

Maryland Shallow Water Monitoring Program – 2015 DATAFLOW

Metadata:

Identification_Information:

Citation:

Citation_Information:

Originator: Maryland Department of Natural Resources, Resource Assessment Service (MD DNR RAS)

Publication_Date: 20160322

Title: MD DNR Water Quality Mapping Project 2015

Geospatial_Data_Presentation_Form: Spatial dataset

Description:

Abstract:

This record describes one year of an on-going water quality monitoring project. Mapping surveys were performed monthly from April through October 2015.

A total of thirty-five mapping cruises were conducted on Maryland water bodies. The spatial extent of water quality was measured on waters of the Back River, Corsica River, Chesapeake and Delaware Canal and Chesapeake Bay segment CB2OH.

Two surveys were required to map the Chesapeake Bay segment CB2OH. Data collected during two surveys were combined. The monthly surveys were conducted on the same days.

Water quality mapping was conducted using DATAFLOW, a compact, self-contained surface water quality mapping system deployed in a small boat operating at planing speeds of up to 45 km/hr (24.3 kts). Measurements were made approximately every four seconds, or 30 meters (100 feet). Seven water quality parameters were measured: water temperature, salinity, conductivity, dissolved oxygen, turbidity, fluorescence and pH. The May through October Corsica River surveys were conducted using a second sonde equipped with blue-green algal (phycoerythrin) sensors used to measure blue green algal cells/ml and Relative Fluorescence Units (RFUs). Water depth was also measured. The DATAFLOW system sampled water at approximately 0.5-m depths below the surface.

Additional water-quality measurements were made at twenty-three calibration stations. Secchi disk depth, HydroLab (water temperature, pH, dissolved oxygen, specific conductance, and salinity) and photosynthetic active radiation measurements were made each station during each survey. Three sites were sampled on the Chesapeake and Delaware Canal survey. Five sites were sampled on each of the other four surveys. Calibration sample collection at station XIG7901 began during the July 2015 survey.

Water-quality calibration chlorophyll and total suspended solids "grab" water samples were collected at five stations during each monthly mapping survey. The "grab" samples were collected, after stopping the boat, at 0.5-m depth and filtered, when possible, on site.

A suite of nutrient "grab" water samples were also collected monthly at Corsica River stations: COR0056, XHH3851, XHH4528, XHH4916 and XHH4931. The Corsica survey was the only water quality mapping survey on which nutrient samples were collected.

Laboratory analyses were performed on calibration "grab" sample water. Concentrations of chlorophyll a and total suspended solids were determined for all stations. Corsica River stations were also analyzed for total dissolved nitrogen, particulate nitrogen, nitrite, nitrite + nitrate, ammonium, total dissolved phosphorus, particulate phosphorus, particulate inorganic phosphorus, orthophosphate, particulate carbon and volatile suspended solids.

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.

Water quality mapping provides data on variability and patchiness that are valuable in assessing water quality criteria, and in determining attainment of those criteria. For example, spatial information on turbidity can be correlated to the spatial coverage of living resources such as Submerged Aquatic Vegetation (SAV). This information can be used to determine and assess water clarity criteria necessary to support SAV growth, address the progress of meeting SAV restoration goals, and target specific locations for SAV restoration.

Spatially intensive data can also help pinpoint localized areas of water quality concern, such as areas of low dissolved oxygen that can cause fish kills, and their possible links to nearby land uses or point sources.

Water quality maps can capture localized areas of algae blooms, high turbidity, or low dissolved oxygen that may adversely affect living resources in shallow water habitats and spawning areas.

Spatial data can also be aggregated across watershed units to aid in the evaluation of entire systems. Water quality mapping data are 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:

DATAFLOW project dataset includes mapping and calibration data acquired during monthly sampling runs, between April and October.

Sampling-event, water-quality-calibration, pigment and suspended solids data from thirty-five stations are included in the dataset. Three calibration samples were collected each month's Chesapeake and Delaware Canal survey. Five calibration samples were collected during each of the following monthly sampling runs: Back, CB2OH_E, and Corsica. Samples were collected on the CB2OH_W April, May and June surveys at just four stations. Sampling began at a new location, station: XIG7901, in July 2015. Five CB2OH_W survey calibration samples were collected July, August, September and October.

Beginning in January 2010, collection of full suites of nutrient samples ended on most Water Quality Mapping Surveys. Nutrient sampling on Corsica River surveys continued, and, during 2015, full nutrient suites were collected monthly at stations: COR0056, XHH3851, XHH4528, XHH4916 and XHH4931.

Samples from the five calibration stations on the Corsica River were collected and analyzed for the same suite of nutrients as those measured for the Chesapeake Bay Mainstem Program (chlorophyll a, pheophytin, total dissolved nitrogen, particulate nitrogen, nitrite, nitrite + nitrate, ammonium, total dissolved phosphorus, particulate phosphorus, orthophosphate, particulate carbon, total suspended solids and volatile suspended solids) plus particulate inorganic phosphorus.

Contour maps based on 2015 Dissolved Oxygen, Salinity, Turbidity, Temperature and Chlorophyll data acquired during DATAFLOW monthly mapping cruises are available on-line. [<http://www.eyesonthebay.net>].

Data users may discover a few interruptions in sonde datasets. These were related to short-term problems with flow, power or sonde operation.

Turbidity data were censored in cases where bottom sediment disturbances were determined to be caused by the sampling vessel or other vessels.

April 2015: Many Corsica River survey sonde depth measurements were not acquired, possibly due to shallow water conditions.

May 2015: Many sonde depth measurements were not acquired, possibly due to shallow water conditions on part of the Back River survey.

June 2015: A hardware malfunction during the Chesapeake Bay segment CB2OH West survey resulted in a six minute data gap.

August 2015: There was an eight minute data gap during the Back River survey due to a hardware malfunction.

September 2015: Rough seas precluded collection of LiCOR measurements at stations XIF7748 and XIG4800 during the Chesapeake Bay segment CB2OH West survey. During the Chesapeake Bay segment CB2OH East survey a ten minute data gap was caused by a human

error. The CB2OH East survey was terminated early due to concerns about weather and low fuel supply.

There were no known completeness issues during sampling conducted July and October 2015.

Time_Period_of_Content:

Time_Period_Information:

Range_of_Dates/Times:

Beginning_Date: 20150414

Ending_Date: 20151022

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: Global Change Master Directory (GCMD). 2015. GCMD Keywords, Version 8.1. Greenbelt, MD: Global Change Data Center, Science and Exploration Directorate, Goddard Space Flight Center (GSFC) National Aeronautics and Space Administration (NASA). URL: [<http://gcmd.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 > NUTRIENTS

Theme_Keyword: TERRESTRIAL HYDROSPHERE > WATER QUALITY/WATER CHEMISTRY > OXYGEN

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: Baltimore County

Place_Keyword: Cecil County

Place_Keyword: Harford County

Place_Keyword: Kent County

Place_Keyword: Queen Anne's County

Place_Keyword: Back River

Place_Keyword: C & D Canal

Place_Keyword: Chesapeake and Delaware Canal

Place_Keyword: Corsica River

Temporal:

Temporal_Keyword_Thesaurus: Producer Defined

Temporal_Keyword: 2015

Access_Constraints: None

Use_Constraints: None

Point_of_Contact:

Contact_Information:

Contact_Person_Primary:

Contact_Person: Mark Trice

Contact_Position: Program Chief, Water Quality Informatics, Tidewater Ecosystem

Assessment

Contact_Address:

Address_Type: Mailing and Physical Address

Address: Tawes State Office Building, 580 Taylor Avenue, D2

City: Annapolis

State_or_Province: MD

Postal_Code: 21401

Contact_Voice_Telephone: 410 260-8630

Contact_Electronic_Mail_Address: mark.trice_nospam_@maryland.gov[Remove_nospam_ for valid email address]

Browse_Graphic:

Browse_Graphic_File_Name: MDDNR Water Quality Mapping Monitoring Project 2015 Station Map can be found using publication type 'map' to search the monitoring stories and publications page of [<http://www.eyesonthebay.net>]

Browse_Graphic_File_Description: Overview map of twenty-three 2015 DATAFLOW calibration station sites located on Maryland Chesapeake Bay tributaries and in Chesapeake Bay Segment CB2OH.

Browse_Graphic_File_Type: PDF

Data_Set_Credit:

Survey and calibration data were collected by MD DNR Resource Assessment Service (RAS) Annapolis Field Office staff.

The Nutrient Analytical Services Laboratory (NASL) at the Chesapeake Biological Laboratory (University of Maryland) analyzed chlorophyll, nutrient 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, and the National Atmospheric and Oceanic Administration Chesapeake Bay Program Office.

Data_Quality_Information:

Attribute_Accuracy:

Attribute_Accuracy_Report:

QUALITY ASSURANCE/QUALITY CONTROL

MD DNR followed specific procedures to ensure that the DATAFLOW component of 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 used for the measurement of physical and chemical parameters.

YSI 6600 V2 sondes were configured with the following probes: 6025 (chlorophyll); 6136 (turbidity); 6560 (spCond & temperature); 6561(pH); and 6150ROX (dissolved oxygen) during 2013. A second sonde configured with 6132 (blue-green phycoerythrin) probe was also used (Corsica surveys only). Resolution, range and accuracy specifications for the sonde and probes may be obtained from the manufacturer [<https://www.ysi.com/search?k=6600+AND+probes>].

Procedures used to control and assure the accuracy of field measurements included: calibration of field instruments, verification of calibration results, equipment maintenance, and collection of filter blanks. Most of the details of how data acquired with YSI sondes were quality assured and quality controlled are described in process description elements in the

Lineage portion of this metadata record. Water quality calibration-station laboratory analytical results were used to crosscheck sonde data for accuracy.

PAR sensors were returned to LICOR, Inc. prior to the field season for factory calibration.

Daily quality control checks (including the running of blanks and standards) were used to control and assure laboratory analytical accuracy.

Accuracy of Chesapeake Biological Laboratory, Nutrient Analytical Services Laboratory (CBL NASL) 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. Analytical results were compared using appropriate statistical tests to determine if results differed significantly among labs. If a difference occurred, discussions began regarding techniques and potential methods changes to resolve discrepancies.

OTHER ATTRIBUTE ACCURACY INFORMATION

April 2015: An algal sample was collected due to elevated fluorescence observations at two Back River calibration stations: XIF7918 and WT4.1.

June 2015: An algal sample was collected due to elevated fluorescence readings during the Corsica River survey near station COR0056.

August 2015: Comments regarding the occurrence of thunder storms the preceding night were entered in Bark River survey calibration station field data sheets. The raw sonde data files, acquired during the Chesapeake Bay segment CB2OH East survey and the Corsica River survey, received many edits due to anomalies. A detailed description of the editing processes can be found within the second Lineage Process_Step Process_Description element in this document.

September 2015: An algal sample was collected near station COR0056 during the Corsica River survey due to elevated fluorescence readings.

October 2015: The raw sonde data file acquired during the Chesapeake Bay segment CB2OH East survey received many edits due to anomalies. As noted above, a detailed description of the editing processes can be found within the second Lineage element in this document. An algal sample was collected, because of elevated fluorescence readings, during the Corsica River survey near station COR0056. Results from post calibration of the pH sensor used on the Chesapeake and Delaware Canal were within allowable range. However, a sonde data comment indicated concern about pH readings, although it was noted that the Hydrolab cross reference match-ups for all three calibration stations were consistent.

There were no known attribute accuracy issues during May and July 2015.

Logical Consistency Report:

June 2015: The track of the Chesapeake Bay segment CB2OH West survey was modified to avoid artillery fire. Depth readings were deemed uncertain due to possible fathometer malfunction.

October 2015: A deviation was made from the Back River survey cruise track for a comfort stop.

There were no other known logical consistency issues during sampling conducted during May, July, August and September 2015.

Completeness Report:

DATAFLOW project dataset includes mapping and calibration data acquired during monthly sampling runs, between April and October.

Sampling-event, water-quality-calibration, pigment and suspended solids data from twenty-three stations are included in the dataset. Three calibration samples were collected during each month's Chesapeake and Delaware Canal survey. Five calibration samples were collected during each of the following monthly sampling runs: Back, CB2OH_E, and Corsica. Samples were collected on the CB2OH_W April, May and June surveys at just four stations. Sampling began at a new location, station: XIG7901, in July 2015. Five CB2OH_W survey calibration samples were collected July, August, September and October.

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There were no known completeness issues during sampling conducted July and October 2015.

Lineage:

Process_Step:

Process_Description:

SONDE CALIBRATION and POST-CALIBRATION:

YSI 6600 data sondes equipped with a 6560 conductivity/temperature probe, a 6136 turbidity probe, a 6025 chlorophyll probe, a 6561 pH probe, a 6150ROX (Optical) Dissolved Oxygen probe and in one case, a 6132 (blue-green phycoerythrin) probe, were maintained and calibrated before and after each deployment in accordance with YSI recommendations. [<http://www.y.si.com/resource-library.php>]

CONTINUOUS SURFACE WATER QUALITY MAPPING:

DATAFLOW is a compact, self-contained surface water quality mapping system, suitable for use in a small boat operating at planing speeds of about 25 knots. The system collects water through a pipe ("ram") deployed on the transom of the vessel, pumps it through an array of water quality sensors, and then discharges the water overboard. Orientation of the sonde vertically, with probes upward, ensures that no air bubbles are conveyed to the sensors, preventing errors that might be caused by such bubbles.

Water quality instrumentation consisted of a YSI 6600 Sonde equipped with a flow-through chamber. The system was configured with conductivity/temperature, turbidity,

chlorophyll, pH and dissolved oxygen probes. A second sonde, configured with a phycoerythrin probe, was deployed on some Corsica River surveys. The sonde transmitted data sensor measurements to a data logger.

Positioning and depth instrumentation consisted of a Raymarine A70D Chartplotter/Sounder. The data logger matched the position data with water-quality sensor data for each observation. The Raymarine A70D GPS transmitted NMEA data to a Panasonic toughbook. A DATAFLOW/LabVIEW program was used to merge position and depth data with data collected by the logger and create an output file.

The system was equipped with an inline flow meter. Although the flow rate did not affect sensor readings, decreased flow was an indication of either a partial blockage or an interruption of water flow to the instrument. Flow data were used in the field as a diagnostic tool to ensure that the system was working properly and, later, as a quality assurance tool to verify that water flow was uninterrupted. A boat horn was wired to the flow meter. If the flow-rate fell below 3.0 L/s, the horn sounded and warned operators that a problem needed to be corrected.

Cruise tracks varied depending on the water body being mapped. In general, a square-wave pattern was followed by alternately sampling shallow shoreline areas, and open, deeper waters while traveling up and down river. Alternative cruise paths were followed if water body size, shape impediments, or obstructions dictated otherwise. Cruise patterns were selected to obtain representative coverage of shallow water habitats and open waters so that segment-wide criteria could be assessed as accurately as possible. Navigational issues and placement of representative calibration sites also determined ultimate cruise tracks.

WATER QUALITY CALIBRATION SAMPLES:

At each calibration station, "grab" water quality samples were collected from the outflow of the DATAFLOW unit.

"Grab" samples were collected at the same time as the Hydrolab surface sample was recorded. Numbered two quart bottles were triple-rinsed and filled with water for chlorophyll and total suspended solids samples and, on the Corsica River survey, "whole" and "filtered" nutrient samples.

Nutrient, chlorophyll 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, Phaeophytin, 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. Nitrate, Nitrite, Ammonia, Orthophosphate, Total Dissolved Nitrogen and Total Dissolved Phosphorus samples were collected.

HYDROLAB PROFILE:

The first reading of the Hydrolab water-column profile at each calibration station was recorded at the same time the water quality bottle sample was collected. The first Hydrolab record logged was for the 0.5-meter depth. The sonde was then 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 than 3-meters, the sonde was raised in 1-meter increments).

SECCHI DEPTH:

Secchi Disk Depth was measured at each calibration station. 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, and the depth at which it was no longer visible was recorded. The Secchi depth reading was taken near the stern of the vessel, and the time at which the reading was taken was noted (to the second) from the Global Positioning System. This facilitated later matching of Secchi depth readings with turbidity probe data.

PAR MEASUREMENT:

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

At each calibration station, down-welling light penetrating the water column (PAR) was measured underwater at several depths to calculate the light attenuation coefficient, K_d . Simultaneous deck and submersed PAR intensity measurements were taken to account for variability in incident surface irradiance due to changes in cloud cover. Data collected using 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).

Deck 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% of 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.

Process_Date: Unknown

Process_Contact:

Contact_Information:

Contact_Person_Primary:

Contact_Person: Kristen Heyer

Contact_Position: Project Chief (Acting), 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: 410 990-4600
Contact_Electronic_Mail_Address: kristen.heyer_nospam_@maryland.gov[Remove
nospam for valid email address]

Process_Step:

Process_Description:

DATAFLOW FILE POST-PROCESSING:

Each raw .txt file, created by DATAFLOW/LabVIEW during 2015 mapping cruises on all water bodies was post-processed in the following manner.

Hardware issues with a subset of 2015 surveys made extra processing steps necessary. Data in the August CB2OH_E, August Corsica River and October CB2OH_E survey data files were affected. Characters, in addition to standard numeric values, populated parameter values in multiple fields. No pattern was discerned in the way the anomalous strings were distributed throughout in the text file. Each field in each row of the three data files was reviewed. All anomalous strings in fields were edited to remove extra symbols if possible or deleted. In cases where strings in fields appeared to have shifted to other fields, the values were evaluated in the context of preceding and subsequent values. In cases where values clearly appeared to be consistent with preceding and following data field values, the values in question were realigned to the appropriate field. Coordinate values were plotted Using ArcGIS Desktop. Records with coordinates that were inconsistent with preceding and following cruise track values were deleted. Copies of the unedited, raw files were retained. Finally, the edited files were processed with other survey files using the Excel(tm) macro described in the next paragraph.

Each file was opened in Microsoft Excel(tm) and renamed. Rows of data acquired before and after mapping were deleted. Records (if any) were also deleted if they did not have associated GPS values. A macro was executed that rearranged columns and inserted error-tracking columns and headings. Next, negative values were flagged, and values outside each parameter's normal range were highlighted. The macro also returned a form summarizing exceedances. Finally, mapping cruise event and instrument information were appended to each record.

Flagged values were evaluated for common anomalies including 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 nearby 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) values were determined to be "bad" were documented with error codes and comments. Unreliable data were masked. No data were discarded. All DATAFLOW data for each mapping cruise, both "good"

and "bad", were retained in an archival file. Only data considered reliable were published in reports.

MERGING PRIMARY AND SECONDARY SONDE DATA

When a second data sonde was used on a survey, tables of sonde text files were merged in Excel. A bridge table comprised of the full range of possible sonde date times (yyyymmdd hhmmss) for the text files acquired on each survey date was generated using Excel's Autofill capability. The date times of each record in both sonde files were aligned to bridge table date times.

Process_Date: Unknown

Process_Contact:

Contact_Information:

Contact_Person_Primary:

Contact_Person: Mark Trice

Contact_Position: Program Chief, Water Quality Informatics, Tidewater Ecosystem

Assessment

Contact_Address:

Address_Type: mailing and physical

Address: Tawes State Office Building, 580 Taylor Avenue, D2

City: Annapolis

State_or_Province: Maryland

Postal_Code: 21401

Country: United States

Contact_Voice_Telephone: 410 260-8630

Contact_Electronic_Mail_Address: mark.trice_nospam_@maryland.gov[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 (NASL) analyzed chlorophyll, phaeophytin, total dissolved nitrogen, particulate nitrogen, nitrite, nitrite + nitrate, ammonium, total dissolved phosphorus, particulate phosphorus, particulate inorganic phosphorus, orthophosphate, particulate carbon, total suspended solids, and volatile suspended solids.

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: Jerry Frank

Contact_Position: Manager Nutrient Analytical Services Laboratory

Contact_Address:

Address_Type: mailing and physical

Address: Chesapeake Biological Laboratory, Center for Environmental and Estuarine Studies, The University of Maryland System, P.O. BOX 38, SOLOMONS, MD 20688

City: Solomons

State_or_Province: Maryland

Postal_Code: 20688

Country: USA

Contact_Voice_Telephone: 410 326-7252

Contact_Electronic_Mail_Address: frank_nospam_@umces.edu[Remove _nospam_ for valid email address]

Process_Step:

Process_Description:

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 water quality calibration "grab" sample data were plotted. 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 outlying values. In cases where values were not considered to be legitimate, they were masked from the published dataset with the approval of the field staff and the Quality Assurance Officer.

Process_Date: Unknown

Process_Contact:

Contact_Information:

Contact_Person_Primary:

Contact_Person: Mark Trice

Contact_Position: Program Chief, Water Quality Informatics, Tidewater Ecosystem Assessment

Contact_Address:

Address_Type: mailing and physical

Address: Tawes State Office Building, 580 Taylor Avenue, D2

City: Annapolis

State_or_Province: Maryland

Postal_Code: 21401

Country: USA

Contact_Voice_Telephone: 410 260-8630

Contact_Electronic_Mail_Address: mark.trice_nospam_@maryland.gov[Remove _nospam_ for valid email address]

Spatial_Data_Organization_Information:

Indirect_Spatial_Reference: Back River, Corsica River, C&D Canal, CB2OH, 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 describes water quality data collected during a water-quality mapping project. Project data are an aggregation of data collected during thirty-five year 2015 DATAFLOW mapping cruises.

The data are contained in six related entities (tables): *Station_Information*, *Monitoring_Event_Data*, *Water_Quality_Data*, *Light_Attenuation_Data*, *SONDE_DATA* and *BGA_DATA*. Each table contains attributes (fields). NOTE: *SONDE_DATA* and *BGA_DATA* were not served by the Chesapeake Bay Program at the time this metadata record was developed.

The entity *Station_Information* is comprised of the attributes: *Station*, *StationDescription*, *CBSeg2003*, *CBSeg2003Description*, *CBSegmentShed2009*, *CBSegmentShed2009Description*, *HUC12*, *FIPS*, *State*, *CountyCity*, *USGSGage*, *FallLine*, *Latitude*, *Longitude*, *UTMX*, *UTMY* and *LLDatum*.

The entity *Monitoring_Event_Data* is comprised of the attributes: *Details*, *GaugeHeight*, *EventId*, *Source*, *Program*, *Project*, *Station*, *Latitude*, *Longitude*, *EventStartDate*, *EventStartTime*, *Cruise*, *TotalDepth*, *UpperPycnocline*, *LowerPycnocline*, *WindSpeed*, *WindDirection*, *PrecipType*, *TideStage*, *CloudCover*, *Pressure* and *FlowStage*.

The entity *Water_Quality_Data* is comprised of the attributes: *MeasureValue*, *EventId*, *Station*, *Source*, *Project*, *SampleDate*, *SampleTime*, *Depth*, *TotalDepth*, *Layer*, *SampleType*, *SampleReplicateType*, *Parameter*, *Qualifier*, *MeasureValue*, *Unit*, *Method*, *Lab*, *Problem*, *Details*, *Latitude*, *Longitude*, *UpperPycnocline* and *LowerPycnocline*.

The entity *Light_Attenuation_Data* is comprised of the attributes: *EventId*, *Source*, *Station*, *Program*, *Project*, *SampleDate*, *SampleTime*, *HUC8*, *CatalogingUnitDescription*, *SampleReplicateType*, *Parameter*, *Depth*, *Unit*, *Method*, *Details*, *UpperPycnocline*, *LowerPycnocline*, and *TotalDepth*.

The entity SONDE_DATA is comprised of the attributes: SAMPLE_DATE, SAMPLE_TIME, WATER_BODY, SECTION, PRI_SEG, SONDE, LATITUDE, LONGITUDE, TOTAL_DEPTH, BOAT_SPEED, BATT, WTEMP, SPCOND, SALINITY, DO_SAT, DO, PH, TURB_NTU, FLUOR, TCHL_PRE_CAL and COMMENTS.

Cyanobacteria are commonly referred to as Blue Green algae (BGA). YSI 6600 sondes are not configured with enough sensor ports to measure water quality and Cyanobacteria with a single instrument so two sondes are used. Cyanobacteria sonde data are merged and with primary sonde data by aligning record timestamps.

The entity BGA_DATA is comprised of the attributes: bridgeDate, bridgetime, SAMPLE_DATE, SAMPLE_TIME, STATION, WATER_BODY, PRI_SEG, SONDE, LATITUDE, LONGITUDE, TOTAL_DEPTH, TOTAL_DEPTH_A, BOAT_SPEED, BOAT_SPEED_A, BATT, BATT_A, WTEMP, WTEMP_A, SPCOND, SPCOND_A, SALINITY, SALINITY_A, DO_SAT, DO_SAT_A, DO, DO_A, PH, PH_A, TURB_NTU, TURB_NTU_A, FLUOR, FLUOR_A, TCHL_PRE_CAL, TCHL_PRE_CAL_A, COMMENTS, bgaTime, bgaDate, bgaTemp, bgaSpCond, bgaSal, BGA_PE_RFU and BGA_PE_ConcCell/ml.

Maps created by interpolating the Dissolved Oxygen, Turbidity, Chlorophyll a, Salinity and Temperature data acquired during monthly mapping cruises show spatial distribution of water quality parameter values on the day of the survey. The maps may be viewed and downloaded from [<http://www.eyesonthebay.net>].

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://www.chesapeakebay.net/documents/3676/cbwqdb2004_rb.pdf].

Quality Assurance Project Plan for the Maryland Department of Natural Resources, Chesapeake Bay Shallow Water Quality Monitoring Program, for the period July 1, 2015 - June 30, 2016, can be found using publication type 'Quality Assurance Project Plan' to search the monitoring stories and publications page of [<http://www.eyesonthebay.net>]

Guide to Using Chesapeake Bay Program Water Quality Monitoring Data, EPA 903-R-12-001, February 2012, CBP/TRS 304-12 [http://www.chesapeakebay.net/documents/3676/wq_data_userguide_10feb12_mod.pdf]

Distribution_Information:

Distributor:

Contact_Information:

Contact_Person_Primary:

Contact_Person: Michael Mallonee

Contact_Position: Water Quality Data Manager

Contact_Address:

Address_Type: mailing

Address: 410 Severn Avenue

City: Annapolis

State_or_Province: Maryland

Postal_Code: 71403

Contact_Voice_Telephone: 800 968-5785

Contact_Electronic_Mail_Address: mmallone@_no_spam_chesapeakebay.net[Remove
nosпам for valid email address]

Resource_Description: Downloadable data

Distribution_Liability: None of the Chesapeake Bay Program partners nor any of their employees, contractors, or subcontractors make any warranty, expressed or implied, nor assume 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, Monitoring Event data, Light Attenuation data and Water Quality data.

File-Decompression_Technique: No compression applied

Transfer_Size: 0.9

Digital_Transfer_Option:

Online_Option:

Computer_Contact_Information:

Network_Address:

Network_Resource_Name:

[http://www.chesapeakebay.net/data/downloads/cbp_water_quality_database_1984_present]

Access_Instructions: Data are available via 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 (ASCII file, formatted for text attributes, declared "ASCII" format)

Format_Information_Content: Water quality mapping sonde data

File-Decompression_Technique: No compression applied

Transfer_Size: 12.2

Digital_Transfer_Option:

Online_Option:

Computer_Contact_Information:

Network_Address:

Network_Resource_Name:

[http://www.chesapeakebay.net/data/downloads/cbp_water_quality_database_1984_present]

Access_Instructions: UNKNOWN ++++++ TO BE DETERMINED when data are served by CBP.

Digital_Form:

Digital_Transfer_Information:

Format_Name: XLS (Microsoft Excel)

Format_Information_Content: Cyanobacteria sonde data merged with primary sonde data.

File-Decompression_Technique: Unzip

Transfer_Size: 2.4

Digital_Transfer_Option:

Online_Option:

Computer_Contact_Information:

Network_Address:

Network_Resource_Name:

[http://www.chesapeakebay.net/data/downloads/cbp_water_quality_database_1984_present]

Access_Instructions: UNKNOWN ++++++ TO BE DETERMINED when data are served by CBP.

Fees: None

Metadata_Reference_Information:

Metadata_Date: 20160606

Metadata_Contact:

Contact_Information:

Contact_Person_Primary:

Contact_Person: Ben Cole

Contact_Address:

Address_Type: Mailing and physical address

Address:

Maryland Department of Natural Resources, D-2

580 Taylor Avenue

City: Annapolis

State_or_Province: MD

Postal_Code: 21401

Contact_Voice_Telephone: (410) 260-8630

Contact_Electronic_Mail_Address: benjamin.cole_nospam_@maryland.gov[Remove _nospam_ for valid email address]

Metadata_Standard_Name: FGDC Content Standards for Digital Geospatial Metadata

Metadata_Standard_Version: FGDC-STD-001-1998