Jacques Cousteau (JAC) NERR 2009 Nutrient Metadata
January 2009 to December 2009
Latest Update: 19 January 2015

I. Data Set and Research Descriptors

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2) **Research objectives**

a) **Monthly grab**

Monthly grab samples for the Jacques Cousteau National Estuarine Research Reserve (JCNERR) are taken along a well-defined salinity gradient of the Mullica River-Great Bay

estuarine system. The sites where the samples are taken along this salinity gradient include Lower Bank and Chestnut Neck in the Mullica River and Buoy 126 and Buoy 139 in Great Bay (see site descriptions below). These four sampling sites span a distance of more than 30 km. In addition a monthly grab sample is taken in Little Egg Harbor estuary at Buoy 115 (see site description below). A major objective of this monitoring program is to determine the nutrient concentrations along the aforementioned salinity gradient over a long-term time series. Previous studies have shown that nitrogen standing stocks in the Mullica River-Great Bay Estuary largely consist of nitrate, ammonium, and nitrogen in organic combination. The nitrogen enters at the head of the estuary largely in inorganic form, but in Great Bay it is transformed mainly to organic combination. However, more data are needed to accurately assess the concentrations of the various nitrogen forms along the salinity gradient, and to determine seasonal variations in the concentrations over a protracted period of several years. It is also necessary to obtain continuous monthly measurements of phosphate, which is also a macronutrient of considerable importance to the system.

Monthly grab samples are needed to obtain accurate measurements of nitrate, ammonium, and phosphate because of their overriding importance to primary production in waters of the JNERR. These data can then be compared to chlorophyll *a* measurements to assess their relationship to phytoplankton biomass. A major goal of JNERR is to characterize biotic communities along the salinity gradient of the Mullica River-Great Bay Estuary, and it is therefore vital to obtain physical-chemical measurements (including nutrient concentrations) along the gradient. A part of this effort is to determine the nutrient concentrations along the salinity gradient, and how these concentrations are influencing biotic processes down-estuary. In addition, a long-term objective of monthly grab sampling is to develop a nutrient (nitrogen) budget for JCNERR. To develop a budget, data (concentrations) are needed on the various nitrogen species monitored at the SWMP sites as well as data collected on the nitrogen forms associated with atmospheric deposition. An accurate nutrient budget will be useful for analyzing the overall productivity of estuarine waters in the JNERR, which will be important to resource managers of the system.

b) **Diel sampling program**

Diel sampling is conducted via an ISCO automated sampler at Buoy 126 in Great Bay to assess nutrient concentrations and changes in concentrations over tidal cycles. In addition, these data augment monthly grab samples taken at Buoy 126 (see above). It is believed that nutrients entering from the watershed estuary are not utilized within the Mullica River because of the lack of light penetration. The depth of the river and the dark color from the tannins flowing down the river from the Pine Barrens hinder the utilization of these nutrients by planktonic organisms. Where the river empties into the bay, light penetration reaches the bottom and allows utilization of the nutrients by phytoplankton, making this region more productive. A major goal of ISCO sampling is to compare nutrient concentrations over a 24-hour period with phytoplankton rate processes. To this end, JNERR is also deploying a backscatter fluorometer to obtain an accurate measure of phytoplankton biomass in the area of Buoy 126. By relating nutrient measures with chlorophyll *a* over a continuous diel period, it is hoped that a strong correlation can be made of the significance of nutrient inputs to

phytoplankton rate processes in the system. Diel sampling at Buoy 126 will also be useful in the development of a nutrient budget for the system.

3) **Research methods**

a) **Monthly grab sampling program**

Monthly grab samples were taken at four stations within the Mullica River-Great Bay estuary and at one station in the Little Egg Harbor estuary. Samples were taken at four principle JNERR datasonde stations (Buoy 126, Buoy 139, Chestnut Neck and Lower Bank) and at one station in Little Egg Harbor estuary (Buoy 115). Samples were collected at approximately 30-day intervals. Effort was made to obtain grab samples at or before slack low tide conditions (+3 hour before low tide), approximately one month after the previous sampling period. No distinction was made between neap and spring tide conditions. Water-related field parameters were measured in situ with a YSI 600XL paired with a YSI 650MDS display unit and manually recorded on a field datasheet. Weather-related field parameters were assessed by observation and estimation. Replicate (N=2) samples were collected by hand with a bucket at an approximate depth of 10 cm. All samples were collected in amber, nalgene, 500 ml sample bottles that were previously acid washed (15 % H_2SO_4), rinsed (5x) with distilled-deionized water, and rinsed (1x) with ambient water prior to collection of the sample. Samples were immediately placed on ice in a cooler and returned to the laboratory at the Rutgers Marine Field Station. Once in the laboratory, samples were shaken and processed for nutrient and Chl a analysis. Samples were then frozen in a -10 °C freezer overnight at RMFS and transported to Rutgers University, IMCS as soon as possible thereafter. Once the processed samples were transported to Rutgers University, IMCS they were stored in a –20 °C freezer until analyses were performed.

b) **Diel sampling program**

Monthly diel samples were taken at the principle long-term datasonde station Buoy 126. Samples were collected at approximately 30-day intervals. Sampling occurred during any tidal condition and no distinction was made between spring and neap tide conditions. Twelve samples were collected over a 22 hour time period at 2 hour intervals using an ISCO auto-sampler. Samples were taken at a fixed depth, approximately 2.0 meters from the bottom. All samples were collected in clear, plastic, 1000 ml ISCO sample bottles. Samples were retrieved as soon as possible after completion of the auto-sampler program. Samples were then transferred from the clear, plastic ISCO bottles to 500 ml amber nalgene bottles that were previously acid washed (15 % H_2SO_4), rinsed (5x) with distilled-deionized water, and rinsed (1x) with ambient water prior to collection of the sample. Samples were immediately placed on ice in a cooler and returned to the laboratory at Rutgers Marine Field Station. Once in the laboratory, samples were shaken and processed for filtered for nutrient and Chl a analysis. Samples were then frozen in a -10°C freezer overnight at RMFS and transported to Rutgers University, IMCS as soon as possible thereafter. Once the filtered samples were transported to Rutgers University, IMCS they were stored in a –20 °C freezer until analyses were performed.

4) **Site location and character**

The Jacques Cousteau National Estuarine Research Reserve (JNERR) at the Mullica River-Great Bay estuary is located on the south-central coastline of New Jersey. The estuary is near Tuckerton, New Jersey about 14 kilometers north of Atlantic City. Water is the predominant habitat in the Jacques Cousteau National Estuarine Research Reserve, covering 27,599 ha (~60% of the area). Marsh blankets an additional 13,034 ha (>28% of the area). Forest cover is the next largest category; it amounts to 4,616 ha (~10% of the area). Developed landscape, which is relatively sparse, provides the least cover (553 ha or slightly over 1% of the area). Domestic development is concentrated in two small communities, Mystic Island and Tuckerton; the boundaries of these communities extend to within 3 km of the margin of Great Bay. There is little impact from development or pollution at the 5 monitoring station in the JNERR

There are five nutrient monitoring stations in the JCNERR for which data are reported in this document: B5 (Buoy 115, secondarySWMP) in Little Egg Harbor, B6 (Buoy 126) near the mouth of the Little Egg Inlet, B9 (Buoy 139) in Great Bay, and NE (Chestnut Neck) and BA (Lower Bank) in the Mullica River. Data loggers are located at the four principal SWMP stations (BA, NE, B6, and B9); an extensive water quality database has been developed for these sites. Water quality data is collected on-demand at B5 via a hand-held YSI MDS 650 unit paired with a 600XL sonde.

The characteristics of the nutrient monitoring sites are summarized below:

1) Buoy 115 (B5) - 39° 31’07.68”N, 74° 17’13.92”W - This most recent monitoring site is in Little Egg Harbor Bay, bordering the Edwin B. Forsythe Refuge on Holgate (Long Beach Island) about 3 km northeast of the Rutgers University Marine Field Station. Full-time water-quality monitoring of this non-SWMP station was discontinued in 2003 after ice-floes tore the hardware and housings from the structure. The following site description is from 2002 (the most recent year-long dataset); we do not expect this description to differ significantly from present conditions: The depth of the bay at this site is approximately 3 meters, with a tidal range of 6.73 to 8.76 meters. The bottom consists predominantly of sand with little shell or organic material. Salinity values averaged 30.8 ppt, with a range of 29.3 to 32.5 ppt. Groundwater inputs from margins of the estuary, as well as surface flow from Mullica River, account for most of the freshwater entering that affects this site. The input of freshwater from local precipitation and marsh surface runoff is of secondary importance.

2) 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 datalogger 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 2008, the reported salinity at this station ranged from 16.5ppt to 33.4ppt, with an average of 28.4ppt. It is important to note that fouling may have occasionally depressed some salinity readings and are "flagged" as such in the water-quality dataset, so the aforementioned average and range may not be accurate. Presuming the datasondes were measuring 1m above the sediment as intended, the average depth at the B6 station was 3.91m, with a range of 2.72 to 5.09m.

3) 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 datalogger 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 sufficient navigable depth of approximately 2.5 meters at mean low water. 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 2008, the reported salinity at this station ranged from 18.2ppt to 32.9ppt, with an average of 27.9ppt. Presuming the datasondes were measuring 1m above the sediment as intended, and omitting some suspect depth measurements recorded by the instrument (and "flagged" accordingly in the B9 dataset), the average depth at the B9 station was 3.18m, with a range of 2.13 to 4.55m.

4) 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 datalogger 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 2008, the reported salinity at this station ranged from 1.3ppt to 25.1ppt, with an average of 15.5ppt. Presuming the datasondes were measuring 1m above the sediment as intended, and omitting some suspect depth measurements recorded by the instrument (and "flagged" accordingly in the NE dataset), the average depth at the NE station was 2.32m, with a range of 1.11 to 3.45m.

5) 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 datalogger 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 2008, the reported salinity at this station ranged from 0.0ppt to 17.7ppt, with an average of 3.7ppt. Presuming the datasondes were measuring 1m above the sediment as intended, and omitting some suspect depth measurements recorded by the instrument (and "flagged" accordingly in the BA dataset), the average depth at the BA station was 2.77m, with a range of 1.43 to 3.98m. This station is potentially more impacted by development than the other four sites due to its location south of the bulkhead waterfront communities of Long Beach Island and the town of Manahawkin, NJ.

5) **Code variable definitions**

jacb5nut = Jacques Cousteau Reserve nutrient data for Buoy 115
jacb6nut = Jacques Cousteau Reserve nutrient data for Buoy 126
jacb9nut = Jacques Cousteau Reserve nutrient data for Buoy 139
jacnenut = Jacques Cousteau Reserve nutrient data for Chestnut Neck
jacbanut = Jacques Cousteau Reserve nutrient data for Lower Bank

The monitoring codes are set as "1" to indicate grab samples and "2" to indicate diel samples. Replicates are also given specific codes. Grab samples in which duplicates sample are taken utilize a "1" for the first sample and a "2" for the second sample. Diel samples are always labeled with a "1" since only one sample is taken at each 2 hr interval.

6) **Data Collection Period**

GRAB SAMPLING

Site	Month Date	Rep1 Time	Rep2	Time
B5	January	1/12/2009	14:31	14:33
B5	February	2/26/2009	13:55*	13:57*
B5	March	3/24/2009	11:04	11:06
B5	April	4/22/2009	09:31	09:33
B5	May	5/19/2009	10:44	10:46
B5	June	6/1/2009	10:10	10:12
B5	July	7/6/2009	12:39	12:41
B5	August	8/18/2009	10:22	10:24
B5	September	9/15/2009	10:50	10:52
B5	October	10/26/2009	08:34	08:36
B5	November	11/17/2009	14:14	14:16
B5	December	12/14/2009	10:26	10:28
B6	January	1/12/2009	14:02	14:04
B6	February	2/26/2009	13:16	13:18
B6	March	3/24/2009	10:54	10:56

B6	April	4/22/2009	11:39	11:41
B6	May	5/19/2009	10:07	10:09
B6	June	6/1/2009	09:50	09:52
B6	July	7/6/2009	12:28	12:31
B6	August	8/18/2009	09:46	09:48
B6	September	9/15/2009	10:25	10:27
B6	October	10/26/2009	08:16	08:18
B6	November	11/17/2009	14:04	14:06
B6	December	12/14/2009	10:16	10:18
B9	January	1/12/2009	14:16	14:18
B9	February	2/26/2009	13:31	13:33
B9	March	3/24/2009	10:41	10:43
B9	April	4/22/2009	09:10	09:12
B9	May	5/19/2009	10:26	10:28
B9	June	6/1/2009	09:40	09:42
B9	July	7/6/2009	12:19	12:21
B9	August	8/18/2009	09:59	10:01
B9	September	9/15/2009	10:35	10:37
B9	October	10/26/2009	07:58	08:01
B9	November	11/17/2009	13:52	13:54
B9	December	12/14/2009	09:59	10:01
NE	January	1/12/2009	16:01	16:03
NE	February	2/26/2009	14:20	14:22
NE	March	3/24/2009	13:01	13:03
NE	April	4/22/2009	12:57	12:59
NE	May	5/19/2009	12:01	12:03
NE	June	6/1/2009	13:34	13:36
NE	July	7/6/2009	13:33	13:35
NE	August	8/18/2009	12:50	12:52
NE	September	9/15/2009	12:01	12:03
NE	October	10/26/2009	09:36	09:38
NE	November	11/17/2009	15:25	15:27
NE	December	12/14/2009	11:16	11:18
BA	January	1/12/2009	16:32	16:34
BA	February	2/26/2009	15:05	15:07
BA	March	3/24/2009	13:46	13:48
BA	April	4/22/2009	13:24	13:26
BA	May	5/19/2009	12:40	12:42
BA	June	6/1/2009	14:05	14:07
BA	July	7/6/2009	14:01	14:03
BA	August	8/18/2009	13:32	13:34
BA	September	9/15/2009	12:28	12:31
BA	October	10/26/2009	10:01	10:03

BA	November	11/17/2009	15:50	15:52
BA	December	12/14/2009	11:40	11:42

*= no sample was collected at this secondary SWMP station, times are estimates

DIEL (ISCO) SAMPLING

Site	Month	Start Date	Start Time	End Date	End Time
B6	January	1/14/2009	14:00	1/15/2009	12:00
B6	February	*	*	*	*
B6	March	3/24/2009	11:00	3/25/2009	09:00
B6	April	4/22/2009	10:00	4/23/2009	08:00
B6	May	5/19/2009	10:00	5/20/2009	08:00
B6	June	6/1/2009	10:00	6/2/2009	08:00
B6	July	7/6/2009	13:00	7/7/2009	11:00
B6	August	8/18/2009	10:00	8/19/2009	08:00
B6	September	9/14/2009	11:00	9/15/2009	09:00
B6	October	10/25/2009	11:00	10/26/2009	09:00
B6	November	11/17/2009	14:00	11/18/2009	12:00
B6	December	12/14/2009	10:00	12/15/2009	08:00

* Unable to sample during this period due to overnight deep-freeze conditions

7) **Associated researchers and projects**

As part of the SWMP long-term monitoring program, WKB NERR also monitors Meteorological and Water Quality data which may be correlated with this Nutrient dataset. These data are available from the Research Coordinator or online at http://cdmo.baruch.sc.edu/.

8) **Distribution**

NOAA/ERD retains the right to analyze, synthesize and publish summaries of the NERRS System-wide Monitoring Program data. The PI retains the right to be fully credited for having collected and processed the data. Following academic courtesy standards, the PI and NERR site where the data were collected will be contacted and fully acknowledged in any subsequent publications in which any part of the data are used. Manuscripts resulting from this NOAA/OCRM supported research that are produced for publication in open literature, including refereed scientific journals, will acknowledge that the research was conducted under an award from the Estuarine Reserves Division, Office of Ocean and Coastal Resource Management, National Ocean Service, National Oceanic and Atmospheric Administration. 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.

NERR nutrient 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/ as well as www.nerrsdata.org . Data are available in text tab-delimited format.

II. Physical Structure Descriptors

9) **Entry verification**

Monthly nutrient and plant pigment data files, in excel format, are sent to JNERR by the Rutgers University, IMCS, Ecosystems Lab. Files consist of sampling station ID, date and time and parameter values expressed in micro moles; these are converted to milligrams per liter (with the exception of Chlorophyll a, which is reported as micrograms per Liter). The Laboratory Supervisor, Ronald Lauck, verifies all parameter values in the excel file through cross comparison with the laboratory data sheets. The data are reviewed for values that appear erroneous or illogical. Any samples found to have questionable results are reanalyzed. JNERR staff (Gregg P. Sakowicz, SWMP Technician/Field Researcher) then performs the following:

Since the Rutgers University Laboratory calculates and reports results in µM, values must first be converted to mg/L as N, P, or C for consistency in the NERR System. JNERR staff calculates the concentrations as mg/ l-1 based on atomic weights of 14.01, 30.97, and 12.01 for N, P, and C respectively. Therefore, JNERR staff multiplies the concentrations reported by the Rutgers Laboratory by 0.01401, 0.03097, and 0.01201 to yield concentrations in mg/L as N, P, and C respectively.

Nutrient data are entered into a Microsoft Excel worksheet and processed using the NutrientQAQC Excel macro. The NutrientQAQC macro sets up the data worksheet, metadata worksheets, and MDL worksheet; adds chosen parameters and facilitates data entry; allows the user to set the number of significant figures to be reported for each parameter and rounds using banker's rounding rules; allows the user to input MDL values and then automatically flags/codes measured values below MDL and inserts the MDL ; calculates parameters chosen by the user and automatically flags/codes for component values below MDL, negative calculated values, and missing data; allows the user to apply QAQC flags and codes to the data; produces summary statistics; graphs selected parameters for review; and exports the resulting

data file to the CDMO for tertiary QAQC and assimilation into the CDMO's authoritative online database.

10) **Parameter titles and variable names by data category**

Required NOAA/NERRS System-wide Monitoring Program water quality parameters are denoted by an asterisks "*".

Data Category	Parameter	Variable Name	Units of Measure
Phosphorus and Nitrogen:			
	*Orthophosphate	PO4F	mg/L as P
	*Nitrite + Nitrate, Filtered	NO23F	mg/L as N
	*Ammonium, Filtered	NH4F	mg/L as N
	Dissolved Inorganic Nitrogen	DIN	mg/L as N
	Total Dissolved Nitrogen	TDN	mg/L as N
Carbon:			
	Dissolved Organic Carbon	DOC	mg/L as C
Plant Pigments:			
	*Chlorophyll a	CHLA_N	µg/L
Field Parameters:			
	Water Temperature	WTEM_N	ºC
	Specific Conductivity	SCON_N	mS/cm^3
	Salinity	SALT_N	ppt
	Dissolved Oxygen	DO_S_N	% Sat
	Dissolved Oxygen	DO_N	mg/L
	pH	PH_N	pH units

Notes:

1. Time is coded based on a 2400 clock and is referenced to Eastern Standard Time (EST).

2. Reserves have the option of measuring either NO2 and NO3 or they may substitute NO23 for individual analyses if they can show that NO2 is a minor component relative to NO3. JAC NERR and analytical laboratory staff determined that analysis to isolate individual concentrations for NO2 and NO3 is not necessary. The concentration of NO2 is negligible when compared to the concentration of NO3.

11) **Measured and calculated laboratory parameters**

a) **Variables measured directly**

Nitrogen species: NO23F, NH4F, TDN
Phosphorus species: PO4F

Carbon species: DOC
Other: CHLA_N

b) **Computed variables**
DIN: NO23F+NH4F

12) **Limits of detection**

Method Detection Limits (MDL), the lowest concentration of a parameter that an analytical procedure can reliably detect, have been established by the Rutgers University, IMCS, Ecosystems Laboratory. The MDL is determined as 3 times the standard deviation of a minimum of 7 replicates of a single low concentration sample. Table 1 presents the current MDL's; these values are reviewed and revised periodically. Methods are from Lachat Instruments QuikChem methods.

Table 1. Method Detection Limits (MDL) for measured water quality parameters.

Parameter	**Variable**	**MDL mg/L**	**Dates in Use**
Ammonium	NH4F	0.001	Jan 2007-present
Nitrate/Nitrite	NO23F	0.001	Jan 2007-present
Orthophosphate	PO4F	0.003	Jan 2007-present
Total Dissolved Nitrogen	TDN	0.029	Apr 2004-present
Dissolved Organic Carbon	DOC	0.084	Apr 2003-present
Chlorophyll a	CHLA_N	0.01(μg/L)	Jan 2003-present

13) **Laboratory methods**

i) **Parameter: PO4F**
Rutgers University, IMCS, Ecosystems Lab Laboratory Method
Method Reference: Lachat Instruments, 1993. QuikChem Method 31-115-01-1-H.
Method Descriptor: Samples were filtered with a 0.45 μm membrane filter and subjected to ammonium molybdate and antimony potassium tartate under acidic conditions to form a complex. The complex is reduced with ascorbic acid to form a blue complex that absorbs light at 880 nm.
Preservation Method: Stored in dark at –20 °C for up to 30 days.

ii) **Parameter: NO23F**
Rutgers University, IMCS, Ecosystems Lab Laboratory Method

Method Reference: Lachat Instruments, 1992. QuikChem Method 30-107-04-1-C&D.
Method Descriptor: Samples were filtered with a 0.45 μm membrane filter. Nitrate is reduced to nitrite by passage of sample through a copperized cadmium column. The nitrite (reduced nitrate plus original nitrite) is then determined with sulfanilamide under acidic conditions to form a diazonium ion. The diazonium ion is coupled with N-(1-naphthyl)ethylenediamine dihydrochloride, which results in a pink dye that absorbs at 520 nm.
Preservation Method: Stored in dark at -20 °C for up to 14 days.

iii) **Parameter: NH4F**
Rutgers University, IMCS, Ecosystems Lab Laboratory Method
Method Reference: Lachat Instruments, 1993. QuikChem Method 31-107-06-1-B.
Method Descriptor: Samples were filtered with a 0.45 μm membrane filter. The method used is based on the Berthelot reaction. Samples are subjected to hypochlorite-phenol, which results in indophenol blue. The indophenol blue is measured at 630 nm and is proportional to the ammonium concentration.
Preservation Method: Stored in dark at –20 °C for up to 3 days.

iv) **Parameter: DIN**
Rutgers University, IMCS, Ecosystems Lab Laboratory Method
Method Reference: N/A
Method Descriptor: Dissolved inorganic nitrogen is calculated by adding the ammonium concentration to the nitrate plus nitrite concentration. Ammonium and nitrate plus nitrite concentrations are determined as stated above.
Preservation Method: N/A

v) **Parameter: CHLA**
Rutgers University, IMCS, Ecosystems Lab Laboratory Method
Method Reference: US.EPA 1997. Method 445.0
Method Descriptor: Samples with a known volume were filtered with a 0.45 μm membrane filter. Samples were dissolved in 5 ml 90% acetone/ 10% $MgCO_3$ solution. Fluorescence determined using a Shimadzu RF-1501 spectrofluorometer.
Preservation Method: Filter is drawn dry, removed, placed in a glass tube with a phenolic screw cap, wrapped in aluminum foil and stored at –20 °C for up to 30 days.

vi) **Parameter: TDN**
Rutgers University, IMCS, Ecosystems Lab Laboratory Method
Method Reference: SM 5310 B
High Temperature Combustion (HTC) measurements of DOC (using Shimadzu's NPOC method) and TDN are performed using a Shimadzu TOC 5000A total carbon analyzer (Shimadzu Corp, Japan) coupled with a Antek (PAC) 7000B nitrogen chemiluminescence detector (Antek Instruments).

vii) **Parameter: DOC**
Rutgers University, IMCS, Ecosystems Lab Laboratory Method
Method Reference: SM 5310 B

High Temperature Combustion (HTC) measurements of DOC (using Shimadzu's NPOC method) and TDN are performed using a Shimadzu TOC 5000A total carbon analyzer (Shimadzu Corp, Japan) coupled with a Antek (PAC) 7000B nitrogen chemiluminescence detector (Antek Instruments).

14) **Field and Laboratory QA/QC programs**

a) **Precision**

i) **Field variability**

JCNERR collects two successive grab samples for the monthly grab sample program.

ii) **Laboratory variability**

Rutgers University, IMCS, Ecosystems Lab analyzes a laboratory duplicate once for every nine samples.

iii) **Inter-organizational splits**

None

b) **Accuracy**

i) **Sample spikes**

Rutgers University, IMCS, Ecosystems Lab analyzes a matrix spike once for every ten samples.

ii) **Standard reference material analysis**

None

iii) **Cross calibration exercises**

None

15) QAQC flag definitions – This section details the primary and secondary 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_). QAQC flags are applied to the nutrient data during secondary QAQC to indicate data that are out of sensor range low (-4), rejected due to QAQC checks (-3), missing (-2), optional and were not collected (-1), suspect (1), and that have been corrected (5). All remaining data are flagged as having passed initial QAQC checks (0) when the data are uploaded and assimilated into the CDMO ODIS as provisional plus data. The historical data flag (4) is used to indicate data that were submitted to the CDMO prior to the initiation of secondary QAQC flags and codes (and the use of the automated primary QAQC system for WQ and MET data). This flag is only present in historical data that are exported from the CDMO ODIS.

-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
4 Historical Data: Pre-Auto QAQC
5 Corrected Data

16) QAQC code definitions – This section details the secondary QAQC Code definitions used in combination with the flags above.

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 sample or sample collection, sensor errors document common sensor or parameter specific problems, 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. However, a record flag column (F_Record) in the nutrient data allows multiple comment codes to be applied to the entire data record.

General errors

GCM	Calculated value could not be determined due to missing data
GCR	Calculated value could not be determined due to rejected data
GDM	Data missing or sample never collected
GQD	Data rejected due to QA/QC checks
GQS	Data suspect due to QA/QC checks

Sensor errors

SBL	Value below minimum limit of method detection
SCB	Calculated value could not be determined due to a below MDL component
SCC	Calculation with this component resulted in a negative value
SNV	Calculated value is negative
SRD	Replicate values differ substantially
SUL	Value above upper limit of method detection

Parameter Comments

CAB	Algal bloom
CDR	Sample diluted and rerun
CHB	Sample held beyond specified holding time
CIP	Ice present in sample vicinity
CIF	Flotsam present in sample vicinity
CLE	Sample collected later/earlier than scheduled
CRE	Significant rain event
CSM	See metadata
CUS	Lab analysis from unpreserved sample

Record comments

CAB	Algal bloom
CHB	Sample held beyond specified holding time
CIP	Ice present in sample vicinity
CIF	Flotsam present in sample vicinity
CLE	Sample collected later/earlier than scheduled
CRE	Significant rain event
CSM	See metadata
CUS	Lab analysis from unpreserved sample

Cloud cover

CCL	clear (0-10%)
CSP	scattered to partly cloudy (10-50%)
CPB	partly to broken (50-90%)
COC	overcast (>90%)
CFY	foggy
CHY	hazy
CCC	cloud (no percentage)

Precipitation

PNP	none
PDR	drizzle
PLR	light rain
PHR	heavy rain
PSQ	squally
PFQ	frozen precipitation (sleet/snow/freezing rain)
PSR	mixed rain and snow

Tide stage

TSE	ebb tide
TSF	flood tide
TSH	high tide
TSL	low tide

Wave height

WH0	0 to <0.1 meters
WH1	0.1 to 0.3 meters
WH2	0.3 to 0.6 meters
WH3	0.6 to > 1.0 meters
WH4	1.0 to 1.3 meters
WH5	1.3 or greater meters

Wind direction

N	from the north
NNE	from the north northeast
NE	from the northeast
ENE	from the east northeast
E	from the east
ESE	from the east southeast
SE	from the southeast
SSE	from the south southeast
S	from the south

SSW	from the south southwest
SW	from the southwest
WSW	from the west southwest
W	from the west
WNW	from the west northwest
NW	from the northwest
NNW	from the north northwest

Wind speed

WS0	0 to 1 knot
WS1	> 1 to 10 knots
WS2	> 10 to 20 knots
WS3	> 20 to 30 knots
WS4	> 30 to 40 knots
WS5	> 40 knots

17) **Other remarks**

Data may be missing due to problems with sample collection or processing. Laboratories in the NERRS System submit data that are censored at a lower detection rate limit, called the Method Detection Limit or MDL. MDLs for specific parameters are listed in the Laboratory Methods and Detection Limits Section (Section II, Part 12) of this document. Concentrations that are less than this limit are censored with the use of a QAQC flag and code, and the reported value is the method detection limit itself rather than a measured value. For example, if the measured concentration of NO23F was 0.0005 mg/l as N (MDL=0.0008), the reported value would be 0.0008 and would be flagged as out of sensor range low (-4) and coded SBL. In addition, if any of the components used to calculate a variable are below the MDL, the calculated variable is removed and flagged/coded -4 SCB. If a calculated value is negative, it is rejected and all measured components are marked suspect. If additional information on MDL's or missing, suspect, or rejected data is needed, contact the Research Coordinator at the Reserve submitting the data.

Note: The way below MDL values are handled in the NERRS SWMP dataset was changed in November of 2011. Previously, below MDL data from 2007-2010 were also flagged/coded, but either reported as the measured value or a blank cell. Any 2007-2011 nutrient/pigment data downloaded from the CDMO prior to November of 2011 will reflect this difference.

Sample notes:

No samples were collected at Buoy 115 (jacb5nut) in February (02/26/09); this station is not a required SWMP station, but is collected as additional station.

Field Notes:

Heavy construction on the Garden State Parkway bridge (just up-river of the Chestnut Neck sample site) was being performed intermittently in 2009, potentially affecting samples taken at all stations (except Buoy 115), and particularly those at Chestnut Neck.

A rain event on 12/13/09 may have affected samples collected on 12/14/09 (grab and diel) and 12/15/09 (diel).

While basic and notable weather information was inserted into the F_Record column for all grab samples, it is recommended that users of these data refer to the JCNERR's meteorological dataset for weather information. The meteorological dataset can be accessed online at the CDMO home page http://cdmo.baruch.sc.edu/ or www.nerrsdata.org .

Additionally, regarding inserting comment codes concerning weather, only significant rain events potentially affecting the data were inserted into the diel portion of the dataset. If users seek to correlate the diel samples with weather conditions, it is recommended that they refer to the JCNERR's meteorological dataset. The meteorological dataset can be accessed online at the CDMO home page http://cdmo.baruch.sc.edu/ or www.nerrsdata.org .