Maryland Shallow Water Monitoring Program – 2011 Continuous Monitoring

Metadata:

Identification_Information:
Citation:
Citation_Information:
Originator: Maryland Department of Natural Resources, Resource Assessment Service (MD DNR RAS)
Publication_Date: 20120515
Title: MD DNR Continuous Water Quality Monitoring Project 2011
Geospatial_Data_Presentation_Form: Spatial dataset

Description:
Abstract:

Water quality was monitored at thirty-four Maryland shallow water sites located in Chesapeake Bay, Chesapeake Bay tributaries and Maryland Coastal Bay tributaries during 2011. YSI (6600 V2) data loggers sampled seven environmental parameters: water temperature, specific conductance, dissolved oxygen concentration, oxygen percent saturation, pH, turbidity and fluorescence. Water depth was measured at stations where loggers were deployed at fixed depths. Salinity and chlorophyll were derived from specific conductance and fluorescence, respectively. Each parameter was sampled at 15-minute intervals, except at station XEF3551. The surface monitor at station XEF3551 sampled parameters at 10-minute intervals for the entire deployment. The bottom monitor at station XEF3551 sampled parameters at 10-minute intervals from 11-Jan-2011 to 31-Jan-2011, 30-minute intervals from 19-Apr-2011 to 31-May-2011, at 60-minute intervals from 31-May-2011 to 22-Jul-2011, at 30-minute intervals from 22-Jul-2011 to 31-Aug-2011, and at 10-minute intervals from 31-Aug-2011 to 2-Nov-2011. The number of days that data were collected at individual stations ranged from one hundred ninety to three hundred sixty-five.

Data loggers at most stations were exchanged bi-weekly. Data loggers deployed greater than 10m below surface at station XEF3551 were exchanged monthly. Loggers were deployed simultaneously at two depths at stations XEF3551, XIE4741, XHH4931, and XHH4916.

When data loggers were exchanged, water samples for pigments, nutrients and suspended solids were collected for later analysis. At the same time, Secchi disk depth was measured and a Hydrolab (series III or IV) water quality sonde was used to collect discrete water temperature, salinity, dissolved oxygen and pH data. Light attenuation was also measured using a LiCor instrument.

Purpose:

The Maryland Department of Natural Resources Shallow Water Monitoring program is part of a cooperative effort between the Federal government and State and local governments in the

Chesapeake Bay watershed to assess the ambient water quality criteria for dissolved oxygen, chlorophyll and water clarity in shallow water habitats.

Shallow water monitoring data describe the 2011 state of thirty-four shallow water sites on Chesapeake Bay and Maryland Coastal Bay tributaries using key water quality indicators.

The information is integrated with data from other Bay water quality stations and living resources monitoring projects and used to understand linkages, temporal variation and long-term trends.

Water quality data are used to refine, calibrate and validate Chesapeake Bay ecological models. The models are used to develop and assess water quality criteria with the goal of removing the Chesapeake Bay and its tidal rivers from the list of impaired waters.

Supplemental_Information:
The target audiences for this information include Resource Managers, Technical/Scientific Users, Government, Educators, Students and General Public.

Data users who desire very detailed information about Water Quality Monitoring data-definition, sampling-procedures and data-processing are encouraged to refer to the two documents listed below. The documents may be obtained from the Chesapeake Bay Program Office.

Water Quality Database - Database Design and Data Dictionary Prepared For: U.S. Environmental Protection Agency, Region III, Chesapeake Bay Program Office, January 2004. [http://archive.chesapeakebay.net/pubs/cbwqdb2004_RB.PDF]

The most current version of the Water Quality Data Dictionary - Online may be found at: [http://archive.chesapeakebay.net/data/data_dict.cfm?DB_CODE=CBP_WQDB]

Quality Assurance Project Plan for the Maryland Department of Natural Resources, Chesapeake Bay Shallow Water Quality Monitoring Program, for the period July 1, 2011 - June 30, 2012.
[http://mddnr.chesapeakebay.net/eyesonthebay/documents/SWM_QAPP_2011_2012_FINAL.pdf]

Time_Period_of_Content:
Time_Period_Information:
Range_of_Dates/Times:
Beginning_Date: 20110101
Ending_Date: 20111231
Currentness_Reference: Ground condition
Status:
Progress: Complete
Maintenance_and_Update_Frequency: As needed
Spatial_Domain:

Bounding_Coordinates:
West_Bounding_Coordinate: -79.4938
East_Bounding_Coordinate: -75.0405
North_Bounding_Coordinate: 39.7425
South_Bounding_Coordinate: 37.8713
Keywords:
Theme:
Theme_Keyword_Thesaurus:
Olsen, L.M., G. Major, K. Shein, J. Scialdone, R. Vogel, S. Leicester, H. Weir, S. Ritz, T. Stevens, M. Meaux, C.Solomon, R. Bilodeau, M. Holland, T. Northcutt, R. A. Restrepo, 2007 . NASA/Global Change Master Directory (GCMD) Earth Science Keywords. Version 6.0.0.0.0 online: [http://gcmd.nasa.gov/Resources/valids//gcmd_parameters.html]
Theme_Keyword: Biosphere > Aquatic Ecosystems > Estuarine Habitat
Theme_Keyword: Biosphere > Aquatic Ecosystems > Rivers/Stream Habitat
Theme_Keyword: Biosphere > Ecological Dynamics > Ecosystem Functions > Nutrient Cycling
Theme_Keyword: Biosphere > Ecological Dynamics > Ecosystem Functions > Primary Production
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Theme_Keyword: Terrestrial Hydrosphere > Water Quality/Water Chemistry > Chlorophyll
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Place:
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Place_Keyword: United States
Place_Keyword: Maryland
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Access_Constraints: None
Use_Constraints: None
Point_of_Contact:
Contact_Information:
Contact_Person_Primary:
Contact_Person: Mark Trice
Contact_Position: Chief, Water Quality Informatics
Contact_Address:
Address_Type: Mailing Address
Address: MDDNR, 580 Taylor Avenue, D2
City: Annapolis
State_or_Province: MD
Postal_Code: 21401
Contact_Voice_Telephone: 410 260-8630
Contact_Electronic_Mail_Address: MTRICE_nospam_@dnr.state.md.us[Remove _nospam_ for valid email address]

Browse_Graphic:
Browse_Graphic_File_Name:
[http://mddnr.chesapeakebay.net/newmontech/contmon/stn_map/Cmon_stns_2011.pdf]
Browse_Graphic_File_Description:
Map of thirty-four 2011 Continuous Monitoring Sites.

Note symbol and coordinates for station XGF7832 (NAP) are not on the map. Also, symbol and coordinates for station XHG4413 (PRO) are included on the map. Data collected at station XHG4413 are not currently submitted to the Chesapeake Bay Program by MD DNR.

Browse_Graphic_File_Type: PDF

Data_Set_Credit:

Maryland Department of Natural Resources (MDDNR) Resource Assessment Service (RAS) staff collected the majority of samples and processed the data. The Nutrient Analytical Services Laboratory (NASL) at the Chesapeake Biological Laboratory (Univ. of MD) analyzed the nutrient, chlorophyll and suspended solids samples.

The project was made possible with funding provided by The State of Maryland, the United States Environmental Protection Agency Chesapeake Bay Program, the National Atmospheric and Oceanic Administration National Estuarine Research Reserve System program, Anne Arundel, County Maryland, and the Dominion Foundation.

Data_Quality_Information:

Attribute_Accuracy:

Attribute_Accuracy_Report:

Quality Assurance/Quality Control: MD DNR followed specific procedures to ensure that the Shallow Water Quality Monitoring Program project design was properly implemented and managed with sufficient accuracy, precision and detection limits. Accuracy (closeness to the true value) of collected data was controlled and assured by the proper use, calibration and maintenance of both field and laboratory equipment for the measurement of physical and chemical parameters.

The YSI 6600 V2 sondes were configured with the following probes: 6560(conductivity/temperature); 6561(flat glass pH) or 6579(tall pH); 6136(turbidity); 6150(ROX dissolved oxygen); 6025(fluorescence/chlorophyll). Sondes at two sites (XHH3851 and XIE5748) were also configured with 6132 (blue-green phycoerythrin) probes and sondes at two additional sites (XEA3687 and XJI2396) were also configured with 6131 (blue-green phycocyanin) probes.

Resolution, range and accuracy specifications for the sonde and probes may be obtained from the manufacturer. [http://www.ysi.com/support.php]

Procedures used to control and assure the accuracy of field measurements consisted of calibration of field instruments, verification of calibrations, equipment maintenance, and collection of filter blanks. Details of how data acquired with YSI sondes were quality assured and quality controlled may be found in the process description elements in the Lineage portion of this metadata record.

Water quality laboratory analysis results were used to calibrate and cross-check sonde data for accuracy. Daily quality control checks (including the running of blanks and standards) were used to control and assure laboratory accuracy.

Accuracy of Chesapeake Biological Laboratory, Nutrient Analytical Services Laboratory (CBL NASL) laboratory results was also assessed through DNR's participation in the Chesapeake Bay Coordinated Split Sample Program (CSSP), a split sampling program in which five laboratories involved in Chesapeake Bay monitoring analyze the coordinated split samples. CSSP was established in June 1989 to establish a measure of comparability between sampling and analytical operations for water quality monitoring throughout the Chesapeake Bay and its tributaries. DNR followed the protocols in the Chesapeake Bay Coordinated Split Sample Program Implementation Guidelines (EPA 1991) and its revisions. Split samples were collected quarterly. Results were analyzed by appropriate statistical methods to determine if results differed significantly among labs. If a difference occurred, discussions began regarding techniques and potential method changes to resolve discrepancies.

Additionally, CBL NASL participated two times per year in the United States Geologic Survey (USGS) reference sample program.

Logical_Consistency_Report:

Two of the attributes in the water quality data set are PARAMETER and VALUE. In cases where PARAMETER value is "SIGMA_T" and the VALUE measurement in the record is a negative number, the number should be considered unreliable. SIGMA_T values are not measured. SIGMA_T values are derived.

During 2011, at all but four stations, water quality monitoring sondes were deployed at a single depth. At four stations: The Sill (XHH4916), Possum Point (XHH4931), Masonville Cove (XIE4741), and the Gooses (XEF3551) sondes were deployed concurrently at two depths: one meter from the surface and 0.3 meters from the bottom.

Values in the 'LAYER' column of sonde data files may be used to determine the depth at which a sonde was deployed. Sonde data from all 2011 sites, except XHH4916, XHH4931, XIE4741, and XEF3551, list a value of 'BS', 'below surface' in the LAYER column. For stations XHH4916, XHH4931, and XEF3551, a LAYER column value of 'B' indicates the sonde was deployed 0.3 meters above the bottom and a LAYER column value of 'S' indicates the sonde was deployed 1 meter below the surface. For station XIE4741, a LAYER column value of 'B' indicates the sonde was deployed 0.3 meters above the bottom and a LAYER column value of 'BS' indicates the sonde was deployed 1 meter below the surface.

In the 2011 sonde data, there are numerous instances of turbidity measurements with negative values. The turbidity probe accuracy is plus or minus 5 NTU. In cases where turbidity probe post-deployment calibration values were within acceptable limits, negative values greater than or equal to -5.0 NTU are reported.

The 2011 position of the sonde at station XIE2581 was about 3 meters removed from the 2009 position.

During 2011, it was not always possible, for logistical reasons, to replace sondes at all sites every two weeks, or every month for station XEF3551 (Gooses – Bottom).

The sonde at station XHH3851 was not switched on 9-Feb-2011, 8-Nov-2011, 1-Dec-2011, and 22-Dec-2011.

The sonde at station XGE0320 was not switched on 13-Aug-2011 and 18-Nov-2011.
The sonde at station XHF6841 was not switched on 21-Jul-2011 and 17-Nov-2011.
The sonde at station XDM4486 was not switched on 22-Nov-2011.
The sonde at station XKH0375 was not switched on 28-Apr-2011 and 23-Nov-2011, and 7-Dec-2011.
The sonde at station XDN6921 was not switched on 22-Nov-2011.
The sonde at station XIF1735 was not switched on 21-Jul-2011 and 4-Oct-2011.
The sonde at station XEB5404 was not switched on 5-Sep-2011.
The sonde at station WXT0013 was not switched on 19-Jan-2011, 2-Feb-2011, 16-Feb-2011, 9-Mar-2011, 8-Sep-2011, 9-Nov-2011, and 28-Nov-2011.
The sonde at station PXT0455 was not switched on 19-Jan-2011, 2-Feb-2011, 16-Feb-2011, 9-Mar-2011, 8-Sep-2011, 9-Nov-2011, and 28-Nov-2011.
The sonde at station XHG2318 was not switched on 14-Nov-2011.
The sonde at station XEA3687 was not switched on 5-Sep-2011.
The sonde at station XIE5748 was not switched on 24-Feb-2011 and 13-Apr-2011.
The sondes at station XIE4741 (surface and bottom) were not switched on 13-Apr-2011, 11-Aug-2011, 8-Sep-2011, and 20-Oct-2011.
The sonde at station MTI0015 was not switched on 8-Sep-2011, 10-Nov-2011, and 28-Nov-2011.
The sonde at station XGF7832 was not switched on 20-May-2011 and 6-Sep-2011.
The sonde at station NPC0012 was not switched on 22-Nov-2011.
The sonde at station XJG7035 was not switched on 21-Jul-2011 and 17-Nov-2011.
The sonde at station XBM8828 was not switched on 22-Nov-2011.
The sonde at station XHF9808 was not switched on 13-Apr-2011.
The sonde at station XHF0460 was not switched on 16-Nov-2011 and 30-Nov-2011.
The sonde at station XKH2949 was not switched on 5-Dec-2011.
The sonde at station XEF3551 (surface) was not switched on 25-Jan-2011, 23-Feb-2011, 17-Mar-2011, 31-Mar-2011, 25-May-2011, 29-Aug-2011, 25-Oct-2011, 22-Nov-2011, and 20-Dec-2011.
The sonde at station XEF3551 (bottom) was not switched on 19-May-2011, 30-Jun-2011, 22-Aug-2011, and 30-Sep-2011.
The sondes at station XHH4931 (surface and bottom) were not switched on 8-Nov-2011 and 1-Dec-2011.
The sondes at station XHH4916 (surface and bottom) were not switched on 8-Nov-2011.
An aerator was intermittently deployed between late July and late September (exact dates unknown) at station XEA3687.

Completeness_Report:
2011 Data from thirty-four continuous monitoring stations are available on-line.

The 2011 Continuous Monitoring project dataset includes twelve months of sonde records from the continuous monitoring stations: WXT0013 (Iron Pot Landing), PXT0455 (Jug Bay), XHH3851 (Sycamore Point), and XEF3551 (Gooses – Surface).
Sonde data were collected for eleven months at station: XIE5748 (Baltimore Harbor).
Ten month deployments occurred at stations: XHF0460 (Sandy Point - South Beach), XHG2318 (Love Point), XHF6841 (Down's Park), MTI0015 (Mataponi), XJG7035 (Otter Point

Creek), XIE4741 (Masonville Cove - Surface), XKH0375 (Susquehanna Flats), XKH2949 (Havre de Grace), XHH4931 (Possum Point - Bottom and Surface), and XHH4916 (The Sill - Surface).

Deployments at stations: XDM4486 (Bishopville Prong), XDN6921 (Grey's Creek), NPC0012 (Newport Creek), XBM8828 (Public Landing), XHH4916 (The Sill - Bottom), XBF7904 (St Georges Creek), ZDM0001 (Harness Creek – Downstream), XEB5404 (Indian Head), XEA3687 (Mattawoman), XIF1735 (Fort Howard), and XEF3551 (Gooses – Bottom) lasted nine months.

Sondes were deployed eight months at stations: XGE0320 (Chesapeake Yacht Club), XJH2362 (Betterton), XJI2396 (Budd's Landing), XHG8442 (Gratitude Marina), XIE4741 (Masonville Cove – Bottom), XHF9808 (Fort Smallwood), XGF7832 (Annapolis CBIBS), XBJ3220 (Coulbourn Creek), LMN0028 (Little Monie Creek), and XBI6387 (Westover).

Sonde deployment at station: XIE2581 (Fort Armistead) lasted seven months.

In 2011, the full suite of nutrients were only collected at stations: XHH3851 (Sycamore Point), XHH4931 (Possum Point), XHH4916 (The Sill), and XEB5404 (Indian Head). A sub-set of nutrients (VSS, Ammonium, Orthophosphate, Nitrite plus Nitrate, Total Dissolved Nitrogen, and Total Dissolved Phosphorus) were collected at stations XJG7035 (Otter Point Creek), PXT0455 (Jug Bay), MTI0015 (Mataponi), WXT0013 (Iron Pot Landing), and LMN0028 (Little Monie Creek). TSS and chlorophyll were collected at all other stations. For station XIE4741 (Masonville Cove), only TSS and chlorophyll were collected prior to 19-May-2011. A partial suite of nutrients (Ammonium, Nitrite plus Nitrate, Total Dissolved Nitrogen, Particulate Nitrogen, Phosphate, Total Dissolved Phosphorus, and Particulate Carbon) were collected for the remainder of 2011

Silicate samples were only collected at the four Coastal Bays stations during 2011: XDM4486 (Bishopville Prong), XDN6921 (Grey's Creek), NPC0012 (Newport Creek) and XBM8828 (Public Landing).

The user may discover a few interruptions in sonde datasets. In most cases, these interruptions were related to short-term problems with sonde operation.

Station XHH4916 (The Sill – Surface) was out of service from 10-Jan-2011 to 29-Mar-2011 due to concerns about ice and low temperatures.

Station XEF3551 (Gooses - Bottom) was out of service from 31-Jan-2011 to 19-Apr-2011 due to concerns about ice and low temperatures.

Station XIE5748 (Baltimore Harbor) was not deployed until 10-Feb-2011 due to a damaged pier from which the sonde is deployed.

Station XJG7035 (Otter Point Creek) was removed from service 19-Dec-2011due to concerns about ice and low temperatures.

Station XHH4916 (The Sill – Bottom and Surface) was removed from service 17-Nov-2011 due to heavy bio-fouling and equipment damage.

There were gaps in the sonde data for a few stations for the following reasons.

The sonde at station XIF1735 (Fort Howard) was out of service from 21-Apr-2011 to 26-Apr-2011 due to damage to the pier from which the sonde was deployed. The sonde at station XIF1735 (Fort Howard) was located approximately six-meters from its original location when it was redeployed on 26-Apr-2011.

The sonde at station XIE2581 (Fort Armistead) was out of service from 19-May-2011 to 24-May-2011 due to damaged equipment.

Sondes at stations XHH3851 (Sycamore Point), XHH4916 (The Sill – Bottom and Surface), and XHH4931 (Possum Point – Bottom and Surface) were out of service from 21-Jun-2011 to 6-Jul-2011 due to heavy bio-fouling and equipment damage, Similarly, the sondes at station XHH4931 (Possum Point – Bottom and Surface) were out of service from 2-Aug-2011 to 30-Aug-2011 due to heavy bio-fouling and equipment damage. Also, the bottom sonde at station XHH4916 (The Sill) was out of service from 17-Aug-2011 to 30-Aug-2011 and 28-Sep-2011 to 12-Oct-2011 due to heavy bio-fouling and equipment damage.

The sonde at station XHG8442 (Gratitude Marina) was out of service from 24-Aug-2011 to 7-Sep-2011 due to concerns about Hurricane Irene damaging the sonde.

Station LMN0028 (Little Monie Creek) is missing data from 6-Jul-2011 to 20-Jul-2011 due to a sonde failure.

Station XIE5748 (Baltimore Harbor) is missing data from 18-Nov-2011 to 6-Dec-2011 due to a data logging error.

Station XBM8828 (Public Landing) is missing data from 7-Jun-2011 to 21-Jun-2011 due to a sonde failure.

Station XDM4486 (Bishopville Prong) is missing data from 20-Aug-2011 to 30-Aug-2011 due to a sonde failure.

Station XHH3851 (Sycamore Point) is missing data from 7-Aug-2011 to 10-Aug-2011 due to battery failure.

Station XGE0320 (Chesapeake Yacht Club) is missing data from 26-Aug-2011 to 6-Sep-2011 due to a sonde failure.

Station XHF6841 (Down's Park) is missing data from 11-Aug-2011 to 23-Aug-2011 due to a data logging error. Also, station XHF6841 (Down's Park) is missing data from 23-Nov-2011 to 6-Dec-2011 due to battery failure.

Station XEF3551 (Gooses – Surface) is missing data from 19-Apr-2011 to 11-May-2011 due to a sonde failure.

Station ZDM0001 (Harness Creek – Downstream) is missing data from 14-Jun-2011 to 15-Jun-2011 due to a sonde failure.

Station XEB5404 (Indian Head) is missing data from 24-Jul-2011 to 27-Jul-2011 due to a sonde failure.

Station WXT0013 (Iron Pot Landing) is missing data from 31-Jan-2011 to 23-Feb-2011, 16-May-2011 to 17-May-2011, 2-Oct-2011 to 11-Oct-2011, and 29-Nov-2011 to 13-Dec-2011 due to battery failure.

Station XHG2318 (Love Point) is missing data from 27-May-2011 to 1-Jun-2011 and 12-Jun-2011 to 15-Jun-2011 due to battery failure.

Station XBI6387 (Westover) is missing data from 1-May-2011 to 12-May-2011 due to battery failure.

Station XEA3687 (Mattawoman) is missing data from 10-Jun-2011 to 14-Jun-2011 due to a sonde failure.

Station XIE4741 (Masonville Cove – Surface) is missing data from 1-Oct-2011 to 6-Oct-2011 due to a sonde failure.

Station MTI0015 (Mataponi) is missing data from 1-Dec-2011 to 13-Dec-2011 due to battery failure.

Station XJG7035 (Otter Point Creek) is missing data from 17-Dec-2011 to 19-Dec-2011 due to battery failure.

Station XHH4931 (Possum Point - Surface) is missing data from 26-Jul-2011 to 2-Aug-2011 due to battery failure.

Station XHH4916 (The Sill - Surface) is missing data from 13-Jun-2011 to 21-Jun-2011 due to battery failure.

Station XHF9808 (Fort Smallwood) is missing data from 4-Oct-2011 to 6-Oct-2011 due to a sonde failure.

Station XHF0460 (Sandy Point - South Beach) is missing data from 22-Jun-2011 to 30-Jun-2011, 10-Aug-2011 to 23-Aug-2011, and 26-Nov-2011 to 5-Dec-2011 due to battery failure.

Station XHG8442 (Gratitude Marina) is missing data from 25-Jun-2011 to 29-Jun-2011 due to a sonde failure. Also, station XHG8442 (Gratitude Marina) is missing data from 27-Jul-2011 to 10-Aug-2011 due to a data logging error.

On a few occasions, due to extreme low tide conditions, sondes were not submerged. These data are not included in the published dataset.

All other missing sonde attribute values were removed because the data were determined to be unreliable during the quality control process.

Lineage:

Process_Step:

Process_Description:

SONDE CALIBRATION and POST-CALIBRATION

The Yellow Springs Instrument (YSI) 6600 data sondes were maintained and calibrated before and after each deployment in accordance with YSI recommendations. [http://www.ysi.com/support.php]

FIELD MEASUREMENTS AND SAMPLING

SONDES:

The continuous monitoring sensors at the sites recorded seven water quality parameters every 15 minutes, except at station XEF3551. The surface monitor at station XEF3551 sampled parameters at 10-minute intervals for the entire deployment. The bottom monitor at station XEF3551 sampled parameters at 10-minute intervals from 11-Jan-2011 to 31-Jan-2011, 30-minute intervals from 19-Apr-2011 to 31-May-2011, at 60-minute intervals from 31-May-2011 to 22-Jul-2011, at 30-minute intervals from 22-Jul-2011 to 31-Aug-2011, and at 10-minute intervals from 31-Aug-2011 to 2-Nov-2011. Data were uploaded to DNR's web site [http://www.eyesonthebay.net] shortly after retrieval.

At all sites the seven water quality parameters measured continuously were: water temperature, specific conductance, salinity, dissolved oxygen, turbidity (NTU), fluorescence (used to estimate chlorophyll a) and pH. Sondes deployed at fixed depths also measured water depth.

Each monitoring station was equipped with a YSI 6600 sonde. The sonde logged data onto an internal memory, where it was stored until retrieval. Thirteen stations were equipped with cellular telemetry units, which allowed data to be transmitted hourly to a server computer

at DNR. Sondes were deployed inside vertically-oriented four-inch diameter PVC pipes with several two-inch holes drilled along their length to allow for water exchange. Depending on location, sondes were either suspended from a float 1.0-meters below surface or fixed 0.3-meters or 0.5-meters above bottom resting on a stop bolt.

Sondes at the following stations were deployed at a fixed depth of 0.3 meters above the bottom: XBJ3220 (Coulbourn Creek), XGE0320 (Chesapeake Yacht Club), XBI6387 (Westover), LMN0028 (Little Monie Creek), MTI0015 (Mataponi), NPC0012 (Newport Creek), PXT0455 (Jug Bay), WXT0013 (Iron Pot Landing), XBM8828 (Public Landing), XDM4486 (Bishopville Prong), XDN6921 (Grey's Creek), XEA3687 (Mattawoman), XEB5404 (Indian Head), XEF3551 (Gooses – Bottom), XHH4916 (The Sill - Bottom), XHH4931 (Possum Point - Bottom), XJG7035 (Otter Point Creek), XIE4741 (Masonville Cove – Bottom) and XKH0375 (Susquehanna Flats).

Sondes at station XBF7904 (St Georges Creek) and ZDM0001 (Harness Creek – Downstream) were deployed at a fixed depth of 0.5 meters above the bottom.

All other sondes were deployed suspended from buoys at a depth of 1.0 meters below the surface.

Note that meters were deployed concurrently at two depths at stations: XEF3551, XHH4916, XHH4931, and XIE4741.

WATER QUALITY CALIBRATION SAMPLES:

Each time sondes were exchanged at each Continuous Monitoring station, "Grab" water quality samples were collected at meter depth using a horizontal "Alpha" water sampler. At the time the water was collected, a Hydrolab sonde measurement was taken at 1.0 meter depth.

Numbered two-quart bottles were triple-rinsed and filled with water for "whole" and "filtered" nutrient and chlorophyll samples. (As noted previously, full suites of nutrient samples were not collected at all stations).

Nutrient, pigment and suspended-solid water samples were filtered on station or shortly thereafter. Sample waters and filters were placed on ice immediately after filtration.

Particulate samples included: Chlorophyll, Particulate Carbon, Particulate Nitrogen, Particulate Phosphorus (PP), Particulate Inorganic Phosphorous (PIP), Total Suspended Solids (TSS) and Volatile Suspended Solids (VSS).

Filtrate collected from TSS/VSS or PP/PIP filtrations was used for dissolved nutrient samples. Total Dissolved Nitrogen and Total Dissolved Phosphorus, Nitrate, Nitrite, Ammonium, Orthophosphate, Silicate and Dissolved Organic Carbon samples were collected.

HYDROLAB PROFILE:

The first reading of the Hydrolab water-column profile at each station was recorded at the same time the water quality "grab" sample was collected. After the 1.0-meter depth record was logged, the sonde was lowered to the bottom. A reading was taken at 0.3-meters above the bottom. The sonde was raised and measurements were recorded at 0.5-meter or 1.0-meter increments until it reached the surface. (In cases where station depth was greater then 3-meters, the sonde was raised in 1-meter increments).

SECCHI DEPTH:

Secchi Disk Depth was measured each time sondes were exchanged. Readings with the Secchi disk were made in-situ without the aid of sunglasses. The Secchi disk was lowered into the water, on the shady side of the boat or pier. The depth at which the disk was no longer visible was recorded. The time at which the reading was taken was noted. This facilitated later matching of Secchi depth readings with transmissometer and turbidity data.

PAR MEASUREMENT:

Underwater Photosynthetically Active Radiation (PAR, 400-700nm)

When meters were exchanged at a site, down-welling light penetrating the water column (PAR) was measured underwater at several depths to calculate the light attenuation coefficient, Kd. Simultaneous surface and submersed PAR intensity measurements were taken to account for variability in incident surface irradiance due to changes in cloud cover. Data collected from this procedure were used to estimate the depth of the photic zone.

The equipment used was manufactured by LI-COR, Inc. and consisted of a LI-192SA, flat cosine Underwater Quantum Sensor, a LI-190SA air (deck) reference sensor and a Data Logger (LI-1000 or LI-1400).

Surface and underwater readings were recorded simultaneously. Readings were allowed to stabilize before being recorded. If the station depth was less than 3 meters, readings were taken at 0.1 meter and at 0.25-meter intervals until 10% for the 0.1-meter reading was reached. If the station depth was greater than 3 meters, a reading was taken at 0.1-meter and at 0.5-meter intervals until 10% of the 0.1-meter reading was reached.

SONDE DATA CHECKS

At most stations, the continuous monitoring sondes were retrieved, calibrated and replaced bi-weekly from January to December. Data loggers deployed greater than 10m below surface at station XEF3551 were exchanged monthly. At each deployment, sondes were replaced with clean, recalibrated units and data from the data loggers were downloaded to a computer.

In the field, before an instrument was replaced, field staff allowed both the new (freshly calibrated) sonde and the old (deployed) sonde to log two readings (fifteen minutes apart at most stations; ten minutes apart for the surface sonde at station XEF3551) side by side at the same depth. For the bottom sondes at station XEF3551, only one simultaneous reading was

taken using the new and old sondes. In addition at all of the stations, for one of the readings, data were recorded from a discrete instrument -usually a Hydrolab sonde. This three-way comparison assured that the "new" and "old" sondes were both reading each parameter within a certain tolerance. The Hydrolab reading was used as a "double-check," and since it was a discrete reading, it allowed staff to watch the display and note whether the parameters were fluctuating or stable.

EcoWatch(tm) software (a YSI product) was used to calibrate the instruments as well as to upload and view data collected. Data downloaded from the sonde were subjected to quality assurance/quality control checks to ensure that values outside the range of possibility were not displayed on the DNR web site.

Data were evaluated using both three-way in-situ comparison results and data from sonde calibrations. The comparison tolerances were as follows - for both pre- post- calibration and in-situ comparisons: Temperature (deg C) +- 0.2; Specific Conductance (uM/cm) +- 5%; Dissolved Oxygen (mg/l) +- 0.5 mg/l; pH +- 0.2; Turbidity (NTU) +- 5%; Chlor +- 5%.

Excessive drift between pre- and post- calibration values of sonde probes, variance from in-situ measurements or probe failures caused data to be flagged. When post-calibration drift exceeded the limits stated above in both the post-calibration and the in-situ comparables, the "bad data" were masked within the data set with an error code (see QAPP for list of error codes).

SONDE FILE POST-PROCESSING:

Each "raw" .csv file of sonde data was post-processed using an Excel(tm) Macro. The file was opened and renamed. Rows of data acquired before and after deployment were deleted. Records (if any) were also deleted if instrument error codes indicated "garbage" data. The macro rearranged columns and inserted error-tracking columns and headings. Macro statements flagged negative values, missing values and highlighted values outside each parameter's normal range. The macro also returned a report summarizing range exceedances. Event and instrument information was appended to each record.

Flagged values were evaluated. Common anomalies included spikes in fluorescence and turbidity, dips in specific conductance, and extremely high dissolved oxygen readings. Instrument post-calibration results, in-situ comparisons with Hydrolab, LI-COR readings, historical data from near-by locations and survey crew remarks were used to determine whether sensor values were acceptable.

In cases where data were determined to be unreliable, the reason(s) were documented with error codes and comments. Unreliable data were masked. No data were discarded. Only data considered reliable were published in reports.

Field staff and Tawes Office staff reviewed continuous monitoring data weekly. If a problem was identified, a field team member was dispatched to replace the instrument as soon as possible.

VERIFICATION AND DATA MANAGEMENT

At the end of the monitoring season, DNR Tawes Office and Field Office personnel conducted additional data QA/QC procedures. All of the data were plotted and outliers and anomalous values were thoroughly researched. Staff compared unusual values to historic values from the site and values from nearby sites in the Bay. Weather events were considered, event logs were reviewed and field staff members were consulted regarding possible legitimate causes for the values. In cases where values were not considered legitimate, error codes were assigned. All data were retained in the archive data set. After field staff and the Quality Assurance Officer reviewed error flags, the values were masked within the published dataset.

Process_Date: Unknown
Process_Contact:
Contact_Information:
Contact_Person_Primary:
Contact_Person: Sally Bowen
Contact_Position: Project Chief, Monitoring Field Office, DNR
Contact_Address:
Address_Type: mailing and physical
Address: 1919 Lincoln Drive
City: Annapolis
State_or_Province: Maryland
Postal_Code: 21401
Country: USA
Contact_Voice_Telephone: 410 263-3369
Contact_Electronic_Mail_Address: SBOWEN_nospam_@dnr.state.md.us[Remove _nospam_ for valid email address]

Process_Step:
Process_Description:
Laboratory analysis – CBL

University of Maryland's Chesapeake Biological Laboratory (CBL), Nutrient Analytical Services Laboratory analyzed total dissolved nitrogen, particulate nitrogen, nitrite, nitrite + nitrate, ammonium, total dissolved phosphorus, particulate phosphorus, particulate inorganic phosphorus, orthophosphate, dissolved organic carbon, particulate carbon, total suspended solids, and volatile suspended solids.

Note that beginning in 2010, the full suite of nutrients were only collected at stations: XHH3851 (Sycamore Point), XHH4931 (Possum Point), XHH4916 (The Sill), and XEB5404 (Indian Head). A sub-set of nutrients (VSS, Ammonium, Orthophosphate, Nitrite plus Nitrate, Total Dissolved Nitrogen, and Total Dissolved Phosphorus) were collected at stations XJG7035 (Otter Point Creek), PXT0455 (Jug Bay), MTI0015 (Mataponi), WXT0013 (Iron Pot Landing), and LMN0028 (Little Monie Creek). TSS and chlorophyll were collected at all other stations. For station XIE4741 (Masonville Cove), only TSS and chlorophyll were collected prior to 19-May-2011. A partial suite of nutrients (Ammonium, Nitrite plus Nitrate, Total Dissolved

Nitrogen, Particulate Nitrogen, Phosphate, Total Dissolved Phosphorus, and Particulate Carbon) were collected for the remainder of 2011

Note that beginning in 2008, Shallow Water Monitoring silicate samples were only collected and analyzed for four Maryland Coastal Bays stations: XDM4486 (Bishopville Prong), XDN6921 (Grey's Creek), NPC0012 (Newport Creek) and XBM8828 (Public Landing).

Further information about laboratory analytical procedures may be obtained from the "Process_Contact".

Process_Date: Unknown
Process_Contact:
Contact_Information:
Contact_Person_Primary:
Contact_Person: Carl Zimmerman
Contact_Position: Director of Analytical Services/Quality Assurance Officer
Contact_Address:
Address_Type: mailing and physical
Address: Chesapeake Biological Laboratory, 1 Williams St; P.O. Box 38
City: Solomons
State_or_Province: Maryland
Postal_Code: 20688
Country: USA
Contact_Voice_Telephone: 410 326-7252
Contact_Electronic_Mail_Address: carlz _nospam_@cbl.umces.edu[Remove _nospam_ for valid email address]

Spatial_Data_Organization_Information:
Indirect_Spatial_Reference: Big Annemessex River, Bush River, Chesapeake Bay, Maryland Coastal Bays, Corsica River, Manokin River, Mattawoman Creek, Patapsco River, Patuxent River, Potomac River, Sassafras River, South River, Susquehanna River, West River, Wicomico River, Maryland, USA
Direct_Spatial_Reference_Method: Point

Spatial_Reference_Information:
Horizontal_Coordinate_System_Definition:
Geographic:
Latitude_Resolution: 0.0001
Longitude_Resolution: 0.0001
Geographic_Coordinate_Units: Decimal degrees
Geodetic_Model:
Horizontal_Datum_Name: North American Datum of 1983
Ellipsoid_Name: Geodetic Reference System 80
Semi-major_Axis: 6378137
Denominator_of_Flattening_Ratio: 298.257

Entity_and_Attribute_Information:

Overview_Description:

Entity_and_Attribute_Overview:

This metadata record is a description of a continuous monitoring project. Project data are an aggregation of data collected at thirty-four Maryland stations during 2011.

The data are contained in five related entities (tables): Station_Information, Monitoring_Event_Data, Water_Quality_Data, Light_Attenuation_Data and CMON_DATA. Each table contains attributes (fields).

The entity Station_Information is comprised of the attributes: STATION, DESCRIPTION, WATER_BODY, CBP_BASIN, TS_BASIN, BASIN, CBSEG_2003, CBSEG_2003_DESCRIPTION, HUC8, CATALOGING_UNIT_DESCRIPTION, HUC11, WATERSHED, FIPS, STATE, COUNTY/CITY, FALL_LINE, LATITUDE, LONGITUDE, LL_DATUM, UTM_X and UTM_Y

The entity Monitoring_Event_Data is comprised of the attributes: EVENT_ID, SOURCE, AGENCY, PROGRAM, PROJECT, STATION, EVENT_START_DATE, EVENT_START_TIME, CRUISE, TOTAL_DEPTH, UPPER_PYCNOCLINE, LOWER_PYCNOCLINE, AIR_TEMP, WIND_SPEED, WIND_DIRECTION, PRECIP_TYPE, TIDE_STAGE, WAVE_HEIGHT, CLOUD_COVER, GAGE_HEIGHT, PRESSURE, FLOW_STAGE, DETAILS and WATER_BODY.

The entity Water_Quality_Data is comprised of the attributes: EVENT_ID, SOURCE, PROJECT, STATION, SAMPLE_DATE, SAMPLE_TIME, DEPTH, LAYER, SAMPLE_TYPE, SAMPLE_ID, PARAMETER, QUALIFIER, VALUE, UNIT, METHOD, LAB, PROBLEM, DETAILS, TOTAL_DEPTH, UPPER_PYCNOCLINE, LOWER_PYCNOCLINE, LAT, and LONG.

The entity Light_Attenuation_Data is comprised of the attributes: EVENT_ID, SOURCE, PROJECT, STATION, SAMPLE_DATE, SAMPLE_TIME, SAMPLE_REPLICATE_TYPE, DEPTH, EPAR_S, EPARU_Z, EPARD_Z, UNIT, METHOD, DETAILS, WATER_BODY, TOTAL_DEPTH, UPPER_PYCNOCLINE, and LOWER_PYCNOCLINE.

The entity CMON_DATA is comprised of the attributes: DATE, TIME, STATION, SONDE, TOTAL_DEPTH, DISSOLVED OXYGEN, PERCENT OXYGEN SATURATION, SALINITY, TEMPERATURE, PH, TURBIDITY AND CHLOROPHYLL.

Entity_and_Attribute_Detail_Citation:

Water Quality Database - Database Design and Data Dictionary Prepared For: U.S. Environmental Protection Agency, Region III, Chesapeake Bay Program Office, January 2004. [http://archive.chesapeakebay.net/pubs/cbwqdb2004_RB.PDF]

The most current version of the Water Quality Data Dictionary - Online may be found at: [http://archive.chesapeakebay.net/data/data_dict.cfm?DB_CODE=CBP_WQDB]

Quality Assurance Project Plan for the Maryland Department of Natural Resources, Chesapeake Bay Shallow Water Quality Monitoring Program, for the period July 1, 2011 - June 30, 2012. [http://mddnr.chesapeakebay.net/eyesonthebay/documents/SWM_QAPP_2011_2012_FINAL.pdf]

Distribution_Information:
Distributor:
Contact_Information:
Contact_Person_Primary:
Contact_Person: Michael Mallonee
Contact_Position: Water Quality Database Manager
Contact_Address:
Address_Type: mailing
Address: 410 Severn Avenue, Suite 109
City: Annapolis
State_or_Province: Maryland
Postal_Code: 21403
Contact_Voice_Telephone: 800 968-5785
Contact_Electronic_Mail_Address: mmallone@_no_spam_chesapeakebay.net[Remove _nospam_ for valid email address]
Resource_Description: Downloadable data
Distribution_Liability: None of the Chesapeake Bay Program partners or any of their employees, contractors, or subcontractors makes any warranty, expressed or implied, nor assumes any legal liability or responsibility for the accuracy, completeness, or usefulness of any information or data contained within the web site. Reference to any specific commercial products, processes, or services or the use of any trade, firm, or corporation name is for the information and convenience of the public and does not constitute endorsement, recommendation or favoring by the Chesapeake Bay Program partners.

Standard_Order_Process:
Digital_Form:
Digital_Transfer_Information:
Format_Name: ASCII file, formatted for text attributes, declared format
Format_Information_Content: Station Information data, Monitoring Event data, Light Attenuation data and Water Quality data
File_Decompression_Technique: No compression applied
Transfer_Size: 2.2

Digital_Transfer_Option:
Online_Option:
Computer_Contact_Information:
Network_Address:
Network_Resource_Name:
[http://www.chesapeakebay.net/data/index.cfm?subjectarea=WATER_QUALITY]

Access_Instructions: Station Information, Monitoring Event, Light Attenuation and Water Quality data are available though the Chesapeake Bay Programs CIMS data hub. Select Water Quality Database (1984-Present). Access the data by following web site (see network resource name) instructions.

Digital_Form:

Digital_Transfer_Information:

Format_Name: ASCII file, formatted for text attributes, declared format

Format_Information_Content: Continuous monitoring sonde data

File_Decompression_Technique: No compression applied

Transfer_Size: 100

Digital_Transfer_Option:

Online_Option:

Computer_Contact_Information:

Network_Address:

Network_Resource_Name:

[http://mddnr.chesapeakebay.net/newmontech/contmon/archived_results2.cfm?year=2011]

Access_Instructions: CMON data (sonde data) for 2011 are available through the Continuous Monitoring - Archived Results page of Eyes on the Bay website. Access sonde data by following web site (see network resource name) instructions. Select station and specify dates. Station record set counts range from 8,200 to 51,060. Depending on connection speed, downloads may take a very long time. Downloading partial record sets will proceed more quickly.

Fees: None

Metadata_Reference_Information:

Metadata_Date: 20120515

Metadata_Contact:

Contact_Information:

Contact_Person_Primary:

Contact_Person: Brian Smith

Contact_Address:

Address_Type: Mailing and physical address

Address: MDDNR, 580 Taylor Ave, D-2

City: Annapolis

State_or_Province: MD

Postal_Code: 21401

Contact_Voice_Telephone: (410) 260-8630

Contact_Electronic_Mail_Address: brsmith_nospam_@dnr.state.md.us[Remove _nospam_ for valid email address]

Metadata_Standard_Name: Content Standards for Digital Geospatial Metadata

Metadata_Standard_Version: FGDC-STD-001-1998