00	10.00	DI	124.0	DI	Rhodamine	Std value
	%	mmHg	m	m	mS/cm			NTU	NTU	µg/L	µg/L	µg/L
05/16/2017	99.8	757.0	-0.051	-0.041	50.09	6.83	9.86	0.16	129.27	-0.1	71.8	71.1
06/09/2017	99.6	752.0	-0.109	-0.109	50.17	7.06	10.07	0.27	125.8	0.02	70.1	70.7
06/30/2017	99.7	760.1	-0.003	0.001	50.0	7.11	10.07	0.32	118.6	-0.03	62.7	68.2
07/19/2017	99.2	758.8	-0.02	-0.017	49.7	6.97	10.01	0.39	50.9	31.06	34.2	65.3
08/04/2017	100.3	762.0	0.028	0.027	50.13	7.01	10.03	0.62	131.3	-0.11	63.2	66.2
08/22/2017	100.1	754.2	-0.088	-0.079	50.13	7.06	10.09	0.44	131.27	0.01	68.2	68.2
09/18/2017	100.1	760.5	-0.003	0.007	49.76	7.08	10.08	0.83	161.2	-0.01	69.2	66.4
10/10/2017	99.8	759.2	-0.013	-0.011	49.91	6.78	9.79	0.51	123.8	0.19	69.6	67.2
10/31/2017	99.5	759.2	-0.03	-0.011	50.31	7.08	10.12	0.13	130.4	0.03	70.5	69.3
11/21/2017	99.6	755.9	-0.064	-0.056	50.21	7.04	10.06	0.22	125.0	0.03	69.1	71.2
12/19/2017	99.6	754.3	-0.092	-0.078	50.06	7.05	10.01	0.14	124.3	0.03	69.1	70.2

Menauhant *(starting 12/04/2017, switched from 6600-series to EXO2)*

Date Retrieved	DO	Baro.	Depth	Depth	SpCond	pH 7	pH 10	Turb	Turb	Chl 0	Chl	Rhodamine
dd/mm/yyyy	100%	Pres.		Offset	50.00	7.00	10.00	DI	124.0/126.0	DI	Rhodamine	Std value
	%	mmHg	m	m	mS/cm			NTU	NTU	µg/L	µg/L	µg/L
01/17/2017	100.9	763.5	0.049	0.048	49.91	7.01	10.08	0.3	125.4	0.2	125.5	117.8
02/03/2017	101.5	762.2	NA	0.03	49.89	7.03	10.03	0.3	123.9	-0.4	117.4	119.4
03/03/2017	100.3	762.9	0.024	0.039	50.0	7.03	10.02	0.6	130.7	-0.1	117.8	117.8
03/30/2017	100.6	763.2	0.045	0.044	50.32	7.0	9.99	-0.2	131.8	0.2	118.1	122.5
04/24/2017	101.0	764.8	0.062	0.065	50.37	7.04	10.04	0.4	128.7	0.1	119.4	120.9
05/16/2017	98.7	757.0	-0.048	-0.041	50.34	7.0	9.98	0.0	128.3	0.2	119.1	121.1
06/09/2017	107.7	752.8	-0.117	-0.098	50.17	7.08	10.07	-0.1	121.0	0.3	122.6	122.1
06/30/2017	100.0	760.8	0.013	0.011	50.8	7.02	10.01	0.3	125.7	-0.8	121.5	118.2
07/19/2017	100.9	758.9	-0.014	-0.015	50.03	7.09	10.09	0.7	125.1	1.1	110.0	111.7
08/04/2017	101.3	762.2	0.043	0.03	50.02	7.06	10.07	0.3	130.0	0.1	112.2	113.5
08/22/2017	99.1	754.5	-0.079	-0.075	50.08	7.02	10.06	0.1	126.0	-0.2	118.2	117.8
08/29/2017	99.9	756.5	-0.053	-0.048	50.14	7.06	10.06	600.0	NA*	158.2	NA*	117.7
09/18/2017	99.4	760.1	0.003	0.001	48.53	7.04	10.05	-0.5	126.1	0.5	114.4	114.0
10/10/2017	100.2	759.2	-0.007	-0.011	49.82	7.10	10.11	0.1	123.8	-0.3	118.5	116.4
10/31/2017	100.2	759.1	-0.018	-0.013	50.37	7.03	10.06	-0.1	125.5	-0.1	118.1	119.6
11/21/2017	100.0	756.7	-0.053	-0.045	50.79	7.04	10.03	0.05	126.2	-0.2	121.0	122.3
12/05/2017	100.3	764.0	0.059	0.054	49.88	6.97	9.96	1.6	126.1	-0.3	122.4	123.8
01/09/2018	101.8	750.9	-0.013	-0.124	50.21	6.97	9.96	3.3	124.9	0.14	77.1	72.9

* Turbidity probe failed affecting chlorophyll. Standard was not wasted on the post-cal readings.

Metoxit Point *(Starting 07/06/16, switched from 6600-series to EXO2)*

Date Retrieved	DO	Baro.	Depth	Depth	SpCond	pH 7	pH 10	Turbidity	Turbidity	Chl 0	Chl	Rhodamine

dd/mm/yyyy	100%	Pres.		Offset	50.00	7.00	10.00	DI	124.0	DI	Rhodamine	Std value
	%	mmHg	m	m	mS/cm			NTU/FNU	NTU/FNU	µg/L	µg/L	µg/L
05/17/2017	100.2	757.1	-0.041	-0.04	49.99	7.05	10.06	0.04	119.2	-0.08	67.5	70.2
06/07/2017	-66.2	758.7	-0.016	-0.018	50.11	7.03	9.98	0.16	119.6	0.08	69.5	70.1
07/05/2017	100.5	764.3	0.062	0.058	49.93	7.09	10.05	0.47	124.7	0.13	70.2	67.0
07/20/2017	99.6	756.5	-0.041	-0.048	49.92	7.02	10.03	0.31	122.4	-0.02	62.5	64.4
08/09/2017	100.7	764.0	0.061	0.054	50.23	7.10	10.11	0.50	185.5	0.01	92.8	68.8
08/24/2017	100.5	761.0	0.015	0.014	50.10	7.11	10.11	0.14	125.5	-0.06	68.4	68.7
09/18/2017	99.9	760.9	-0.001	0.012	50.07	7.13	10.14	0.10	118.9	0.03	66.5	66.4
10/13/2017	101.1	771.0	0.14	0.15	49.99	7.08	10.11	0.33	121.9	0.1	66.9	71.2
11/03/2017	99.5	760.7	-0.02	0.01	50.14	7.05	10.07	0.18	130.5	-0.1	74.8	69.8
11/22/2017	99.8	756.1	-0.083	-0.054	50.09	7.16	10.16	0.02	124.5	0.12	70.2	71.1
12/19/2017	NA	754.8	-0.075	-0.071	49.91	7.05	10.03	0.10	128.7	-0.05	72.5	70.9

Sage Lot

Date Retrieved	DO	Baro.	Depth	Depth	SpCond	pH 7	pH 10	Turbidity	Turbidity	Chl 0	Chl	Rhodamine
dd/mm/yyyy	100%	Pres.		Offset	50.00	7.00	10.00	DI	126.0	DI	Rhodamine	Std value
	%	mmHg	m	m	mS/cm			NTU	NTU	µg/L	µg/L	µg/L
05/17/2017	109.0	757.5	-0.032	-0.034	50.04	6.96	10.03	-0.1	123.5	0.4	119.8	120.4
06/07/2017	100.2	758.8	-0.015	-0.017	49.77	7.02	10.04	0.2	125.9	0.2	120.6	119.6
06/27/2017	110.0	761.2	0.031	0.016	49.98	7.08	10.07	0.4	126.4	-0.5	117.1	117.2
07/20/2017	109.4	756.6	-0.039	-0.047	49.98	7.05	10.03	-0.2	126.6	-0.6	105.8	110.6
08/09/2017	100.6	764.0	0.057	0.054	50.67	7.00	9.99	0.0	129.0	-0.2	116.8	118.4
08/24/2017	101.0	761.0	0.016	0.014	50.15	7.02	10.05	-0.1	126.2	0.0	115.8	118.6
09/15/2017	100.1	761.0	0.021	0.014	50.29	7.03	10.02	0.4	125.8	0.3	112.6	112.7
10/04/2017	101.7	770.0	0.089	0.136	50.33	6.94	10.01	0.2	124.8	0.1	124.8	124.4
10/27/2017	99.4	761.1	-0.003	0.015	49.56	7.03	10.03	-0.1	127.9	0.1	120.4	119.6
11/15/2017	100.4	757.9	-0.028	-0.029	49.96	7.01	10.03	-0.1	126.1	0.1	119.5	121.5
12/12/2017	98.2	743.2	-0.251	-0.229	50.46	7.05	10.08	0.3	125.9	0.1	124.2	124.2

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.

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 50 NTU 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 100 NTU 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. Sporadic values which only occur for 1 or 2 15-minute readings, exceed 25 ug/L, and/or go over five times the magnitude of surrounding values are flagged as suspect <1> and given the code [SCS] indicating a chlorophyll spike. Sporadic values which only occur for 1 or 2 15-minute readings, exceed 40 ug/L, and/or go over ten times the magnitude of surrounding values are flagged as rejected <-3> and given the code [SCS] indicating a chlorophyll spike.

Additionally, values > 100µg/L directly following or during low or ebbing tides are likely caused by high levels of colored dissolved organic matter, or CDOM, (e.g., tannins) interfering with fluorescence optics and should be given special consideration when analyzing chlorophyll fluorescence data. Extremely high and sustained chlorophyll fluorescence data impacted by CDOM interference and/or biofouling are rejected and flagged as <-3>[SQR].

FIELD and "CSM" NOTES:

All times reported in Eastern Standard Time (EST)

Menauhant (MH)

General (affected all sensors) (MH)

- 03/02/2017, <0> (CSM) - An extreme drop in temperature (>20°C in 24 hours) and an extreme low tide event resulted in dramatic declines in specific conductivity and salinity and pH and may have influenced the spike in chlorophyll.

- 03/12/2017 11:45, <-3> [GMC](CSM) – The PVC station where the sonde is deployed was covered with algae and was disrupting turbidity measurements. The sonde was removed at 11:42 and returned at 11:47. While the sonde was removed, the PVC was scraped with a brush attached to a long pole. to remove the algae off the PVC and wipe the optic sensors with a kimwipe.

- 03/14/2017 through 03/15/2017, <0> {CWE}(CSM) – A strong nor'easter hit New England bringing almost 40mm of rain in 24 hours and causing extreme tides. The data recorded appear to fit conditions as a result of this storm.

- 06/15/2017, 10:00 to 10:45, <-3> [GMC] (CSM) – The PVC tube which contains the sonde was removed and replaced with another PVC tube with new antifouling paint. All data are rejected while the sonde was removed for maintenance.

- 08/30/2017, 11:00, <-3> [CMS](CSM) – The sonde was removed to reconnect the telemetry field cable following a troubleshooting process confirming the cause of the turbidity and chlorophyll probe failure on 08/25/2017.

- 10/05/2017 11:30, <-3> [GMC] (CSM) – The sonde was removed from 11:18 to 11:33 to improve the seal on the field cable connection. The o-ring was replaced inside the field cable "boot", parafilm was wrapped around the connection point, and electrical tape was added over the parafilm.

- 11/09/2017 13:15, <-3> [GMC] (CSM) – Removed sonde to check algae buildup and for deployment demonstration for Jeff Adams.

- 12/04/2017 12:15 to 13:45 <-2> [GMC] (CSM) – No sonde deployed while telemetry station was converted from 6600-series cable hookup to the EXO2 cables and signal output adapter.

Specific Conductivity and Salinity (MH)

- 6/3/2017 to 6/9/2017, <-3> [SSD] (CSM) – Sensor drift caused by biofouling.

- 6/17/2017 to 6/30/2017, <-3> [SSD] (CSM) - Sensor drift caused by biofouling.

- 8/14/2017 to 08/22/2017, <1> (CSM) – Following a biofouling event (likely piece of algae or small mobile creature inside the conductivity ports) from 08/12/2017 to 08/17/2017, data are marked suspect until the end of the deployment.

- 12/22/2017 to 12/23/2017, <-3> (CSM) – Although there was a heavy rainfall event over these two days which may explain the drop in specific conductivity and salinity, the changes are very abrupt and do not always correspond with the outgoing tide. Therefore, these data are rejected. The most likely scenario is some macroalgae or small fish was covering the sensors during the storm.

Turbidity (MH)

- 03/08/2017 to 03/12/2017 12:00, <-3> [SBO](CSM) – The PVC tube which the sonde rests inside during deployment was covered with a thick algae which was interfering with turbidity measurements. The sonde was removed on 03/12/2017 and the tube was brushed clean and the turbidity measurements resumed a normal baseline and range.

- 08/25/2017 to 08/29/2017, <-3> [SSM] (CSM) – The turbidity probe started showing signs of drift on 08/25/2017. Upon checking the probe in the field, the wiper was observed parking incorrectly. The sonde was removed shortly after the observation, and during the post-calibration, it was noted that the problem with the turbidity probe had also affected the chlorophyll fluorescence readings. Because the signal in the chlorophyll probe were also impacted, it's likely that the turbidity probe suffered a water leak. Once the turbidity probe was removed, the chlorophyll probe resumed normal function.

  The turbidity readings immediately leading up to the failure are marked as suspect <1> [SSM](CSM).

Chlorophyll fluorescence (MH)

- 08/25/2017 to 08/29/2017, <-3> [SSM] (CSM) – The turbidity probe started showing signs of drift on 08/25/2017. Upon checking the probe in the field, the wiper was observed parking incorrectly. The sonde was removed shortly after the observation, and during the post-calibration, it was noted that the problem with the turbidity probe had also affected the chlorophyll fluorescence readings. Because the signal in the chlorophyll probe were also impacted, it's likely that the turbidity probe suffered a water leak. Once the turbidity probe was removed, the chlorophyll probe resumed normal function.

Childs River (CR)

General (CR)

- 06/15/2017 11:00 to 11:45, <-3> [GMC] (CSM) – The PVC tube which contains the sonde was removed and replaced with another PVC tube with new antifouling paint. All data are rejected while the sonde was removed for maintenance.

- 12/13/2017 to 12/15/2017, <0> (CDF){CSM} – The irregular temperature, specific conductivity, and salinity data collected during this period seem to fit the weather and tide events. During these few days, there was a significant air temperature drop and several inches of snow fell (~3-5 inches). The water temperature fluxes appear to correspond with the tides as a result of the decreasing air temperatures and incoming warmer ocean water.

Specific Conductivity and Salinity (CR)

- 12/05/2017 to 12/06/2017, <0> (CDF){CSM} – Specific conductivity and salinity drop due to a significant rain event. The Carriage House cumulative precipitation gauge totaled 21.8mm of rain on 12/6/2017.

Turbidity (CR)

- 08/22/2017 to 09/18/2017, <-3> [SIC] (CSM) – The pre-and post-calibration were off. All data during deployment are rejected.

Chlorophyll Fluorescence (CR)

- 08/22/2017 to 09/18/2017, <-3> [SIC] (CSM) - The pre-and post-calibration were off. All data during deployment are rejected.

- 10/11/2017 to 10/31/2017, <1> or <-3> [SWM] (CSM) – The sonde was accidentally deployed without a wiper. It's unclear whether the spikes in chlorophyll fluorescence are a result of silt buildup over the optical sensor or due to a phytoplankton bloom.

Metoxit Point (MP)

Dissolved oxygen (MP)

- 05/30/2017 01:15 to 06/07/2017 09:30, <-3> [SSM] (CSM) – The dissolved oxygen probe failed. All data are rejected due to the malfunction. The failed probe was sent into YSI under warranty and it was replaced with a new probe.

Specific Conductivity and Salinity (MP)

- 07/18/2017 to 07/20/2017, {CSM} <-3> or <1> (CBF) – At retrieval four small fish were observed inside the fine mesh covering the sonde guard. Also, algae were growing on the central wiper and probes where copper/anti-fouling tape was not completely covering. This biofouling is likely the cause of the intermittent, irregular specific conductivity and salinity readings. Erratic readings have been rejected, and all other readings which occurred after the start of the interference have been flagged as suspect.

- 08/09/2017 – 08/24/2017, {CSM} <-3> (CBF) –Macroalgae are likely the cause of the intermittent, irregular specific conductivity and salinity readings. Macroalgae was observed on the central wiper and stuck between probes at retrieval and during post-calibration.

YSI EXO1 In-Situ Comparison Data

A handheld YSI EXO1 was used for field calibration and data were recorded at approximate sonde deployment depths (influenced by tide). The handheld 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 sonde is highly accurate on its initial measurement at deployment. 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: Child's River Deployment/Retrieval EXO1 Data

	Date	Time	Temp	SpCond	Salinity	DO %	DO Conc.	pH	Depth
	M/D/YY	hh:mm	C	mS/cm	ppt	%	mg/L		m
Deploy	04/24/17	15:51	13.33	44.37	28.64	151.6	13.28	8.17	0.77
Retrieve	05/16/17	8:25	13.76	44.73	28.92	84.3	7.3	7.71	0.41
Deploy	05/16/17	8:25	13.76	44.73	28.92	84.3	7.3	7.71	0.41
Retrieve	06/09/17	11:06	19.18	43.57	28.15	120.7	9.44	7.85	0.70
Deploy	06/09/17	11:06	19.18	43.57	28.15	120.7	9.44	7.85	0.70
Retrieve	06/30/17	9:48	24.02	42.22	27.12	29.3	2.1	7.23	0.93
Deploy	06/30/17	9:48	24.02	42.22	27.12	29.3	2.1	7.23	0.93
Retrieve	07/19/17	14:49	25.8	25.8	15.74	122.3	9.25	7.70	0.51
Deploy	07/19/17	14:49	25.8	25.8	15.74	122.3	9.25	7.70	0.51
Retrieve	08/04/17	10:55	25.71	42.01	26.93	81.2	8.7	7.64	0.75
Deploy	08/04/17	10:55	25.71	42.01	26.93	81.2	8.7	7.64	0.75
Retrieve	08/22/17	14:31	25.33	37.4	23.66	101.0	7.27	7.66	0.62
Deploy	08/22/17	14:31	25.33	37.4	23.66	101.0	7.27	7.66	0.62
Retrieve	09/18/17	13:53	23.74	43.13	27.77	52.3	3.78	7.47	0.68
Deploy	09/18/17	13:53	23.74	43.13	27.77	52.3	3.78	7.47	0.68
Retrieve	10/10/17	7:53	20.18	40.89	26.20	31.2	2.4	7.36	0.81
Deploy	10/10/17	7:53	20.18	40.89	26.20	31.2	2.4	7.36	0.81
Retrieve	10/31/17	9:41	16.76	39.94	25.47	56.9	4.73	7.23	0.71
Deploy	10/31/17	9:41	16.76	39.94	25.47	56.9	4.73	7.23	0.71
Retrieve	11/21/17	13:47	9.89	41.49	26.44	115.9	11.07	7.98	0.91
Deploy	11/21/17	13:47	9.89	41.49	26.44	115.9	11.07	7.98	0.91
Retrieve	12/19/17	10:02	2.69	46.63	29.35	103.7	11.51	7.93	0.89

Table 2: Menauhant (MH) Deployment/Retrieval YSI EXO1 Data

	Date	Time	Temp	SpCond	Salinity	DO %	DO Conc.	pH	Depth
	M/D/Y	hh:mm	C	mS/cm	ppt	%	mg/L		m
Deploy	12/20/2016	13:41	3.48	49.91	31.76	102.3	10.97	8.02	0.94
Retrieve	01/17/2017	12:12	2.97	49.47	31.56	103.3	11.22	7.94	1.04
Deploy	01/17/2017	12:12	2.97	49.47	31.56	103.3	11.22	7.94	1.04
Retrieve	02/03/2017	11:07	2.33	47.40	30.51	101.6	11.30	8.00	0.87
Deploy	02/03/2017	11:07	2.33	47.40	30.51	101.6	11.30	8.00	0.87
Retrieve	03/03/2017	10:48	4.50	49.44	31.58	103.3	10.81	7.90	0.74
Deploy	03/03/2017	10:48	4.50	49.44	31.58	103.3	10.81	7.90	0.74
Retrieve	03/30/2017	12:16	5.11	49.60	31.77	108.1	11.12	7.95	1.35
Deploy	03/30/2017	12:16	5.11	49.60	31.77	108.1	11.12	7.95	1.35
Retrieve	04/24/2017	15:25	12.45	47.63	30.96	108.3	9.51	7.98	0.72
Deploy	04/24/17	15:25	12.45	47.63	30.96	108.3	9.51	7.98	0.72
Retrieve	05/16/17	8:05	12.66	48.03	31.25	96.8	8.45	7.87	0.77
Deploy	05/16/17	8:05	12.66	48.03	31.25	96.8	8.45	7.87	0.77
Retrieve	06/09/17	10:37	17.15	46.88	30.50	100.9	8.12	7.84	1.35
Deploy	06/09/17	10:37	17.15	46.88	30.50	100.9	8.12	7.84	1.35
Retrieve	06/30/17	9:32	20.9	47.54	31.0	94.1	7.02	7.83	0.93
Deploy	06/30/17	9:32	20.9	47.54	31.0	94.1	7.02	7.83	0.93
Retrieve	07/19/17	14:30	25.58	47.35	30.79	117.0	8.03	7.94	1.05
Deploy	07/19/17	14:30	25.58	47.35	30.79	117.0	8.03	7.94	1.05
Retrieve	08/04/17	10:34	24.37	47.71	31.08	109.7	7.68	7.92	1.12
Deploy	08/04/17	10:34	24.37	47.71	31.08	109.7	7.68	7.92	1.12
Retrieve	08/22/17	14:05	24.51	47.05	30.61	107.1	7.46	7.91	0.68
Deploy	08/22/17	14:05	24.51	47.05	30.61	107.1	7.46	7.91	0.68
Retrieve	08/29/17	9:32	21.94	47.26	30.79	85.3	6.2	7.83	0.95
Deploy	08/29/17	9:32	21.94	47.26	30.79	85.3	6.2	7.83	0.95
Retrieve	09/18/17	13:40	22.27	46.51	30.23	100.7	7.36	7.86	0.88
Deploy	09/18/17	13:40	22.27	46.51	30.23	100.7	7.36	7.86	0.88
Retrieve	10/10/17	7:30	19.92	46.46	30.23	82.8	6.3	7.76	0.75
Deploy	10/10/17	7:30	19.92	46.46	30.23	82.8	6.3	7.76	0.75
Retrieve	10/31/17	10:12	15.14	47.68	31.08	96.6	8.03	7.88	0.77

Menauhant Continued									
	Date	Time	Temp	SpCond	Salinity	DO %	DO Conc.	pH	Depth
	M/D/Y	hh:mm	C	mS/cm	ppt	%	mg/L		m
Deploy	10/31/17	10:12	15.14	47.68	31.08	96.6	8.03	7.88	0.77
Retrieve	11/21/17	13:20	9.62	48.61	31.51	103.9	9.66	7.97	1.15
Deploy	11/21/17	13:20	9.62	48.61	31.51	103.9	9.66	7.97	1.15
Retrieve	12/04/17	12:09	7.89	48.21	31.09	104.4	10.13	7.93	1.24
Deploy	12/04/17	12:09	7.89	48.21	31.09	104.4	10.13	7.93	1.24
Retrieve	01/09/18	10:04	-0.64	50.76	31.53	100.5	11.99	7.95	0.60

Table 3: Metoxit Point (MP) Deployment/Retrieval EXO1 Data Data

	Date	Time	Temp	SpCond	Salinity	DO %	DO Conc.	pH	Depth
MP	M/D/Y	hh:mm	C	mS/cm	ppt	%	mg/L		m
Deploy	04/2817	8:12	13.64	44.98	29.1	96.6	8.38	7.84	0.40
Retrieve	05/17/17	7:51	15.09	45.10	29.2	106.4	9.08	7.97	0.55
Deploy	05/17/17	7:51	15.09	45.1	29.2	106.4	9.08	7.97	0.55
Retrieve	06/07/17	9:37	15.39	45.50	29.5	70.8	5.89	7.53	0.92
Deploy	06/07/17	9:37	15.39	45.50	29.5	70.8	5.89	7.53	0.92
Retrieve	07/05/17	10:48	25.76	45.62	29.53	119.2	8.31	7.98	1.03
Deploy	07/05/17	10:48	25.76	45.62	29.53	119.2	8.31	7.98	1.03
Retrieve	07/20/17	13:38	28.13	43.60	28.01	124.2	8.27	8.04	0.98
Deploy	07/20/17	13:38	28.13	43.60	28.01	124.2	8.27	8.04	0.98
Retrieve	08/09/17	11:50	23.09	44.24	28.58	112.0	8.14	8.01	1.02
Deploy	08/09/17	11:50	23.09	44.24	28.58	112.0	8.14	8.01	1.02
Retrieve	08/24/17	14:14	25.24	44.71	28.88	114.0	7.96	7.90	0.72
Deploy	08/24/17	14:14	25.24	44.71	28.88	114.0	7.96	7.90	0.72
Retrieve	09/18/17	9:04	23.21	44.86	29.04	88.3	6.38	7.85	0.78
Deploy	09/18/17	9:04	23.21	44.86	29.04	88.3	6.38	7.85	0.78
Retrieve	10/13/17	10:46	17.82	45.77	29.73	95.5	7.6	7.96	1.07
Deploy	10/13/17	10:46	17.82	45.77	29.73	95.5	7.6	7.96	1.07
Retrieve	11/03/17	9:29	14.65	43.59	28.13	102.0	8.72	7.79	0.99
Deploy	11/03/17	9:29	14.65	43.59	28.13	102.0	8.72	7.79	0.99
Retrieve	11/22/17	9:30	8.02	45.14	28.92	96.9	9.5	7.91	0.61
Deploy	11/22/17	9:30	8.02	45.14	28.92	96.9	9.5	7.91	0.61
Retrieve	12/18/17	12:10	NA	NA	NA	NA	NA	NA	NA

Table 4: Sage Lot Deployment/Retrieval EXO1 Data

	Date	Time	Temp	SpCond	Salinity	DO %	DO Conc.	pH	Depth
	M/D/Y	hh:mm	C	mS/cm	ppt	%	mg/L		m
Deploy	04/24/17	8:49	12.32	46.48	30.1	86.2	7.64	7.79	0.31
Retrieve	05/17/17	10:39	16.06	43.38	27.93	112.7	9.35	7.97	0.45
Deploy	05/17/17	10:39	16.06	43.38	27.93	112.7	9.35	7.97	0.45
Retrieve	06/07/17	10:58	15.6	44.80	29.0	81.7	6.82	7.53	0.57
Deploy	06/07/17	10:58	15.6	44.80	29.0	81.7	6.82	7.53	0.57
Retrieve	06/27/17	14:09	24.13	44.42	28.65	128.1	9.07	7.99	0.44
Deploy	06/27/17	14:09	24.13	44.42	28.65	128.1	9.07	7.99	0.44
Retrieve	07/20/17	12:08	27.04	45.49	29.41	108.4	7.92	7.93	0.62
Deploy	07/20/17	12:08	27.04	45.49	29.41	108.4	7.92	7.93	0.62
Retrieve	08/09/17	8:12	21.74	45.31	29.36	77.6	5.33	7.61	0.47
Deploy	08/09/17	8:12	21.74	45.31	29.36	77.6	5.33	7.61	0.47
Retrieve	08/24/17	12:47	25.15	43.82	28.24	114.5	8.05	7.79	0.35
Deploy	08/24/17	12:47	25.15	43.82	28.24	114.5	8.05	7.79	0.35
Retrieve	09/15/17	14:22	23.98	44.92	29.05	117.8	8.43	7.91	0.29
Deploy	09/15/17	14:22	23.98	44.92	29.05	117.8	8.43	7.91	0.29
Retrieve	10/04/17	7:44	16.16	43.48	28.07	100.9	8.37	8.04	0.69
Deploy	10/04/17	7:44	16.16	43.48	28.07	100.9	8.37	8.04	0.69
Retrieve	10/27/17	12:31	14.25	41.62	26.67	98.5	8.55	7.70	0.55
Deploy	10/27/17	12:31	14.25	41.62	26.67	98.5	8.55	7.70	0.55
Retrieve	11/15/17	15:02	8.42	45.48	29.19	118.5	11.45	8.01	0.62
Deploy	11/15/17	15:02	8.42	45.48	29.19	118.5	11.45	8.01	0.62
Retrieve	12/12/17	12:58	5.1	45.17	28.66	99.2	10.44	7.88	0.24

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