Maryland Shallow Water Monitoring Program – 2012 Continuous Monitoring

Metadata:

Identification_Information:
Citation:
Citation_Information:
Originator: Maryland Department of Natural Resources, Resource Assessment Service (MD DNR RAS)
Publication_Date: 20130419
Title: MD DNR Continuous Water Quality Monitoring Project 2012
Geospatial_Data_Presentation_Form: Spatial dataset

Description:
Abstract:

Water quality was monitored at thirty-five Maryland shallow water sites located in Chesapeake Bay, Chesapeake Bay tributaries and Maryland Coastal Bay tributaries during 2012. 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 stations XEF3551, XFG4618, and XBF7904. The surface monitor at station XEF3551 sampled parameters at 10-minute intervals from 1-Jan-2012 to 6-Mar-2012 and at 60-minute intervals from 14-Mar-2012 to 31-Dec-2012. The bottom monitor at station XEF3551 sampled parameters at 60-minute intervals for the entire deployment. The monitor at station XFG4618 sampled parameters at 60-minute intervals for the entire deployment. The monitor at station XBF7904 sampled parameters at 10-minute intervals from 2-Apr-2012 to 18-Apr-2012 and at 15-minute intervals for the remainder of the deployment. The number of days that data were collected at individual stations ranged from twenty-two to three hundred sixty-six.

Data loggers at most stations were exchanged bi-weekly. Data loggers deployed greater than 10m below surface at station XEF3551 were exchanged monthly. Data loggers deployed in a contained lake at station XFI9597 were exchanged monthly. Loggers were deployed simultaneously at two depths at stations XEF3551, XIE4741, and XHH4931.

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. The Shallow Water Monitoring Program includes two components, the Water Quality Mapping Project and the Continuous Water Quality Monitoring Project.

Continuous Water Quality monitoring data describe the 2012 state of thirty-five 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, 2012 - June 30, 2013.
[http://mddnr.chesapeakebay.net/eyesonthebay/documents/SWM_QAPP_2012_2013_Draft_v2.1.pdf]

Time_*Period_of_Content:*
Time_Period_Information:
Range_of_Dates/Times:
Beginning_Date: 20120101

Ending_Date: 20121231
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, S. Ritz, T. Stevens, M. Morahan, A. Aleman, R. Vogel, S. Leicester, H. Weir, M. Meaux, S. Grebas, C.Solomon, M. Holland, T. Northcutt, R. A. Restrepo, R. Bilodeau,2012. NASA/Global Change Master Directory (GCMD) Earth Science Keywords. Version 7.0.0.0.0.
online: [http://gcmd.gsfc.nasa.gov/learn/keywords.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
Theme_Keyword: Terrestrial Hydrosphere > Surface Water > Rivers/Streams
Theme_Keyword: Terrestrial Hydrosphere > Water Quality/Water Chemistry > Chlorophyll
Theme_Keyword: Terrestrial Hydrosphere > Water Quality/Water Chemistry > Conductivity
Theme_Keyword: Terrestrial Hydrosphere > Water Quality/Water Chemistry > Light Transmission
Theme_Keyword: Terrestrial Hydrosphere > Water Quality/Water Chemistry > Nitrogen Compounds
Theme_Keyword: Terrestrial Hydrosphere > Water Quality/Water Chemistry > Oxygen
Theme_Keyword: Terrestrial Hydrosphere > Water Quality/Water Chemistry > Nutrients
Theme_Keyword: Terrestrial Hydrosphere > Water Quality/Water Chemistry > pH
Theme_Keyword: Terrestrial Hydrosphere > Water Quality/Water Chemistry > Phosphorous Compounds
Theme_Keyword: Terrestrial Hydrosphere > Water Quality/Water Chemistry > Suspended Solids
Theme_Keyword: Terrestrial Hydrosphere > Water Quality/Water Chemistry > Turbidity
Theme_Keyword: Terrestrial Hydrosphere > Water Quality/Water Chemistry > Water Temperature

Place:
Place_Keyword_Thesaurus: Producer Defined

Place_Keyword: United States
Place_Keyword: Maryland
Place_Keyword: Chesapeake Bay Watershed
Place_Keyword: Chesapeake Bay
Place_Keyword: Anne Arundel County
Place_Keyword: Baltimore City
Place_Keyword: Calvert County
Place_Keyword: Caroline County
Place_Keyword: Cecil County
Place_Keyword: Charles County
Place_Keyword: Dorchester County
Place_Keyword: Harford County
Place_Keyword: Kent County
Place_Keyword: Prince George's County
Place_Keyword: Queen Anne's County
Place_Keyword: Somerset County
Place_Keyword: St. Mary's County
Place_Keyword: Talbot County
Place_Keyword: Wicomico County
Place_Keyword: Worcester County
Place_Keyword: Big Annemessex River
Place_Keyword: Bush River
Place_Keyword: Choptank River
Place_Keyword: Coastal Bays
Place_Keyword: Corsica River
Place_Keyword: Harris Creek
Place_Keyword: Manokin River
Place_Keyword: Mattawoman Creek
Place_Keyword: Nanticoke River
Place_Keyword: Patapsco River
Place_Keyword: Patuxent River
Place_Keyword: Pocomoke River
Place_Keyword: Potomac River
Place_Keyword: Sassafras River
Place_Keyword: South River
Place_Keyword: Susquehanna Flats
Place_Keyword: Susquehanna River
Place_Keyword: West River
Place_Keyword: Wicomico River
Place_Keyword: Williston Lake
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_2012.pdf]
Browse_Graphic_File_Description:
Map of thirty-five 2012 Continuous Monitoring Sites.
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 2012, at all but three stations, water quality monitoring sondes were deployed at a single depth. At three stations: 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 2012 sites, except XHH4931, XIE4741, XEF3551, and XFG4618 list a value of 'BS', 'below surface' in the LAYER column. For stations 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. For station XFG4618, a LAYER column value of 'S' indicates the sonde was deployed 1 meter below the surface.

In the 2012 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.

During 2012, 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) and station XFI9597 (Williston Lake).

The sonde at station XHH3851 was not exchanged on 1-Feb-2012, 21-Feb-2012, 20-Mar-2012, 30-May-2012, 14-Nov-2012, and 19-Dec-2012.

The sonde at station XGE0320 was not exchanged on 20-Jan-2012, 24-Feb-2012, 21-Mar-2012, 26-Apr-2012, 5-Nov-2012, and 4-Dec-2012.

The sonde at station XKH0375 was not exchanged on 3-May-2012, 19-Jul-2012, 27-Sep-2012, and 25-Oct-2012.

The sonde at station ZDM0001 was not exchanged on 3-Apr-2012 and 9-May-2012,

The sonde at station WXT0013 was not exchanged on 24-Jan-2012, 23-Feb-2012, 30-Oct-2012, 19-Nov-2012, and 27-Dec-2012.

The sonde at station PXT0455 was not exchanged on 24-Jan-2012, 23-Feb-2012, 30-Oct-2012, and 27-Dec-2012.

The sonde at station XBI6387 was not exchanged on 1-Nov-2012.

The sonde at station XIE5748 was not exchanged on 12-Mar-2012, 4-Apr-2012, 10-May-2012, and 4-Dec-2012.

The surface sonde at station XIE4741 was not exchanged on 4-Apr-2012, 10-May-2012, and 21-Nov-2012.

The bottom sonde at station XIE4741 was not exchanged on 4-Apr-2012, and 10-May-2012.

The sonde at station MTI0015 was not exchanged on 30-Oct-2012 and 19-Nov-2012.

The sonde at station XGF7832 was not exchanged on 5-Apr-2012 and 9-May-2012.

The sonde at station XJG7035 was not exchanged on 22-Nov-2012.

The sonde at station POK0187 was not exchanged on 6-Nov-2012.

The sonde at station POK0009 was not exchanged on 6-Nov-2012.

The sonde at station POK0316 was not exchanged on 6-Nov-2012.

The sonde at station XAJ5327 was not exchanged on 23-May-2012.

The sonde at station XHF0460 was not exchanged on 3-Apr-2012 and 9-May-2012.

The sonde at station XKH2949 was not exchanged on 11-Apr-2012, 3-May-2012, 25-Oct-2012, and 15-Nov-2012.

The sonde at station XCI9167 was not exchanged on 31-Oct-2012.

The sonde at station XDJ8905 was not exchanged on 10-Jul-2012.

The sonde at station XFI9597 was not exchanged on 8-Jun-2012, 22-Jul-2012, and 10-Sep-2012.

The sonde at station XEF3551 (surface) was not exchanged on 7-Feb-2012, 28-Mar-2012, 4-Jun-2012, 10-Sep-2012, 8-Oct-2012, 5-Nov-2012, and 17-Dec-2012.

The sonde at station XEF3551 (bottom) was not exchanged on 22-Jul-2012 and 7-Sep-2012.

The sondes at station XHH4931 (surface and bottom) were not exchanged on 30-May-2012 and 14-Nov-2012.

The sonde at station XFG4618 was not exchanged on 5-Nov-2012 and 3-Dec-2012.

An aerator was intermittently deployed between late June and early September near station XEA3687. Approximate dates of deployment for the aerator were 29-Jun-2012, 2-Jul-2012 to 10-Jul-2012, 17-Jul-2012 to 26-Jul-2012, 17-Aug-2012 to 19-Aug-2012, and 6-Sep-2012.

Completeness_Report:

2012 Data from thirty-five continuous monitoring stations are available on-line.

The 2012 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), XIE5748 (Baltimore Harbor), XGE0320 (Chesapeake Yacht Club), and XEF3551 (Gooses - Surface).

Sonde data were collected for ten months at station: XIE4741 (Masonville Cove - Surface).

Nine month deployments occurred at stations: XDM4486 (Bishopville Prong), XDN6921 (Grey's Creek), MTI0015 (Mataponi), XJG7035 (Otter Point Creek), NPC0012 (Newport Creek), XKH2949 (Havre de Grace), XHH4931 (Possum Point - Bottom and Surface), XGF7832 (Annapolis CBIBS), XBM8828 (Public Landing), and ZDM0001 (Harness Creek - Downstream).

Deployments at stations: XHF0460 (Sandy Point - South Beach), XKH0375 (Susquehanna Flats), XBJ3220 (Coulbourn Creek), LMN0028 (Little Monie Creek), XBI6387 (Westover), POK0187 (Pocomoke City), POK0009 (Shelltown), POK0316 (Snow Hill), XEJ2464 (Sharptown), XCI9167 (Tyaskin), XDJ8905 (Vienna), and XIE4741 (Masonville Cove - Bottom) lasted eight months.

Sondes were deployed seven months at stations: XBF7904 (St Georges Creek), XEB5404 (Indian Head), XEA3687 (Mattawoman), XJI2396 (Budd's Landing), and XFG4618 (Harris Creek Profiler).

Sonde deployment at station: XFI9597 (Williston Lake) and XEF3551 (Gooses - Bottom) lasted six months.

Sonde data were collected for one month at station XAJ5327 (Pocomoke Sound).

In 2012, the full suite of nutrient samples was collected at stations: XHH3851 (Sycamore Point), XHH4931 (Possum Point), XEA3687 (Mattawoman), 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, chlorophyll, and pheophytin were collected at all stations.

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 XHH4931 (Possum Point - Bottom and Surface) was not deployed until 4-Apr-2012 due to concerns about ice and low temperatures. Station XHH4931 was also removed from service 5-Dec-2012 due to concerns about ice and low temperatures.

Station XEF3551 (Gooses - Bottom) was not deployed until 22-Jun-2012 and was removed from service on 26-Nov-2012.

Station XJG7035 (Otter Point Creek) was not deployed until 19-Mar-2012 due to concerns about ice and low temperature. Station XJG7035 was also removed from service 27-Nov-2012 due to concerns about ice and low temperatures.

Station XAJ5327 (Pocomoke Sound) was removed from service on 30-May-2012 due to equipment damage.

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

Station XEJ2464 (Sharptown) is missing data from 10-Jul-2012 to 26-Jul-2012 due to a sonde failure.

Station XGF7832 (Annapolis CBIBS) was out of service from 9-Oct-2012 to 25-Oct-2012 due to equipment maintenance.

Station XIE5748 (Baltimore Harbor) is missing data from 4-Jan-2012 to 10-Jan-2012 due to a sonde failure.

Station XEF3551 (Gooses - Surface) was out of service from 6-Mar-2012 to 14-Mar-2012 due to equipment maintenance.

Station XFI9597 (Williston Lake) is missing data from 24-Jun-2012 t0 25-Jun-2012 due to a sonde failure.

Station XFG4618 (Harris Creek Profiler) was out of service from 26-Oct-2012 to 31-Oct-2012 due to concerns about Hurricane Sandy damaging the equipment.

Station XGE0320 (Chesapeake Yacht Club) is missing data from 20-May-2012 to 7-Jun-2012 due to equipment malfunction.

Station XDM4486 (Bishopville Prong) is missing data from 25-Aug-2012 to 29-Aug-2012 due to a sonde failure.

Station XEA3687 (Mattawoman) is missing data from 2-Apr-2012 to 16-Apr-2012 due to a sonde failure.

Station XIE5748 (Baltimore Harbor) is missing data from 4-Jun-2012 to 19-Jun-2012 and 12-Aug-2012 to 14-Aug-2012 due to sonde failures.

Station XIE4741 (Masonville Cove - Surface) is missing data from 18-Dec-2012 to 31-Dec-2012 due to a power failure.

Station XIE4741 (Masonville Cove - Bottom) is missing data from 17-Sep-2012 to 25-Sep-2012 due to a sonde failure.

Station POK0187 (Pocomoke City) is missing data from 20-Oct-2012 to 23-Oct-2012 due to a power failure.

Station XHH4931 (Possum Point - Surface) is missing data from 26-Jun-2012 to 27-Jun-2012 and 22-Sep-2012 to 4-Oct-2012 due to power failures.

Station POK0009 (Shelltown) has daily intermittent data gaps between 18-Jul-2012 and 29-Aug-2012 due to equipment malfunction.

Station POK0316 (Snow Hill) is missing data from 11-Sep-2012 to 12-Sep-2012 due to a power failure.

Station POK0316 (Snow Hill) has data gaps between 7-Nov-2012 and 13-Nov-2012 due to power failures.

Station XHF0460 (Sandy Point - South Beach) is missing data from 18-May-2012 to 23-May-2012 due to a power failure.

Station XCI9167 (Tyaskin) is missing data from 11-Nov-2012 to 14-Nov-2012 due to equipment malfunction.

Station XFI9597 (Williston Lake) is missing data between 13-Aug-2012 and 14-Aug-2012, 20-Aug-2012 and 21-Aug-2012, 7-Sep-2012 and 8-Sep-2012, 20-Sep-2012 and 24-Sep-2012, 25-Sep-2012 and 27-Sep-2012, due to equipment malfunctions.

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 V2 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 stations XEF3551, XFG4618, and XBF7904. The surface monitor at station XEF3551 sampled parameters at 10-minute intervals from 1-Jan-2012 to 6-Mar-2012 and at 60-minute intervals from 14-Mar-2012 to 31-Dec-2012. The bottom monitor at station XEF3551 sampled parameters at 60-minute intervals for the entire deployment. The monitor at station XFG4618 sampled parameters at 60-minute intervals for the entire deployment. The monitor at station XBF7904 sampled parameters at 10-minute intervals from 2-Apr-2012 to 18-Apr-2012 and at 15-minute intervals for the remainder of the deployment. 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 (used to derive salinity values), dissolved oxygen, oxygen percent saturation, 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 V2 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), XHH4931 (Possum Point - Bottom), XJG7035 (Otter Point Creek), XIE4741 (Masonville Cove - Bottom) XKH0375 (Susquehanna Flats), XAJ5327 (Pocomoke Sound), and XCI9167 (Tyaskin).

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, XHH4931, and XIE4741.

WATER QUALITY CALIBRATION SAMPLES:

Each time sondes were exchanged at each Continuous Monitoring station, "Grab" water quality samples were collected at 1.0 meter depth using a horizontal "Alpha" water sampler. At Station XFG4618, a second (bottom) grab sample was collected at 2.0m depth. 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, 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 during deployment. Data loggers deployed greater than 10m below surface at station XEF3551 were exchanged monthly. Data loggers deployed in a contained lake at station XFI9597 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 from 1-Jan-2012 to 6-Mar-2012) side by side at the same depth. For the surface sondes at station XEF3551 (after 6-Mar-2012), bottom sondes at station XEF3551, and the monitor at station XFG4618, only one simultaneous reading was taken using the new and old sondes. In addition at all of the stations, for one of the simultaneous 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% or 5.0 NTU (whichever is greater); Chlor (ug/l) +- 5% or 5.0 ug/l (whichever is greater).

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 in 2012, the full suite of nutrients was only collected at stations: XHH3851 (Sycamore Point), XHH4931 (Possum Point), XEA3687 (Mattawoman), 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.

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). Beginning in 2012, silicate samples were no longer collected at these four Coastal Bays stations.

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: Kathy Wood
Contact_Position: Director of Analytical Services/Quality Assurance Officer
Contact_Address:
Address_Type: mailing and physical
Address: Chesapeake Biological Laboratory, 146 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: wood _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, Choptank River, Corsica River, Harris Creek, Manokin River, Mattawoman Creek, Nanticoke River, Patapsco River, Patuxent River, Pocomoke River, Potomac River, Sassafras River, South River, Susquehanna River, Susquehanna Flats, West River, Wicomico River, Williston Lake, 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-five Maryland stations during 2012.

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, 2012 - June 30, 2013.

[http://mddnr.chesapeakebay.net/eyesonthebay/documents/SWM_QAPP_2012_2013_Draft_v2.1.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=2012]
Access_Instructions: CMON data (sonde data) for 2012 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 2,002 to 35,138. 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: 20130419
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