Jacques Cousteau (JAC) NERR Water Quality Metadata
1 January 2011 – 31 December 2011
Latest Update: 4 September 2014

I. Data set and Research Descriptors

1) Principal investigator & contact persons

Principal investigator:
Dr. Michael Kennish
Research Coordinator JCNERR
Institute of Marine & Coastal Sciences, Rutgers University
71 Dudley Road
New Brunswick, NJ 08901
Voice: (732) 932-6555 x240
Fax: (732) 932-1821
kennish@marine.rutgers.edu

Contact Person:
Gregg P. Sakowicz
Field Researcher/SWMP Technician
Jacques Cousteau National Estuarine Research Reserve (JCNERR)
Rutgers University Marine Field Station (RUMFS)
800 Great Bay Blvd.
C/o 132 Great Bay Blvd.
Tuckerton, NJ 08087
Voice: (609) 296-5260 x267
Fax: (609) 296-1024
sakowicz@marine.rutgers.edu

2) Entry verification

Deployment data are uploaded from the YSI data logger to a Personal Computer (IBM compatible). Files are exported from EcoWatch in a comma-delimited format (.CDF) and uploaded to the CDMO where they undergo automated primary QAQC and become part of the CDMO's online provisional database. Pre-deployment and post-retrieval readings are identified by depth and salinity values near zero. Excessive pre- and post-deployment data are removed from the file prior to upload with at least one-half hour (2 sample periods) of pre- and post-deployment data retained to assist in data management. During primary QAQC, data are flagged if they are missing, out of sensor range, or outside 2 or 3 standard deviations from the historical seasonal mean. The edited file is then returned to the Reserve 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 graphs the data for review. It allows the user to apply QAQC flags and codes to the data, remove remaining pre- and post-deployment data, append files, and export the resulting data file to the CDMO for tertiary QAQC 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. Data management is handled by the JCNERR's SWMP Technician, Gregg P. Sakowicz.

3) Research Objectives

The water quality of the Mullica River and Great Bay has traditionally been relatively clean and free of excessive nutrient loading from anthropogenic sources. This is due to the fact that there is very little development or industry within the drainage basin of the Mullica River and its tributaries. Great Bay had a large source of nutrient loading coming from a menhaden fish processing factory that was in operation from the early 1930's to the early 1960's and affected the lower portion of the bay. The river is relatively deep, three to nine meters in the section that is monitored. Great Bay averages about two meters in depth. The river also has a dark color due to tannins and humic compounds that are a natural product coming from the Pine Barrens and are present in large amounts within the river. It is believed that nutrients entering the river upstream do not get utilized within the river because of the lack of light penetration. The great depth of the river and the dark color from the tannins flowing down the river from the Pine Barrens hinders the utilization of these nutrients by planktonic organisms. Where the river empties into the bay, light penetration reaches the bottom of the bay and allows the utilization of the nutrients by phytoplankton, making this region more productive (Durand 1979). Water circulation questions within this unique estuary can be addressed by the use of datasondes. Because of the close proximity of the lower station (site name: B6) to Little Egg Inlet, the effects of an influx of ocean water can have dramatic effects on both the water quality and on the biological aspect of the region. Upwelling along the coast is a common occurrence during the summer months. The influx of this water into the bay can and does affect larval fish transport into and out of the bay. The cooler ocean waters can have dramatic effects on the growth rates of many different species living in the area. Datasondes have been useful in tracking the physical changes within the estuary due to occurrences such as upwelling and storm events and will be helpful in translating the resulting biological events.

4) Research Methods

The YSI datasondes (a.k.a. "dataloggers") are programmed to record temperature, specific conductance, salinity, dissolved oxygen, depth, pH, and turbidity every 15 minutes. Presently, four SWMP monitoring stations are established in the Mullica River/Great Bay Reserve. These monitoring sites extend from the fresh water/salt water interface at Lower Bank, approximately 25 kilometers up the Mullica River from the point where it joins Great Bay to the mouth of Great Bay, a distance of eight kilometers. Thus the datasondes cover a total of 33 kilometers in this estuarine system.

Calibration standards required for pH were purchased from Y.S.I. (p/n 003822 (pH 7) and 003823(pH 10)). A two-point calibration was employed for pH, the first being pH 7 followed by pH 10. Calibration of the pH probe was performed via immersion in the standard and using the calibration feature of the EcoWatch software and accepting the reading after sixty seconds.

Calibration standards required for conductivity were purchased from Y.S.I.. A standard of 10 mS/cm (p/n 060911) was used to calibrate for conductivity. Calibration of the conductivity probe was performed via immersion in the standard and using the calibration feature of the EcoWatch software and accepting the reading after sixty seconds.

Dissolved oxygen was calibrated via immersion in a bucket of oxygen-saturated tap water and utilizing the dissolved oxygen calibration function of the datasonde(s). Oxygenation of the water was accomplished via aeration with an aquarium pump and air-stone for a minimum of 2 hours to saturate tap water prior to calibration. Prior to calibration, the membrane (when using a Clark-style polargraphic Y.S.I. Rapid Pulse probe), was "burned in" by allowing the datasonde to run in discrete mode for a minimum of 10 minutes to assess its suitability and stability. The sensor was then allowed to "rest" overnight prior to calibration. Calibration of the dissolved oxygen probe was performed via immersion in the aerated water and using the calibration feature of the EcoWatch software and accepting the reading after sixty seconds. The membrane on the oxygen probe was changed prior to every deployment. Installation of the D.O. membrane was as follows: the datasonde was inverted (probes facing upwards) and the reservoir of the DO probe was filled with the appropriate solution, allowing a meniscus bubble to form over the DO terminals. The DO membrane was then stretched over the face of the probe and secured using a rubber O-ring. The membrane was inspected for folds or trapped bubbles.

Y.S.I. ROX optical D.O. probes were utilized at the down-river stations (B6 and B9) through the entire 2011 period, and installed in place of the Y.S.I. Rapid Pulse D.O. probe at the NE station on 05/06/2011 and at the BA station on 04/11/2011 (and replaced the Rapid Pulse probes thereafter). This probe requires no between-deployment reinstallation or maintenance of the optical surfaces and probe "face" beyond gentle cleaning and inspection for damage. Calibration of this probe is performed in the same manner as the Rapid Pulse probe, described above.

Calibration of the turbidity probe was performed with a 0 NTU (Nephelometric Turbidity Units) solution (de-ionized water) and a 126 NTU standard (supplied by YSI, inc., p/n 607300) in the longer version of the datasonde cup/cap (YSI p/n 116275). Calibration of the Turbidty probe was performed via immersion in each standard and using the calibration feature of the EcoWatch software and accepting the reading when stable.

Used conductivity and pH standards were stored for rinsing probes and performing post-deployment calibrations after retrieval and prior to cleaning loggers. Great care was taken to clean the datasondes before calibration, and each used standard was used once as a post-calibration solution and once as a rinse solution before being discarded (unless egregious contamination was suspected).

Datasondes were deployed by inserting them in PVC pipes that are affixed to a permanent structure (i.e. two US Coast Guard channel markers (Buoy 126 and Buoy 139), one commercial dock (Chestnut Neck), and one bridge (Lower Bank). The bottoms of the PVC pipes were situated approximately 1m above the sediment. A line was used to lower and recover the datasondes within the pipes. A cross-pin (stainless steel or brass bolt) was inserted across the bottom of the pipe and served as an end-stop for the datasonde during its descent, assuring a maximum fixed depth and retaining the datasonde if the line parted. Two-inch vent holes or two- by ten-inch-wide slots were drilled or cut in the bottom of the pipe to allow for circulation of water across the probes. An antifouling paint (Petit Trinidad SLR) was used to coat the last few meters of the PVC pipes, both inside and out, to retard biofouling and subsequent blockage of the holes/vents. A locking cap provided security.

In 2011, two methods of deployment and data collection were employed. The first being a stand-alone deployment during which a datasonde autonomously collected data on 15-minute intervals on Eastern Standard Time (EST) and record these data internally, to later be downloaded onto a desktop/laptop computer post-retrieval. This method was employed at stations Buoy 139 (B9) and Lower Bank (BA). The second method employed was the pairing of datasondes with telemetry equipment that received data from the datasondes and broadcast it to the GOES satellite for receipt by the NOAA Hydrometeorological Automated Data System (HADS) as well as an independent array at the NERRS CDMO. These data were also recorded independently every 15 minutes in Eastern Standard Time (EST) by the datasondes for redundancy and to continue with the pre-existing NERRS SOP. Telemetry was employed at Buoy 126 (B6) and Chestnut Neck (NE) in 2007. For more detail concerning these telemetered datasonde stations, see below:

The Sutron Sat-Link2 transmitter was installed at this Buoy 126 (B6) on 06/22/06 and transmits data to the NOAA GOES satellite, NESDIS ID #3B00C264. The transmissions are scheduled hourly and contain four (4) data sets reflecting fifteen minute data sampling intervals. Upon receipt by the CDMO, the data undergoes the same automated primary QAQC process detailed in Section 2 above. The “real-time” telemetry data become part of the provisional dataset until undergoing secondary and tertiary QAQC and assimilation in the CDMO’s authoritative online database. Provisional and authoritative data are available at http://cdmo.baruch.sc.edu.

The Sutron Sat-Link2 transmitter was installed at Chestnut Neck (NE) on 09/19/06 and transmits data to the NOAA GOES satellite, NESDIS ID #3B03E386. The transmissions are scheduled hourly and contain four (4) data sets reflecting fifteen minute data sampling intervals. Upon receipt by the CDMO, the data undergoes the same automated primary QAQC process detailed in Section 2 above. The “real-time” telemetry data become part of the provisional dataset until undergoing secondary and tertiary QAQC and assimilation in the CDMO’s authoritative online database. Provisional and authoritative data are available at http://cdmo.baruch.sc.edu.

During each sampling period, measurements of specific conductance, salinity, temperature, dissolved oxygen, (percent saturation and concentration measured in mg/L), water level (depth), pH, and turbidity were recorded. After approximately 30 days datasondes were retrieved from the PVC pipe. Deployment periods were occasionally extended during 2007 because of weather restrictions. A YSI 600 datasonde attached to a YSI 650-MDS "handheld unit" was then lowered to depth in order to sample in-situ water conditions at approximately the same depth at which data was recorded. A different calibrated and programmed YSI datasonde was then deployed to replace the datasonde being recovered. The recovered datasonde was brought back to the laboratory for downloading, post-deployment calibration checking, cleaning, and re-calibration. For some retrievals (due to one of our three 6600 datasondes being out for repairs or our desire to keep the same datasonde at the same SWMP site for consistency), the datasonde was not replaced but rather brought back to the field station, processed as described above, and re-deployed or replaced later that day or the following day.

Upon retrieval, datasondes were wrapped in a white towel and placed in a cooler for transport back to the laboratory. Datasondes were then placed in an aerated bucket of tap water overnight before post-processing according to SWMP standard operating procedures. Post-processing involves the placing of the un-cleaned datasonde in standards and recording of the displayed values, to judge how well the probes maintained calibration, determine the effect of bio-fouling (if any), and judge whether probe failure occurred during the deployment. After this post-deployment calibration check, probes were cleaned as per SWMP standard operating procedures and either re-calibrated for the next deployment or capped for storage for later calibration and deployment.

Datasondes were programmed to start recording data (ranging from one sample period to a few hours) before they were deployed in the field and allowed to run in either a wet, enclosed environment or an aerated water-filled bucket, so these deployment files often contained "tail ends" of non-deployment ("out-of-water event") data, which were used to diagnose the probes but deleted before the data were processed for import into the yearly datasets. The beginning and end of each data file was compared to the 600/650MDS handheld unit values and the data were checked for probe failure and fouling.

5) Site Location and Character

The Jacques Cousteau National Estuarine Research Reserve (JCNERR) at Mullica River/Great Bay is located on the northeast coast of the United States on the Atlantic Ocean. The estuary is near Tuckerton, New Jersey about 14 kilometers north of Atlantic City. There were four active sampling stations in 2009. All four locations can be characterized by having little macroalgae (few to no established beds in the immediate locale; only occasional seasonal and structurally-dependent fouling-type macroalgal communities), fast moving tidal currents, and tidal ranges of approximately 1m (although this can vary significantly depending on moon state, storm events, and coastal wind conditions (e.g.- "blow out tides" associated with strong offshore winds). All sites are in a relatively undisturbed area with minimal impact from development or pollution.

1) Buoy 126 (B6) - 39deg 30'28.44"N, 74 deg 20'18.67"W- located three kilometers from Little Egg Inlet on the eastern side of Great Bay and is 100 meters from the nearest land that is a natural marsh island. This is a naturally deep area that has never been dredged, but it is located about 0.5 kilometers from an area in the Intracoastal Waterway that is dredged regularly. The datasonde at this location is attached to Intracoastal Waterway Buoy 126 and is the closest monitoring station to Little Egg Inlet. This site can be characterized by having strong tidal currents, 2-3 knots, fine to course sand bottom with an extensive blue mussel bed surrounding the area. Groundwater inputs from margins of the estuary as well as surface flow from Mullica River account for the majority of freshwater coming into the system at this site, followed by input from rainwater from the marsh surface. In 2011, the reported temperature at this station ranged from 4.2°C to 29.0°C, with an average of 16.6°C, BUT the sonde was removed for ice-over conditions in early 2011; it is likely that the minimum temperature at this station was closer to 0C and the average was slightly lower than the aforementioned value. The reported salinity at this station ranged from 18.7ppt to 31.5ppt, with an average of 27.7ppt. It is important to note that fouling may have occasionally depressed some salinity readings and are "flagged" as such in the dataset, so the aforementioned average and range may not be accurate. The maximum tidal range, as recorded by the datasonde, was 2.30m. It has been some time since the actual depth at this station has been surveyed (sediment deposition and erosion around the structure has effect on the actual depth of the water column at this station), but in 2008 average depth at the B6 station was assessed at 3.91m, with a range of 2.72 to 5.09m. The results of a sonar depth-survey of reserve waters are expected in 2012, and we (the JCNERR) plan to independently survey the area in the upcoming year as well.

2) Buoy 139 (B9) - 39deg 29'24.65"N, 74 deg 22'53.83"W- is located 4 kilometers from Buoy 126 on the western side of Great Bay and is located about one to one and one-half kilometers from land. The datasonde at this location is attached to Intracoastal Waterway Buoy 139. The closest landform is an extensive salt marsh approximately 1.5 kilometers wide, which borders the upland area. This area is dredged by the U.S. Army Corp of Engineers approximately every five to six years to maintain the channel at a depth of approximately 2.5 meters. The surrounding depth of the bay is approximately 1.5 to 2 meters. This site is characterized by having maximum currents of about 1.5 knots with a muddy sand bottom and with little structure or shell. Groundwater inputs from margins of the estuary as well as surface flow from Mullica River account for the majority of freshwater coming into the system at this site, followed by input from rainwater from the marsh surface and above. In 2011, the reported temperature at this station ranged from 3.3°C to 29.1°C, with an average of 17.3°C, BUT the sonde was removed for ice-over conditions in early 2011; it is likely that the minimum temperature at this station was closer to 0C and the average was slightly lower than the aforementioned value. The reported salinity at this station ranged from 16.6ppt to 30.8ppt, with an average of 26.7ppt. It is important to note that fouling may have occasionally depressed some salinity readings and are "flagged" as such in the dataset, so the aforementioned average and range may not be accurate. The maximum tidal range, as recorded by the datasonde, was 2.92m. It has been some time since the actual depth at this station has been surveyed

(sediment deposition and erosion around the structure has effect on the actual depth of the water column at this station), but in 2008 average depth at the B9 station was assessed at 3.18m, with a range of 2.13 to 4.55m. The results of a sonar depth-survey of reserve waters are expected in 2012, and we (the JCNERR) plan to independently survey the area in the upcoming year as well.

3) Chestnut Neck (NE) - 39deg 32'52.37"N, 74deg 27'38.77"W - located 12 kilometers up the Mullica River from the mouth of the river. The river begins at a line drawn between Graveling Point and Oysterbed Point on the northwestern side of Great Bay. The Mullica River at this location is quite wide, about 250 meters. The datasonde is attached to the dock of a small marina along the southern shore of the river adjacent to the main channel. This location has never been dredged. The site is characterized by having tidal currents of less then one knot, during both ebb and flood tide, and has a mixed organic mud/sand bottom. Freshwater input is primarily from groundwater and watershed runoff. In 2011, the reported temperature at this station ranged from -0.9°C to 30.6°C, with an average of 17.0°C, BUT the sonde was removed for ice-over conditions in early 2011; it is likely that the average was slightly lower than the aforementioned value. The reported salinity at this station ranged from 0.97ppt to 38.85ppt, with an average of 21.85ppt. It is important to note that fouling may have occasionally depressed some salinity readings and are "flagged" as such in the dataset, so the aforementioned average and range may not be accurate. The maximum tidal range, as recorded by the datasonde, was 1.92m. It has been some time since the actual depth at this station has been surveyed (sediment deposition and erosion around the structure has effect on the actual depth of the water column at this station), but in 2008 average depth at the NE station was assessed at 2.32m, with a range of 1.11 to 3.45m. The results of a sonar depth-survey of reserve waters are expected in 2012, and we (the JCNERR) plan to independently survey the area in the upcoming year as well.

4) Lower Bank (BA) - 39deg 35'37.18"N, 74 deg 33'05.44"W- located 13 kilometers upriver of the Chestnut Neck location. The Mullica River at this site is about two hundred meters wide. The datasonde is located at the center of a bridge spanning the Mullica River. The northern bank of the river is sparsely developed with single-family houses and has a steep bank about five meters high. The southern shore has an extensive marsh and fresh water wetland area about three kilometers wide. This site can be characterized by having fast tidal currents, just over one knot, deep water, and fine mixed organic mud and sandy sediment. Freshwater input is primarily from groundwater and watershed runoff. In 2011, the reported temperature at this station ranged from -3.4°C to 32.8°C, with an average of 19.0°C, BUT the sonde was removed for ice-over conditions in early 2011; it is likely that the minimum temperature at this station was closer to 0C and the average was slightly lower than the aforementioned value. The reported salinity at this station ranged from 0.07ppt to 21.16ppt, with an average of 3.25ppt. It is important to note that fouling may have occasionally depressed some salinity readings and are "flagged" as such in the dataset, so the aforementioned average and range may not be accurate. The maximum tidal range, as recorded by the datasonde, was 1.91. It has been some time since the actual depth at this station has been surveyed (sediment deposition and erosion around the structure has effect on the actual depth of the water

column at this station), but in 2008 average depth at the BA station was assessed at 2.77m, with a range of 1.43 to 3.98m. The results of a sonar depth-survey of reserve waters are expected in 2012, and we (the JCNERR) plan to independently survey the area in the upcoming year as well.

6) Data Collection Period

Data collection at the JCNERR is often performed on a seasonal (rather than year-round) basis due to ice-over conditions in local waters and the damages associated with ice formation and movement. Typically, the target date for redeployment after the winter is mid-March, but is often earlier if conditions permit or later if winter conditions linger and/or stations are significantly damaged post-thaw. Datasondes are pulled and stations deactivated when ice-over conditions are anticipated (typically in early- or mid-December) in an attempt to avoid damage and/or loss of equipment due to the destructive nature of ice movements.

Site	Filename	Deploy Date	Time	Retrieve Date	Time
B6	b6031711	03/17/2011*	14:15	04/18/2011	18:15
	b6041811	04/18/2011	18:29	05/17/2011	13:59
	b6051711	05/17/2011	14:15	06/24/2011	14:15
	b6062411	06/24/2011	14:30	07/22/2011	10:15
	b6072211	07/22/2011	10:30	08/19/2011	09:45
	b6081911	08/19/2011	10:15	10/17/2011	21:15
	b6102811	10/28/2011	13:15	12/19/2011	16:45
	b6122211	12/22/2011	13:15	01/25/2012	14:30
B9	b9wq031711	03/17/2011*	14:30	04/22/2011	13:00
	b9wq042211	04/22/2011	13:29	05/19/2011	14:29
	b9wq051911	05/19/2011	15:00	06/30/2011	13:30
	b9wq063011	06/30/2011	14:00	07/28/2011	13:00
	b9wq072811	07/28/2011	13:15	09/22/2011	10:30
	b9wq091411	09/22/2011	11:00	10/25/2011	11:00
	b9wq102511	10/25/2011	11:15	12/12/2011	14:15
	b9wq121211	12/12/2011	14:30	01/11/2012	11:30
NE	ne113010	11/30/2010	14:00	07/04/2011	12:45
	ne010411	01/04/2011*	13:15	01/10/2011	12:30
	ne030411	03/04/2011	11:00	04/06/2011	13:15
	ne040611	04/06/2011	13:45	05/06/2011	08:15
	ne050611	05/06/2011	08:45	05/17/2011	15:00
	ne051711	05/17/2011	15:30	06/26/2011	10:00
	ne062911	06/29/2011	13:45	08/22/2011	10:00
	ne082211	08/22/2011	10:30	10/26/2011	09:30
	ne102611	10/26/2011	14:00	12/29/2011	13:45

	ne122911	12/29/2011	14:15	02/02/2012	11:45
BA	ba041111	04/11/2011*	10:45	06/6/2011	13:45
	ba060611	06/06/2011	14:00	07/11/2011	13:00
	ba071111	07/11/2011	13:30	08/26/2011	13:30
	ba082611	08/26/2011	13:45	10/31/2011	09:15
	ba103111	10/31/2011	16:00	01/02/2012	12:00

*= data for this year were not collected prior to this date and time due to the sondes being removed from the field due to ice-over conditions and subsequent repairs made to the stations after damages to the sonde tubes were remedied in the springtime. These periods of missing data are excused for the northeastern reserves until March 15th, after which point the NERRS Oversight Committee weighs judgment as to whether the data are considered excused or missing; all missing data AFER March 15, 2011 were reviewed and excused by the Oversight Committee.

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:
National Estuarine Research Reserve System (NERRS). 2012. System-wide Monitoring Program. Data accessed from the NOAA NERRS Centralized Data Management Office website: http://cdmo.baruch.sc.edu/; *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 http://cdmo.baruch.sc.edu/. Data are available in comma delimited format.

8) Associated Researchers and Projects

As per the requisites of the national SWMP program, the JCNERR performs nutrient sampling and meteorological monitoring correlated with the water-quality data addressed in this report. Data can be accessed by visiting www.nerrsdata.org

During 2011, weekly ichthyoplankton sampling at Little Sheepshead Creek Bridge (LSCB) continued as part of the long-term sampling conducted by the Rutgers University Marine Field Station (RUMFS) in the Jacques Cousteau National Estuarine Research Reserve (JCNERR). Presence and abundance of larval fishes are determined with a plankton net (1 m, 1 mm mesh) deployed during night flood tides from a bridge near Little Egg Inlet (New Jersey) in the Great Bay/Little Egg harbor portion of the JCNERR.

RUMFS conducts annual trawl survey at numerous sites from offshore of Little Egg Inlet to the freshwater interface up the Mullica River. SWMP data are regularly used in the analysis of community composition and species assemblage.

A wire-mesh trapping survey of fish and crustaceans conducted by RUMFS within the RUMFS boat basin also continued in 2011 as part of long-term sampling within the Reserve.

Drs. Kenneth W. Able and Thomas Grotheus from the Rutgers University Marine Field Station (RUMFS) are studying species distributions, daily movements, and seasonal migration patterns of numerous finfish and crustaceans using surgically implanted or tethered hydroacoustic transmitters and an array of buoy-mounted and hand-operated receivers. The study area includes the Mullica River/Great Bay estuary, the southern end of Barneget Bay, and the coastal ocean outside of Little Egg Inlet off Tuckerton, New Jersey. Dr. Thomas Grotheus is using the 2011 SWMP water quality data extensively in his multivariate statistical analyses. Visit www.stripertracker.org for more information.

Jason Turnure, a graduate student at RUMFS, utilized SWMP data in his analyses of movements of telemetered weakfish (*Cynoscion regalis*)

Dr. Mark Sullivan's class at Stockton College has extensively utilized the JCNERR's SWMP dataset, including WQ data, in their curriculum.

Over-wintering populations of seals near the B6 site were observed/studied over the winter 2010-2011 and 2011-2012 as a joint Rutgers University/Stockton College program; SWMP data from B6 were utilized in these observations/study.

Dr. Karen Lee from the University of Pittsburg performed a number of experiments regarding European Green Crab (*Carcinus maenas*) invasion in a number of East-coast locations, including the JCNERR, and will be utilizing SWMP data in her analyses.

Ben Wurst from Conserve Wildlife NJ has been studying Eastern Diamondback Terrapins in the JCNERR and plans to utilize SWMP data in his analyses.

The JCNERR continued a biofouling project that was initiated in 2003. Conducted by the Research Coordinator and JCNERR staff, several biofouling panels constructed of PVC plates were secured to cages and placed on the bottom. Many of these panels were deployed near SWMP stations. One set of panels was retrieved per month from June through the end of October and were processed for species content after the samples were preserved.

II. Physical Structure Descriptors

9) Sensor Specifications

JAC NERR utilized three datasonde types in 2011: Three YSI vented-level 6600EDS datasondes were utilized at the upriver stations (NE and BA). Two YSI non-vented 6600EDS and two YSI unvented V2-4 datasondes were utilized, interchangeably, at the two downriver stations (B6 and B9).

Two dissolved-oxygen probes were utilized at JAC NERR in 2011:
ROX optical DO probes were installed in the downriver sondes in 2010, so the 2011 SWMP datasets for B6 and B9 contain D.O. data collected entirely with ROX probes. ROX ODO probes were installed in the upriver dataloggers in early 2011; all data collected at BA in 2011 were via the ROX sensor. Data collected between 01/01/11 and 04/06/11 13:30 at the NE station were with the Clark-type polarographic sensor; all subsequent DO data at this station were via the ROX sensor.

YSI 6600EDS and V2-4 datasonde

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

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

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

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

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

Or

Sensor Type: Optical probe w/ mechanical cleaning
Model#: 6150 ROX
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: +/- 15% or reading
Resolution: 0.1% air saturation

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

Parameter: 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 0-10 ft: +/- 0.01 ft (0.003 m)
Accuracy 10-30 ft: +/- 0.06 ft (0.018 m)
Resolution: 0.001 ft (0.001 m)

Parameter: pH
Units: units
Sensor Type: Glass combination electrode (glass "globe" type)
Model #: 6561
Range: 0 to 14 units
Accuracy: +/- 0.2 units
Resolution: 0.01 units

Parameter: pH
Units: units
Sensor Type: Glass combination electrode (flat glass type)
Model #: 605091
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

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 1.03 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.

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.

10) Coded Variable Definitions

Sampling Station:	Sampling Site Code	Station Code
Buoy 126	B6	jacb6wq
Buoy 139	B9	jacb9wq
Lower Bank	BA	jacbawq
Chestnut Neck	NE	jacnewq

jac = Jacques Cousteau National Estuarine Research Reserve

wq = water quality data

example 1: B6031711 = this demonstrates the naming convention for deployment files. This denotes a deployment at Buoy 136 starting on 03/17/11.

example 2: jacb6wq2011= water quality data from JCNERR's Buoy 126 station for the year 2011

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

Deployment filename Datasonde ID#, Dissolved Oxygen #1, Dissolved Oxygen #2, depth measured/expected offset, Specific Conductivity, pH7, pH10, Turbidity0

Deployment date	SpCond 10mS/cm3	DO 1 (100%)	DO 2 (100%)	pH (7)	pH (10)	Turb 0NTU	Depth m
B6							
03/17/11	10.04	100.6	99.6	7.05	10.06	-0.5	0.037
04/18/11	9.985	98.7	98.4	6.67	9.67	6.1	-0.027
05/17/11	9.667	0.6	0.7	7	9.93	0.9	-0.084
06/24/11	9.27	92.5	92.3	7.12	10.04	50.3	-0.022
07/22/11	9.848	0	0	7.08	10.21	4.3	0.096
08/19/11	*	*	*	*	*	*	*

10/28/11	9.959	99.2		7.09	10.14		-0.013
12/22/11	9.99	101.2		6.93	9.93	0	0.07

B9

03/17/11	10.02	102.8	102.8	7.03	10.11	-0.2	0.186
04/22/11	9.914	97	97.3	7.08	10.05	0.8	-0.001
05/19/11	10.01	97.8	97.7	7.08	9.99	2.6	0.015
06/30/11	9.827	96.4	96.8	7.13	10.11	-0.3	0.041
07/28/11	9.739	101.5	101.6	7.02	10.04	641.3	0.039
09/22/11	9.988	100.3	**	6.99	9.94	0.2	0.093
10/25/11	10.02	102	**	7.18	10.09	0.3	0.132
12/12/11	9.857	99.6	**	6.92	9.93	0.7	0.02

NE

01/04/11	9.97	99.9	100.5	7	10.26	2.2	-0.004
03/04/11	9.95	108.1	108.3	7.61	10.59	-0.6	-0.006
04/06/11	10.02	101	101	7.17	10.03	2.5	-0.018
05/06/11	10.25	98.5	98.3	7.41	10.42	0	0.036
05/17/11	9.75	99	99.5	7.13	10.03	1	0.018
06/29/11	10.02	98.1	97.8	7.01	10.07	16.2	0.037
08/22/11	10.92	98.8	99.3	7.1	9.79	31	-0.004
10/26/11	9.3	99.7	99.6	7.21	10.1	0.8	-0.004
12/29/11	10.31	101.8	101.7	7.06	10.01	1	-0.004

BA

04/11/11	9.69	97.4	98.3	6.88	9.82	0.8	0
06/06/11	10.51	98.1	98.4	6.88	9.83	0.4	-0.004
07/11/11	9.909	98.7	98.7	7.04	9.81	5.8	0.059
08/26/11	9.909	98.7	98.7	7.04	9.81	2.7	0.059
10/31/11	9.063	96.9	96.9	7.15	10.07	0.6	-0.012

*= data not recorded due to power failure of sonde long before recovery date; comparison with postcal values would have had no correlation with values obtained before failure.

**= data not recorded

SpCond= datasonde output in a 10mS/cm3 Specific Conductivity standard

D.O.% (1)= first datasonde output in a 100% Dissolved Oxygen-saturated environment

D.O.% (2)= second datasonde output in a 100% Dissolved Oxygen-saturated environment pH7= datasonde output in a pH7 standard solution

pH10= datasonde output in a pH10 standard solution

Turbidity0= datasonde output in a 0 NTU turbidity standard (e.g.- Deionized water)

Depth= datasonde output with depth port exposed (above-water); should be zero or near-zero, depending on barometric pressure and sonde being vented vs. unvented

14) Other Remarks/Notes

This section details comments concerning data in the data set that are not adequately described by the coding convention or require additional comment/qualification.

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. Occasionally, supplementary data are available from proximal non-SWMP stations. If additional information and/or missing data are needed, contact the Research Coordinator at the reserve submitting the data.

There are instances at this NERR site where negative turbidity values between -0001 and -0002 NTU's are recorded. Because such values fall within the range of accuracy (+/-2 NTU) of the turbidity probes, these data are considered suspect but not rejected.

There are instances at this NERR site where negative turbidity values less than -0002NTU's are recorded. Because such values fall outside the range of accuracy (+/-2 NTU) of the turbidity probes, these data were rejected and flagged with a <-3> <SNV> (negative value) designation in the dataset.

Note to users: When utilizing these data, it is always best to also review the SWMP Meteorological (MET) dataset from this reserve to provide weather conditions that may affect the SWMP Water Quality (WQ) data from this reserve. For example, strong precipitation and strong sustained winds may cause elevations in turbidity and alter dissolved oxygen levels. Periods of drought may alter salinity patterns and lead to anoxic conditions in poorly-circulated regions of reserve waters. Hurricane and Nor'easter events may alter WQ parameters in the above, and other, manners. Provisional MET data from the JCNERR's MET station (station code: jacncmet) are available at the CDMO website (http://nerrsdata.org/), and are scheduled for review mid-April 2011.

All stations: Hurricane Irene impacted the New Jersey area 08/27/2011 – 08/29/2011, actually making landfall over the B6 station early morning 08/28/2011. The aforementioned dates were labeled as "CWE" (extreme weather event) in the dataset, and it should be noted that the effect of this storm persisted long after the weather cleared in the form of runoff and mixing/agitation of local waters.

The Hurricane Irene event was followed up by a broad low-pressure setup over the eastern seaboard, combined with the remnants of Tropical Storm Lee, delivering additional rainfall 09/05/11 through 09/12/2011. Considerable coastal flooding, winds, rainfall, and runoff occurred during these events and influenced the SWMP data (water, weather, and nutrients) for some time thereafter. Because this phenomenon was not as extreme as the Hurricane Irene event, the data were not flagged as "CWE" BUT its effect may or should be considered in analysis of these data.

Station-Specific Comments:

B6

The pipe at B6 was discovered missing on 03/29/2011. The condition of the pipe and straps upon recovery on 03/30/2011 suggested vandalism and/or a boat-strike. All data recorded by the instrument 03/20/2011 14:15 – 03/30/2011 12:15 were recorded while the sonde and pipe were lying on the bottom, so all data recorded during this period were rejected based on the assumption (which the data appear to support) that the data were compromised by blockage/interference by sediment EXCEPT temperature, which appears to fit the conditions and should have been minimally affected by sediment blockage.

The cross-piece at the bottom of the pipe failed during the b6081911 deployment, preventing recovery/swap of the sonde and resulting in an extended deployment, heavier-than-usual biofouling, and terminated with battery failure. Data for a number of the parameters are flagged as suspect in this dataset depending to the degree to which they were affected by the biofouling.

B9

The b9072811 deployment became stuck halfway up the pipe upon attempted retrieval on 09/14/11 09:45, requiring the removal and replacement of the pipe, resulting in data being collected at the wrong depth from 09/14/11 10:00 until the recovery date on 09/22/11 10:30. Because this deployment was extended longer than the recommended 30 days, the latter half of the deployment was also plagued by heavy biofouling; data are flagged reflecting this.