Reserve Name NOC NERR Nutrient Metadata
January 1st – December 31st, 2019
Latest Update: February 13, 2023

I. Data Set and Research Descriptors

1) Principal investigator(s) and contact persons –

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2) Research objectives –

The objective of this research is to provide baseline information on inorganic nutrient and chlorophyll *a* water quality status within the North Carolina (NOC) NERR. Water samples are collected, processed, and analyzed for the following parameters: ammonium (NH4+), nitrite+nitrate (NO23), nitrite (NO2-), ortho-phosphate (PO4-), and chlorophyll *a* concentrations. Data collected will assist in understanding the impacts of anthropogenic impacts on the watersheds.

a) Monthly grab

Monthly grab samples are collected to quantify the spatial and temporal variability of selected nutrients and chlorophyll *a* concentrations in the water column at sites representative of the local estuarine system.

b) Diel sampling program

Once per month, 13 samples are collected at Research Creek every two hours and four minutes through a complete tidal cycle to quantify the short-term temporal variability of selected nutrients and chlorophyll *a* in the water column.

3) Research methods

a) Monthly grab sampling program:

Monthly grab samples were taken at four stations within the Masonboro Island and Zeke's Island components of the NOCNERR. Samples are taken at each of the principal NOCNERR datasonde stations, which are Research Creek, Loosin Creek, Zeke's Basin and East Cribbings. Efforts are made to collect all samples within a 24-hour time period during an ebb tide. No distinctions are made between neap and spring tide conditions. Single samples are collected by hand at an approximate depth of 10 cm at each site monthly, and triplicate (N=3) samples are collected at one site selected randomly, every other month. All samples are collected in amber, wide-mouth, Nalgene sample bottles that are previously acid washed (10% HCl), rinsed (3x) with distilled-deionized water, dried and followed by rinsing (3x) of ambient water prior to collection of the sample. Samples are immediately placed on ice, in a dark cooler and returned to the laboratory.

Once in the NOCNERR laboratory, samples are inverted and processed for chlorophyll *a* and nutrient analyses. Sample processing includes the filtration of samples, then either shipment to the Virginia Institute for Marine Science (VIMS) or in-house analysis (chlorophyll *a*). For chlorophyll *a*, volumes of 100 ml are filtered through a 25 mm Millipore glass microfiber filter using a vacuum pump and filtering apparatus. Filters are folded in half, placed in aluminum foil, and stored in a freezer at -20°C with a desiccant until time of sample analysis. For nutrient processing, samples are filtered through a 47 mm Millipore MF membrane filter (mixed cellulose ester, pore size 0.45 μm). The membrane filter is discarded and the liquid filtrate poured into a 125 ml acid washed Nalgene bottle and placed in the freezer at -20°C until shipment time. Sample collection bottles are acid washed (10% HCl) and rinsed (3x) using distilled-deionized water between sampling events to avoid any contamination.

b) Diel sampling program:

Diel samples are taken at the Research Creek datasonde station, located in the Masonboro Island reserve. Diel Sample protocol was changed after January 2009. 13 samples are now collected over a complete tidal cycle at intervals of two hours and four minutes (from 12 samples every 2:11) using an ISCO 6700 auto-sampler. Samples are collected at a fixed depth (0.5 m) from the bottom, representing the water mass sampled by the datasonde. No distinction is made between neap and spring tide conditions. Sampling events are staggered approximately 30 days apart to the best of the research staff's ability. All samples are collected in 1000 ml polyethylene bottles that are acid washed (10% HCL), rinsed (3x) with distilled-deionized water and dried. Samples are stored inside the ISCO sampler and kept cool with ice. Once in the laboratory, samples are inverted and processed for nutrient and chlorophyll *a*, in the same manner as described in previous section; "monthly grab sampling program".

4) Site location and character –

The components of North Carolina's National Estuarine Research Reserve (from north to south) are: Currituck Banks, Rachel Carson, Masonboro Island, and Zeke's Island. They are located along the southeast Atlantic coast of the United States. Currently, only data from Masonboro Island and Zeke's Island components are transferred to the CDMO. The four monitoring sites are:

a) Research Creek, Masonboro Island

The first Masonboro Island site (formerly called Masonboro Island (MS)) is 0.72 km north east from the mouth of Whiskey Creek, and east of the Intracoastal Waterway (ICW), in a small navigable channel called Research Creek at 34°09'21.7" latitude and 77°50'59.9" longitude. The site typically has a salinity range of 20-35 ppt and a tidal range that averages around 1.2 meters. The sole source of freshwater is rain and salinity values as little as 10 ppt have been recorded during periods of heavy rain. The creek bottom is characterized by sand and detritus based sediment with areas of soft mud with a depth ranging from 0.2 to 2.6 m. *Spartina* spp. marsh and dunes surround the site, which is relatively unimpacted by manmade perturbations and it is not accessible to road traffic. The site does experience minimal boat traffic.

b) Loosin Creek, Masonboro Island

The second Masonboro Island site (added in 2002) is 1.2 km east of the ICW, and 2.5 km south west of Masonboro Inlet, in a small navigable channel called Loosin Creek at 34° 10'20.0" latitude and 77° 49'58.1" longitude. The site generally has a salinity range of 22-35 ppt and a tidal range that averages 1.2 meters. The sole source of freshwater is rain and salinity values as little as 15 ppt have been recorded during periods of heavy rain. The creek bottom is characterized by sand and detritus based sediment with areas of soft mud with a depth ranging from 0.1 to 2.5 m. Spartina spp. marsh and dunes surround the site, which is relatively unimpacted by manmade perturbations and it is not accessible to road traffic. The site experiences minimal boat traffic.

c) East Cribbings, Zeke's Island

The first Zeke's Island site (formerly called Zeke's Island (ZI)) is located 1.8 km south of Federal Point boat launch in a tidal basin estuary at 33°56'23.5" latitude and 77°56'28.1" longitude. This site receives minimal freshwater input from leakage of the Cape Fear River through the 5.6 km rock jetty that separates the two bodies of water. The site typically has a salinity range of 15-33 ppt, although values as little as 10 ppt have been recorded. Tidal range averages 1.2 meters. Depth varies, but usually can be found to range from 0.5 to 2.7 meters. Bottom type substratum consists of large rocks (the cribbings) with sand and detritus based sediment. Marsh and dunes surround the site. It is not accessible to road traffic but experiences minimal boat traffic.

d) Zeke's Basin, Zeke's Island

The second Zeke's Island site (added in 2002) is located 0.8 km south east of the Federal Point boat launch in a tidal basin estuary at 33°57'17.0" latitude and 77°56'6.0" longitude. This site receives estuarine exchange from the Cape Fear River through the 5.6 km rock jetty that separates the river and shallow lagoonal basin. The site has a characteristic salinity range of 12-30 ppt, but values below 10 ppt have been observed and are often associated with periods of heavy rainfall. Tidal range averages 1.2 meters. Depth varies, but typically it can be found to range from 0.1 to 1.8 meters. Bottom type substratum consists of sand and detritus based sediment with a layer of soft anoxic mud. Marsh and dunes surround the site. It is not accessible to road traffic but experiences minimal boat traffic.

All NOC NERR historical nutrient/pigment monitoring stations:

Station Code	SWMP Status	Station Name	Location	Active Dates	Reason Decommissioned	Notes
NOCECNUT	P	East Cribbing	33° 56' 23.64 N, 77° 56' 27.96 W	01/01/2002 00:00 -	NA	NA
NOCLCNUT	P	Loosin Creek	34° 10' 19.92 N, 77° 49' 58.08 W	02/01/2002 00:00 -	NA	NA
NOCRCNUT	P	Research Creek	34° 9' 21.60 N, 77° 50' 59.64 W	01/01/2002 00:00 -	NA	NA
NOCZBNUT	P	Zeke's Basin	33° 57' 16.92 N, 77° 56' 6.00 W	03/01/2002 00:00 -	NA	NA

5) Coded variable definitions –

Station codes:

nocrcnut	North Carolina Reserve Research Creek Nutrient data
nocecnut	North Carolina Reserve East Cribbing Nutrient data
noclcnut	North Carolina Reserve Loosin Creek Nutrient data
noczbnut	North Carolina Reserve Zeke's Basin Nutrient data

Program Codes:

Monthly Grab Sampling =1
Monthly Diel Sampling = 2

See Section 15 for QAQC flag definitions

6) Data collection period –

a) Diel Sampling (all times in EST):

Site	Start	End
nocrcnut	1/9/19 11:43	1/10/19 12:31
nocrcnut	2/12/19 12:04	2/13/19 12:52
nocrcnut	3/11/19 11:12	3/12/19 12:00
nocrcnut	4/8/19 10:41	4/9/19 11:29
nocrcnut	5/7/19 11:01	5/8/19 11:49
nocrcnut	6/4/19 9:36	6/5/19 10:24
nocrcnut	7/2/19 9:13	7/3/19 10:01
nocrcnut	8/19/19 10:47	8/20/19 11:35
nocrcnut	9/18/19 9:15	9/19/19 10:03
nocrcnut	10/22/19 10:31	10/23/19 11:19
nocrcnut	11/11/19 10:42	11/12/19 11:30
nocrcnut	12/11/19 10:16	12/12/19 11:04

b) Grab Sampling (all times in EST):

East Cribbings

Station Code	Date/Time Stamp	Rep
nocecnut	1/9/19 15:07	1
nocecnut	2/13/19 14:44	1
nocecnut	3/11/19 12:20	1
nocecnut	4/9/19 13:13	1
nocecnut	5/7/19 14:00	1
nocecnut	6/5/19 13:05	1
nocecnut	7/2/19 11:30	1
nocecnut	8/20/19 14:40	1
nocecnut	9/17/19 11:30	1
nocecnut	10/22/19 15:17	1
nocecnut	10/22/19 15:18	2
nocecnut	10/22/19 15:19	3
nocecnut	11/14/19 11:26	1
nocecnut	12/12/19 11:41	1

Loosin Creek

Station Code	Date/Time Stamp	Rep
noclcnut	1/9/19 13:57	1
noclcnut	1/9/19 13:58	2
noclcnut	1/9/19 13:59	3
noclcnut	2/13/19 13:34	1

noclcnut	3/12/19 11:19	1
noclcnut	3/12/19 11:20	2
noclcnut	3/12/19 11:21	3
noclcnut	4/9/19 11:57	1
noclcnut	5/8/19 14:30	1
noclcnut	6/5/19 11:24	1
noclcnut	7/2/19 10:25	1
noclcnut	8/20/19 13:20	1
noclcnut	9/18/19 9:26	1
noclcnut	10/22/19 11:47	1
noclcnut	11/14/19 12:30	1
noclcnut	12/12/19 10:25	1

Research Creek

Station Code	Date/Time Stamp	Rep
nocrcnut	1/9/19 13:48	1
nocrcnut	2/13/19 13:48	1
nocrcnut	3/12/19 11:12	1
nocrcnut	4/9/19 11:40	1
nocrcnut	4/9/19 11:41	2
nocrcnut	4/9/19 11:42	3
nocrcnut	5/8/19 14:00	1
nocrcnut	6/5/19 10:43	1
nocrcnut	7/2/19 10:07	1
nocrcnut	8/21/19 15:55	1
nocrcnut	8/21/19 15:56	2
nocrcnut	8/21/19 15:57	3
nocrcnut	9/18/19 9:26	1
nocrcnut	10/22/19 10:35	1
nocrcnut	11/14/19 12:21	1
nocrcnut	12/12/19 10:06	1
nocrcnut	12/12/19 10:07	2
nocrcnut	12/12/19 10:08	3

Zeke's Basin

Station Code	Date/Time Stamp	Rep
noczbnut	1/9/19 15:17	1
noczbnut	2/13/19 14:53	1
noczbnut	3/11/19 13:35	1
noczbnut	4/9/19 13:22	1
noczbnut	5/7/19 14:15	1
noczbnut	6/5/19 13:13	1
noczbnut	6/5/19 13:14	2
noczbnut	6/5/19 13:15	3

noczbnut	7/2/19 11:42	1
noczbnut	8/20/19 14:50	1
noczbnut	9/17/19 11:45	1
noczbnut	10/22/19 15:43	1
noczbnut	11/14/19 11:32	1
noczbnut	12/12/19 12:03	1

7) Associated researchers and projects–

As part of the SWMP long-term monitoring program, NOC NERR also monitors 15-minute meteorological and water quality data which may be correlated with this nutrient/pigment dataset. These data are available at www.nerrsdata.org. Additional projects are ongoing and continually changing. Check with the Research Coordinator for an updated list of research (see section I.1.)

8) Distribution –

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

Requested citation format:
NOAA National Estuarine Research Reserve System (NERRS). System-wide Monitoring Program. Data accessed from the NOAA NERRS Centralized Data Management Office website: www.nerrsdata.org; *accessed* 12 October 2020.

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 www.nerrsdata.org. Data are available in comma separated version format.

II. Physical Structure Descriptors

9) Entry verification –

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. Byron Toothman and Heather Wells were responsible for data management during 2019.

10) Parameter titles and variable names by category –

Required NOAA NERRS System-wide Monitoring Program nutrient parameters are denoted by an asterisk "*".

Data Category	Parameter	Variable Name	Units of Measure
Phosphorus and Nitrogen:			
	*Orthophosphate	PO4F	mg/L as P
	*Ammonium, Filtered	NH4F	mg/L as N
	*Nitrite, Filtered	NO2F	mg/L as N
	*Nitrate, Filtered	NO3F	mg/L as N
	*Nitrite + Nitrate, Filtered	NO23F	mg/L as N
	Dissolved Inorganic Nitrogen	DIN	mg/L as N
Plant Pigments:			
	*Chlorophyll a	CHLA_N	µg/L

Notes:
1. Time is coded based on a 2400 clock and is referenced to Standard Time.
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.

11) Measured or calculated laboratory parameters –

a) **Parameters measured directly**

Nitrogen species:	NH4F, NO2F, NO23F
Phosphorus species:	PO4F
Other:	CHLA_N

b) **Calculated parameters**

NO3F	NO23F-NO2F
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 VIMS Analytical Service Center for nutrients. The MDL is determined as 3 times the standard deviation of a minimum of 7 replicates of a single low concentration sample. These values are reviewed and revised periodically.

Parameter	Start Date	End Date	MDL	Date Last Revisited
CHLA_N	1/1/2019	12/31/2019	0.4	12/16/19
NH4F	1/1/2019	12/31/2019	0.0062	3/8/2018; 12/10/19
NO23F	1/1/2019	12/31/2019	0.0055	3/8/2018; 12/10/19
NO2F	1/1/2019	12/31/2019	0.0016	3/8/2018; 12/10/19
PO4F	1/1/2019	12/31/2019	0.0016	12/12/2018; 12/10/19

13) Laboratory methods –

a) **Parameter: NH4F**

Method References: Virginia Institute of Marine Science Analytical Service Center. U.S. EPA. 1974. Methods for Chemical Analysis of Water and Wastes, pp. 168-174.
Standard Methods for the Examination of Water and Wastewater, 14th edition. p 410. Method 418A and 418B (1975). Annual Book of ASTM Standards, Part 31. "Water", Standard 1426-74, Method A, p 237 (1976). EPA 600/R-97/072 Method 349.0. Determination of Ammonia in Estuarine and Coastal Waters by Gas Segmented Continuous Flow Colorimetric Analysis. IN: Methods for the Determination of Chemical Substances in Marine and Estuarine Environmental Matrices - 2nd Edition. National Exposure Research Laboratory, Office of Research and Development U.S. EPA, Cincinnati, Ohio 45268.

Method Descriptor: Alkaline phenol and hypochlorite react with ammonia to form indophenol blue that is proportional to the ammonia concentration. The blue color formed is intensified with sodium nitroprusside. Reaction is heat catalyzed at 37°C and is measured colorimetrically at 660 nm. The range is 0.01 - 2.0 mg/L.

Preservation Method: A 100 ml volume of sample is filtered through a Whatman glass fiber filter (0.45 μm pore size, 47 mm diameter) using a vacuum pump. The pooled filtrate is then filtered through a Millipore membrane filter (0.45 μm pore size, 47 mm diameter). The liquid volume is then poured into a Nalgene bottle and stored at –20°C until sent for analysis.

b) **Parameter: Nitrate + Nitirite (NO23F), Nitrate (NO3F), and Nitrite (NO2F)**

Method References: Virginia Institute of Marine Science Analytical Service Center.
SKALAR Method: Nitrate + Nitrite/ Total Dissolved Nitrogen Catnr. 461-353.2 issue 120293/MH/93128060. SKALAR Method 467. U.S. EPA. 1974 Methods for Chemical Analysis of Water and Wastes, pp. 207 -212. Wood, E.D., F.A.G. Armstrong and F.A. Richards. 1967. Determination of nitrate in seawater by cadmium-copper reduction to nitrite. J. Mar. Biol. Assoc. U.K. 47: 23. Grasshoff, K., M. Ehrhardt and K. Kremling. 1983. Methods of Seawater Analysis. Verlag Chemie, Federal Republic of Germany. 419 pp. EPA 600/R-97/072 Method 353.4 Determination of Nitrate and Nitrite in Estuarine and Coastal Waters by Gas Segmented Flow Colorimetric Analysis. IN: Methods for the Determination of Chemical Substances in Marine and Estuarine Environmental Matrices - 2nd Edition. National Exposure Research Laboratory, Office of Research and Development U.S. EPA, Cincinnati, Ohio 45268.

Method Descriptor: Nitrate is reduced to nitrite by a copper/cadmium reductor column. The nitrite ion then reacts with sulfanilimide to form a diazo compound. This compound then couples with n-1-napthylenediamine dihydrochloride to form a reddish/purple azo dye and is read colorimetrical at 540 nm. Nitrate concentration is obtained by subtracting the corresponding nitrite value from the NO_3^- + NO_2^- concentration. The color development chemistry is the same as that used in Nitrite. Range is 0 -1.2 mg/L.

Preservation Method: A 100 ml volume of sample is filtered through a Whatman glass fiber filter (0.45 μm pore size, 47 mm diameter) using a vacuum pump. The pooled filtrate is then filtered through a Millipore membrane filter (0.45 μm pore size, 47 mm diameter). The liquid volume is then poured into a Nalgene bottle and stored at –20°C until sent for analysis.

c) **Parameter: Orthophosphate (PO4F)**

Method References: Virginia Institute of Marine Science Analytical Service Center.
SKALAR Method: O-Phosphate / Total Phosphate Catnr. 503-365.1, issue 042993/MH/93-Demo1. Murphy, J. and J.P. Riley. 1962. A modified single solution method for the determination of

phosphate in natural waters. Analytica Chim. Acta 27:31-36. EPA 600/R-97/072 Method 365.5 Determination of Orthophosphate in Estuarine and Coastal Waters by Automated Colorimetric Analysis. IN: Methods for the Determination of Chemical Substances in Marine and Estuarine Environmental Matrices - 2nd Edition. National Exposure Research Laboratory, Office of Research and Development. U.S. EPA, Cincinnati, Ohio 45268.

Method Descriptor: Ammonium molybdate and antimony potassium tartrate react in a sulfuric acid environment to form an antimony-phospho-molybdo complex, which is reduced to a blue colored complex by ascorbic acid. Reaction is heat catalyzed at 40°C and measured colorimetrically at 880 nm. The range is 1-50 ppb.

Preservation Method: A 100 ml volume of sample is filtered through a Whatman glass fiber filter (0.45 μm pore size, 47 mm diameter) using a vacuum pump. The pooled filtrate is then filtered through a Millipore membrane filter (0.45 μm pore size, 47 mm diameter). The liquid volume is then poured into a Nalgene bottle and stored at –20°C until sent for analysis.

d) **Parameter: Chlorophyll *a* (CHLA_N)**

Method Reference: EPA /600/ R-97/072 - Method 445.0. *In Vitro* Determination of Chlorophyll a and Pheophytin a in Marine and Freshwater Algae by Fluorescence. Methods for the Determination of Chemical Substances in Marine and Estuarine Environmental Matrices Revision 1.2. September 1997. Using the Turner Designs Model 10 Analog, The 10AU Digital, Or the TD-700 Fluorometer with EPA Method 445.0. January 19, 1999. Turner Designs, 845 West Maude Avenue, Sunnyvale, CA 94086.
Method Descriptor: Turner Design fluorometer method requires filtering a known quantity of water through a glass fiber filter (4.7 cm GF/F). This filter is later ground with a tissue grinder made of teflon/glass. Approximately 1-3 ml of 90% acetone are added to the filter before grinding. Acetone is also used to wash the filter into a 15ml polypropylene centrifuge tube with tight fitting cap. The sample is steeped at least 2 hours and not exceeding 24 hours at 4°C, in the dark. The samples read on a spectrophotometer or fluorometer. If the samples cannot be read within that time period, storage in the freezer at -20°C for 30 days is acceptable.

14) Field and Laboratory QAQC programs –

a) **Precision**
- i) **Field variability** – All diel samples are taken as single samples and monthly grab are replicated with field triplicates from randomly selected sites at least every other month (20% of all samples). Replicates are collected as duplicates or triplicates and efforts are made to collect these one minute later than initial sample.
- ii) **Laboratory variability** – laboratory replication is 10% for nutrient samples, chlorophyll samples are not replicated
- iii) **Inter-organizational splits** – no samples are split between different laboratories for analyses

b) **Accuracy**
- i) **Sample spikes** – accepting data at 100 % +/- 20 %, samples are typically in the 90-110 % range
- ii) **Standard reference material analysis –** no NOCNERR samples are sent to EPA for analyses

Cross calibration exercises – NOCNERR did not participate in any cross calibration exercises during this time period.

15) 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 –

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 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
GSM	See metadata

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
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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/notes –

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.

CSM codes in metadata:

The NOCRCNUT 8/21/19 15:57 CHLA_N value was marked <1> [SRD] as it differs substantially from the other replicates. This elevated measurement may have been caused by a small piece of macroalga in the sample.

The NOCRCNUT 12/11/19 20:36 NH4F value is an order of magnitude above the NOx for that same time and is a possible outlier. It has been marked suspect.

Sample hold times for 2019: Samples are held at -20°C. NERRS SOP allows nutrient samples to be held for up to 28 days (CHLA for 30) at -20°C, plus allows for up to 5 days for collecting, processing, and shipping samples. Samples held beyond that time period are flagged suspect and coded CHB.

Sample Date(s)	Sample Descriptor	PO4F	NH4F	NO2F	NO23F	CHLA_N
1/9 - 1/10/2019	All Samples	1/28/19	1/28/19	1/28/19	1/28/19	1/31/2019
2/12 - 2/13/2019	All Samples	3/14/19	3/26/19*	3/14/19	3/14/19	2/28/2019
3/11 - 3/12/2019	All Samples	4/8/19	4/8/19	4/8/19	4/8/19	4/1/2019
4/8 - 4/9/2019	All Samples	4/30/19	4/30/19	4/30/19	4/30/19	5/1/2019
5/7 - 5/8/2019	All Samples	5/30/19	5/30/19	5/30/19	5/30/19	6/3/2019
6/4 - 6/5/2019	All Samples	6/28/19	6/28/19	6/28/19	6/28/19	6/19/2019
7/2-7/3/2019	All Samples	7/23/19	7/23/19	7/23/19	7/23/19	8/1/2019
8/19 - 8/21/2019	All Samples	9/25/2019*	9/25/2019*	9/25/2019*	9/25/2019*	8/29/2019
9/18 - 9/19/2019	All Samples	10/10/19	10/10/19	10/10/19	10/10/19	10/3/2019
10/22 -10/23/2019	All Samples	11/13/19	11/13/19	11/13/19	11/13/19	10/31/2019
11/11 - 11/14/2019	All Samples	12/10/19	12/10/19	12/10/19	12/10/19	12/3/2019
12/11 - 12/12/2019	All Samples	1/8/20	1/8/20	1/8/20	1/8/20	1/9/2020

*sample held longer than allowed by NERRS protocols